



P3 event-related potentials and childhood maltreatment in successful and unsuccessful psychopaths

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ARTICLE INFO

Article history:

Available online 5 August 2011

Keywords:

Successful psychopaths
P3b
Novelty P3
Oddball
Childhood abuse
Frontoparietal

ABSTRACT

Although P3 event-related potential abnormalities have been found in psychopathic individuals, it is unknown whether successful (uncaught) psychopaths and unsuccessful (caught) psychopaths show similar deficits. In this study, P3 amplitude and latency were assessed from a community sample of 121 male adults using an auditory three-stimulus oddball task. Psychopathy was assessed using the Psychopathy Checklist-Revised (Hare, 2003) while childhood physical maltreatment was assessed using the Conflict Tactic Scale (Straus, 1979). Results revealed that compared to normal controls, unsuccessful psychopaths showed reduced parietal P3 amplitudes to target stimuli and reported experienced more physical abuse in childhood. In contrast, successful psychopaths exhibited larger parietal P3 amplitude and shorter frontal P3 latency to irrelevant nontarget stimuli than unsuccessful psychopaths. This is the first report of electrophysiological processing differences between successful and unsuccessful psychopaths, possibly indicating neurocognitive and psychosocial distinctions between these two subtypes of psychopathy.

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1. Introduction

Individuals with psychopathic personality are characterized by a constellation of traits, including interpersonal-affective features (e.g., superficial charm, manipulativeness, lack of affect and emotion) and antisocial features (e.g., impulsivity and aggression; Hare, 2003). These traits in turn have been linked to violent and aggressive behavior (Porter & Woodworth, 2006). Although studies have generally indicated neurobiological deficits in incarcerated criminal psychopaths, little is known about whether “successful psychopaths” who escape conviction for the crimes they perpetrate are similar to institutionalized psychopaths in terms of psychophysiological and psychosocial risk factors.

One of the cognitive deficits found in psychopaths consists of an abnormality in the P3 (or P300), a positive-going electrophysiological waveform occurring approximately 300 ms after stimulus onset. In a three-stimulus oddball paradigm, participants are asked to detect an infrequent deviant tone (target; e.g., low-pitched tone) amongst a series of standard stimuli (nontarget; e.g., high-pitched tone) and novel stimuli (e.g., dog barks, bird chirp). Two P3 components assess the participant’s capability to direct attention to events of importance. First, a novelty P3, maximally recorded at

frontal sites, is elicited by novel stimuli and is considered to be functionally related to the detection of novelty (Courchesne, Hilliard, & Galambos, 1975; Friedman & Simpson, 1994). Second, a P3b component, maximally recorded at parietal sites, is elicited during processing of the target stimulus and is viewed as reflecting relatively later conscious, decisional, and premotor response-related states (Polich, 2007). At the neuroanatomical level, it has been suggested that the locus coeruleus–norepinephrine (LC–NE) system underlies parietal P3b generation in a target detection task (Nieuwenhuis, Aston-Jones, & Cohen, 2005), whereas the novelty P3 is generally interpreted as reflecting frontal cortical activity related to the hippocampus and mediated by dopaminergic activity (Knight, 1996; Polich & Criado, 2006). Neuropsychologically, the novelty P3 is thought to reflect top-down control associated with attention allocation, whereas P3b involves a bottom-up control that promotes memory operations (see Polich, 2007 for an extensive review on differences between P3b and novelty P3). Some have also argued that the novelty P3 is considered to be an automatic response to salient stimuli, acting as a bottom-up gating mechanism (Knight, 1996).

The P3b, conversely, is dependent on a psychological set that defines the target as salient and therefore is more a result of top-down processing since it can be manipulated by conscious attention (e.g., Polich, 1986). Reduced P3b amplitude and longer latency have been found in caught criminal psychopaths (Kiehl, Bates, Laurens, Hare, & Liddle, 2006; Kiehl, Hare, Liddle, & McDonald, 1999), although some studies have reported enhanced P3 in unsuccessful

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psychopathic individuals (Raine & Venables, 1987; Raine & Venables, 1988) or no association (Jutai, Hare, & Connolly, 1987; Munro et al., 2007; Raine, 1993; Sydulko, Parker, Jens, Maltzman, & Ziskind, 1975). A recent meta-analysis aggregating studies on P3b measures and psychopathy revealed a significant moderate correlation between P3b and psychopathic traits in oddball tasks, suggesting some attention and information-processing deficits in these individuals (Gao & Raine, 2009). Therefore, we hypothesized in the current study that unsuccessful psychopaths would show reduced P3b amplitude and longer latency compared to normal controls. To our knowledge, only one prior study has examined novelty P3 in any psychopathic population. Using an auditory three-stimulus oddball task, Kiehl et al. (2006) found that in one sub-sample, novelty P3 amplitudes were significantly smaller for caught psychopaths compared to caught nonpsychopaths at midline sites, although the findings were not replicated in another sub-sample. In sum, there is some evidence that unsuccessful psychopaths are characterized by P3b and novelty P3 deficits.

There has been virtually no research on successful psychopaths who escape detection by the criminal justice system. Preliminary evidence has suggested that successful and unsuccessful psychopaths may be etiologically distinct population, and that the observed neurobiological deficits may be specific to the unsuccessful psychopaths. In the first experimental study on successful and unsuccessful psychopaths, Ishikawa, Raine, Lencz, Bihle, & LaCasse, 2001 found *reduced* heart rate stress reactivity and impaired executive functioning (Wisconsin Card Sorting Task) in unsuccessful psychopaths. In contrast, successful psychopaths showed *heightened* stress reactivity and significantly *outperformed* nonpsychopathic controls on executive functioning. These findings suggest that enhanced autonomic responding and better executive functioning may protect a subgroup of psychopaths from being detected and arrested, allowing them to perpetrate significant harm to others in the community. Based on these findings, we hypothesized that impaired information processing, as indexed by abnormal P3 amplitude and latency, may be found in unsuccessful psychopaths. In contrast, successful psychopaths may be characterized by enhanced information processing (increased P3 amplitude and shorter P3 latency) which may give rise to their being more sensitive to environmental cues predicting detection and capture, and in turn be a compensatory factor that helps them escape long-term incarceration.

Although research on psychopathy has focused on neurobiological processes, a few studies have implicated childhood maltreatment as a psychosocial factor predisposing some individuals to psychopathy in incarcerated populations (Campbell, Porter, & Santor, 2004; Koivisto & Haapasalo, 1996; Marshall & Cooke, 1999; Patrick, Zempolich, & Levenson, 1997). For example, Marshall and Cooke (1999) found that male prison psychopaths compared to nonpsychopathic prisoners were more likely to have negative home backgrounds (e.g., abuse, neglect, poor supervision) as assessed in an open-ended interview. The association between childhood maltreatment and psychopathic traits has also been found in community population (Lang, af Klinteberg, & Alm, 2002; Weiler & Widom, 1996). In a 20-year follow-up study, those children abused and neglected before age 11 years had higher scores in adulthood on the Psychopathy Checklist-Revised (PCL-R) (Weiler & Widom, 1996). Similarly, in a longitudinal study of males and females, children who suffered child abuse were more likely to show a psychopathic personality at age 28 years (Gao, Raine, Chen, Venables, & Mednick, 2010). Overall, this small literature on family factors is beginning to identify physical maltreatment as a significant correlate of psychopathy. No study has assessed physical abuse by a caregiver in successful and unsuccessful psychopaths, and given prior work on unsuccessful, caught

psychopaths, it is hypothesized that childhood abuse will be a characteristic of unsuccessful psychopaths in particular.

Following on from our prior study (Ishikawa et al., 2001), psychopathic traits were assessed among a new community male sample at risk for psychopathy using the PCL-R (Hare, 2003). P3 amplitudes and latencies were recorded during an auditory three-stimulus oddball task, while self-report physical abuse was assessed using the Conflict Tactic Scale (CTS; Straus, 1979). P3 measures and physical abuse data were compared between the successful psychopaths, unsuccessful psychopaths, and nonpsychopathic controls. It is hypothesized that in comparison to the controls (1) unsuccessful psychopaths would show P3b and novelty P3 deficits; (2) successful psychopaths would in contrast show enhanced cognitive performance as indexed by larger P3 amplitude and shorter P3 latency; and (3) unsuccessful psychopaths would be characterized by significant childhood physical abuse. No definitive hypotheses on the differences between the two subtypes of psychopaths were formed, given the limited knowledge on this subject, but these issues were explored in the current study.

2. Methods

2.1. Participants

One hundred and twenty-one males (mean age = 35.84, $SD = 8.30$, range = 23 to 56 years) were recruited from temporary employment agencies in the greater Los Angeles area, and represents a different sample to that used in our prior work (Ishikawa et al., 2001; Raine et al., 2004; Yang et al., 2005). Participants were informed of the nature of the study and of its potential risks and benefits. After giving written informed consent, participants were individually assessed for two days. All participants were paid \$15/h for participation. The study and all its procedures were approved by the university's institutional review board. IQ scores were created by prorating four subscales of the WAIS-III (Similarities, Arithmetic, Digit Symbol and Picture Completion).

2.2. Psychopathy assessment

Psychopathy was assessed using the PCL-R: 2nd Edition (Hare, 2003), and supplemented by 10 sources of collateral data. The PCL-R: 2nd Edition consists of 20 items and reflects two factors: interpersonal/affective characteristics (e.g., glibness/superficial charm, pathological lying, shallow affect) and antisocial behavior (e.g., impulsivity, need for stimulation/proneness to boredom, juvenile delinquency; Hare, 2003). Ratings were made by a clinical neuroscience Ph.D-level research assistant (the third author RS) who received systematic training on the administration and scoring of the PCL-R by Robert D. Hare and Adelle Forth—including the completion of a series of PCL-R assessments on standardized videotaped case histories of adult male offenders (Pearson r correlations between rater's and standardized criterion scores: Total PCL-R = .92, Factor 1 = .93, and Factor 2 = .91). Assessments were supervised by the second author (AR).

Expanding on our prior work on community assessment with the PCL-R (Ishikawa et al., 2001), we met the challenge of using the PCL-R in a community sample by further developing a systematic and comprehensive protocol for the collation of 10 sources of objective collateral data derived from professional web-based background check services. These data not only provided new additional background information for item evaluation (e.g., irresponsibility, proneness to boredom, criminal versatility), but also allowed for assessment of inconsistencies and conflicts between the participant's oral report and objective data reports that aid assessment of pathological lying and deception. The ten collateral

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