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Behind the Mask of Sanity: Startle Reactivity and Emotional Regulation in Subclinical Psychopathy

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Abstract

Psychopathy is conceptualized as a dimensional construct whose affective core is captured by the boldness trait, which encompasses social dominance, fearlessness, and a propensity for risk-taking. Boldness may be particularly relevant to subclinical (“successful”) psychopathy, which is frequently accompanied by psychosocial adjustment and emotional resilience. This study investigated defensive mechanisms and emotion regulation in healthy individuals in relation to boldness. Groups with high (n = 35) and low (n = 32) boldness were selected from a large participant pool (n = 434) using the Boldness scale of the Triarchic Psychopathy Measure. The startle reflex was quantified via electromyography as the eyeblink following intense noise stimulation during passive viewing of affective pictures (adventure, erotic, threats, victims) and instructed emotion modulation (enhance, decrease, don’t change). Trait anxiety and emotion regulation strategies were assessed via questionnaires. Participants high in boldness showed smaller startle responses than those low in boldness, irrespective of affective picture valence. Regardless of boldness, startle responses were greater during negative versus positive pictures, and increased following instructed emotion enhancement. Moreover, the high boldness group rated images as more positive overall and reported lower state and trait anxiety, as well as more adaptive and less maladaptive emotion regulation strategies than the low boldness group. The finding concerning the startle response reflects general defensive hypo-reactivity linked to boldness. The ability to deliberately modulate emotion-related physiological responses was unaffected by boldness. Low threat sensitivity and efficient emotion regulation may contribute to psychosocial adjustment and stress resilience associated with boldness, facilitating success within social and professional contexts despite antisocial tendencies.

1. Introduction

Psychopathy has been conceptualized as a constellation of affective, behavioral, and interpersonal traits (Hare, 2003; Patrick, 2018). Key features include antisocial and aggressive behaviors; deception and manipulation; a disinhibited lifestyle; irresponsible behavior; a lack of empathy, guilt, and remorse; impulsivity; and superficial interpersonal relationships (Hare, 2003; Hare & Neumann, 2008). Affective features of psychopathy play a central role, as they are thought to contribute causally to many of the associated deficits and behavioral manifestations (Lykken, 1957; Patrick, Bradley, & Lang, 1993; Patrick, Fowles & Krueger, 2009).

The triarchic model of psychopathy provides an integrative framework that accounts for the heterogeneity of the construct (Patrick et al., 2009). The model postulates three distinct but partially overlapping traits: Disinhibition, Meanness, and Boldness. Disinhibition refers to a predisposition toward impulsivity and deficits in behavioral regulation, reflecting tendencies such as irresponsibility, impatience, and emotional instability. Meanness is characterized by a lack of empathy, emotional insensitivity, and an exploitative interpersonal style; individuals high in Meanness exhibit cruelty, callousness, and the use of others for personal gain. Finally, Boldness encompasses social dominance,

superficial charm, emotional resilience, and a propensity for risk-taking and fearlessness in the face of threat or uncertainty (Dotterer et al., 2017; Sellbom & Phillips, 2013).

Psychopathy is understood as a dimensional construct whose severity may range from subclinical to clinical manifestations (Babiak & Hare, 2006; Lykken, 2013). Clinical psychopathy is frequently associated with overt criminal behavior and the resulting legal consequences (Hare, 2003). In contrast, subclinical psychopathy is characterized by emotional detachment, manipulativeness, and instrumental aggression without necessarily involving illegal behavior (Babiak & Hare, 2006). Individuals in this subgroup often exhibit adaptive functioning in social and occupational domains, leading researchers to refer to them as “successful psychopaths” (Gao & Raine, 2010). Central to subclinical psychopathy is the Boldness trait, which encompasses a strong capacity to remain calm under pressure or in the face of threat, in addition to social efficacy and venturesomeness. The low threat sensitivity characterizing this phenotype is consistent with the low-fear hypothesis of psychopathy, which posits that reduced anxiety in individuals with psychopathic traits facilitates risk-taking behavior and impairs learning from negative experiences

(Hofmann, Mokros, & Schneider, 2026; Lykken, 1957).

Individual differences in threat reactivity can be studied based on defensive mechanisms such as the startle reflex, which involves a rapid, automatic response to sudden and intense stimuli (Bradley & Lang, 2016). The most important physiological component of the startle reflex is the blink response, which can be quantified using electromyography (EMG) of the orbicularis oculi (Grillon & Baas, 2003). The amplitude of the blink response varies as a function of emotional context. The reflex is typically potentiated during exposure to unpleasant stimuli and inhibited during exposure to pleasant stimuli (Bradley & Lang, 2016; Lang, Bradley, & Cuthbert, 1990; Miranda, Duschek, & Mata, 2025). Although the startle response provides a valid index of individual sensitivity to threat cues, its affective modulation reflects differential activation of the defensive motivational system as a function of emotional context (Bradley & Lang, 2016).

Individuals with psychopathy exhibit smaller overall startle responses and lower startle potentiation during aversive stimulation than controls, which has been linked to reduced engagement of the limbic structures involved in threat processing (Benning, Patrick, & Iacono, 2005; Buckels et al., 2023; Loomans, Tulen, & van Marle, 2015). Moreover, the emotional features of psychopathy might more accurately capture individual differences in startle responding than antisocial behaviors (Benning et al., 2005; Vaidyanathan, Hall, Patrick, & Bernat, 2011). Although these aberrations have been repeatedly demonstrated in forensic samples, studies examining community samples remain scant. However, a similar, albeit attenuated, pattern has been observed in individuals with subclinical psychopathic traits (Esteller, Poy, & Moltó, 2016). In that study, Boldness, but not Disinhibition or Meanness, was inversely related to startle potentiation during exposure to unpleasant stimuli.

Experimental paradigms based on instructed emotion modulation may be useful to explore emotional reactivity in psychopathy (Jackson, Malmstadt, Larson, & Davidson, 2000). In contrast to passive

exposure to emotional stimuli, this approach requires the voluntary modulation of emotional responses. Instructed enhancement and suppression of emotion during pleasant and unpleasant visual stimuli results in increased and decreased startle response amplitudes, respectively (Jackson et al., 2000; Conzelmann, McGregor & Pauli, 2015). The application of this method in violent offenders revealed a smaller increase in heart rate during deliberate emotion enhancement among individuals with higher levels of psychopathy (Casey, Rogers, Burns, & Yiend, 2013). However, subjective emotional experience during the procedure was unaffected by psychopathy. To date, such research has not been conducted in subclinical psychopathy, and the potential role of Boldness in deliberate emotion regulation remains unexplored. The association of Boldness with low fear during threat or uncertainty may even suggest an enhanced ability to downregulate emotional responses under such conditions.

Individual differences in emotional experiences during threatening situations may be associated with differences in emotion regulation – i.e., the ability to deliberately influence affective states and their expression in interpersonal contexts (Gross, 2015). Cognitive emotion regulation strategies have been extensively studied, with adaptive strategies being effective in reducing the emotional impact of aversive stimuli (Buhle et al., 2014; Morawetz, Bode, Derntl, & Heekeren, 2017). For example, strategies such as deliberate distraction and cognitive reappraisal may reduce subjective and physiological responses to unpleasant stimuli (Buhle et al., 2014; Paul, Simon, Kniesche, Kathmann, Endrass, 2013). Accordingly, it may be hypothesized that the smaller emotional responses to threatening situations seen in individuals with high Boldness relates to greater use of adaptive emotion regulation strategies (Brislin et al., 2016; Burghart, Sahm, Schmidt, Bulla, & Mier, 2024).

The present study aimed to investigate defensive responses in individuals differing in Boldness levels. Boldness was chosen because, among the components of the triarchic model of psychopathy, it is the one most closely associated with low anxiety and reduced threat sensitivity (Patrick et al., 2009; Sellbom & Phillips, 2013). Psychophysiological threat responses were assessed using a startle paradigm, in which the blink response was recorded during exposure to unpleasant and pleasant pictures, including images depicting adventure, erotic content, threats, and victims of violence (Lang, 2005). In addition to passive viewing of the images, an instructed emotion modulation paradigm was employed to assess the ability to deliberately influence psychophysiological responses (Jackson et al., 2000). Moreover, habitual emotion regulation strategies were assessed using self-report questionnaires.

The following hypotheses were tested. (1) As a psychophysiological indicator of reduced threat sensitivity, individuals high in Boldness were expected to exhibit an overall weaker blink response in the startle paradigm than individuals low in Boldness. (2) With regard to affective modulation of the startle reflex (Lang et al., 2016), the blink response was expected to be stronger during the viewing of images depicting threats and victims of violence than when viewing images with adventure and erotic content across the entire sample. (3) Based on previous findings in psychopathy (Benning et al., 2005; Pastor et al., 2003; Patrick et al., 2009), and in accordance with the low-fear hypothesis of psychopathy, high Boldness was expected to be associated with reduced startle potentiation during exposure to images depicting threats and victims of violence. (4) In the entire sample, deliberate enhancement and

suppression of emotion were expected to result in increased and decreased startle response amplitudes, respectively (Jackson et al., 2000; Conzelmann et al., 2015). (5) Given the lower threat sensitivity related to Boldness (Patrick et al., 2009; Sellbom & Phillips, 2013), attenuation of the startle response during unpleasant stimuli (i.e., threats and victims of violence) through deliberate emotion modulation was expected to be greater in individuals high in Boldness than in those low in Boldness. (6) Finally, given the lower anxiety and reduced threat sensitivity associated with Boldness, individuals high in Boldness were expected to report greater use of adaptive emotion regulation strategies than those low in Boldness.

2. Methods

2.1. Participants

Participants were selected according to two steps. In the first step (screening), 434 undergraduate students from the University of Granada (Spain) completed the Triarchic Psychopathy Measure (TriPM; Brislin et al., 2015; Patrick, 2010) (see section 2.3). Students with scores from the two extreme quintiles of the Boldness scale of the TriPM (percentile ranks > 80% and < 20%, respectively) were selected as potential participants. In the second step, the resulting 174 students were contacted by telephone. Only those who met the following criteria were invited to participate in the study: (1) aged between 18 and 45 years; (2) good physical health; (3) absence of relevant current mental disorders; (4) no use of psychoactive drugs; (5) no (uncorrected) visual or auditory deficiencies; and (6) availability to participate in a testing session at University of Granada.

A total of 67 participants were finally enrolled in the study (42 women, 25 men; mean age = 21.33 years, standard deviation [SD] = 4.62 years; age range: 18–44 years). The High Boldness group comprised 35 participants (23 women, 12 men; mean age = 21.09 years, SD = 4.39 years); the Low Boldness group comprised 32 participants (19 women, 13 men; mean age = 21.59 years, SD = 4.92 years). Table 1 includes the statistics of the three TriPM scales according to gender. While men scored higher than women on the Meanness scale ($p = .021$, $d = 0.60$), no gender differences were found for the Boldness or Disinhibition scales. Age, gender, and TriPM scale scores in both study groups are shown in Table 2. The groups did not differ in gender distribution or mean age. The High Boldness group showed a higher Meanness scale score; Disinhibition scale scores did not differ between groups.

Table 1

Triarchic Psychopathy Measure (TriPM) scores in the final sample according to gender.

	All (N = 67)		**Men (n = 22)**		**Women (n = 45)**	
	M	***SD***	***M***	***SD***	***M***	***SD***
Boldness	29.72	11.61	31.21	9.83	28.88	12.53
Meanness	11.09	8.01	14.08	8.86	9.42	7.06
Disinhibition	19.76	8.56	20.29	9.07	19.47	8.35

Table 2

Demographics and Triarchic Psychopathy Measure (TriPM) scores in the High and Low Boldness groups; statistics of the group comparisons.

Gender (women/men)	**High Boldness (*n* = 35)**	**Low Boldness (*n* = 32)**	**Test statistics**	***p***
	23/12	**19/13**	**$\chi^2(1) = 0.29$**	**.592**
Age, M (SD)	21.09 (4.39)	21.59 (4.92)	$F(1, 65) = 0.20$	.657
Boldness, M (SD)	39.00 (6.46)	19.56 (6.13)	$F(1, 65) = 158.88$	< .001
Meanness, M (SD)	13.66 (9.32)	8.28 (5.08)	$F(1, 65) = 8.37$	.005
Disinhibition, M (SD)	19.49 (7.98)	20.06 (9.27)	$F(1, 65) = 0.08$	.785

Note. Group differences in gender were tested with a chi-square test, and differences in age and TriPM scores with one-way ANOVAs.

2.2. Experimental task

In total, 70 images from the International Affective Picture System (IAPS; Lang, 2005; Spanish validation by Moltó et al., 1999, 2013 and Vila et al., 2001) were selected for the task. They included 15 adventure-related pictures (e.g., extreme sports), 15 erotic pictures (e.g., erotic couples), 15 pictures depicting threats to others (e.g., people wielding weapons) and 15 pictures of victims (e.g., mutilations). In addition, 10 neutral pictures (e.g., furniture) were used.

The reference values of the pictures on the valence and arousal domains were as follows (Moltó et al., 1999; Lang et al., 2005). Adventures: valence, M = 7.12, SD = 1.15; arousal, M = 6.32, SD = 0.53; erotic: valence, M = 7.44, SD = 0.23; arousal, M = 6.16, SD = 0.73; threat-to-others: valence, M = 2.97, SD = 0.55; arousal, M = 6.66, SD = 0.6; victims: valence, M = 2.15, SD = 0.31; arousal, M = 6.91, SD = 0.35; and neutral: valence, M = 5.16, SD = 0.34; arousal, M = 1.84, SD = 0.48).[1]

The task was controlled by E-Prime 2.0 software (Psychology Software Tools, Sharpsburg, PA, USA) and followed the structure described by Conzelmann et al. (2015) (Fig. 1). Stimuli were presented on a computer monitor at eye level in front of the participants (viewing distance = 80 cm). All trials including

emotional images began with an emotion regulation instruction ("Enhance," "Decrease," or "Don't change"), which was presented for 2 s in the center of the screen. The emotional image (1,024 × 768 pixels, visual angle 22.3° × 16.8°) was then shown for 8 s. Startle probes (105 dB, 50 ms, instantaneous rise time) were presented 2, 4, or 7 s after picture onset. Neutral images were not preceded by emotion regulation instructions. The interstimulus interval was 8, 10, or 12 s; four interstimulus intervals contained a startle probe at 6 s to reduce predictability. Trials were presented in 10 blocks, each including seven images (three pleasant, three unpleasant, one neutral). Block order was randomized across participants (10 different orders). Before the task began, participants completed a practice block of three trials (one trial per regulation instruction).

Instructed Emotion modulation followed the procedure described by Jackson et al. (2000). When the instruction was "Enhance" or "Decrease," participants were asked to intensify or attenuate the emotion evoked by the image. When the instruction was "Don't change," they had to attend to the image without altering the emotion. Participants were not provided with specific strategies; they were free to use their own. The only constraint was that they should keep their gaze focused on the screen and that the strategy should be related to the image (i.e., they were instructed not to think about anything other than the image).

After completing the task, participants rated the images on the Self-Assessment Manikin (SAM) scale (Bradley & Lang, 1994; Lang, 1980) (see section 2.3). Moreover, they completed a post-task questionnaire including the question of how difficult they found it to modulate their emotions and which techniques they used for this purpose (see section 2.3).

2.3. Self-report measures

The TriPM (Brislin et al., 2015; Patrick, 2010; Spanish version by Poy et al., 2014) is a self-report instrument designed to assess the three domains of the triarchic model of psychopathy: Boldness, Disinhibition, and Meanness. The questionnaire consists of 58 items rated on a 4-point Likert scale (False, Mostly False, Mostly True, True). In our initial sample (N = 434), Cronbach's alpha was .84 for Boldness, .81 for Disinhibition, and .81 for Meanness.

The Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski, Kraaij, & Spinhoven, 2002; Spanish version by Domínguez-Sánchez, Lasa-Aristu, Amor, & Holgado-Tello, 2013) includes 36 items assessing the cognitive regulation of emotions in response to stressful, threatening, or traumatic events. Items are rated on a 5-point Likert scale (1 = [almost] never, 5 = [almost] always). The nine subscales of the instrument are Self-Blame, Acceptance, Rumination, Positive Refocusing, Refocus on Planning, Positive Reappraisal, Putting into Perspective, Catastrophizing, and Other-Blame. In the Spanish validation, Cronbach's alpha for the subscales ranged from .60 to .89 (Domínguez-Sánchez et al., 2013).

The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004; Spanish version by Hervás & Jódar, 2008) evaluates aspects of the emotion regulation process on Lack of Emotional Control, Life Interference, Emotional Inattention, Emotional Confusion, and Emotional Rejection subscales (5-point

Likert scale ranging from 1 = almost never to 5 = almost always). In the Spanish validation, Cronbach's alpha of the subscales ranged from .73 to .91 for the subscales (Hervás & Jódar, 2008).

The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003; Spanish version by Cabello, Salguero, Fernández-Berrocal, & Gross, 2013) is a 10-item questionnaire that quantifies the use of two of the emotion-regulation strategies Cognitive Reappraisal and Expressive Suppression. Items are rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). In the Spanish validation, Cronbach's alpha was .79 and .75, respectively (Cabello et al., 2013).

State and Trait Anxiety were assessed with the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1982; Spanish version by Guillén-Riquelme & Buela-Casal, 2011). The State and Trait scales both include 20 items rated on a 4-point Likert scale (0 = almost never, 3 = almost always). Cronbach's alpha for the State and Trait scales was .94 and .90, respectively (Guillén-Riquelme & Buela-Casal, 2011).

Participants rated the emotional images on the SAM (Bradley & Lang, 1994; Lang, 1980), a pictorial assessment tool that measures three dimensions of emotional experience: Valence, Arousal, and Dominance. Only the Arousal and Valence scales were used in this study. The computerized version of the SAM was used, which provides a 9-point Likert-type continuum for each stimulus and dimension.

The post-task questionnaire included the question of how difficult it was for the participant to modify their emotional response to the different images. The response was provided on a 5-point Likert scale (0 = not difficult at all, 4 = extremely difficult) for pleasant and unpleasant images. Furthermore, participants were asked to describe in their own words the strategy they used to modify their emotions.

2.4. Apparatus and psychophysiological recordings

Visual stimuli were presented on a 19-inch LG VGA monitor (resolution: 1366 × 768 pixels, refresh rate: 60 Hz). Auditory stimuli were generated using a LabLinc V85-05 sound generator (Coulbourn Instruments, Allentown, PA, USA) connected to an audio amplifier (IMG Stage Line; Monacor International, Bremen, Germany). Sounds were delivered binaurally through K240 headphones (AKG Acoustics, Vienna, Austria). Prior to each experimental session, sound intensity was calibrated using a model 2235 precision sound-level meter equipped with a model 4153 artificial ear (Brüel & Kjær, Nærum, Denmark).

The EMG was recorded using a Biopac MP150 system with an EMG100C amplifier (Biopac Systems Inc., Goleta, CA, USA). Two Ag/AgCl electrodes (4 mm diameter) were placed below the left eye, over the orbicularis oculi muscle, to record muscular activity associated with the eye-blink response, following the SPR Committee guidelines (Blumenthal et al., 2005). Prior to electrode placement, the skin was cleaned with distilled water and gently abraded with a fine abrasive paste to reduce electrode impedance. Impedance was kept below 4 kΩ; electrodes were reattached if necessary. The signal was sampled at 1000 Hz and high-pass (28 Hz) and a low-pass (500 Hz) filtered; a notch filter at 50 Hz was applied to remove power-line noise.

AcqKnowledge 4.2 software (Biopac Systems Inc.) was used for offline signal processing. The signal was integrated and rectified using root-mean-square (RMS) integration with a 20-ms time constant. Startle-reflex amplitude was determined as the difference in EMG signal between baseline (average over the 20-ms window prior to probe onset) and peak (between 21 and 160 ms after probe onset). Trials with no detectable response within this window were scored as zero-magnitude responses, in line with Blumenthal et al. (2005); trials contaminated by movement artifact or spontaneous EMG activity during baseline were rejected and treated as missing. Amplitudes were standardized within participants (T scores) to control for between-subject variability in baseline EMG.

2.5. Procedure

Each participant attended a single experimental session lasting approximately 2 hours. After being informed about the study, participants read and signed an informed consent form and completed the questionnaires. The experiment was performed in an isolated, dimly lit room; participants sat in a comfortable armchair during task execution. A 5-min adaptation period preceded the task; its duration was approximately 30 min.

The Ethics Committee of the University of Granada approved the experimental protocol, which complied with the American Psychological Association ethical standards and the Declaration of Helsinki. All participants received academic credit as compensation.

2.6. Data analysis

For statistical analysis of the eyeblink response, a mixed ANOVA was conducted with the between-subjects factor Group (High Boldness, Low Boldness) and the within-subjects factors Image Valence (adventure, erotic, threat-to-others, victims) and Regulation Instruction (Enhance, Decrease, Don't change). The amplitude of the EMG response served as dependent variable. SAM ratings were analyzed using mixed ANOVAs with the between-subjects factor Group (High Boldness, Low Boldness) and the within-subjects factor Image Valence (adventure, erotic, threat-to-others, victims). Separate models were computed for Valence and Arousal. The perceived difficulty of emotion modulation was analyzed using a mixed ANOVA with the between-subjects factor Group (High Boldness, Low Boldness) and the within-subjects factors Valence (pleasant, unpleasant) and Regulation Instruction (Enhance, Decrease, Don't change). When the sphericity assumption was violated in the ANOVAs, the Greenhouse–Geisser correction was applied. Corrected p values are reported alongside the original degrees of freedom. Alpha was set at .05 in these analyses.

Group differences in trait anxiety (STAI) and emotion regulation questionnaire (DERS, CERQ, and ERQ) scores were examined by one-way ANOVAs with the between-subjects factor Group (High Boldness, Low Boldness). When the assumption of homogeneity of variance was violated, Welch's F values were reported. To account for multiple testing, p values were adjusted using the Holm–Bonferroni procedure within each questionnaire (Holm, 1979).

Effect sizes (partial eta-squared, η^2, and Cohen's *d*) are reported together with the ANOVA statistics. η^2 values of .01, .06, and .14 and Cohen's *d* of .20, .50, and .80 denote small, medium, and large effect sizes, respectively (Cohen, 1988). All analyses were performed using SPSS Statistics 25 (IBM Corp., Armonk, NY, USA).

3. Results

3.1. Startle response

The startle response amplitudes are displayed in Fig. 2. ANOVA revealed an effect of Group (F[1, 65] = 4.80, p = .032, η^2 = .069); the High Boldness group (M = 48.88, SD = 8.87) showed a smaller response than the Low Boldness group (M = 55.98, SD = 16.77). The effect of Regulation Instruction was also significant (F[2, 130] = 12.62, p < .001, η^2 = .163). Response amplitude was larger for the Enhance than for the Decrease (t[66] = 4.97, p < .001) and Don't change (t[66] = 3.14, p = .003) instructions. Amplitude did not differ between the Decrease and Don't change instructions (t[66] = 1.54, p = .129). Finally, an effect of Image Valence was seen (F[3, 63] = 5.78, p = .001, η^2 = .216). The response was largest for threat-to-others images (M = 52.89, SD = 14.21), followed by victims (M = 52.52, SD = 14.15), adventure (M = 52.10, SD = 13.55), and erotic images (M = 51.57, SD = 13.61). However, only the differences between threat-to-others and erotic images (t[66] = 2.24, p = .028) and adventure and erotic images (t[66] = 2.62, p = .011) were significant. None of the interaction effects reached significance: Group × Image Valence, F(3, 195) = 0.31, p = .638, η^2 = .005; Group × Regulation Instruction, F(2, 130) = 0.03, p = .967, η^2 < .001; Image Valence × Regulation Instruction, F(6, 390) = 2.06, p = .057, η^2 = .031; Group × Image Valence × Regulation Instruction, F(6, 390) = 0.67, p = .672, η^2 = .010.

3.2. Self-report data

3.2.1. Self-Assessment Manikin

The ratings on the Arousal and Valence SAM scales are depicted in Fig. 3. The ANOVAs revealed an effect of Image Valence for both the Valence (F[4, 260] = 378.18, p < .001, η^2 = .853) and Arousal (F[4, 260] = 152.94, p < .001, η^2 = .702) scales. Threat-to-others (M = 3.20, SD = 0.88) and victims (M = 2.47, SD = 0.68) images were rated as more unpleasant than neutral (M = 5.05, SD = 0.48), adventure (M = 6.70, SD = 1.07), and erotic (M = 7.22, SD = 1.19) images (all ps < .001). Victims (M = 5.53, SD = 1.21), erotic (M = 5.47, SD = 1.72), adventure (M = 5.44, SD = 1.85), and threat-to-others (M = 5.13, SD = 1.40) images were rated as more arousing than neutral images (M = 1.83, SD = 1.05) (all ps < .001), and victims images were rated as more arousing than threat-to-others images (p < .001). An effect of Group arose for the Valence scale (F[1, 65] = 10.83, p = .002, η^2 = .143); the High Boldness group rated images as more pleasant overall (M = 5.08, SD = 0.37) than the Low Boldness group (M = 4.76, SD = 0.44). The remaining main effects and the interaction effects did not reach significance.

3.2.2. Post-task questionnaire

The ANOVA for the perceived difficulty of emotion modulation revealed an effect of Group (F[1, 65] = 6.13, p = .016, η^2 = .086); the High Boldness group reported less difficulty (M = 1.26, SD = 0.49) than the Low Boldness group (M = 1.59, SD = 0.59). An effect of Regulation Instruction also arose (F[2, 130] = 41.31, p < .001, η^2 = .389). Participants indicated the highest difficulty for the Decrease instruction (M = 2.10, SD = 0.77), followed by Enhance (M = 1.31, SD = 0.83) and Don't change (M = 0.87, SD = 0.94). Pairwise comparisons showed that all three instructions differed significantly from each other (all p < .01). While the effect of Valence was not significant (F[1, 65] = 1.51, p = .224, η^2 = .023; pleasant: M = 1.37, SD = 0.54; unpleasant: M = 1.48, SD = 0.77), a Valence × Regulation Instruction interaction was seen (F[2, 130] = 13.17, p < .001, η^2 = .168). Enhancing emotional responses was rated as more difficult for pleasant (M = 1.56, SD = 1.06) than for unpleasant pictures (M = 1.07, SD = 1.10), p = .005, whereas not changing them was rated as more difficult for unpleasant (M = 1.12, SD = 1.13) than for pleasant pictures (M = 0.62, SD = 0.94), p < .001. The difference between valence categories was not significant for the Decrease instruction.

3.2.3. Anxiety and emotion regulation

Table 3 presents the results of the group comparisons for the self-report questionnaires of anxiety and emotion regulation. The High Boldness group reported lower State and Trait Anxiety on the STAI than the Low Boldness group. For the DERS, the High Boldness group scored lower on the Lack of Emotional Control, Emotional Rejection, Emotional Confusion, and Emotional Inattention scales. For the CERQ, the High Boldness group exhibited higher scores for the Refocus on Planning and Positive Reappraisal strategies and lower scores for Catastrophizing. Furthermore, higher scores in the High Boldness group were seen on the Cognitive Reappraisal ERQ scale. No group differences arose for the remaining questionnaire scales.

Table 3

Self-Report measures of anxiety and emotion regulation in both groups.

Measure	High Boldness (*n* = 35)		Low Boldness (*n* = 32)				
	M	***SD***	***M***	***SD***	***F* (1, 65)**	p_{Holm}	***d***
STAI							
State Anxiety	12.74	5.74	17.13	7.67	7.09	.010	−0.65
Trait Anxiety	14.03	7.21	24.78	9.54	26.72	< .001	−1.28
DERS							
Lack of Emotional Control	15.14	6.19	19.81	5.73	10.21	.011	−0.78
Emotional Rejection	13.11	6.07	18.00	6.93	9.45	.012	−0.75
Life Interference	9.97	3.86	11.44	5.11	1.73	.194	−0.33
Emotional Inattention	6.91	2.49	8.88	3.66	6.67	.024	−0.63
Emotional Confusion	6.57	1.82	8.63	3.61	8.41	.017	−0.73
CERQ							
Self-Blame	10.00	2.98	11.97	3.31	6.57	.076	−0.63
Acceptance	14.60	2.56	14.19	2.72	0.41	> .99	0.16
Rumination	14.23	3.18	14.84	3.91	0.50	> .99	−0.17
Positive Refocusing	12.11	3.39	9.97	4.11	5.48	.089	0.57
Refocus on Planning	17.11	1.97	14.63	3.89	10.61	.019	0.82
Positive Reappraisal	16.23	3.37	13.44	4.30	8.84	.033	0.73
Putting into Perspective	14.94	3.56	12.41	4.61	6.43	.076	0.62
Catastrophizing	6.89	2.72	9.16	3.58	8.65	.033	−0.72
Other-Blame	7.63	3.20	7.88	2.25	0.13	> .99	−0.09
ERQ							
Cognitive Reappraisal	31.63	5.43	28.06	5.89	6.65	.024	0.63

Note. STAI = State–Trait Anxiety Inventory; DERS = Difficulties in Emotion Regulation Scale; CERQ = Cognitive Emotion Regulation Questionnaire; ERQ = Emotion Regulation Questionnaire; p_{Holm} = *p* value adjusted using the Holm–Bonferroni procedure within each questionnaire; *d* = Cohen's *d* (negative values indicate lower scores in the High Boldness group).

Measure	High Boldness (*n* = 35)		Low Boldness (*n* = 32)				
	M	*SD*	*M*	*SD*	*F* (1, 65)	p_{Holm}	*d*
Expressive Suppression	12.37	6.74	14.13	5.70	1.31	.257	−0.28

Note. STAI = State–Trait Anxiety Inventory; DERS = Difficulties in Emotion Regulation Scale; CERQ = Cognitive Emotion Regulation Questionnaire; ERQ = Emotion Regulation Questionnaire; p_{Holm} = *p* value adjusted using the Holm–Bonferroni procedure within each questionnaire; *d* = Cohen's *d* (negative values indicate lower scores in the High Boldness group).

4. Discussion

The present study aimed to investigate defensive responses in individuals differing in the Boldness dimension of the triarchic model of psychopathy using a startle paradigm (Patrick et al., 2009). The startle reflex was quantified via EMG as the eyeblink response following intense noise stimulation during passive viewing of affective images and instructed emotion modulation. Participants scoring high on the Boldness scale of the TriPM showed smaller response amplitudes than those scoring low, irrespective of affective stimulus valence. In the total sample, negatively valenced images were associated with stronger eyeblink responses than positively valenced images, while deliberate emotion enhancement led to increased amplitude. However, the effects of image valence and emotion modulation did not differ as a function of Boldness. Participants from the High Boldness group rated the emotional images as more pleasant overall than those from the Low Boldness group. In addition, they reported less state and trait anxiety and scored higher on several questionnaire scales assessing adaptive emotional regulation strategies and lower on those assessing maladaptive strategies.

The smaller startle response in the High Boldness group compared with the Low Boldness group, which showed a medium effect size, is consistent with previous findings on psychopathy (Buckels et al., 2023; Loomans et al., 2015). The observed amplitude reduction, irrespective of emotional context, supports the hypothesis of generally lower defensive reactivity in individuals high in Boldness (Lang et al., 1990; Bradley, Moulder, & Lang, 2005). Although Buckels et al. (2023) likewise reported an inverse association between Boldness and the general startle amplitude, most studies have related individual differences in Boldness to differences in emotional startle modulation. For example, Esteller et al. (2016) observed a smaller increase in amplitude during the viewing of threat-related compared with neutral images in undergraduates with high versus low Boldness levels. Similarly, in a community sample, Benning et al. (2005) found an inverse relationship between fearless dominance and fear-induced startle potentiation. Among female undergraduates classified according to their level of fearless dominance, those with high expression of the trait exhibited a blunted increase in the startle response when viewing unpleasant compared with pleasant images (Anderson, Stanford, Wan, & Young, 2011).

According to the motivational priming hypothesis, defensive responses, such as the startle reflex, are automatically potentiated during aversive experiences and inhibited during positive emotional experiences (Lang, 1995; Lang et al., 1990). Therefore, the previous findings may reflect lower negative affect and defensive motivation in those with higher Boldness. In contrast, the conclusion that can be drawn from the present observation of an overall smaller eyeblink amplitude is limited to generally defensive hypo-reactivity in individuals high in Boldness. The differences between these findings may relate to the characteristics of the present paradigm, which involved emotion modulation, in addition to passive picture viewing. The expected effect of emotional image valence emerged in the total sample with a medium effect size. Though unpleasant images were overall associated with a larger startle response than pleasant images, significant differences in response were observed only between threat-to-others and erotic images, and between adventure and erotic images. A lack of systematic differences in the startle response between these image categories has previously been reported and ascribed to limited differences in the motivational salience of the stimuli (Bernat et al., 2006; Bradley et al., 2001; Conzelmann et al., 2015). Moreover, the instructed enhancement and reduction of emotional responses, which was required during two-thirds of the emotional image presentations, might have interfered with the primary effect of image valence. In turn, this may have limited the ability of the paradigm to differentiate between individual levels of emotional startle potentiation and inhibition.

The High Boldness group rated the emotional images more positively overall than the Low Boldness group, with a large effect size for the effect of Group. This is in line with the assumption of a more positive affective profile associated with Boldness. Boldness correlates positively with positive affect, sociability, and resilience, and negatively with negative affect, fearfulness, and distress (Brislin, Drislane, Smith, Edens, & Patrick, 2015; Dotterer et al., 2017; Ruchensky, Donnellan, Hopwood, Edens, Skodol, & Morey, 2022). This is also consistent with the lower state and trait anxiety observed in the High Boldness group in the present study. Previous findings on the relationship between Boldness and ratings of experimental stimuli are mixed. Schneider, Hofmann, and Mokros (2025) reported that higher Boldness was associated with more positive evaluations of fear-inducing stimuli, whereas in other studies Boldness was unrelated to the valence ratings of emotional images (Ruchensky, Bauer, Edens, & MacNamara, 2023; Soong et al., 2026). The more positive stimulus evaluations in the High Boldness group may be relevant to the interpretation of the smaller startle response observed in this group. It is well established that the startle reflex is sensitive to the valence dimension of emotion (Grillon & Baas, 2003; Kuhn et al., 2000; Miranda et al., 2025). Thus, a more positive emotional experience during stimulus exposure in individuals high in Boldness may have contributed to their smaller eyeblink responses.

Deliberate emotion modulation was followed by substantial changes in the startle response in the total sample, with a large effect size for the Regulation Instruction factor. Instructed emotion enhancement led to a stronger startle response compared with the instruction not to change the emotion, whereas no effect of instructed emotion decrease was seen. The method of emotion modulation was adapted from Jackson et al. (2000), in which instructed emotion enhancement and suppression increased and decreased startle amplitudes, respectively, during exposure to negative stimuli. This finding was

replicated by Lissek et al. (2007), who found that instructed emotion modulation changed the startle response in the expected directions while viewing unpleasant images and in a threat-of-shock condition. A similar finding was reported by Lee, Shackman, Jackson, and Davidson (2008) using unpleasant images. A more recent study included both positive (erotic, adventure) and negative (threat, victims) images (Conzelmann et al., 2015). Instructed emotion modulation produced the predicted effects on startle response, although they were independent of image valence; that is, neither the direction nor the magnitude of the effect differed between exposure to positive and negative images. This is consistent with our observation of an increased startle response following emotion enhancement, which did not vary according to image valence. Contrary to our hypothesis, the effect of the regulation instruction was independent of Boldness, indicating that the ability to influence the defensive responses through deliberate emotion modulation did not differ between individuals high and low in this trait. Though the High Boldness group reported less difficulty in modulating their emotions than the Low Boldness group (medium effect size), it is unlikely that greater active emotion suppression during the task accounts for the smaller defensive response in this group. Overall, participants reported far greater difficulty in decreasing than enhancing their emotional responses (large effect size of the Regulation Instruction factor), consistent with the lack of effect of decreased instructed emotion on the startle response.

On the STAI, state and trait anxiety were lower in the High Boldness group compared to the Low Boldness group (medium and large effect sizes, respectively). This accords with the definition of the Boldness construct, for which fearlessness and the propensity for risky behaviors are core components (Patrick et al., 2009; Sellbom & Phillips, 2013). Consistently, in previous studies, TriPM Boldness scale scores exhibited strong negative correlations with scores on both the STAI and the Sensation Seeking scale of the Revised Multiple Affect Adjective Check List (Zuckerman, Lubin, & Rinck, 1983), and with scores on the Fearlessness scale of the Revised Psychopathy Personality Inventory (Brislin et al., 2015; Dotterer et al., 2017; Lilienfeld, & Widows, 2005). Regarding emotion regulation, the High Boldness group scored lower than the Low Boldness group on the Lack of Emotional Control, Emotional Rejection, Emotional Confusion and Emotional Inattention DERS scales and the Catastrophizing CERQ scale (medium-to-large effect sizes), all of which reflect maladaptive regulation strategies. In contrast, this group scored higher on the Refocus on Planning (large effect size) and Positive Reappraisal CERQ (medium effect size) scales and the Cognitive Reappraisal ERQ scale (medium-to-large effect sizes), which measure positive cognitive strategies of emotion regulation.

Boldness is associated with adaptive and maladaptive behavioral tendencies (Brislin et al., 2015). For example, it is linked to a grandiose interpersonal style, which is reflected by a substantial correlation with scores on the Narcissistic Personality Inventory (Raskin & Terry, 1988; Sellbom & Phillips, 2013). Moreover, fearlessness and stress tolerance are closely related to thrill seeking and engagement in dangerous activities (Lykken, 1995; Sellbo, & Phillips, 2013). By contrast, the present study revealed positive emotional regulation strategies in individuals high in Boldness. The availability of strategies such as positive appraisal and refocus on planning, and lower use of strategies like catastrophizing and emotional confusion, inattention, and rejection is beneficial to general wellbeing and may contribute to good mental health (Aldao, Nolen-Hoeksema, & Schweizer, 2010). This is in accordance with reports of

more positive affect and resilience and less negative affect in individuals high in Boldness (Brislin et al., 2015; Dotterer et al., 2017; Ruchensky et al., 2022). Moreover, social dominance, fearlessness, and efficient coping with negative emotions are certainly helpful in asserting oneself against others and can thereby help one attain privileged positions within social groups and in professional hierarchies. In psychopathy research, it has been argued that good psychological adjustment may mask antisocial behaviors (Patrick, 2006). This view is consistent with the notion that a “mask of sanity” covers behavioral pathology in psychopathy (Cleckley, 1976, 1982). The positive behavioral correlates of the Boldness trait may be particularly relevant to the high psychosocial functioning observed in individuals with subclinical psychopathy, often referred to as “successful psychopaths.” (Gao & Raine, 2010).

The limitations of this study relate to the characteristics of the investigated sample. First, the predominance of female participants does not reflect the gender distribution in Boldness and Psychopathy in the general population, which limits the generalizability of the findings (Verona, Bresin, & Patrick, 2013). Moreover, although the study groups were defined based on Boldness, they also differed in Meanness, such that a confounding effect of the two traits in the analyses cannot be ruled out. This is particularly relevant insofar as the Meanness construct also encompasses thrill and adventure seeking (Patrick et al., 2009). Another limitation relates to the sample recruitment procedure, which involved selecting students according to their Boldness TriPM scale scores (percentile ranks > 80% and < 20). Although the initial sample was relatively large (N = 434), a considerable proportion of potential candidates were either ineligible for participation or met one or more exclusion criteria, resulting in relatively small study groups. Therefore, post hoc sensitivity analysis was conducted for the mixed ANOVAs. Based on an alpha error of 5% and a beta error of 20%, analysis with G* power (Faul, Erdfelder, Lang, & Buchner, 2007) revealed a critical F value of 3.99 for the effect of Group and a critical F value of 3.07 for the interactions. Although the sample size was sufficient to detect a significant effect of Group in the ANOVAs for the startle response, the valence SAM scale and the post-task questionnaire, potential smaller main effects and interactions may not have been detected.

In conclusion, the present study revealed a weaker startle response in individuals high in Boldness than in those low in Boldness, irrespective of emotional context, suggestive of generally lower defensive reactivity associated with this trait. Across the total sample, instructed emotion enhancement resulted in a marked increase in startle responses, indicating that individuals high in Boldness are equally capable of modulating their emotions and the associated physiological responses as individuals low in Boldness. Moreover, high Boldness was associated with lower trait anxiety and greater use of adaptive, as well as less use of maladaptive, emotion regulation strategies, which may contribute to better psychosocial adjustment and well-being. Social dominance and fearlessness, combined with resistance to threat and effective coping with emotional challenges, may facilitate success within social systems despite the presence of antisocial tendencies.

Declarations

Declaration of competing interests: We have nothing to declare.

Declaration of generative AI use: During the preparation of this work, the author(s) used Copilot in order to improve readability and language. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

Author Contributions Statement

L.M.L.R.: Writing – original draft, Data Curation, Formal analysis. **J.L.M.M.:** Conceptualization Supervision, Formal analysis, Validation. **J.P.C.:** Conceptualization, Investigation, Formal analysis, Methodology. **S.R.R.:** Investigation, Methodology. **S.D.:** Methodology, Supervision and Writing – review and editing-.

Ethical statement

Informed consent was obtained from all participants. All procedures in this study were in accordance with the Declaration of Helsinki and the study protocol was approved by the Ethics Committee of the University of Granada (No. 5386/CEIH/2025).

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Footnotes

1. IAPS codes of the images: adventures, 5623, 5626, 8021, 8031, 8034, 8040, 8041, 8080, 8161, 8180, 8200, 8210, 8250, 8400, 8490; erotic, 4599, 4606, 4607, 4608, 4611, 4640, 4641, 4650, 4651, 4653, 4658, 4660, 4670, 4680, 4680, 4690; threat-to-others, 2100, 2120, 2130, 2682, 6210, 6230, 6241, 6242, 6243, 6244, 6250, 6260, 6300, 6314, 6350; victims, 3051, 3400, 3500, 3550, 4621, 6212, 6312, 6530, 6571, 6821, 6831, 9250, 9400, 9420, 9421; neutral, 5534, 7006, 7009, 7034, 7035, 7080, 7090, 7175, 7233, 7235; practice trials, 2221, 3000, 4611

Figures

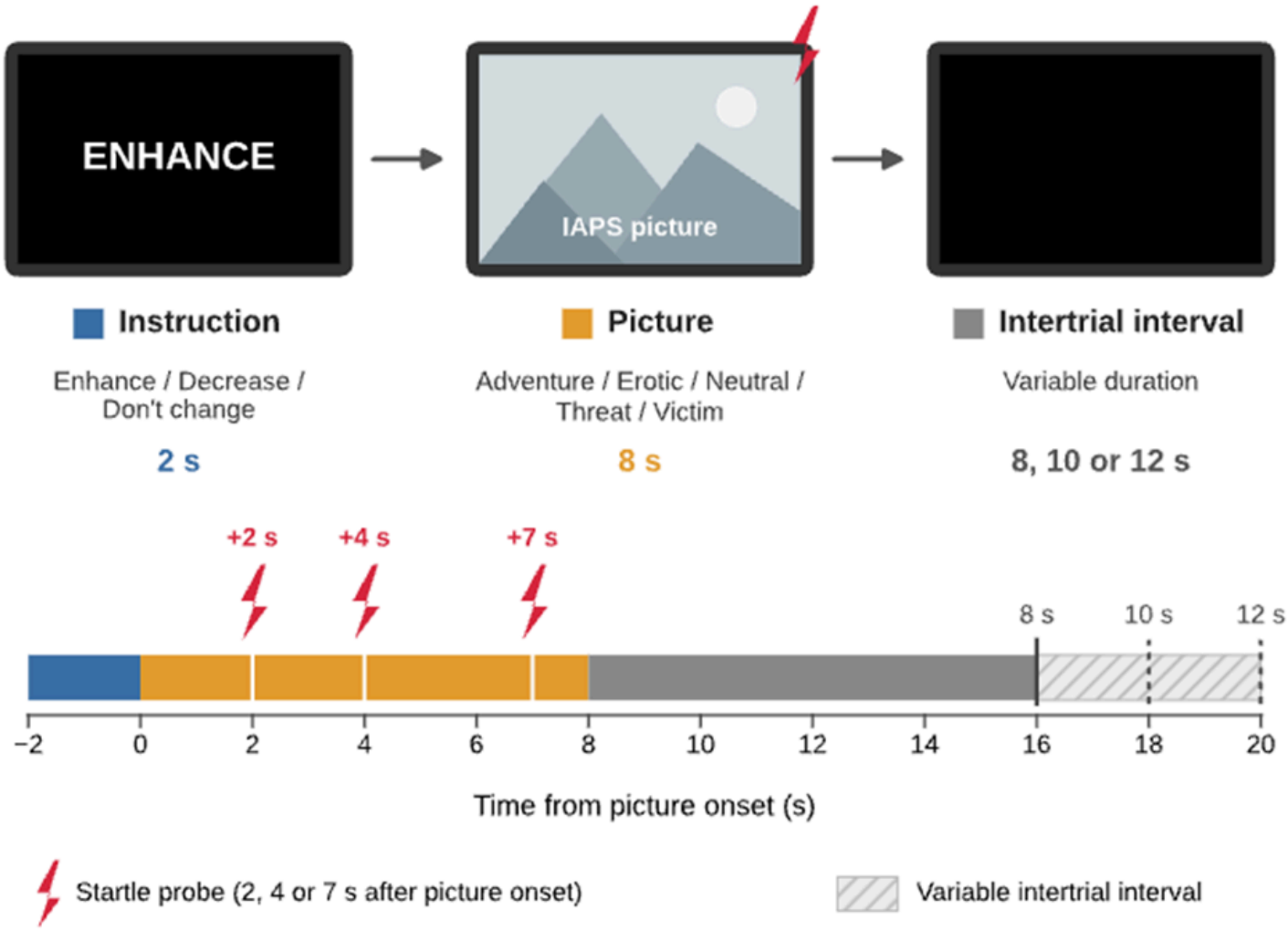


Figure 1

Note. Trials with emotional images began with an emotion regulation instruction (“Enhance”, “Decrease” or “Don't Change”; 2 s), followed by an IAPS picture (adventure, erotic, neutral, threat-to-others or victim; 8 s). An acoustic startle probe was delivered 2, 4 or 7 s after picture onset. Trials were separated by a variable intertrial interval of 8, 10 or 12 s. IAPS = International Affective Picture System.

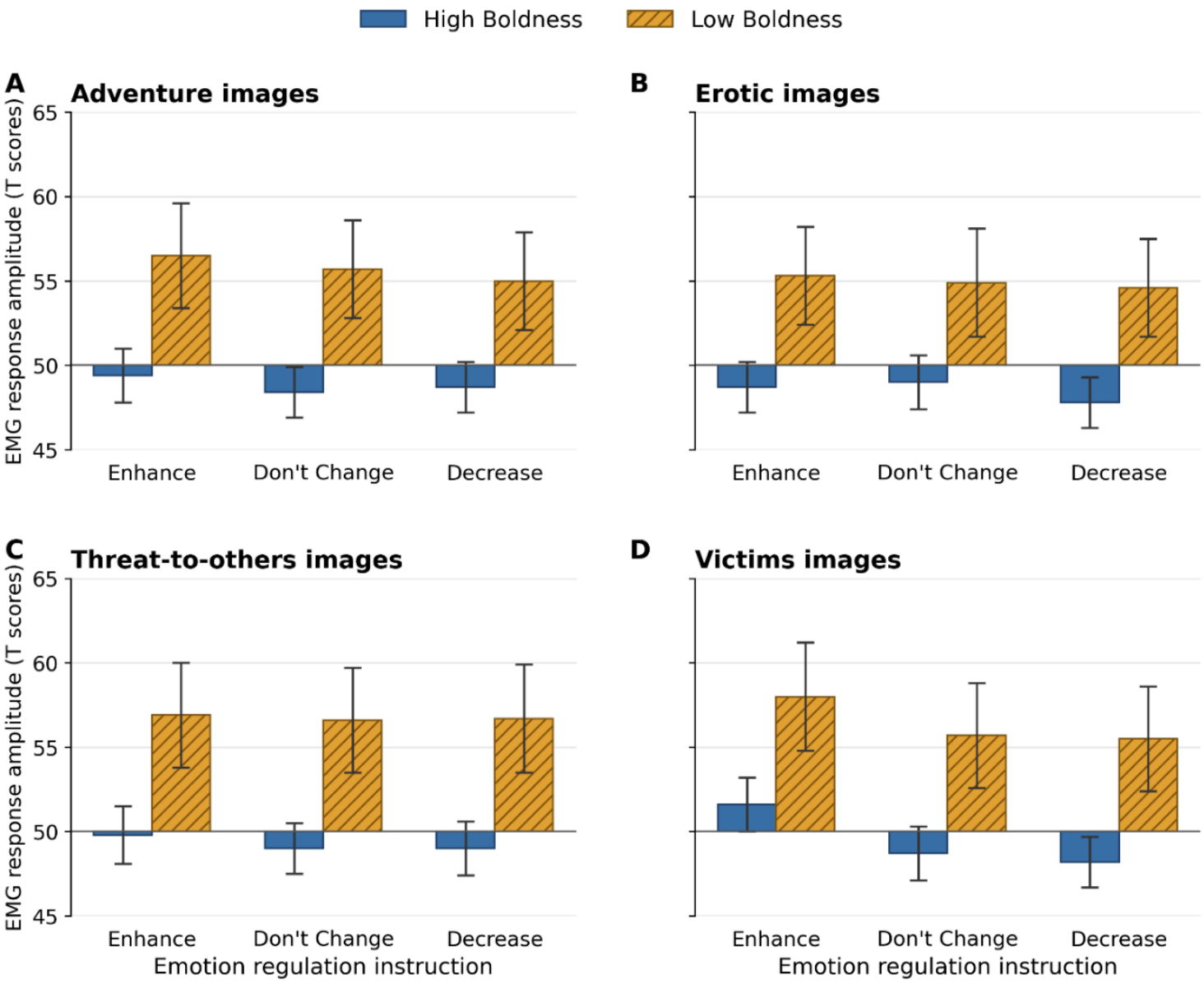


Figure 2

Note. Mean EMG response amplitudes (T scores) for the High and Low Boldness groups under each emotion regulation condition for (A) threat-to others, (B) victims, (C) adventure and (D) erotic images. Bars represent standard errors of the mean.

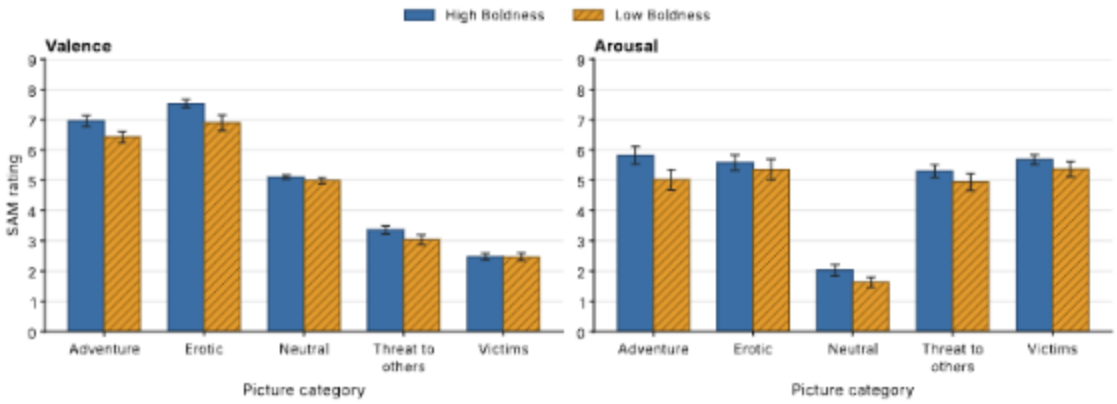


Figure 3

Note. Mean Self-Assessment Manikin (SAM) scores of Valence and Arousal for the four categories of Image Valence in the High and Low Boldness groups. Error bars represent standard errors of the mean.