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Emotional processing and psychopathic traits in male college students: An event-related potential study

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ABSTRACT

Emotional processing deficits are often considered a hallmark of psychopathy. However, there are relatively few studies that have investigated how the late positive potential (LPP) elicited by both positive and negative emotional stimuli is modulated by psychopathic traits, especially in undergraduates. Attentional deficits have also been posited to be associated with emotional blunting in psychopathy, consequently, results from previous studies may have been influenced by task demands. Therefore, we investigated the relationship between the neural correlates of emotional processing and psychopathic traits by measuring event-related potentials (ERPs) during a task with a relatively low cognitive load. A group of male undergraduates were classified as having either high or low levels of psychopathic traits according to their total scores on the Psychopathic Personality Inventory — Revised (PPI-R). A subgroup of these participants then passively viewed complex emotional and neutral images from the International Affective Picture System (IAPS) while their EEGs were recorded. As hypothesized, in general the late LPP elicited by emotional pictures was found to be significantly reduced for participants with high Total PPI-R scores relative to those with low scores, especially for pictures that were rated as less emotionally arousing. Our data suggest that male undergraduates with high, but subclinical levels of psychopathic traits did not maintain continued higher-order processing of affective information, especially when it was perceived to be less arousing in nature.

1. Introduction

Psychopathy is a personality disorder characterized by distinct emotional, behavioral, and interpersonal features (Cleckley, 1941). Historically, psychopathy has been operationalized as a categorical construct, and research has focused predominantly on incarcerated individuals (for a review see Skeem et al., 2011). However, in an effort to better understand the heterogeneity of psychopathic traits, it is increasingly common for studies to include non-incarcerated individuals (Anderson and Stanford, 2012; Benning et al., 2005a; Justus and Finn, 2007; Sellbom and Verona, 2007; Skeem et al., 2003), including undergraduates (Anderson et al., 2011; Del Gaizo and Falkenbach, 2008; Falkenbach et al., 2008; Fulton et al., 2010; Gordon et al., 2004; Mullins-Nelson et al., 2006; Ragbeer and Burnette, 2013). Undergraduates with high levels of psychopathic traits share similarities with their incarcerated counterparts, in terms of negative emotional experiences (Del Gaizo and Falkenbach, 2008), and increased incidence of antisocial behaviors (Fulton et al., 2010; Mullins-Nelson et al., 2006), which underscores the relevance of investigating these traits in college students.

Perhaps the most well documented phenomenon in psychopathy, in both incarcerated (Blair et al., 2002; Kiehl et al., 1999; Lorenz and Newman, 2002; Patrick et al., 2009; Sadeh and Verona, 2012) and non-incarcerated samples (Anderson et al., 2011; Dvorak-Bertsch et al., 2009; Justus and Finn, 2007; Sellbom and Verona, 2007), is abnormal responsivity to affective information, especially negatively valenced stimuli. Studies have consistently reported that individuals with high psychopathic traits from incarcerated (Herpertz et al., 2001; Levenston et al., 2000), community-based (Dvorak-Bertsch et al., 2009; Justus and Finn, 2007; Vanman et al., 2003), and undergraduate (Anderson et al., 2011) samples showed reduced startle potentiation in response to loud noises when viewing negative images, in comparison to controls.

Whether or not this "emotional blunting" extends to positively valenced stimuli has been less extensively investigated, furthermore, this literature appears to be more contentious. Some studies have shown that psychopathy is associated with deficits in processing positive words (Blair et al., 2006; Kiehl et al., 1999; Lorenz and Newman, 2002; Williamson et al., 1991), and pleasant sounds (Verona et al., 2004). However, studies that have used high proportions of erotic or

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pleasant "thrilling" images have reported startle-inhibition at a level that was similar to (Benning et al., 2005a; Justus and Finn, 2007; Patrick et al., 1993; Vaidyanathan et al., 2011), or greater than (Levenston et al., 2000; Pastor et al., 2003) that seen in controls. In contrast, studies that have either excluded erotic images (Carolan et al., 2014) or have also included a large number of photos of interpersonal interactions or cute animals (Herpertz et al., 2001), have shown reduced responsivity to positive images in those with high psychopathic traits. Therefore, "normal" responsivity to positive emotional stimuli in psychopathy may be specific to particular stimuli and/or paradigms.

Several psychobiological models have been developed in an attempt to integrate and explain the phenomenon of diminished responsivity to emotional information in psychopathy (for a review see Baskin-Sommers et al., 2012, 2013). Some posit that psychopathy is associated with functional or structural abnormalities in the amygdala, ventromedial prefrontal cortex (vmPFC) (Blair, 2006; Kiehl, 2006), and paralimbic regions (Kiehl, 2006). Others have suggested that the core deficit lies within neural areas associated with attention, making it more difficult for individuals with psychopathic traits to attend to emotional information if it is not central to the task (Glass and Newman, 2009; Gorenstein and Newman, 1980; Newman and Lorenz, 2003). More recently, researchers have begun to utilize the excellent temporal resolution of event-related potentials (ERPs) to examine the ways in which individual differences in psychopathic traits give rise to variations in the timing of affective processing. Relatively few studies have investigated the relationship between psychopathy and the late positive potential (LPP; Anderson and Stanford, 2012; Carolan et al., 2014; Eisenbarth et al., 2013; Howard and McCullagh, 2007; Kiehl et al., 1999; Sadeh and Verona, 2012).

The LPP is a positive-going slow wave that is maximal over the centro-parietal region of the scalp (Cuthbert et al., 2000; Foti et al., 2009; Hajcak and Olvet, 2008). The LPP starts as early as 200 ms after stimulus onset and typically lasts for the duration of an emotional stimulus (Gable et al., 2015), or even longer for prolonged stimulus durations (for review see Hajcak et al., 2010). The timeframe of LPP modulation appears to depend on both extrinsic and intrinsic motivational factors. Gable and colleagues reported that paying attention to the onset of a neutral target produced larger LPPs in early (<1000 ms) windows, but keeping track of its offset (after 2 s or 3 s) evoked larger LPPs in later (>2 s) time periods. However, they also found that non-target affective stimuli were intrinsically motivating. Even when participants are supposed to ignore them they both captured attention (as evidenced by larger LPPs than for neutral non-targets in the early window in both tasks) and sustained it (LPPs in the late window were comparable in size to those produced by the neutral targets in the offset task) (Gable and Adams, 2013; Gable et al., 2015). Therefore, broadly speaking, the LPP is believed to index the amount of attention and cognitive processing that an individual devotes to a stimulus and is typically larger for both positive and negative emotional stimuli than for equivalent neutral ones (Ferrari et al., 2008; Kok, 2001; Lang and Bradley, 2010).

LPP studies have generally demonstrated that individuals with high trait psychopathy have smaller LPPs in response to emotional stimuli, and this has been reported in community (Anderson and Stanford, 2012), incarcerated/offender-based (Howard and McCullagh, 2007; Kiehl et al., 1999; Sadeh and Verona, 2012), and undergraduate samples (Carolan et al., 2014). However, some of these studies have used paradigms in which the affective information was not central to the task (Carolan et al., 2014; Howard and McCullagh, 2007), while others have used oddball paradigms where the emotional stimuli were presented infrequently (Anderson and Stanford, 2012). Psychopathy has been associated with deficits in response modulation (Glass and Newman, 2009; Gorenstein and Newman, 1980; Newman and Lorenz, 2003), therefore, it is possible that these task demands may have contributed to reduced LPP amplitudes in individuals with high trait psychopathy because they may have found it difficult to switch their attention to the affective content. Furthermore, of the remaining two studies of psychopathy and the LPP (Kiehl et al., 1999; Sadeh and Verona, 2012), only Sadeh and Verona (2012) used picture stimuli. However, because they did not include pleasant images, it is not known whether individuals with high levels of psychopathic traits have smaller LPPs to positive picture stimuli.

1.1. Overview of current study

In the current study, we have extended existing findings by comparing differences in pleasant and unpleasant emotional information processing in undergraduates (with either high or low levels of psychopathic traits) in a passive viewing task, by measuring the LPP across both an early (400 to 1000 ms) and a late (1000 to 1800 ms) window. To our knowledge, only one other study (Carolan et al., 2014) has investigated how psychopathy modulates the LPP in this population. Carolan et al. (2014) measured the LPP from 400 to 600 ms during an emotional Stroop task where participants identified the color of a small square superimposed on a photograph. They found larger LPPs for emotional compared to neutral pictures in a low, but not a high-trait group (Carolan et al., 2014). However, the emotional content of the images was processed implicitly in their task, and according to the response modulation theory (Glass and Newman, 2009; Gorenstein and Newman, 1980; Newman and Lorenz, 2003) it is possible that the psychopathy-related attenuation of the LPP was due to the inability to pay attention to the peripheral emotional information because it was not central to the task. In support of this argument, Hiatt et al. (2004) found that offenders with psychopathy showed reduced interference in a picture–word Stroop task, and a spatially separated color–word Stroop task. Additionally, Carolan et al. (2014) did not include any images of erotic or mutilation scenes in their stimulus set, and it is possible that use of these highly arousing images would have been more effective in capturing attention in the high trait group. To help to address these issues, we used a passive viewing task that placed relatively little cognitive demand on the participants, and also included highly arousing emotional images in our stimulus set. Furthermore, we measured the LPP in two contiguous time periods, which allowed us to compare relative differences in the time course of emotional information processing between individuals with high and low levels of psychopathic traits.

1.2. Hypotheses

Based on previous literature that suggests that there should be no emotional blunting in psychopathy when attention is explicitly focused on affective information, we assumed that because of the relatively low cognitive load in a passive viewing task, participants would be more likely to attend to the emotional content of the photographs. Therefore, we predicted that we would see the typical pattern of LPP modulation in the early LPP window in both groups, i.e., larger LPPs for unpleasant and pleasant stimuli compared to neutral ones (for review see Hajcak et al., 2010). However, because psychopathy has been associated with passive attentional deficits (Raine et al., 1990), inability to sustain interest (Cleckley, 1941), and proneness to boredom (Hare, 1991), even in undergraduates (Levenson et al., 1995), we hypothesized that the affective images would fail to hold the attention of the individuals with high levels of psychopathic traits. Given that progressively later parts of the LPP are thought to reflect more elaborative processing (Foti et al., 2009; Schupp et al., 2000) or sustained interest to intrinsically salient information (Gable and Adams, 2013; Gable et al., 2015; Weinberg et al., 2012); we hypothesized that in comparison to individuals with low levels of psychopathic traits, participants with high levels of psychopathic traits would have smaller LPPs in the late window in response to emotional images.