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Deficient Aversive-potentiated Startle and the Triarchic Model of Psychopathy: The Role of Boldness

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Abstract

This study examined the contribution of the phenotypic domains of boldness, meanness, and disinhibition of the Triarchic conceptualization of psychopathy (Patrick, Fowles & Krueger, 2009) to deficient aversive-potentiated startle in a mixed-gender sample of 180 undergraduates. Eyeblink responses to noise probes were recorded during a passive picture-viewing task (erotica, neutral, threat, and mutilation). Deficient threat vs. neutral potentiation was uniquely related to increased boldness scores, thus suggesting that the diminished defensive reaction to aversive stimulation is specifically linked to the charm, social potency and venturesomeness features of psychopathy (boldness), but not to features such as callousness, coldheartedness and cruelty traits (meanness), even though both phenotypes theoretically share the same underlying low-fear disposition. Our findings provide further evidence of the differential association between distinct psychopathy components and deficits in defensive reactivity and strongly support the validity of the triarchic model of psychopathy in disentangling the etiology of this personality disorder.

Keywords: triarchic conceptualization of psychopathy, boldness, aversive-potentiated startle.

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INTRODUCTION

Psychopathy is a multifaceted personality disorder that is characterized by a cluster of interpersonal, affective, lifestyle and antisocial traits and behaviors, including deception, manipulation, irresponsibility, poor behavioral control, shallow affect, a lack of empathy, guilt or remorse, and a range of unethical and antisocial behaviors, that are not necessarily criminal (Hare, 2007). Although multiple psychological theories have attempted to explain the psychopathy construct, controversy about its definition and nature remains (cf. Skeem & Cooke, 2010).

For a long time, the dominant theoretical perspective on psychopathy has conceptualized this personality disorder as a unitary syndrome that arises from a core underlying pathology or deficit. One of the more influential and supported etiological theories included in this unitary-syndrome perspective is the low fear hypothesis, which proposes that psychopaths display a deficit in emotional reactivity that specifically relates to neurobiological systems that modulate fear—that is, psychopathic individuals may be marked by an under-reactivity of the brain's aversive/defensive motivational system (Lykken, 1995). The low fear hypothesis of psychopathy has been supported by different psychophysiological correlates and diverse experimental procedures. One of the most reliable indicators of fear reactivity deficits in psychopathy is a blunted startle reflex potentiation (Patrick, 1994). Startle reflex is an automatic defensive reaction to a sudden, intense event (Lang, Bradley, & Cuthbert, 1990). Research in normal individuals has widely demonstrated that the magnitude of the startle blink response is modulated by the affective valence of the stimulus context in which it is evoked (Lang et al., 1990); the startle blink response is normally attenuated during exposure to appetitive contexts (startle inhibition), and it is increased under aversive conditions (startle potentiation). Consistent with the unitary view of psychopathy, multiple studies

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have demonstrated that incarcerated psychopaths do not show the typical startle potentiation during aversive stimulation processing (Levenston, Patrick, Bradley, & Lang, 2000; Pastor, Moltó, Vila, & Lang, 2003; Patrick, Bradley, & Lang, 1993).

Later, dual-process models of psychopathy emerged (Fowles & Dindo, 2006, 2009; Patrick & Bernat, 2009), challenging the unitary view of psychopathy. The dual- or two-process conceptualization posits that separate neural mechanisms differentially contribute to the affective-interpersonal and impulsive-antisocial components of psychopathy, namely, *trait fearlessness*, which reflects a deficit or under-reactivity of the brain's aversive/defensive motivational system, and *externalizing vulnerability*, which reflects impairments in the frontocortical systems that mediate anticipation, planning, and inhibitory control (for empirical evidence, see, for example, Carlson, Thái, & McLarnon, 2009; Heritage & Benning, 2013; López, Poy, Patrick, & Moltó, 2013; Moltó, Poy, Segarra, Pastor, & Montañés, 2007; Patrick, Durbin, & Moser, 2012; Patrick & Lang, 1999; Venables, Hall, Yancey, & Patrick, 2015). Consistent with this perspective, studies examining the differential contribution of psychopathy components to reduced startle potentiation have demonstrated that this deficit is specifically related to the interpersonal and affective features of psychopathy, but not to its externalizing features. More importantly, this association has been confirmed in different samples, even when assessing affective-interpersonal traits via different psychopathy measures. In this regard, the deficient startle potentiation in psychopaths has been related to Hare Psychopathy Checklist-Revised (PCL-R; Hare, 2003) Factor 1, which encompasses the interpersonal and affective features of psychopathy, in incarcerated men (Patrick, 1994; Vaidyanathan, Hall, Patrick, & Bernat, 2011) and women (Verona, Bresin, & Patrick, 2013), as well as in mixed-gender community populations (Vanman, Mejia, Dawson, Schell, & Raine, 2003). Additionally, this deficit has been associated with the Fearless

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Dominance factor of the Psychopathic Personality Inventory-Revised (PPI-R; Lilienfeld & Widows, 2005) in community men (Benning, Patrick, & Iacono, 2005; estimated from Multidimensional Personality Questionnaire; Tellegen & Waller, 2008) and women (Anderson, Stanford, Wan, & Young, 2011), as well as in mixed-gender community populations (Poy et al., 2012). Therefore, research results suggest that the startle potentiation deficit (as a valid indicator of deficient fear reactivity) is specifically linked to the core affective and interpersonal features of psychopathy, irrespective of the sample characteristics (criminal, non-criminal) and gender. Furthermore, this finding suggests that only the charm, fearlessness, emotional detachment and low anxiety traits of psychopathy reflect an underlying weakness in the brain's core aversive/defensive motivational system.

It is remarkable that defensive deficits in psychopathy have been associated with indicators of emotional and interpersonal traits from different psychopathy measures (PCL-R Factor 1 and PPI-R Fearless Dominance), even though they do not seem to assess the affective/interpersonal features of the disorder in the same manner. First, PCL-R Factor 1 is described by selfishness, callousness, and the remorseless use of others (Hare, 1991, 2003), whereas the PPI-R Fearless Dominance is defined by low trait anxiousness, social dominance, and fearless risk taking (Benning, Patrick, Hicks, Blonigen, & Krueger, 2003). Second, PCL-R Factor 1 and PPI-R Fearless Dominance show small- to medium-sized correlations (Baskin-Sommers, Zeier, & Newman, 2009; Benning, Patrick, Blonigen, Hicks, & Iacono, 2005; Berardino, Meloy, Sherman, & Jacobs, 2005; Malterer, Lilienfeld, Neumann, & Newman, 2010), and although related, PCL-R Factor 1 and PPI-R Fearless Dominance only share a small amount of variance (4%; Marcus, Fulton, & Edens, 2013). Last, PCL-R Factor 1 does not measure anxiety and fear directly in any of its items (Hare, 2003) and is weakly and inconsistently

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correlated with anxiety and anxiety-related scales (Hare, 1991, 2003; Sandvik, Hansen, Hystad, Johnsen, & Bartone, 2015; Schmitt & Newman, 1999; Vitale, Smith, Brinkley, & Newman, 2002; Weizmann-Henelius, Viemerö, & Eronen, 2004). On the other hand, PPI-R Fearless Dominance directly assesses the traits of fearlessness and stress immunity, which are closer to classic descriptions of primary psychopathy than PCL-R (cf. Marcus et al., 2013). In contrast to PCL-R Factor 1, PPI-R Fearless Dominance shows negative associations with anxiety indices and questionnaires (Benning et al., 2003; Benning, Patrick, Blonigen et al., 2005; Edens & McDermott, 2010; Lilienfeld & Widows, 2005; Patrick, Edens, Poythress, Lilienfeld, & Benning, 2006; Ross et al., 2007; Uzieblo, Verschuere, & Crombez, 2007; Uzieblo, Verschuere, Van den Bussche, & Crombez, 2010).

Hence, although both PCL-R Factor 1 and PPI-R Fearless Dominance evaluate the affective and interpersonal traits of psychopathy, it seems that these instruments assess different configurations of interpersonal-affective characteristics. This predicament brings into question whether both clusters of affective-interpersonal traits—PCL-R Factor 1 and PPI-R Fearless Dominance— are equally related to the low fear temperament of psychopathy or, by contrast, one of them might be particularly relevant over and above the other to understand defensive reactivity deficits in psychopathy. Likewise, it is also possible that the contribution of each particular affective-interpersonal cluster to psychopathy-related deficits varies depending on the characteristics of the sample. For example, some affective-interpersonal traits might be more relevant to explain psychopaths' fear deficit in successful individuals (psychopaths that refrain from serious antisocial behavior), but not in unsuccessful individuals (and vice versa). Thus, examining the contribution of simpler configurations of affective-interpersonal psychopathy traits—instead of clustering them in a single

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component— to psychopathy-related deficits may help to clarify the specific psychopathy features that are particularly related to trait fearlessness.

The recently proposed triarchic conceptualization of psychopathy (Patrick, Fowles, & Krueger, 2009) could be useful to disentangle whether the above mentioned defensive deficit is related to both clusters of psychopathic personality features or, by contrast, whether it is specifically linked to one of them. Thus, this model classifies the affective and interpersonal traits of psychopathy into two distinct phenotypes, namely, *boldness* and *meanness* (and adds a third phenotype, *disinhibition*, which is related to the externalizing tendencies of the disorder). These three constructs have distinctive phenotypic identities and can be conceptualized, measured, and understood separately (although they are interrelated at some levels empirically, as well as in terms of their mutual connections with the phenomenon of psychopathy; Patrick et al., 2009). The triarchic conceptualization of psychopathy describes *disinhibition* as a general trend towards impulse control problems, including a lack of planning and foresight, impaired regulation of affect and impulses, an insistence on behaviors that involve immediate gratification, and a deficient control of behavior. In turn, *boldness* encompasses a propensity to remain calm in situations involving pressure or threat, the ability to easily recover from stressful events, high self-confidence, social effectiveness, and tolerance for unfamiliarity or dangers. Overall, this construct reflects the Cleckley traditional descriptions of psychopathy of social efficacy, the apparent absence of anxiety or neurotic psychopathology, a diminished affective responsiveness and certain punishment immunity (Cleckley, 1941/1976). Finally, *meanness* describes a set of attributes including low empathy, indifference and lack of attachment relationships, rebelliousness, sensation seeking, tendency to exploit others, and cruelty. In contrast to

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boldness, which emphasizes the description of non-criminal psychopathy, meanness is related to descriptions of criminal psychopaths (cf. McCord & McCord, 1964).

Etiologically, the triarchic model suggests that boldness and meanness are distinct phenotypic manifestations of the psychopaths' trait fearlessness; that is, both constructs share a fearlessness genotype as an etiological substrate (Patrick et al., 2009) that evolves into a boldness or meanness phenotype depending on certain developmental factors (such as a difficult temperament, or a failure of secure attachment). Then, the triarchic model provides a novel conceptualization of psychopathy that considers the affective-interpersonal component of psychopathy in terms of more elemental constructs or clusters. On the one hand, boldness encompasses the charm, persuasiveness, imperturbability, and venturesomeness characteristics of psychopathy (which would be directly measured by PPI-R Fearless Dominance; cf. Patrick et al., 2009), and on the other hand, meanness encompasses the deficient empathy, lack of close attachments, rebelliousness, and exploitativeness characteristics of the disorder (traits emphasized in PCL-R Factor 1; cf. Patrick et al., 2009). Thus, the triarchic perspective offers a valuable framework that can clarify the core traits that are directly related to the manifestation of fearlessness-related deficits in psychopaths. In this regard, examining aversive-potentiated startle deficits from a triarchic view may help to elucidate the differential contribution of affective-interpersonal clusters of psychopathy traits (represented differentially in boldness and meanness) to the manifestation of the psychopaths' trait fearlessness in different populations.

Hence, although past research has successfully associated a blunted startle potentiation with the affective-interpersonal component of psychopathy (Anderson et al., 2011; Benning, Patrick, & Iacono, 2005; Patrick et al., 1993; Vaidyanathan et al., 2011; Vanman et al., 2003; Verona et al., 2013), recent proposals suggest that this

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component could encompass a wide variety of traits that are distributed into different clusters of affective and interpersonal characteristics—which the triarchic conceptualization (Patrick et al., 2009) could aid to disentangle. To provide new insights into the specific affective and interpersonal traits of psychopathy that are related to deficits in defensive (fear) reactivity in non-incarcerated participants, here we explored the differential contribution of boldness, meanness and disinhibition to the affective modulation of the startle reflex during an affective picture-viewing task in a mixed-gender undergraduate sample. Based on the theoretical description of the boldness and meanness domains—which suggests that both boldness and meanness are phenotypical expressions of a fearlessness genotype (Patrick et al., 2009)— as well as previous findings for psychopathy components in relation to deficient startle potentiation, here we hypothesized that this deficit would be related to boldness and/or meanness, but not to the disinhibition domain.

A secondary aim of this study was to evaluate whether psychopathy-related deficits in startle modulation depend on the specific aversive content depicted, an issue that has been barely addressed in the previous literature. Studies on the psychopaths' blunted startle potentiation during aversive stimulation have usually collapsed different picture contents—such as mutilations, victimization scenes, aimed guns or attacking animals— into one broad unpleasant category (cf. Benning, Patrick, & Iacono, 2005; Pastor et al., 2003; Patrick et al., 1993; Vanman et al., 2003). The few studies that have specifically examined the psychopaths' startle modulation for discrete aversive picture contents have yielded inconsistent results. For example, incarcerated psychopaths in Levenston et al.'s (2000) study showed an abnormal startle inhibition (instead of potentiation) for victim scenes (mutilated figures or attacks on others) and non-significant enhanced startle reactions for direct threat. In contrast, Vaidyanathan et al.

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(2011) reported a significant deficit in startle potentiation for threatening contents, but not for mutilations in high PCL-R Factor 1 prisoners. In the same vein, Vaidyanathan et al. (2009) found that undergraduates high in fearlessness displayed the expected pattern of startle potentiation for mutilation and victim scenes, but failed to potentiate for the pictures depicting threat. These results might tentatively suggest content-specific associations between a deficient aversive-potentiated startle and the affective and interpersonal traits of psychopathy. Therefore, we further explored, in a subsample of the study, psychopathy-related differences in startle potentiation for two distinct picture contents within the unpleasant category—threat and mutilations.

METHOD

Participants

A large sample of 180 undergraduates (72 men, 108 women) from the Universitat Jaume I of Castellón (Spain), aged between 17 and 43 years ($M = 20.62$, $SD = 4.01$), participated for course credit or 10 € as compensation. No participant was undergoing psychiatric or pharmacological treatment at the time of testing, and none presented non-corrected visual or auditory deficits. All participants were informed about the nature of the study and provided informed consent.

The Spanish adaptation (Poy, Segarra, Esteller, López, & Moltó, 2014) of the Triarchic Psychopathy Measure (TriPM; Patrick, 2010) was used to evaluate the participants. The TriPM is a self-report measure developed to specifically index the three phenotypic domains proposed in the triarchic model of psychopathy (boldness, meanness, and disinhibition) and has shown good psychometric properties in both incarcerated and nonincarcerated samples (Almeida et al., 2015; Drislane, Patrick, &

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Arsal, 2014; Marion et al., 2013; Poy et al., 2014; Sellbom & Phillips, 2013; Sica et al., 2015; Stanley, Wygant, & Sellbom, 2013; Strickland, Drislane, Lucy, Krueger, & Patrick, 2013). Its 58 items are answered using a 4-point Likert scale, where 0 = "*false*", 1 = "*mostly false*", 2 = "*mostly true*", and 3 = "*true*". The scale scores can range from 0 to 57 for Boldness and Meanness and from 0 to 60 for Disinhibition. In the current sample, the alpha coefficients for Boldness, Meanness, and Disinhibition scores were .81, .83, and .81, respectively. Evidence for the construct validity of the TriPM scores in this sample is presented in the *Results* section.

Table 1 reports the TriPM Boldness, Meanness, and Disinhibition score means, standard deviations and ranges for the entire sample, and for men and women separately. Independent *t*-tests revealed that men scored significantly higher in all scales, ts > 1.97, ps < .05. To correct for any possible contributory role of gender in the observed relations between the TriPM scores and the dependent measure (cf. López et al., 2013), raw TriPM scale scores were standardized (converted to *T* scores) separately for men and women using gender-specific means and standard deviations from a base sample of 343 undergraduates (112 men). All of the subsequent analyses were performed using these gender-corrected scores.

All 180 participants conducted an affective picture-viewing task. Participants in Subsample 1 (n = 110; 52 men) viewed three picture contents (erotica, neutral faces, and mutilations), whereas participants in Subsample 2 (n = 70; 20 men) viewed 4 picture contents (the same as Subsample 1 in addition to threatening pictures). Given evidence that the aversive startle potentiation effects related to fear/fearlessness may vary for differing picture contents (cf. Vaidyanathan, Patrick, & Bernat, 2009), the picture content was examined in the analyses in addition to the picture category. The

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specific characteristics of the experimental session are given in detail in the next section.

Materials and design

The affective picture-viewing task consisted of the presentation of 54 pictures from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008). These pictures were selected based on their normative ratings on affective valence and arousal (Spanish norms: Moltó et al., 1999, 2013; Vila et al., 2001) to conform three categories, pleasant, neutral and unpleasant. Pleasant pictures depicted 18 erotic nude couples, and neutral pictures consisted of 18 neutral faces. The unpleasant category included 18 mutilation scenes (injured faces, limbs and bodies) for Subsample 1 (n = 110 participants), and as one of the aims of this study was to evaluate psychopathy-related differences in startle potentiation for distinct aversive contents, it included 9 mutilations and 9 threat scenes (threatening weapons) for Subsample 2 (n = 70).[1] The mean valence and arousal ratings were 7.30 and 6.92 for erotica, 5.07 and 3.80 for neutral faces, 2.53 and 7.17 for threat pictures, and 1.62 and 7.42 for mutilations, respectively. All of the contents differed significantly among them according to their valence ratings (ps < .001). Moreover, all of the affective contents were significantly more arousing than neutral faces, and mutilations were more arousing than erotica (ps < .001).

[1] IAPS numbers were: erotica—4647, 4651, 4652, 4658, 4659, 4664, 4668, 4669, 4670, 4672, 4676, 4680, 4687, 4693, 4695, 4697, 4800, 4810; neutral faces—2104, 2107, 2190, 2200, 2210, 2214, 2215, 2220, 2270, 2305, 2372, 2411, 2441, 2493, 2495, 2499, 2512, 2516; threat—2811, 6200, 6230, 6231, 6244, 6250, 6260, 6263, 6510; mutilations (the pictures that were presented only to Subsample 1 are underlined): 3001, 3015, 3051, 3053, 3062, 3063, 3071, 3100, 3101, 3110, 3130, 3131, 3140, 3150, 3170, 3213, 3261, 3266.

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Pictures were presented in 6 blocks of 9 pictures each (3 of each category) in two pseudorandomized orders (counterbalanced across participants), with the only restriction of no more than two pictures of the same category appeared consecutively. Images were presented over 6 s, followed by intertrial intervals (ITIs) of 10, 12 or 14 s. Acoustic probes (50 ms, 105 dB, instantaneous risetime) were administered binaurally at 4.5 or 5.5 s after picture onset in 2/3 of the pictures and 9 during ITIs. All of the pictures were presented with acoustic probes across participants and task orders.

Before the experimental procedure began, 3 practice images (one of each category, IAPS numbers 2221, 3000, and 4611) were presented to habituate participants to the experimental conditions and to inure responses to the sound (Patrick & Berthot, 1995).

Procedure

The experimental session was conducted individually in an isolated and dimly lit room. Prior to the experimental session, the participant provided written informed consent. After this, electrodes were attached for physiological measurement and the participant was informed that he or she would view a series of pictures and occasionally hear sounds that could simply be disregarded. Questionnaires were completed anonymously in sessions of a maximum of 50 participants during the first semester of the academic year, whereas the experimental session was conducted during the second semester.

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Physiological data acquisition and reduction

Stimulus delivery and psychophysiological recording were controlled using VPM 11.8 (Cook, 2001). Blinks to noise probes were recorded from a pair of 4-mm Ag–AgCl electrodes (In Vivo Metric) filled with electrolyte gel (Parker) and positioned over the *orbicularis oculi* muscle under the left eye. Blink responses were amplified (x5000), filtered with a 28-500 Hz passband, integrated with a 20 ms time constant, and recorded at 1000 Hz (Blumenthal et al., 2005) using a Coulbourn LabLinc V polygraph (Coulbourn Instruments). Two participants (1.11%) were excluded due to human or equipment errors during the experimental session.

The magnitude of the blink responses was quantified using an algorithm integrated in VPM (Balaban, Losito, Simons, & Graham, 1986) that selected the highest peak occurring between 21 and 150 ms after acoustic sound onset relative to the average activity during the preceding 20 ms. Afterwards, blink responses were visually examined by the experimenters to identify trials with instable baselines and responses equal to 0. Participants with 30% or more of trials with instable baselines or responses equal to 0 were excluded from analysis ($n = 29$; 16.11%). To establish a common metric for all participants, blink responses were standardized (T scores) using the mean and standard deviation of blinks obtained during ITIs (cf. Blumenthal et al., 2005). Finally, 13 participants (7.22%) were excluded due to outlier startle magnitude values (jackknife distances > 2.83; see Penny, 1996) in any of the picture categories (pleasant, neutral or unpleasant), resulting in a final sample of 136 participants (55 men), with 93 participants from Subsample 1 (46 men) and 43 participants from Subsample 2 (9 men).

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Data analysis

Because analyses including gender yielded no significant main effects or interactions (Fs < 2.57, ps > .07), this factor was not included in the general linear models (GLMs). The full dataset (men and women together) was used to avoid a reduction in N and a loss of statistical power in evaluating the relationship between triarchic domains of psychopathy and the affective modulation of startle.

Two sets of analyses were conducted. First, startle modulation effects were evaluated by 2 repeated measures ANOVAs, including Picture Category (pleasant, neutral, and unpleasant) as within-subjects factors over the overall sample (Subsample 1 plus Subsample 2) and Picture Content (erotica, neutral faces, threat, and mutilations) over Subsample 2. Second, psychopathy-related differences on startle modulation were examined by adding Boldness, Meanness, and Disinhibition scores as between-subjects continuous variables to the GLMs along with the discrete within-subjects variables and their interactions.

Significant effects revealed by GLMs were deeply explored using paired samples t-tests or partial correlations between TriPM scale scores (excluding gender and the effect of the remaining factors) and startle modulation scores. For each participant, the difference between the individual average blink magnitude for emotional pictures and individual average blink magnitude for neutral pictures served to quantify the startle inhibition scores (pleasant–neutral, erotica–neutral faces) and startle potentiation scores (unpleasant–neutral, threat–neutral faces, mutilations–neutral faces; cf. Vaidyanathan et al., 2009). In cases where the effects for the TriPM scale scores on the startle modulation scores emerged as significant, the unique contributions of the three TriPM components were evaluated by entering the scores on Boldness, Meanness, and

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Disinhibition in a hierarchical linear regression model to predict the startle modulation scores. Corresponding depictions of high versus low median groups (using the gender median for the 136 participants in the overall sample) were presented to illustrate the nature of the effects.

In repeated measures analyses, Greenhouse-Geisser correction was applied (Jennings, 1987; Vasey & Thayer, 1987). Two-tailed significant values are reported with the effects. Statistical analyses were conducted using IBM SPSS Statistics 22.

RESULTS

Construct validity of the TriPM

Pearson bivariate and partial correlations of the TriPM scale scores with criterion variables consisting of personality trait measures in the current sample are presented in Table 2[2]. Boldness scores were strongly positively related to fearlessness and moderately related to extraversion, openness, and behavioral activation and showed robust negative associations with trait fear, anxiety, and emotional instability—concordant with boldness being characterized by high fearlessness and some apparent positive psychological adjustment indicators of psychopathy, such as social dominance and the absence of nervousness (Brislin, Drislane, Smith, Edens, & Patrick, 2015; Drislane, et al. 2014; Poy et al., 2014; Sellbom & Phillips, 2013; Sica et al., 2015; Stanley et al., 2013). High scores on Meanness were mainly related instead to high coldheartedness, low agreeableness, and low extraversion, and, to a lesser extent, to

[2] The correlations did not differ across gender (tested via Fisher *r*-to-*z* transformation), except for partial correlations between Meanness and Conscientiousness (men = -.22, women = .17; $p < .011$) and between Disinhibition and Conscientiousness (men = -.39, women = -.65; $p < .019$).

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fearlessness traits and impulsive tendencies, which were overall consistent with the descriptions of meanness in terms of high interpersonal antagonism and unemotionality (Drislane et al., 2014; Hall et al., 2014; Poy et al., 2014; Sellbom & Phillips, 2013; Sica et al., 2015; Stanley et al., 2013; Strickland et al., 2013). Finally, Disinhibition scores showed consistent robust positive correlations across all of the indicators of externalizing proneness and low constraint, with measures of emotional instability, anxiety, and trait fear, and antagonism, thus confirming that the disinhibition domain captures the externalizing component of psychopathy, along with somewhat internalizing vulnerability, as expected (Brislin et al., 2015; Donahue & Caraballo, 2015; Drislane et al., 2014; Hall et al., 2014; Sellbom, Wygant, & Drislane, 2015; Strickland et al., 2013; Venables, Hall, & Patrick, 2014). Overall, these results are congruent with previous studies and provide evidence for the construct validity of the Spanish translation of the TriPM, as well as the clinical relevance of high scores on the Boldness, Meanness and Disinhibition scales in the current study sample.

Basic startle modulation

Picture category: overall sample. Analyses revealed a significant effect of Picture Category, $F(1.96, 264.62) = 90.02$, $p < .001$, $\eta^2_p = .40$, with larger blink magnitudes for unpleasant ($M = 55.50$, $SD = 7.17$) versus neutral pictures ($M = 53.34$, $SD = 6.39$), $t(135) = 3.89$, $p < .001$, $d = .33$, as well as neutral versus pleasant ($M = 48.62$, $SD = 5.23$), $t(135) = 9.65$, $p < .001$, $d = .83$, demonstrating the presence of the typical linear pattern of affective startle modulation with potentiation for unpleasant pictures and inhibition for pleasant pictures (cf. Cuthbert, Bradley, & Lang, 1996; see Figure 1).

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Picture content: subsample 2. Analyses showed a significant effect of Picture Content, $F(2.59, 108.80) = 19.71$, $p < .001$, $\eta^2_p = .32$. Paired samples *t*-tests revealed that in comparison to neutral faces ($M = 52.74$, $SD = 5.23$), blink magnitude was potentiated for mutilations ($M = 56.97$, $SD = 9.22$), $t(42) = 3.53$, $p < .002$, $d = .54$, and inhibited for erotica ($M = 48.01$, $SD = 5.84$), $t(42) = -5.95$, $p < .001$, $d = -.91$ (see Figure 1, left upper box). The blink magnitudes for threat ($M = 53.97$, $SD = 9.00$) and neutral faces pictures did not differ significantly from one another ($p = .33$).

Triarchic constructs and aversive startle potentiation

Picture category: overall sample. The first GLM did not show any effect of the TriPM scores or their interactions with Picture Category on the startle magnitude (*p*s > .53).

Picture content: subsample 2. Analyses revealed a significant Boldness x Picture Content interaction, $F(2.60, 101.36) = 4.31$, $p < .010$, $\eta^2_p = .10$, indicating an effect of Boldness scores on affective startle modulation. Partial correlations showed that Boldness scores were uniquely and inversely related to the threat-neutral potentiation scores, $r(38) = -.37$, $p < .019$. This relationship was explained by diminished startle responses to threat pictures (partial correlations with boldness scores of -.33, $p < .004$), but not by a differential startle response to neutral pictures, $r(38) = .01$, $p = .96$. No significant correlations with startle magnitudes for threat or neutral pictures were found for either Meanness or Disinhibition scores (*r*s < .14, *p*s > .32). None of the TriPM scale scores was significantly related to other startle modulation scores (all *p*s > .19).[3] Figure

[3] Additional mediation analyses including other fearlessness indicators as mediating variables confirmed that the blunted threat-potentiated startle was specific to boldness, as neither Neuroticism, Trait Fear, Trait Anxiety, nor Sensitivity to Punishment scores mediated the relationship between Boldness scores and threat-neutral potentiation scores, all ΔR^2s < .08, ΔFR^2s < 3.28, βs < .36, *p*s > .08.

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2 illustrates this finding: participants with high Boldness scores failed to present a startle potentiation for threat scenes, although they displayed the typical startle modulation pattern for the other affective contents.

Moreover, as shown in Table 3, Boldness scores accounted for a significant proportion of variance in the threat-neutral potentiation scores (13%) when entered on the third step of the hierarchical regression model. Neither gender nor scores on TriPM Disinhibition or Meanness contributed independently to the prediction of the dependent measure. Specifically, Meanness scores did not exceed 0.6% of the explained variance when entered in any step of the hierarchical regression, showing its negligible contribution to the degree of startle potentiation for threat pictures in this sample.

DISCUSSION

The primary aim of the present study was to examine the contribution of the triarchic psychopathy domains to the under-reactivity of the aversive/defensive motivational system—as indexed by deficient startle potentiation (cf. Patrick, 1994)—in a mixed-gender community sample assessed for psychopathy. Specifically, here we investigated the differential relationships between the two distinct clusters of primary psychopathy traits that the triarchic conceptualization embodies in the *boldness* and *meanness* phenotypes (Patrick et al., 2009) and the blunted aversive-potentiated startle. Our results showed that only boldness (and not meanness) scores were associated with a deficit in startle potentiation. A secondary aim was to evaluate possible content-specific relationships between deficient aversive potentiated startle and psychopathy components, as suggested by previous research (Levenston et al., 2000; Vaidyanathan et al., 2009, 2011). In this regard, the boldness-related deficit in startle potentiation was

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found for threat scenes, but not for mutilations. The results are thoroughly discussed hereafter.

First, results in the overall sample replicated the presence of the typical linear valence-modulated startle effect, which consisted of an inhibition for pleasant pictures and a potentiation for unpleasant pictures (Lang et al., 1990). Regarding the picture content, our analyses showed that the magnitude of the startle reflex was inhibited for erotica and potentiated for mutilation pictures. However, the startle magnitude for the threat scenes did not differ from that for neutral faces, contrary to expectations (cf. Bradley, Codispoti, Cuthbert, & Lang, 2001), which was probably due to individual differences in boldness, as reported below.

Indeed, the investigation of the relationship between triarchic psychopathy domains and affective modulation of startle responses revealed a link between boldness—but not meanness or disinhibition— and startle potentiation during aversive picture-viewing (specifically for the threat content), with the direction of the relationship indicating lesser startle potentiation for individuals higher in boldness features. This finding extends evidence on the etiological bases of psychopathy in two ways. First, the fact that the deficit in defensive reactivity was specific to the affective-interpersonal traits of psychopathy and unrelated to its externalizing features adds to the increasing evidence that supports dual-process models of psychopathy (cf. Fowles & Dindo, 2006; Patrick & Bernat, 2009). Second, by demonstrating that boldness was the unique predictor of blunted startle potentiation, whereas the predictive contribution for meanness was virtually null, our study provides empirical support for parsing the affective-interpersonal core of psychopathy in two distinctive and separate configurations of traits (cf. Patrick et al., 2009).

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Our finding that the boldness phenotype exhibited incremental validity over the meanness phenotype in predicting blunted aversive-potentiated startle adds novel empirical evidence to the clarification of the psychopathy construct. Thus, the deficit in fear reactivity seems to be specifically related to the charm, persuasiveness, imperturbability, and venturesomeness features of psychopathy (boldness), but not the callousness, coldheartedness, and antagonism traits (meanness) that are described in the triarchic model of psychopathy, at least in undergraduates. This is highly consistent with previous research showing that participants that are high in PPI-R Fearless Dominance—an indicator of the glibness, grandiosity, and low fear features of psychopathy that directly reflects the construct of boldness (cf. Patrick et al., 2009)—exhibit a deficient startle potentiation (Anderson et al., 2011; Benning, Patrick, & Iacono, 2005; Poy et al., 2012). Most importantly, our findings offer new insight into the debate about the conceptualization of psychopathy by empirically demonstrating that different clusters of traits within the broad affective-interpersonal component of psychopathy can differentially contribute to the manifestation of psychopathy deficits. Although boldness and meanness may represent the affective and interpersonal features commonly attributed to "primary psychopaths" and both are described as differential phenotypic expressions of the low fear temperament of psychopathy (Patrick et al., 2009), the present data suggest that the boldness domain rather than the meanness domain better reflects a weakness in defensive reactivity (i.e., the low fear genotype of psychopathy), at least in undergraduates. Notably, this is consistent with previous studies that have found an association between boldness traits and fear deficits (cf. Dindo & Fowles, 2011; López et al., 2013) and also with the pattern of correlations obtained in the current study between triarchic constructs and personality measures, showing that high fearlessness indicators, such as low trait fear, low anxiety, low

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sensitivity to punishment, and low emotional instability, were better descriptors of the boldness domain rather than the meanness domain (see also Brislin et al., 2015; Sellbom & Phillips, 2013, and Stanley et al., 2013, for empirical evidence in forensic samples).

By elucidating which psychopathy personality features are directly related to the under-reactivity of the aversive/defensive motivational system, this evidence provides valuable information about the role of boldness in the conceptualization of psychopathy. Boldness traits are viewed by some authors as essentially assessing adaptive functioning because of their strong negative correlations with symptoms of internalizing disorders and psychological distress (see Almeida et al., 2015; Brislin et al., 2015; Drislane et al., 2014; Hall et al., 2014; Poy et al., 2014; Strickland et al., 2013), along with their weak correlation with externalizing symptoms (cf. Marcus et al., 2013; Miller & Lynam, 2012). In addition, boldness traits usually show a positive relationship with traits of positive emotionality, extraversion, and sensation seeking (Brislin et al., 2015; Drislane et al., 2014; Poy et al., 2014; Sica et al., 2015). However, there is increasing evidence positing that the adaptive functioning side of the boldness phenotype is not equal to "benign", "desirable" or "healthy adjusted" functioning, as boldness has been related to manipulative and arrogant tendencies (Poy et al., 2014; Strickland et al., 2013), callous affect, erratic lifestyle, dishonesty, grandiosity/lack of modesty and guiltlessness (Drislane et al., 2014), antagonism and impulsive-antisociality features (Brislin et al., 2015; Sica et al., 2015), and self-reported delinquency (Almeida et al., 2015) and positive attitudes towards sexually predatory tactics (interacting with disinhibition; Marcus & Norris, 2014). In this manner, the current study provides novel empirical evidence about the pathological or maladjusted facet of boldness, given that only this triarchic phenotype was a significant predictor of the presence of a well-replicated psychopathy-related fear deficit. This result is reminiscent of Cleckley's "mask of

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sanity" in psychopaths (1941/1976), which provides the appearance of good psychological function despite the severe behavioral pathology (cf. Lilienfeld et al., 2012), and highlights the centrality of boldness to the description of psychopathy (see also Venables et al., 2014; Wall, Wygant, & Sellbom, 2015). In addition to elucidating the significance of the boldness domain, the present study also calls into question the theoretical etiologic mechanism involved in the meanness phenotype, a historically crucial issue of psychopathy in criminal and delinquent samples; that is, at what level is the psychopaths' diminished fear capacity implied in the manifestation of the meanness attributes? Is the meanness construct mediated (totally or partially) by other biological substrates? What factors determine whether low dispositional fear develops toward a bold or a mean temperament? (cf. Skeem, Polaschek, Patrick, & Lilienfeld, 2011).

However, it should be taken into account that this boldness-related deficit may vary across populations, that is, our study can only conclude that the personality features embodied in the boldness construct seem to be particularly significant in the expression of fear deficits—as evidenced by a blunted aversive-potentiated startle— in community or in successful individuals, such as the undergraduates that were assessed for triarchic domains in this study (which were mainly women). Future research in normal samples with a greater number of participants, more heterogeneous in gender, age, economical status, and educational level, would allow for the acquisition of a wider range of scores in the assessment scales, thus enabling group analyses and the possibility of examining the interactive effects between triarchic constructs, as well as generalizing the results to other non-criminal populations. Moreover, future research on criminal or non-successful psychopaths (e. g., incarcerated populations) is also needed to replicate the same association between boldness and the startle potentiation deficit or, by contrast, to find that meanness features, that is, low empathy, exploitativeness, and

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cruelty, are more relevant to fearlessness-related deficits in these populations (a result that would be consistent with previous findings about PCL-R Factor 1 associations with reduced aversive potentiation in prisoner samples; cf. Patrick et al., 1993; Vaidyanathan et al., 2011; Verona et al., 2013). Then, further research examining the relationships between boldness and meanness phenotypes and fear reactivity deficits in other samples can help to elucidate the key etiologic factors that contribute to the development of successful or unsuccessful manifestations of psychopathy—that is, the protective and/or risk factors that may induce genotypic fearlessness in the direction of phenotypic boldness or meanness (cf. Patrick et al., 2009). As stated in the developmental hypothesis of the triarchic model, boldness could be more prominent in successful individuals that have benefited from proper processes of socialization (as the individuals of this study), whereas meanness could be more relevant in non-successful populations, possibly due to awry developmental experiences (Patrick et al., 2009). Therefore, we suggest looking for replication in forensic samples with different constellations of psychopathy traits. Additionally, it has to be considered that, here, we used self-report assessments of psychopathy phenotypes (with its possible problems and pitfalls; cf. Lilienfeld & Fowler, 2006) from a unique measure; thus, alternative assessments of the triarchic constructs are encouraged (e.g., Brislin et al., 2015; Drislane et al., 2015; Hall et al., 2014).

Another implication of the current study is that the observed boldness-related deficit in aversive-potentiated startle was specifically displayed during threatening content viewing, but not during mutilations, paralleling the results of Vaidyanathan et al. (2009) on the relationship between aversive-potentiated startle and the bipolar trait dimension of fearlessness/fearfulness. In that study, it was hypothesized that this content-specific reactivity differences might indicate the existence of a unique or

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distinctive relationship between fear/fearlessness traits and startle potentiation for the threatening content given that the qualitatively different emotional situations they represent—an immediate danger to self-survival— may most directly activate the cue-specific fear system underlying trait fear (cf. Vaidyanathan et al., 2009). However, previous studies have shown startle potentiation deficits in psychopaths for various aversive contents, such as suffering, aggression or mutilations (Benning, Patrick, & Iacono, 2005; Levenston et al., 2000; Patrick et al., 1993). An alternative explanation focuses on a heightened threshold for defensive activation in psychopathy, such that a threat must reach a certain level of intensity to engage the brain's aversive/defensive system in these individuals (cf. Levenston et al., 2000). Pictures that are hedonically potent (e.g., highly aversive and arousing) can easily exceed this threshold in normal populations, evoking clear defensive responses, compared to stimuli with a less affective and arousing intensity. This threshold, however, could be variable as a function of psychopathy severity. Thus, hedonically potent aversive stimuli, such as mutilations, are apparently able to surpass this threshold (i.e., produce an aversive startle potentiation) in non-criminal or subclinical psychopaths (which can be considered to be a less severe manifestation of psychopathy; Cleckley, 1941/1976), but not in criminal individuals (e.g., Leventson et al., 2000). On the other hand, threat content pictures that are less aversive and arousing than mutilations might lead to a greater psychophysiological variability in participants, thus allowing for individual differences in psychopathy to emerge. Therefore, this result emphasizes the importance of considering, in clinical and subclinical psychopathy research, not only affective categories and/or contents of stimulation, but also the intensity of appetitive and aversive motivation (see also the concepts of *strong* vs. *weak* situations formulated from subclinical anxiety research; Lissek, Pine, & Grillon, 2006). Relatedly, future research

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should also include additional pleasurable contents besides erotica —a possible limitation of our study— in order to provide a systematic assessment of appetitive reactivity in psychopathy.

Finally, the present work highlights the utility of the triarchic model of psychopathy (Patrick et al., 2009) to thoroughly examine the differential contribution of distinct psychopathy domains to physiological, behavioral and cognitive deficits that are theoretically related to this personality disorder. This is the first study that examines the triarchic conceptualization of psychopathy in relationship to startle modulation and demonstrates the empirical validity of its constructs by revealing that the traits embodied in the boldness phenotype (but not the meanness features) better reflect a weakness in defensive reactivity, illustrating how this novel approach can help to advance our understanding of etiological mechanisms underlying psychopathy. Moreover, in line with the previous literature (cf. Fowles & Dindo, 2006, 2009; Patrick & Bernat, 2009), our results suggest that psychopathy should be considered to be a combination of differential dimensional traits with distinct neurobiological etiologies, rather than a unitary syndrome.

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Table 1. *TriPM scale scores means, standard deviations, and ranges for participants in the current study (N = 180)*

	All participants (*N* = 180)		Men (*n* = 72)		Women (*n* = 108)	
	M (*SD*)	Range	*M* (*SD*)	Range	*M* (*SD*)	Range
Boldness	28.71 (8.42)	3 – 52	31.56 (7.65)	14 – 49	26.81 (8.41)	3 – 52
Meanness	11.79 (7.27)	0 – 42	15.99 (7.72)	2 – 42	9 (5.40)	0 – 26
Disinhibition	17.71 (8.23)	0 – 43	19.18 (8.26)	3 – 43	16.72 (7.10)	0 – 41

All comparisons between men and women were significant, $p < .05$

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Table 2. *Bivariate / partial correlations of TriPM scores with psychopathy and personality measures in the overall sample (N = 180)*

	Boldness	Meanness	Disinhibition
PPI-R			
Fearless Dominance	.79* / .78*	.34* / .27*	.11 / -.04
Impulsive Antisociality	.13 / .06	.57* / .33*	.68* / .55*
Coldheartedness	.20 / .09	.59* / .59*	.14 / -.23
NEO-FFI			
Neuroticism	-.48* / -.54*	.06 / -.15	.47* / .55*
Extraversion	.45* / .55*	-.27* / -.42*	-.07 / .16
Openness	.24* / .28*	-.06 / -.14	.04 / .12
Agreeableness	-.16 / -.06	-.59* / -.42*	-.50* / -.27*
Conscientiousness	.01 / .05	-.34* / -.03	-.62* / -.54*
STAI-T	-.50* / -.53*	.08 / -.04	.38* / .41*
TF-55	-.76* / -.75*	-.25* / -.26*	.08 / .27*
SPSRQ			
SP	-.63* / -.63*	-.04 / .08	.07 / .05
SR	.30* / .29*	.45* / .20	.50* / .38*
ESI-100	.19 / .14	.53* / .27*	.63* / .50*
BIS-11	.13 / .17	.37* / .01	.66* / .60*

Notes. PPI-R = Psychopathic Personality Inventory-Revised (Lilienfeld & Widows, 2005); STAI-T = Trait scale from State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970); TF-55 = Trait Fearlessness 55 (Patrick, 2009, personal communication); SPSRQ = Sensitivity to Punishment and Sensitivity to Reward Questionnaire (Torrubia, Ávila, Moltó, & Caseras, 2001); ESI-100 = 100-item version of the Externalizing Spectrum Inventory (Krueger, Markon, Patrick, Benning, & Kramer, 2007); BIS-11 = Barratt Impulsiveness Scale 11 (Patton, Stanford, & Barratt, 1995); NEO-FFI = NEO Five Factor Inventory (Costa & McCrae, 2002).

* $p < .001$, two tailed.

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Table 3. *Summary of the hierarchical regression model for threat-neutral potentiation scores using TriPM scores as predictors*

Step and predictor variable		ΔR^2	$F\Delta R^2$	*df*	βs in final model	*p* value for β
Step 1:	Gender	.047	0.994	40	.265	.086
	Disinhibition				-.060	.720
Step 2:	Meanness	.001	0.041	39	.035	.837
Step 3:	Boldness	**.130**	**6.003**	**38**	**-.370**	**.019**

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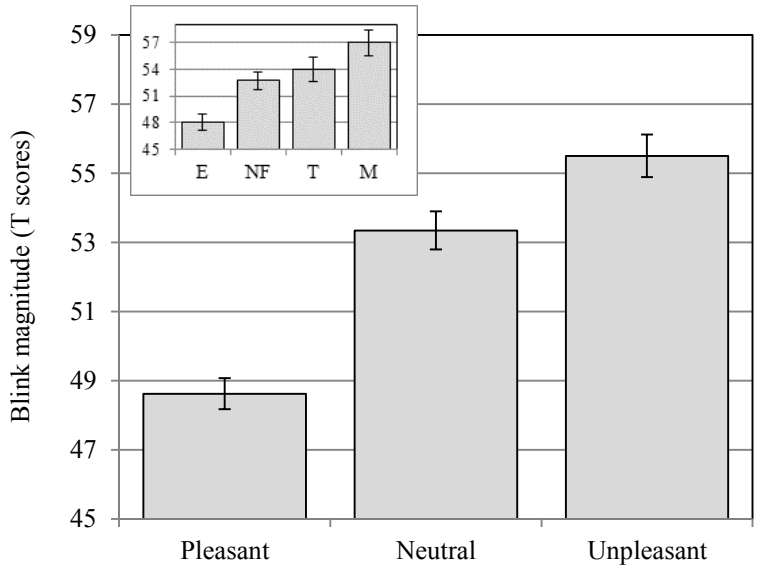

Figure 1. Mean magnitude (± S. E.) of blinks to aversive noises during the viewing of pleasant (erotica), neutral (neutral faces) and unpleasant (threat, mutilation) pictures in the overall sample (*N* = 136), as well as during the viewing of erotica (E), neutral faces (NF), threat scenes (T) and mutilations (M) in Subsample 2 (*n* = 43; left upper box).

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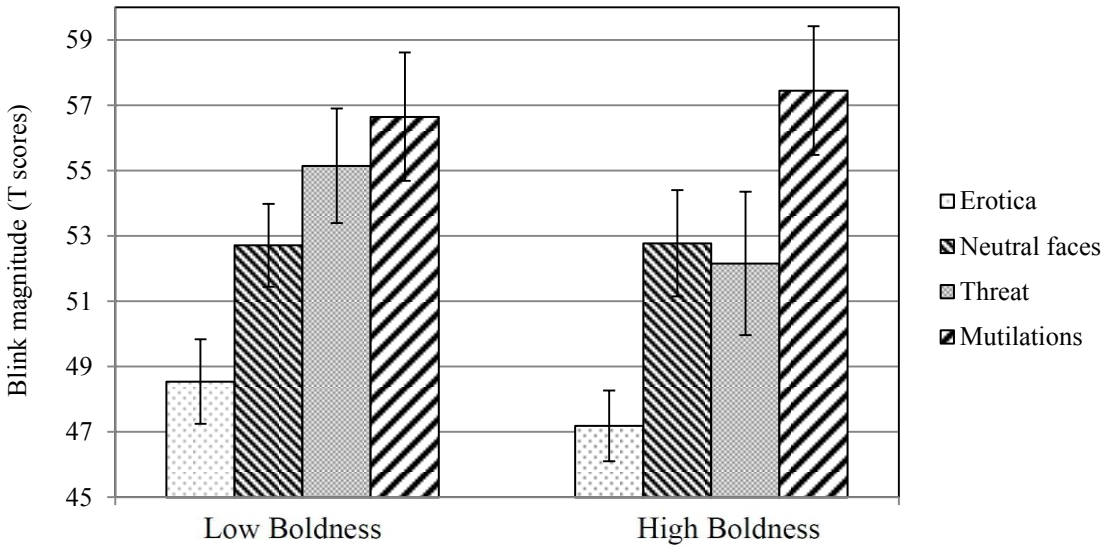

Figure 2. Mean magnitude (± S. E.) of blinks to aversive noise during the viewing of erotica, neutral faces, threat scenes, and mutilations in participants classified as low or high as a function of Boldness scores median values.

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