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## Assessment

# Neuropsychological Assessment in Clinical Evaluation of Children and Adolescents with Complex Trauma

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*Complex trauma (i.e., exposure to chronic, interpersonal trauma in childhood) has been associated with structural and functional alterations in brain development, which in turn can result in cognitive and neuropsychological deficits. The goal of combining neuropsychological assessment with standard trauma specialty evaluation is to gain a comprehensive understanding of each child's unique set of cognitive strengths and weaknesses and associated behavioral manifestations within a trauma-informed framework. This process can be a vital aide in diagnosing, conceptualizing, and designing effective interventions for traumatized youth and avoiding the common misdiagnoses that lead to ineffective treatment. This paper presents a trauma-informed approach to neuropsychological assessment, using two case studies to illustrate the process of integrating neuropsychological testing with trauma specialty evaluation.*

**Keywords** trauma, neuropsychological assessment, children, adolescents

Complex trauma refers to the dual problem of children's exposure to traumatic events and the impact of such exposures on their development and long-term outcomes (Cook, Blaustein, Spinazzola, & van der Kolk, 2003; Cook et al., 2005). Complex trauma exposure is the experience in early childhood of chronic, developmentally adverse traumatic events, typically of an interpersonal nature, occurring within the child's caregiving system. These exposures include sexual, emotional, and physical abuse; neglect; loss; and witnessing domestic and community violence. Research and clinical observation have demonstrated impairment in the regulatory capacities of children with complex trauma exposure in the affective, cognitive, behavioral, physiological/ biological, relational/interpersonal,

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and self-attributional domains (Cook et al., 2003, 2005). It places children at life-long risk for additional trauma exposure, Posttraumatic Stress Disorder (PTSD) and other psychiatric disorders (e.g., mood, anxiety, substance abuse, eating, conduct, personality, dissociative, and attention/learning disorders), chronic medical illness (e.g., fibromyalgia, chronic fatigue, immune system dysfunction), and functional impairments across a variety of domains, including legal, education/vocational, and social.

Given the wide-ranging effects on children, it is not surprising that a large body of empirical research supports that complex trauma exposure is associated with structural and functional alterations in brain development (for reviews, see De Bellis et al., 1999, 2002; Glaser, 2000; Perry, 2001; Teicher, Andersen, Polcari, Anderson, & Navalta, 2002; Teicher et al., 2003; van der Kolk, 1996; Watts-English, Fortson, Gibler, Hooper, & De Bellis, 2006). In turn, these changes in brain development have the potential to result in a vast array of cognitive and neuropsychological deficits in exposed children that may impact their development and functioning across the lifespan. Gaining a comprehensive understanding of each child's unique set of cognitive strengths and weaknesses provides the basis for designing effective intervention strategies. This paper will present a trauma-informed approach to neuropsychological assessment with youth impacted by complex trauma, using two case studies to illustrate the integration of neuropsychological testing with trauma specialty evaluation.

## Neurobiological and Neuropsychological Sequelae of Complex Trauma

Environmental influences, including abuse and neglect, modify the process of early brain development in animals and humans (Glaser, 2000; Perry, 2001). Chronic stress in childhood can lead to lasting changes in the structure and function of the brain because it occurs during sensitive periods of brain growth and development (Teicher, Andersen, Polcari, Anderson, & Navalta, 2002). The psychobiological abnormalities in traumatized individuals extend to multiple levels, from neurohormonal to neuroanatomical (e.g., Glaser, 2000; Teicher et al., 2003; van der Kolk, 1996). Exposure to early stress dysregulates the neurohormonal stress systems—specifically, the sympathetic nervous system (i.e., catecholamine system), the serotonin system, and the limbic-hypothalamic-pituitary-adrenal (LHPA) axis—leading to enhanced physiological responsiveness (Teicher et al., 2003; Watts-English et al., 2006). These neurochemical changes also affect brain maturation during specific, sensitive periods by altering such developmental processes as neurogenesis, myelination, synaptic overproduction, and pruning (Glaser, 2000; Teicher et al., 2003).

Neuroimaging studies have shown clear structural and functional neuroanatomical differences between adults with and without PTSD and histories of maltreatment, and parallel data in children has been accumulating rapidly over the past decade. In children exposed to complex trauma, differences identified include decreased corpus callosum volume (De Bellis et al., 2002; Teicher et al., 1997, 2004); smaller total brain, prefrontal cortex, and cerebral volumes; and larger lateral ventricles and frontal lobe cerebrospinal fluid volumes (Carrion et al., 2001; De Bellis et al., 1999, 2002). Clearly demonstrating the negative effects of complex trauma, De Bellis and colleagues (1999) have found earlier onset of trauma and longer duration of abuse to be significantly correlated with smaller intracranial volume. In addition, electrophysiological abnormalities have been demonstrated in the left frontal and temporal lobes (Ito, Teicher, Glod, & Ackerman, 1998; Ito et al., 1993).

As these studies suggest, chronic stress exposure in childhood dysregulates the biological stress system, leading to changes in brain development and associated impairment in neuropsychological functioning. Cognitive functioning was one of the first areas to be studied in maltreated children. Chronically traumatized children demonstrate lower overall cognitive functioning and academic achievement, with specific deficits on standardized measures of intelligence (Verbal and Full Scale IQ) and academic achievement (reading and math), as well as poorer teacher ratings of school performance, lower grades, and higher rates of grade repetitions (e.g., Crozier & Barth, 2005; Hoffman-Plotkin & Twentyman, 1984; Kendall-Tackett & Eckenrode, 1996; Koenan, Moffitt, Caspi, Taylor, & Purcell, 2003; Palmer et al., 1999; Perez & Widom, 1994; Shonk & Cicchetti, 2001). These results have been found across ages of children (from preschool through college) and subtypes of complex trauma (e.g., physical and sexual abuse, neglect, domestic violence exposure). Studies of adults who experienced maltreatment in childhood suggest that these cognitive deficits may continue into adulthood.

Many studies of adults with maltreatment histories have reported cognitive problems in the domains of attention/concentration, executive function, and learning and memory (Twamley, Hami, & Stein, 2004; Wolfe & Charney, 1991). Studies of specific domains of neuropsychological functioning in children are more limited, with small sample sizes and inconsistent findings. One study that administered a comprehensive battery of neuropsychological tests (Beers & De Bellis, 2002) found performance deficits in children with maltreatment-related PTSD compared to matched healthy controls on measures of attention and abstract reasoning/executive functioning, as well as some suggestion of deficits in verbal memory and visual-spatial skills. Children with PTSD demonstrated greater distractibility and impulsivity. No differences were found in the domains of language or psychomotor speed. Other studies have supported findings of deficits in executive functions (Mezzacappa, Kindlon, & Earls, 2001) and verbal and general memory (e.g., Friedrich, Einbender, & Luecke, 1983; Moradi, Doost, Taghavi, Yule, & Dalgleish, 1999), while others have also found associations between maltreatment and receptive and expressive language skills and language comprehension (e.g., Allen & Oliver, 1982; Friedrich et al.; Prasad, Kramer, & Ewing-Cobbs, 2005). Although more research with larger sample sizes is needed to elucidate the nature of neuropsychological deficits in traumatized youth, strong evidence supports deficits in overall cognitive functioning, academic achievement, school performance, and attention/executive function, with some evidence for deficits in memory, visual-spatial skills, and language.

## Behavioral Manifestations of Complex Trauma

Complex trauma has pervasive effects on brain development and, subsequently, on biological/physiological, interpersonal, affective, behavioral, and cognitive self-regulatory capacities. Impairments in these domains contribute to childhood psychopathology that, without adequate intervention, may persist into adulthood. Children exposed to complex trauma get referred for educational and psychological intervention for a variety of academic, social, and emotional problems, across home, school, and other social settings. In addition to the wide range of reasons for referral, evaluation is made more challenging by developmental differences in behavioral manifestations of complex trauma. Research shows that PTSD and associated symptoms can differ depending on the developmental level of the child (for a review, see Drake, Bush, & van Gorp, 2001; Eth & Pynoos, 1985;

Garbarino, Dubrow, Kostelny, & Pardo, 1992; Kendall-Tackett, Williams, & Finkelhor, 1993; Pynoos, 1990; Shahinfar & Fox, 1997). For preschoolers, the most common trauma-related symptoms are irritability, sleep problems, separation anxiety, and regressive behaviors. For school-aged children, the most prevalent symptoms include fear, aggression, nightmares, school/learning problems, somatic complaints, hyperactivity, and PTSD symptoms. Adolescents' responses to trauma often involve acting-out, risk-taking, and self-destructive behaviors (e.g., sexual promiscuity, substance abuse, dangerous reenactment behavior, and delinquency), as well as depression, withdrawn behaviors, and somatic complaints. Therefore, it is critical to evaluate youth within their developmental context.

Understanding the underlying neuropsychological deficits and their behavioral manifestations in exposed children within the context of complex trauma is essential because of the broad implications for their development. When a trauma framework is not applied to the presenting problems of these youth, key information necessary for case conceptualization and treatment planning can be lost. These youth may end up with diagnoses that capture specific behavioral manifestations (e.g., Attention Deficit Hyperactivity Disorder, Oppositional Defiant Disorder, anxiety, mood, and eating disorders), but not the larger causal mechanism of complex trauma, resulting in providers implementing treatments that target isolated symptoms, without attention to their etiologies or functions. To guide more effective assessment and treatment interventions with these youth, the following section provides guidelines for conducting trauma-informed neuropsychological assessments.

## Guidelines for Trauma-Informed Neuropsychological Assessment of Youth

Clinical neuropsychology, as defined by Lezak, is "an applied science concerned with the behavioral expression of brain dysfunction" (1995, p. 7). Just as in psychological assessment, the targeted subject matter is behavior, as measured through tests, interviews, questionnaires, and observation. The distinctive characteristic of neuropsychological assessment is its conceptual framework that relates behavior to brain function, thus revealing the brain-based reasons for the functional impairments that are bringing the child to the attention of providers. Given the pervasive effects of trauma on the developing brain, neuropsychological assessment can be instrumental in diagnosing, conceptualizing, and treating traumatized youth. Combining standard trauma evaluations with neuropsychological assessment provides a more complete picture of the impact of trauma on the brain and on the child's life and functioning.

### *Trauma Evaluation*

Assessment of traumatized youth must begin with a standard trauma evaluation that assesses both complex trauma exposures and outcomes. The goals of the trauma evaluation include obtaining information about the traumatic event(s), the client's subjective experience of the event(s), the meaning the client has made of the event(s), the impact of event(s) on the child/family's functioning over the course of development, and the client's current needs (Children's Advocacy Center of Suffolk County, 2003). A variety of methods are employed in gathering this information, including (a) clinical interviews with the client and his/her family, teachers, and providers; (b) standardized self-, teacher-, and caregiver-report measures of trauma symptoms, behavior, and general psychopathology;

(c) review of records; and (d) projective testing (drawings, stories, Rorschach). Although this paper focuses on clinical rather than forensic assessment, traumatized children often become court-involved, so evaluation should be conducted in a forensically sound manner (Cook et al., 2005). For more information on trauma evaluations, see Cook et al. (2003).

### *Goals of Neuropsychological Assessment*

Neuropsychological assessment can be useful in achieving several clinical goals with a variety of patient populations (Lezak, 1995), and traumatized individuals in particular (Wolfe & Charney, 1991). First, it can help define the nature of symptoms to help link children's clinical presentation to a particular etiology (e.g., complex trauma, neurological disorder) and help clients and their families and providers understand this link. Second, neuropsychological assessment can improve conceptualization of a child's overall functional abilities and his/her specific cognitive strengths and weaknesses. Third, it can be useful in determining baseline functioning following traumatic exposure and in conducting follow-up assessments over time to monitor change and treatment effects. Fourth, it can help guide treatment planning by assessing the child's cognitive capacities to engage in specific forms of treatment. Finally, neuropsychological assessment is essential for determining the client's need for a variety of rehabilitation efforts across home, school, and other settings. For example, results from such evaluations often guide special education planning for these youth.

### *Process Approach*

The process approach to neuropsychological assessment (Kaplan, 1990) considers the contribution of a range of client variables, such as age, gender, and handedness, as well as the client's history. In a trauma-informed assessment, background information should be gathered on the child's developmental, medical, family, educational, and psychiatric/psychological history, involvement with government agencies (e.g., child protective services) and the legal system, placement history, relationships with peers and attachment figures, coping skills and personal, familial, and environmental resources, and individual and family strengths (Cook et al., 2005). These variables may contribute to the client's level of cognitive functioning and have a significant impact on strategies the client employs to compensate for limitations. Together with the demands of a task, these variables can affect the expression of abilities and provide insights into brain-behavior relations (Kaplan). In this form of assessment, qualitative aspects of behavior are not just described; they are part of the clinical investigative approach (Luria, 1980).

The process approach to neuropsychological assessment differs from other more traditional battery approaches in that the standardized tests are not scored in the binary fashion (right or wrong) and may not be administered in the standardized manner. To permit a better understanding of how an underlying process may be affected, the test administration may have to be modified (Kaplan, 1990). Utilizing a finer neuropsychological analysis provided by the process approach helps to inform diagnosis and guide treatment planning by better understanding brain-behavior relations. This approach also allows for continued monitoring of the client's course of functioning, which may direct ongoing recommendations. We propose the importance of adopting a process approach to neuropsychological assessment with traumatized youth.

***Components of Neuropsychological Assessment***

The specific components of a neuropsychological assessment will vary by client based on the referral question(s), results of general intellectual functioning tests, and information gathered in the trauma evaluation. Using this kind of flexible, rather than fixed, battery of tests is the most commonly used approach among neuropsychologists (Sweet, Moberg, & Sucy, 2000). Following the trauma evaluation is the administration of a test of general cognitive functioning, most commonly one of the Wechsler Tests of Intelligence, which provides composite and subtest scores on a variety of verbal and nonverbal tasks. Children's performance on the IQ test can help guide selection of the neuropsychological domains to be assessed and also provides the client's baseline cognitive functioning from which to interpret neuropsychological test findings. Examining the cognitive demands involved in the subtests on which children show weakness, both relative to their same-aged peers in the general population and to their own overall performance, can aid in the selection of specific test domains needed to elucidate the underlying cognitive deficits. It should be noted that general cognitive testing relies on a variety of functional systems and is not always sensitive to identifying weaknesses in discrete domains.

Neuropsychological functioning reflects independent but related functional systems, and it is these systems that are targeted in an assessment. In a trauma-informed neuropsychological assessment, the most clinically relevant domains of functioning that are assessed are: (a) attention and concentration; (b) executive functions; (c) learning and memory; (d) language; and (e) visuospatial. Some information about specific tests within these domains will be presented in the case illustrations; for a comprehensive review, see Strauss, Sherman, and Spreen, 2006.

*Attention/Concentration.* Attentional functions underlie and affect the efficiency of cognitive processes and refer to how the child becomes receptive to, and begins to process, incoming internal or external stimuli (Lezak, 1995). Several aspects of attention should be assessed: (a) focused or selective attention (concentration); (b) sustained attention (vigilance); (c) divided attention; and (d) shifting attention (Lezak). In children, attentional problems may appear as distractibility or difficulty remaining focused on a task.

*Executive Functions.* Executive functions are the capacities that enable a person to control their behavior and engage successfully in independent, purposive, goal-directed activities (Lezak, 1995). Lezak describes four components of executive functions, each of which relies on its own set of behaviors: (a) volitional activity, which relies on self-awareness, initiation, and motivation; (b) planning and organization; (c) carrying out purposive action; and (d) self-regulation, which relies on monitoring, shifting, inhibiting, and self-correcting. Executive functions have been primarily attributed to the frontal lobes, and specifically the prefrontal cortex (Lezak, 1995; Stuss & Benson, 1986). There are a variety of executive function tests, reflecting the multi-faceted nature of this domain. Problems with executive function may present in children in many ways, such as impulsivity, disorganization, poor judgment, dysregulated behavior, and amotivation. In addition, as will be demonstrated in the case illustrations, problems with executive functioning can also contribute to poor performance on tests in other domains. It should also be noted that dissociation is linked to both attention and executive functions. When presenting problems involve poor attention and/or executive functions, it is thus important to assess these cognitive domains as well as dissociative symptomatology.

*Learning and Memory.* Learning and memory refer to the complex process by which the individual encodes, stores, and retrieves information (Lezak, 1995). At minimum, an evaluation of memory systems should include an assessment of short-term retention with interference; learning capacity and how well newly learned material is retained; and efficacy of retrieval of both recently learned and long-stored information (Lezak). These memory functions should be assessed through receptive and expressive modalities, using recall and recognition of both verbal and visual material. Often, the etiology of learning and memory dysfunction is multifactorial. In evaluating performance on memory tests, the examiner needs to take special care to assess the impact of other variables such as frontal lobe dysfunction (i.e., executive dysfunction) and/or psychopathology (e.g., depression, dissociation).

*Language.* Numerous tests of language function in children have been developed, ranging from comprehensive batteries that are used for diagnostic purposes to assess cognitive strengths and weaknesses, to measures of specific functions, including expressive language (e.g. naming, vocabulary, storytelling), verbal fluency (fluency of speech, writing, reading), and receptive language (following directions, attending to spoken language, comprehension of information). In children, language dysfunction is often identified if a child has academic difficulties in the areas of reading, writing, or spelling. There can, however, be more subtle expressions of language dysfunction, which are often overlooked when focus is on behavioral manifestations, such as not following directions or not paying attention. In evaluating language function, it is essential to recognize that performance can be influenced by other functional systems, including attention, executive functioning, learning and memory.

*Visuospatial.* This domain assesses a variety of skills related to perception and processing of visuospatial information. These behaviors require specific skills, including visual attention, visual discrimination, spatial reasoning, visual-motor integration, and constructional ability. Common tests require children to copy increasingly complex figures. Performance on tests in this domain is often highly dependent on attention and executive functions (Lezak, 1995), regardless of the client's visuospatial abilities.

## Case Illustrations

The advantages of integrating neuropsychological testing with a trauma specialty evaluation are best illustrated by using case examples of the assessment process with traumatized children/adolescents. The following cases are disguised in accordance with consent process and clinical requirements. For the purpose of exemplifying the evaluation process, only the most salient details of these complex cases are included, and assessment measures presented are limited to those that highlight the most significant findings.

### *Case 1: Zachary*

*Step 1: Background Data.* Zachary is a 10-year-old European boy who was adopted from an orphanage as a toddler by a young married couple. He experienced a significant early trauma history, including impaired caregiving by his biological parents and severe emotional and physical neglect due to the deplorable conditions of the orphanage. Zachary was

referred for a trauma-informed neuropsychological evaluation by his parents for diagnostic clarification, identification of cognitive strengths and weaknesses, and recommendations for educational and treatment planning. His parents reported that he has periods of dissociation/amnesia, during which he acts like a different person. His parents reported that he will act aggressively, which is out of character for this typically docile, fun-loving child, and he will have no memory of his aggression. Zachary also has difficulty at school due to trouble with concentration and inability to understand/follow directions. Zachary has few friends and isolates from peers at school.

*Step 2: Trauma Evaluation.* A variety of methods were used to gather information, including clinical interviews, standardized questionnaires and projective measures from Zachary and his parents and teachers. The results of Zachary's trauma evaluation were consistent with his early experience of severe neglect and loss. He showed evidence of complex trauma symptomatology, including: difficulty regulating emotions and impulses (e.g., aggressive outbursts); negative perception of himself; difficulty with attention; periods of dissociation; and difficulty with interpersonal relationships (e.g., unable to make friends). Of particular concern were Zachary's extreme episodes of dissociation. Projective measures indicated that when Zachary was exposed to emotionally arousing situations (e.g., familial relationships, social interactions), he demonstrated limited ability to modulate his emotions, and his thinking became highly disorganized and fragmented.

*Step 3: Cognitive Evaluation.* The results of Zachary's cognitive testing (see Table 1) placed him in the average range of psychometric intelligence relative to same-aged peers in the general population. Although there was some variability between Zachary's verbal and performance scores (higher verbal), both were within average range.

*Step 4: Identifying Neuropsychological Assessment Domains.* Guided by the referral question, presenting problems, and the trauma evaluation, it was determined that applicable domains for assessment would include language, memory/learning, and executive functioning. Assessment of language would aid in determining the etiology of Zachary's difficulty understanding and following directions, while the assessment of memory/learning would evaluate factors contributing to his dissociation. In addition, evaluation of executive functions would help to explain his difficulties with self-regulation and controlling his aggressive impulses. The results of the cognitive evaluation did not provide additional information for this selection process, but were used to interpret results of the neuropsychological testing by comparing performance on discrete tasks to overall cognitive functioning.

*Step 5: Neuropsychological Assessment.* The results of Zachary's language assessment indicated that all language skills were within expectations for his age (see Table 1). Zachary's results on memory and learning tasks indicated that his memory functioning was within the average range, with a slight impairment in his verbal memory, while assessment of his executive functions revealed numerous weaknesses. Results from the Rey-Osterrieth Complex Figure (see Figure 1) indicated that Zachary tends to take in more information than he can organize efficiently. Using a process approach to examining the Rey-Osterrieth Complex Figure, it was apparent that Zachary has great difficulty integrating details and lacks the ability to recognize the gestalt, resulting in fragmented organization and a haphazard approach to recalling information. Zachary's performance on tasks of executive functioning improved when there was more structure (e.g., Trail

**Table 1**
Case 1 (Zachary): Qualitative Classifications of Test Scores

| | |
|---|---|
| GENERAL COGNITIVE FUNCTIONING | |
| **Wechsler Scale for Children** (4th ed.; Wechsler, 2003): All domains in the Average Range | |
| LANGUAGE | |
| **Clinical Evaluation of Language Fundamentals** (4th ed.; Semel, Wiig, & Secord, 2003) | |
| Core Language | Average Range |
| Receptive Language | Average Range |
| Expressive Language | Average Range |
| MEMORY/LEARNING | |
| **Wide Range Assessment of Memory and Learning-Second Edition** (Sheslow & Adams, 2003) | |
| General Memory | Average Range |
| Verbal Memory | Low Average Range |
| Visual Memory | Average Range |
| MEMORY/EXECUTIVE FUNCTIONING | |
| **Rey-Osterrieth Complex Figure, Boston Qualitative Scoring System** (Stern et al., 1999) | |
| Copy Presence and Accuracy | Average Range |
| Immediate Presence and Accuracy | Average Range |
| Delayed Presence and Accuracy | Average Range |
| Organization | Below Average Range |
| EXECUTIVE FUNCTIONING | |
| **Delis-Kaplan Executive Function System** (Delis, Kaplan, & Kramer, 2001) | |
| ***Trail Making Tests*** | |
| Condition 1: Visual Scanning | Below Average Range |
| Conditions 2–5: Number & Letter Sequencing, Letter-Number Switching, & Motor Speed | Average Range |
| ***Color Word Interference Test (Stroop)*** | |
| Conditions 1 & 2: Color Naming & Word Reading | Average Range |
| Conditions 3 & 4: Inhibition & Inhibition/Switching | Extremely Low |

Making Test improved when there was a required sequence to the task, rather than having to create one's own structure), and worsened with tasks that required flexibility and inhibition (e.g., performance on the Color Word Interference Test decreased for inhibition and switching conditions).

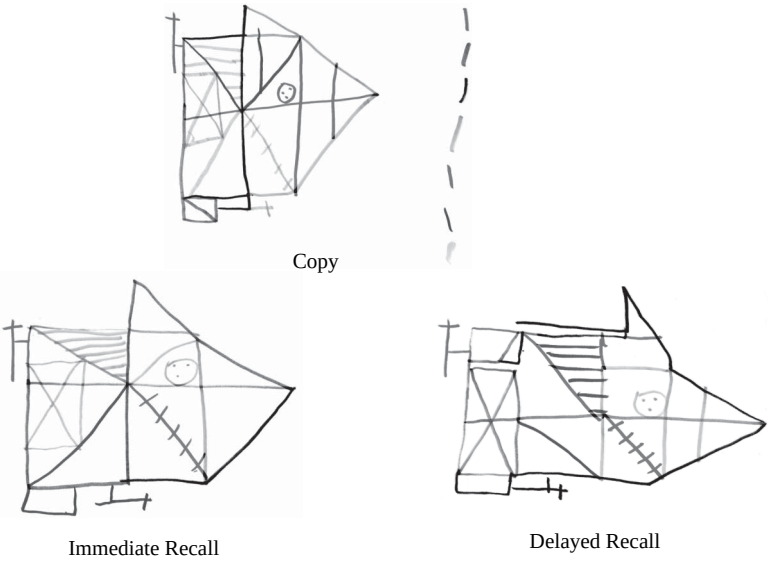


**Figure 1.** Case 1 (Zachary): Rey-Osterrieth Complex Figure Drawings.

*Step 6: Interpretation.* The process of interpreting Zachary's neuropsychological results within a trauma framework is critical to conceptualizing his presentation and designing effective intervention strategies. If a trauma framework were not applied to this case, it is likely that Zachary would be labeled with a diagnosis that captured his specific behavioral manifestations (e.g., Attention Deficit Disorder, Oppositional Defiant Disorder), and treatment would be targeted to his isolated symptoms (aggression/impulsivity, difficulty concentrating, not following directions), without attention to their etiologies or functions. Using a trauma-informed process approach to neuropsychological evaluation provided the contextual framework to understand Zachary's presenting problems. Zachary's early traumatic experiences have resulted in neuropsychological deficits in his executive functioning, and the related complex trauma and dissociative psychopathology have interfered with his development and overall functioning. Zachary's impairment in executive functioning, in combination with his dissociative psychopathology, has put him at high risk for episodes of disinhibition and lack of personal control. In addition, he would likely remain at risk for emotional, interpersonal, and academic impairments if appropriate trauma-informed interventions were not implemented.

*Step 7: Trauma-Informed Recommendations.* Integrating neuropsychological evaluation with trauma specialty evaluation provided the framework and information necessary to design effective interventions for Zachary. In creating trauma-informed recommendations, specific attention was paid to his cognitive strengths and weaknesses, and interventions were recommended across settings (e.g., his home, therapy, and school) in order to create the consistency inherent in trauma-informed treatment. First, it was apparent that Zachary and his family did not have a safe way of managing his dissociation and related aggressive behavior, so a safety plan was created in the home that would also be implemented at school if necessary. Second, the neuropsychological evaluation was critical in determining Zachary's weaknesses in executive functioning, which provided necessary information to guide therapeutic intervention (e.g., skill-building, emotion management). Without this

information, a therapist may have inadvertently engaged in a specific treatment focus that Zachary did not have the skills to manage (e.g., trauma processing, self-exploration). As is common in neuropsychological evaluations, many of the recommended interventions were centered on school. These interventions focused on engaging Zachary's cognitive strengths (e.g., using concrete details when explaining tasks; presenting tasks visually), while adding supports in his areas of weakness (e.g., guidance on integrating details into whole concepts; guidance on planning prior to executing a task). To build peer relations, it was recommended that Zachary engage in after- school activities with children who had interests similar to his own.

***Case 2: Kate***

*Step 1: Background.* Kate is a 17-year-old Caucasian female who recently withdrew from high school and currently lives with her boyfriend. Kate experienced significant early trauma, including impaired caregiving by her substance-abusing parents, and experienced loss when her father left the home. In addition, Kate has been the victim of three sexual assaults over the past two years. Kate has a substance abuse history and had been habitually using methamphetamine for two years; during the time of the evaluation, Kate had decreased her usage to a few times a year. Kate was referred by her aunt for a trauma-informed neuropsychological evaluation to assess her current level of cognitive functioning, to examine the effects of trauma and substance abuse on her presentation, and to provide recommendations for treatment planning. Kate reported that her main concern was that she has been unable to drive her car because she gets confused and cannot pay attention. She reported that she feels "spacey" throughout the day, and has no concept of time. In addition, Kate reported having problems with short-term memory. Kate denied any history of head trauma.

*Step 2: Trauma Evaluation.* The results of Kate's trauma evaluation were consistent with her early experience of impaired caregiving and loss and her recent sexual assaults. Kate met criteria for PTSD, as evidenced by: intrusion/re-experiencing (re-experiencing her sexual assaults), avoidance (avoiding thoughts about her traumatic experiences; diminished interest in activities), and hyperarousal (sleep disturbances; difficulty concentrating; exaggerated startle). Of particular concern was that Kate showed evidence of extreme episodes of dissociation during which she lost periods of time.

*Step 3: Cognitive Evaluation.* The results of Kate's cognitive testing placed her in the average range of psychometric intelligence relative to same-aged peers in the general population (see Table 2). There was no variability between her verbal and performance scores.

*Step 4: Identifying Neuropsychological Assessment Domains.* Using the flexible battery approach, it was determined that the assessment domains would include visuospatial processing, attention, executive functioning, and memory/learning. Assessment of these domains would aid in determining the etiology of Kate's driving difficulty and would evaluate factors contributing to her dissociation, attention, and short-term memory problems. This case was particularly challenging because performance in one domain could be highly dependent on another domain (e.g., visuospatial processing is highly dependent on attention and executive functioning).

*Step 5: Neuropsychological Assessment.* The results of Kate's visuospatial processing tasks were within expectations for her age (see Table 2). She demonstrated mild impairment

**Table 2**
Case 2 (Kate): Qualitative Classifications of Test Scores

| | |
|---|---|
| GENERAL COGNITIVE FUNCTIONING | |
| **Wechsler Adult Intelligence Scale** (3rd ed.; Psychological Corporation, 2002): All domains in the Average Range | |
| VISUOSPATIAL PROCESSING | |
| **Hooper Visual Organization Test** (Hooper, 1958): Average Range | |
| **Benton Judgment of Line Orientation Test** (Benton, Varney, & Hamsher, 1978): Average Range | |
| ATTENTION/EXECUTIVE FUNCTIONING | |
| **Conners' Continuous Performance Test** (Conners & MHS Staff, 2004): Low Average Range | |
| **Wisconsin Card Sorting Test** (Heaton, 1981): Low Average Range | |
| MEMORY/EXECUTIVE FUNCTIONING | |
| **Rey-Osterrieth Complex Figure, Boston Qualitative Scoring System** (Stern et al., 1999) | |
| Copy Presence and Accuracy | Average Range |
| Immediate Presence and Accuracy | Below Average Range |
| Delayed Presence and Accuracy | Below Average Range |
| Organization | Below Average Range |
| MEMORY/LEARNING/ATTENTION | |
| **Wechsler Memory Scale** (3rd ed.; Psychological Corporation, 2002) | |
| ***Primary Indices*** | |
| Auditory Immediate | Extremely Low |
| Visual Immediate | Extremely Low |
| Auditory Delayed | Extremely Low |
| Visual Delayed | Extremely Low |
| Auditory Recognition | Low Average |
| Working Memory | Low Average |

in attention and executive function (with more severe impairment in organization), and severe impairment in memory/learning. Results from the Rey-Osterrieth Complex Figure (see Figure 2) indicated that although Kate appeared to process and encode minimal information (immediate recall condition), the information was retained and improved slightly over time (delayed recall condition). This finding was consistent with her performance on other memory tasks. Kate's improved performance on recognition tasks indicated that she did register stimulus material, but lacked the capacity to spontaneously reproduce more than a small part. A process approach was used to assess whether Kate's poor performance on the memory tasks was in part a function of motivational capacity or drive, by asking leading questions to determine whether performance improved (e.g., with

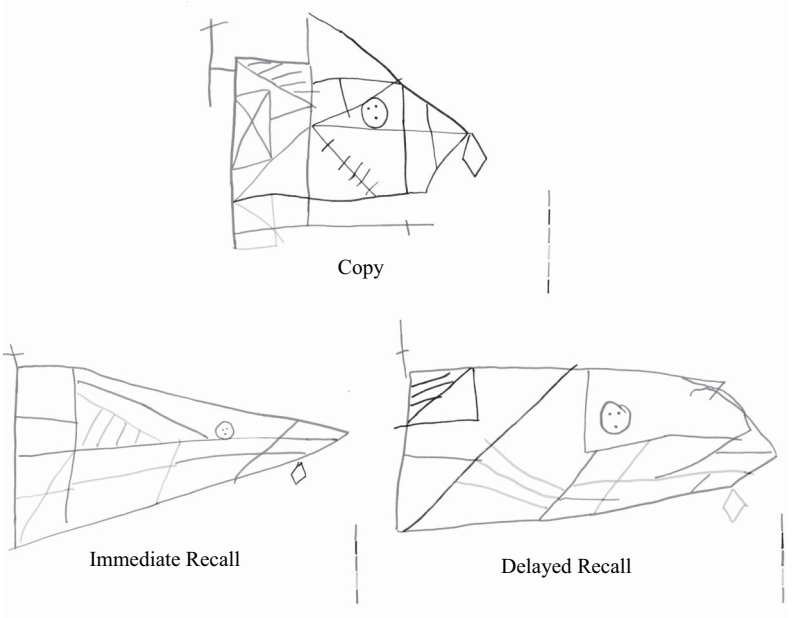


**Figure 2.** Case 2 (Kate): Rey-Osterrieth Complex Figure Drawings.

story material, questions were asked such as: who were the characters, what happened next). Kate's performance did not improve when the limits were tested, indicating that motivational capacity/drive was not a likely factor in her memory performance. It was likely, however, that Kate's organizational difficulties (i.e., executive dysfunction) impacted her ability to encode and to spontaneously reproduce information.

*Step 6: Interpretation.* Using a trauma-informed process approach provided the contextual framework to understand Kate's presenting problems. As is common in complex trauma, Kate's early experiences of loss and neglect left her vulnerable to additional trauma exposure, all of which led to PTSD, dissociative symptomatology, substance abuse, school problems, and neuropsychological deficits in attention, organization, and memory. In addition, prolonged use of methamphetamine may have damaged the same areas of the brain affected by Kate's trauma, resulting in a double injury and increasing impairment in these domains.

*Step 7: Trauma-Informed Recommendation.* Integrating neuropsychological evaluation with trauma specialty evaluation provided the framework and information necessary to design effective interventions for Kate. If a trauma framework were not applied to this case, it is likely that treatment recommendations would have focused on specific behavioral manifestations (i.e., substance use), and interventions would have been geared solely toward recovery. Alternately, it was recommended that Kate concurrently meet with a trauma-informed therapist to help her gain understanding of the functions of self-medicating (e.g., managing PTSD symptoms, keeping emotions out of awareness) and to build effective skills to substitute these functions. The neuropsychological findings guided recommendations for a neurological evaluation to assess structural brain damage, and for cognitive rehabilitation services to improve functional capabilities. In addition, the neuropsychological

evaluation provided essential data for follow-up assessments once Kate's sobriety had been maintained and she received rehabilitation services.

## Conclusions

Children who have suffered complex trauma have to cope with a myriad of developmental and cognitive consequences. A trauma-informed assessment is critical in understanding the context of the symptoms and their etiology. A process approach to neuropsychological evaluation elucidates the nature of the cognitive difficulties, so that the resulting behaviors can be more effectively treated. The trauma-informed neuropsychological assessment can improve the quality of children's lives by providing a more sophisticated conceptualization and offering concrete, specific, and effective recommendations.

## References

Allen, R. E., & Oliver, J. M. (1982). The effects of child maltreatment on language development. *Child Abuse and Neglect, 6*, 299–305.

Beers, S. R., & De Bellis, M. D. (2002). Neuropsychological function in children with maltreatment-related posttraumatic stress disorder. *American Journal of Psychiatry, 159*, 483–486.

Benton, A. L., Varney, N. R., & Hamsher, K. (1978). Visuospatial judgment: A clinical test. *Archives of Neurology, 35*, 364–367.

Carrion, V. G., Weems, C. F., Eliez, S., Patwardhan, A., Brown, W., Ray, R. D., et al. (2001). Attenuation of frontal asymmetry in pediatric posttraumatic stress disorder. *Biological Psychiatry, 50*, 943–951.

Children's Advocacy Center of Suffolk County. (2003, October). *Conducting trauma and sexual abuse evaluations*. Training presented in Boston, MA.

Conners, C. K., & MHS Staff. (2004). *Conners' Continuous Performance Test (CPT-II) computer programs for windows technical guide and software manual*. North Tonawanda, NY: Multi-Health Systems.

Cook, A., Blaustein, M., Spinazzola, J., & van der Kolk, B. (Eds.) (2003). *Complex trauma in children and adolescents*. National Child Traumatic Stress Network, Complex Trauma Taskforce. Retrieved April 12, 2007, from http://www.nctsnet.org/nctsn_assets/pdfs/edu_materials/ComplexTrauma_All.pdf

Cook, A., Spinazzola, J., Ford, J., Lanktree, C., Blaustein, M., Cloitre, M., et al. (2005). Complex trauma in children and adolescents. *Psychiatric Annals, 35*, 390–398.

Crozier, J. C., & Barth, R. P. (2005). Cognitive and academic functioning in maltreated children. *Children & Schools, 27*, 197–206.

De Bellis, M. D., Keshavan, M. S., Clark, D. B., Casey, B. J., Giedd, J. N., Boring, A. M., et al. (1999). Developmental traumatology Part II: Brain development. *Biological Psychiatry, 45*, 1259–1270.

De Bellis, M. D., Keshavan, M. S., Shifflett, H., Iyengar, S., Beers, S., Hall, J., et al. (2002). Brain structures in pediatric maltreatment-related posttraumatic stress disorder: A sociodemographically matched study. *Biological Psychiatry, 52*, 1066–1078.

Delis, D. C., Kaplan, E., & Kramer, J. H. (2001). *Delis-Kaplan Executive Function System*. San Antonio, TX: Psychological Corporation.

Drake, E. B., Bush, S. F., & van Gorp, W. G. (2001). Evaluation and assessment of PTSD in children and adolescents. In S. Eth (Ed.), *PTSD in children and adolescents* (pp. 1–31). Washington, DC: American Psychiatric Association.

Eth, S., & Pynoos, K. (1985). Developmental perspectives on psychiatric trauma in childhood. In C. R. Figley (Ed.), *Trauma and its wake: The study and treatment of posttraumatic stress disorder* (pp. 36–52). New York: Brunner/Mazel.

Friedrich, W. N., Einbender, A. J., & Luecke, W. J. (1983). Cognitive and behavioral characteristics of physically abused children. *Journal of Consulting and Clinical Psychology, 51*, 313–314.

Garbarino, J., Dubrow, N., Kostelny, K., & Pardo, C. (1992). *Children in danger: Coping with the consequences of community violence*. San Francisco: Jossey-Bass.

Glaser, D. (2000). Child abuse and neglect and the brain—A review. *Journal of Child Psychology and Psychiatry, 41*, 97–116.

Heaton, R. K. (1981). *Wisconsin Card Sorting Test manual*. Odessa, FL: Psychological Assessment Resources.

Hoffman-Plotkin, D., & Twentyman, C. T. (1984). A multimodal assessment of behavioral and cognitive deficits in abused and neglected preschoolers. *Child Development, 55*, 794–802.

Hooper, H. E. (1958). *The Hooper Visual Organization Test: Manual*. Beverly Hills, CA: Western Psychological Services.

Ito, Y., Teicher, M., Glod, C., & Ackerman, E. (1998). Preliminary evidence for aberrant cortical development in abused children: A quantitative EEG study. *Journal of Neuropsychiatry and Clinical Neurosciences, 10*, 298–307.

Ito, Y., Teicher, M., Glod, C., Harper, D., Magnus, E., & Gelbard, H. (1993). Increased prevalence of electrophysiological abnormalities in children with psychological, physical and sexual abuse. *Journal of Neuropsychiatry, 5*, 401–408.

Kaplan, E. (1990). The process approach to neuropsychological assessment of psychiatric patients. *Journal of Neuropsychology, 2*(1), 72–87.

Kendall-Tackett, K. A., & Eckenrode, J. (1996). The effects of neglect on academic achievement and disciplinary problems: A developmental perspective. *Child Abuse and Neglect, 20*, 161–169.

Kendall-Tackett, K. A., Williams, L. M., & Finkelhor, D. (1993). Impact of sexual abuse on children: A review of recent empirical studies. *Psychological Bulletin, 113*, 164–180.

Koenan, K., Moffitt, T. E., Caspi, A., Taylor, A., & Purcell, S. (2003). Domestic violence is associated with environmental suppression of IQ in young children. *Development and Psychopathology, 15*, 297–311.

Lezak, M. (1995). *Neuropsychological assessment* (3rd ed.). New York: Oxford University Press.

Luria, A. R. (1980). *Higher cortical functions in man.* New York: Basic Books.

Mezzacappa, E., Kindlon, D., & Earls, F. (2001). Child abuse and performance task assessments of executive functions in boys. *Journal of Child Psychology and Psychiatry, 42*, 1041–1048.

Moradi, A. R., Doost, H. T. N., Taghavi, M. R., Yule, W., & Dalgleish, T. (1999). Everyday memory deficits in children and adolescents with PTSD: Performance on the Rivermead Behavioural Memory Test. *Journal of Child Psychology and Psychiatry, 40*, 357–361.

Palmer, L. K., Frantz, C. E., Armsworth, M. W., Swank, P., Copley, J. V., & Bush, G. A. (1999). Neuropsychological sequelae of chronically psychologically traumatized children: Specific findings in memory and higher cognitive functions. In V. L. Banyard (Ed.), *Trauma and memory* (pp. 229–244). Thousand Oaks, CA: Sage Publications.

Perez, C., & Widom, C. (1994). Childhood victimization and long-term intellectual and academic outcomes. *Child Abuse and Neglect, 18*, 617–633.

Perry, B. D. (2001). The neurodevelopmental impact of violence in childhood. In D. Schetky, & E. Benedek (Eds.), *Textbook of child and adolescent forensic psychiatry* (pp. 221–238). Washington, DC: American Psychiatric Press.

Prasad, M. R., Kramer, L. A., & Ewing-Cobbs, L. (2005). Cognitive and neuroimaging findings in physically abused preschoolers. *Archives of Disease in Childhood, 90*, 82–85.

The Psychological Corporation. (2002). WAIS-III/*WMS-III: Updated technical manual.* San Antonio, TX: Author.

Pynoos, R. S. (1990). Post-traumatic stress disorder in children and adolescents. In B. D. Garfinkel, G. A. Carlson, & E. B. Weller (Eds.), *Psychiatric disorders in children and adolescents* (pp. 48–63). Philadelphia: W. B. Saunders.

Semel, E., Wiig, E. H., & Secord, W. A. (2003). *Clinical evaluation of language fundamentals* (4th ed.). Toronto: The Psychological Corporation/Harcourt Assessment Company.

Shahinfar, A., & Fox, N. A. (1997). The effects of trauma on children: Conceptual and methodological issues. In D. Cicchetti & S. L. Toth (Eds.), *Developmental perspectives on trauma: Theory, research, and intervention* (Vol. 8, pp. 115–139). Rochester, NY: University of Rochester Press.

Sheslow, D. & Adams, W. (2003). *Wide Range Assessment of Memory and Learning: Second edition administration and technical manual.* Wilmington DE: Wide Range.

Shonk, S., & Cicchetti, D. (2001). Maltreatment, competency deficits, and risk for academic and behavioral maladjustment. *Developmental Psychology, 37*, 3–17.

Stern, R. A., Javorsky, D. J., Singer, E. A., Harris, N. G., Somerville, J. A., Duke, L. M., et al. (1999). *The Boston Qualitative Scoring System for the Rey-Osterrieth Complex Figure.* Odessa, FL: Psychological Assessment Resources.

Strauss, E., Sherman, E. M., & Spreen, O. (2006). *A compendium of neuropsychological tests: Administration, norms, and commentary* (3rd ed.). New York: Oxford University Press.

Stuss, D. T., & Benson, D. F. (1986). *The frontal lobes*. New York: Raven Press.

Sweet, J. J., Moberg, P. J., & Sucy, Y. (2000). Ten-year follow-up survey of clinical neuropsychologists: Part 1. practices and beliefs. *The Clinical Neuropsychologist, 14*, 18–37.

Teicher, M. H., Andersen, S. L., Polcari, A., Anderson, C. M., & Navalta, C. P. (2002). Developmental neurobiology of childhood stress and trauma. *Psychiatric Clinics of North America, 25*, 397–426.

Teicher, M. H., Andersen, S. L., Polcari, A., Anderson, C. M., Navalta, C. P., & Kim, D. M. (2003). The neurobiological consequences of early stress and childhood maltreatment. *Neuroscience and Behavioral Reviews, 27*, 33–44.

Teicher, M. H., Dumont, N. L., Ito, Y., Vaituzis, C., Giedd, J. N., & Andersen, S. L. (2004). Childhood neglect is associated with reduced corpus callosum area. *Biological Psychiatry, 56*, 80–85.

Teicher, M. H., Ito, Y., Glod, C. A., Andersen, S. L., Dumont, N., & Ackerman, E. (1997). Preliminary evidence for abnormal cortical development in physically and sexually abused children using EEG coherence and MRI. *Annals of the New York Academy of Sciences, 821*, 160–175.

Twamley, E. W., Hami, S., & Stein, M. B. (2004). Neuropsychological function in college students with and without posttraumatic stress disorder. *Psychiatry Research, 126*, 265–274.

van der Kolk, B. A. (1996). The body keeps the score: Approaches to the psychobiology of Posttraumatic Stress Disorder. In B. A. van der Kolk, A. C. McFarlane, & L. Weisaeth (Eds.), *Traumatic stress: The effects of overwhelming experience on mind, body, and society* (pp. 214–241). New York: Guilford Press.

Watts-English, T., Fortson, B. L., Gibler, N., Hooper, S. R., & De Bellis, M. D. (2006). The psychobiology of maltreatment in childhood. *Journal of Social Issues, 62*, 717–736.

Wechsler, D. (2003). *Wechsler Intelligence Scale for Children* (4th ed.). San Antonio, TX: The Psychological Corporation.

Wolfe, J., & Charney, D. S. (1991). Use of neuropsychological assessment in posttraumatic stress disorder. *Psychological Assessment, 3*, 573–580.