



A META-ANALYTIC REVIEW OF THE RELATION BETWEEN ANTISOCIAL BEHAVIOR AND NEUROPSYCHOLOGICAL MEASURES OF EXECUTIVE FUNCTION

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ABSTRACT. *Previous narrative reviews of the relation between antisocial behavior (ASB) and neuropsychological tests of executive functioning (EF) have raised numerous methodological concerns and produced equivocal conclusions. By using meta-analytic procedures, this study attempts to remedy many of these concerns and quantifies the relation between ASB and performance on six reasonably well validated measures of EF. Thirty-nine studies yielding a total of 4,589 participants were included in the analysis. Overall, antisocial groups performed .62 standard deviations worse on EF tests than comparison groups; this effect size is in the medium to large range. Significant variation within this effect size estimate was found, some of which was accounted for by differences in the operationalizations of ASB (e.g., psychopathy vs. criminality) and measures of EF. Evidence for the specificity of EF deficits relative to deficits on other neuropsychological tasks was inconsistent. Unresolved conceptual problems regarding the association between ASB and EF tests, including the problem of localizing EF tests to specific brain regions, are discussed. © 2000 Elsevier Science Ltd*

THE PAST DECADE has witnessed a heightened appreciation of the role of biological influences on antisocial behavior (ASB) (Lykken, 1995; Raine, 1993). Among the biological factors that have been found to be associated with ASB are genetic influences, pre- and perinatal complications (Raine, Brennan, & Mednick, 1994), psychophysiological abnormalities (Raine, 1997), and differences in neurotransmitter functioning (Berman, Kavoussi, & Coccaro, 1997). One major issue that has received heightened attention in recent years is the relation between ASB and both intellectual and neuropsychological functioning. Antisocial groups score approximately 8 points lower on intelligence tests than nonantisocial groups (Heilbrun, 1979; Heilbrun & Heilbrun, 1985; Henry & Moffitt, 1997), although the reasons for this difference are unclear. In

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addition, numerous authors (e.g., Elliott, 1978; Gorenstein, 1982; Raine, 1997) have conjectured that deficits in the brain's executive functions (EFs) are an important correlate or risk factor for ASB. Nevertheless, the relation between ASB and EF remains controversial, largely because previous studies of this association have typically yielded contradictory results (see Kandel & Freed, 1982; Lilienfeld, 1992, for reviews).

The purpose of this article is to quantify the relation between ASB and EF using meta-analytic methods. Specifically, we combine effect sizes from individual studies into a mean estimate of the relation between ASB and performance on EF tests. Although the ultimate goal of research in this area may be to establish causal factors for ASB, that is not the primary purpose of this article. In all of the studies we reviewed, ASB was already present at the time of assessment. Consequently, it is not possible to determine whether EF is a precursor of ASB, a sequela of ASB, or a correlate that is associated with ASB via unidentified third variables.

THE CONSTRUCT OF EF

What is the F in EF?

EF is an umbrella term that refers to the cognitive processes that allow for future, goal-oriented behavior. It is broadly defined as comprising the abilities needed to achieve and maintain a problem-solving set, and includes such processes as planning, organizational skills, selective attention and inhibitory control, and optimal cognitive-set maintenance. Beginning anterior to the central sulcus, the frontal lobes encompass up to 33% of the human cortex. The frontal lobes are responsible for such behaviors as monitoring and coordination of gross muscle movements, speech and language production and processing, and integration of sensations, perceptions, consciousness, and memory into organized and planned behaviors (Fuster, 1980; Stuss & Benson, 1984).

EFs are considered necessary for socially appropriate adult conduct. They allow an individual to be self-sustaining and self-reliant (Lezak, 1995), and include self-awareness, language comprehension and expression, and the regulation of motoric behavior via verbal instructions (Luria, 1973). In addition, the frontal lobes are related to personality dimensions and emotional regulation. When the frontal lobes are damaged, many patients exhibit distinct personality changes. Some become inert, apathetic, and indifferent, whereas others become euphoric, restless, and impulsive (Stuss & Benson, 1984).

Blumer and Benson (1975) characterized two classes of personality changes that often follow frontal damage: the *pseudodepressed* and *pseudopsychopathic* personality constellations. Pseudodepressed personality, which is marked by apathy, lack of motivation, depressed cognitions, and an inability to plan, is associated with damage to the dorsolateral area of the frontal lobes. Pseudopsychopathic personality, which is characterized by jocular attitude, disinhibition, extreme self-indulgence, poor judgment, and inappropriate sexual humor, is associated with damage to the orbitomedial cortex. Individuals with the latter personality constellation also typically exhibit perseverative responding, an inability to appreciate one's impact on others, and a tendency toward immediate gratification (Gorenstein, 1982). Damasio, Tranel, and Damasio (1990) labeled this set of personality changes produced by frontal damage "acquired sociopathy." It should be noted, however, that patients with frontal lobe damage typically resemble "partial" psychopaths (Elliott, 1978; Hare, 1984) and do not possess su-

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