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Using a clinically aggressive sample to examine the association between impulsivity, executive functioning, and verbal learning and memory

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Abstract

Impulsive behavior has been conceptualized from several vantage points including biological, sociological and psychological phenomenon. A comprehensive review of the empirical literature revealed that there is a paucity of research examining the association between working memory, executive functioning and impulsivity. A total sample of 170 aggressive outpatient participants was recruited for the study. Participants were administered a comprehensive neuropsychological battery. Principal components analysis of the 19 CVLT indices revealed five factors, accounting for 68% of the total variance. Results from the canonical correlation revealed one significant canonical variate with loadings from three CVLT factors (General Verbal Learning, Response Discrimination, and Proactive Interference), two executive functioning measures (Trail Making Test and Controlled Oral Word Association Test), and one impulsivity subscale (Attentional Impulsiveness). The findings of this study underscore the importance of memory functioning in determining impulsive aggressive behavior.

Keywords: CVLT; Memory; Executive function; Impulsivity; BIS-11; Aggression; Verbal learning

There is a growing body of literature devoted to explaining impulsive behavior, particularly in the human aggression literature. Explanations for impulsive behavior are discussed from several vantage points including biological, sociological, and psychological phenomenon (Meloy, 2000; Raine, 1993). The research also illustrates quite nicely that impulsivity is an important feature of aggressive behavior. A good example is found in Hare's (2003) conceptualization of the psychopathic individual. There are also several psychiatric disorders that include both impulsivity and aggression in their behavioral description including, but not limited to, antisocial and borderline personality as well as intermittent explosive disorder (*DSM-IV-TR*; American Psychiatric Association, 2000).

In general, there are two types of aggression posited in the empirical literature, namely premeditated (predatory) and impulsive (affective) (Kockler, Stanford, Nelson, Meloy, & Sanford, 2006). Individuals who display impulsive

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aggressive behaviors are commonly labeled unpredictable and emotionally labile. The impulsive aggressor responds to provocation with immediate and destructive violence; thus, supporting the notion that the behavioral instability observed in the impulsive aggressor is related to cognitive dysfunction (Barratt, Stanford, Kent, & Felthous, 1997; Dolan, Deakin, Roberts, & Anderson, 2002; Raine et al., 1998; Stanford, Greve, & Gerstle, 1997; Villemarette-Pittman, Stanford, & Greve, 2003).

Historically, aggression scientists directed much of their research toward a select group of neurocognitive domains, most notably in the area of executive and verbal functioning (Raine, 1993; Stanford et al., 1997; Villemarette-Pittman et al., 2003). Unfortunately, as a whole, the results from this line of research have been mixed, which has led to new experiments. Current science is expanding on previous research of executive functioning and impulsivity by incorporating measures of working memory in studies using a variety of populations including psychiatric (Dolan & Anderson, 2002) and neurological disorders (Bechara, Damasio, Tranel, & Anderson, 1998), as well as substance users (Bechara & Martin, 2004; Finn, Justus, Mazas, & Steinmetz, 1999), and college students (Hinson, Jameson, & Whitney, 2003; Whitney, Jameson, & Hinson, 2004). In their study of 44 undergraduate college students, Hinson et al. (2003) reported that increased demands on working memory contributed to an impulsive decision-making style. In accord with these findings, Whitney et al. (2004) postulated that individuals who scored high on attentional impulsiveness were more likely to have difficulty with removing irrelevant information from working memory—resulting in cognitive overload (Hinson et al., 2003). Based on the previously mentioned impulsivity studies and given the apparent association between aggression and impulsivity, it could be predicted that aggressive individuals would demonstrate memory impairments.

A comprehensive review of the empirical literature revealed that there is a paucity of aggression research examining the association between working memory, executive functioning and impulsivity. Although these studies suggest that there is an association between the aforementioned constructs of interest, the utilization of college students limits the generalizability of these findings (e.g., Finn et al., 1999; Hinson et al., 2003; Whitney et al., 2004). The lone study that recruited aggressive, personality disordered offenders did not report a significant association between impulsivity and working memory function (Dolan & Anderson, 2002). However, one possible explanation for the lack of findings may be related to the manner in which the participants were classified (51 = psychopaths; 9 = non-psychopaths). More specifically, the psychopathy construct was defined by legal criteria, not by an empirically validated instrument such as the Psychopathy Checklist-Revised (PCL-R). This important methodological issue may help explain why the percentages in this sample are much higher than the base rates reported by Hare (2003). The reviewed empirical research also suffers from underutilization of standardized measures of neuropsychological functioning. In order to improve upon previous impulsivity experiments, this study implemented empirically validated tests known for their sensitivity to brain functioning.

Based on these findings, the primary aim of this investigation was to address two important gaps in our understanding of neurocognitive functioning and impulsivity. First and foremost, the limited amount of empirical research examining the association between executive functioning, working memory and impulsivity has been conducted with college samples. A more heterogeneous patient population would prove to be more beneficial in that it would allow for greater generalizability to traditionally aggressive populations. Second, the previously mentioned studies failed to employ a standardized measure of verbal learning and memory. Accordingly, the authors are of the opinion that by using a well-validated, multifactorial memory instrument such as the CVLT in a clinical aggressive population, it would further contribute to our understanding of impulsive behavior and memory functioning. Hinson et al. (2003) expounded that "...future research [should] explore the relationship between impulsive decision-making and a range of other WM [working memory] tasks in order to determine whether we can more precisely specify the executive control problems that are associated with impulsiveness" (p. 304).

To the best of our knowledge, this is the first study to employ the California Verbal Learning Test (CVLT), in an aggressive population. Previous research on the CVLT has consistently demonstrated a five-factor solution in neurological samples (Delis, Freeland, Kramer, & Kaplan, 1988; Vanderploeg, Schnika, & Retzlaff, 1988). In the Vanderploeg et al.'s study, the authors proffered an association between CVLT indices and several executive functioning measures. The current study set out to test the following hypotheses: (1) there would be positive correlations between several of the CVLT scales and executive functioning measures; and (2) a similar five-factor solution as reported by Vanderploeg et al. (1988), would emerge in a clinically aggressive population.