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Psychopathy and semantic processing: An examination of the N400

Kent A. Kiehl^{a,b,*}, Kristin R. Laurens^c, Alan T. Bates^d, Peter F. Liddle^d

^a *Olin Neuropsychiatry Research Center, The Institute of Living, 200 Retreat Avenue, Hartford, CT 06106, United States*

^b *Department of Psychiatry and Psychology, Yale University, New Haven, CT, United States*

^c *Department of Forensic Mental Health Science, Institute of Psychiatry, King's College London, University of London, UK*

^d *Division of Psychiatry, School of Community Health Sciences, University of Nottingham, Nottingham, UK*

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Abstract

Accumulating evidence suggests that psychopathy is associated with behavioral and event-related potential (ERP) abnormalities during semantic language tasks. Psychopaths' ERP abnormalities are most prominent in the 300–500 ms post-stimulus time window. It is unclear whether these ERP differences are related to neurocognitive processes associated with the P300 (i.e., poor attention/orienting/working memory) or N400 (i.e., aberrant semantic processes). To address this issue, the present study employed a canonical semantic sentence processing paradigm known to selectively elicit the N400. Fifty incarcerated participants were divided into psychopathic ($n = 25$) or nonpsychopathic ($n = 25$) groups based on scores from the Hare Psychopathy Checklist-Revised. The N400 and P600 components elicited by terminal words of sentences either congruent or incongruent with the previous sentence context were examined. No differences were observed between groups in the behavioral or ERP data. These data do not support the hypothesis that the semantic processes, and underlying neural systems, associated with the generation of the N400 during sentence processing tasks are abnormal in psychopathy.

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* Corresponding author. Address: Olin Neuropsychiatry Research Center, The Institute of Living, 200 Retreat Avenue, Hartford, CT 06106, United States. Tel.: +1 860 545 7385; fax: +1 860 545 7066.

E-mail address: kent.kiehl@yale.edu (K.A. Kiehl).

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1. Introduction

Clinicians have noted that the behavior of psychopathic individuals is often strikingly inconsistent with their verbalized reports (Cleckley, 1976; Flor-Henry, 1972; McCord & McCord, 1964). This observation led some clinicians and researchers to speculate that psychopathy may be associated with abnormalities in language processing (Flor-Henry, 1972). Subsequent studies have found that abnormalities in language processes are most prevalent when psychopathic individuals perform tasks that engage semantic processing (Hare, 1979; Hare & Forth, 1985; Hare & McPherson, 1984). For example, Kiehl, Hare, McDonald, and Brink (1999a) tested the hypothesis that psychopathy is associated with language abnormalities during semantic processing of abstract word stimuli. Consistent with predictions, psychopaths made more errors than did nonpsychopaths when having to classify word stimuli as abstract during a concrete/abstract discrimination task. Event-related potential (ERP) data were also recorded and it was observed that psychopathic individuals failed to show the normal electrocortical differentiation between concrete and abstract words (Tasks 1 and 2 in their study). In noncriminals and in criminal nonpsychopathic individuals, concrete words elicit greater ERP negativity in the 300–800 ms window than do abstract words (Kiehl et al., 1999a; Kounios & Holcomb, 1994; Paller, Kutas, Shimamura, & Squire, 1987). Given that the ERP differentiation between concrete and abstract words appears to be most robust 300–500 ms post-stimulus, it has been argued that this effect is due to modulation of the semantic generators believed to contribute to the N400 potential typically observed in semantic word and sentence processing tasks (Kutas & Hillyard, 1980c, 1983, 1984). One hypothesis about the functional significance of the N400 suggests that it may reflect processes related to the integration of a word into ongoing cognitive context (Holcomb, 1993). Using this interpretation, Kiehl et al. (1999a) suggested that psychopaths may differ from others in the process responsible for N400 generation.

Several additional studies have reported that long-latency ERPs (later than 300 ms) are different in psychopaths than in nonpsychopaths, especially during tasks that present language stimuli in the visual modality. Psychopaths consistently show a large frontally distributed negative wave with a latency of approximately 500 ms to word stimuli. Williamson, Harpur, and Hare (1991) reported that psychopaths exhibited a larger fronto-central N500 to word stimuli during a lexical decision task than did nonpsychopaths. Kiehl et al. (1999a) reported that psychopaths exhibited a large centro-frontal negative wave with latency of about 350 ms during three different language tasks. While both Williamson et al. (1991) and Kiehl et al. (1999a) employed tasks that demanded linguistic processing of different word types, the late negative wave in both studies was elicited for all word types (i.e., positive, negative, and neutral words in Williamson et al., 1991); concrete and abstract words (Tasks 1 and 2) and positive and negative words (Task 3) in Kiehl et al. (1999a), raising the possibility that the negative wave is independent of stimulus content.

Based on the similar topography of the psychopathic individuals' N350 and N500, Kiehl et al. (1999a) suggested two possibilities for the functional significance of these components. The tasks employed by Williamson et al. (1991) and Kiehl et al. (1999a) both involved lexico-semantic

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