



SPECIAL TIMES

Community Therapeutic Day School

187 Spring Street, Lexington, MA 02421 781/861-7081

2003 Volume15 #1

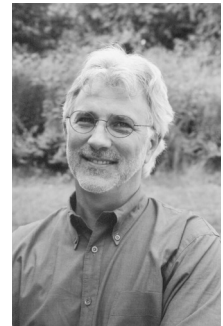
DEVELOPMENTAL CLINICAL NEUROPSYCHOLOGY

by Daniel Reinstein, Ph.D.

**CTDS is now offering Neuropsychological Evaluations
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Background

Clinical neuropsychology is an applied science investigating the relationship between brain and behavior. It evolved out of the parent disciplines of neurology and psychology in the middle of the twentieth century. Nevertheless, its ancestry extends back to at least the fifth century B.C. when Hippocrates claimed that the brain was the organ of intellect and the heart the organ of the senses. The scientific study of the brain began in earnest at the end of the eighteenth century when Gall pioneered the belief that distinct human faculties were localized in different areas of the brain. The work of Broca, in the latter half of the nineteenth century, supported this contention. Broca systematically described patients with speech loss, all of whom, upon autopsy, demonstrated lesions of the left side of the brain. This was the first conclusive evidence that language was predominantly a left hemisphere function. Further study at this time increased the amount of evidence correlating language dysfunction with damage to specific areas of the brain. With the work of Hughlings, Jackson and Wernicke, the concept of localization of function also expanded to include connections between brain regions. In the latter half of the twentieth century, new technologies gave rise to a more intensive inquiry into brain-behavior relationships. Current theories of brain functioning describe the brain as a variety of complex, localized and connected systems with a certain degree of redundancy and plasticity.



Theory

Historically, the discipline of clinical neuropsychology proceeded from the evaluation of brain damage in adults and, therefore, dealt primarily with the physical sequelae of damage to a mature nervous system. The application of neuropsychological theory and methodology to the clinical assessment of children is a recent development and has had to include a consideration of the nervous system as a more rapidly changing and developing entity. Thus, in addition to the three dimensions of structural space involved in localization, developmental neuropsychology has added the dimension of time.

Adding the dimension of time requires a different conceptual framework when considering brain-behavior relationships in the developing child. In an adult who has experienced neurological insult, recovery is largely functional and behavior generally reflects the sustained ability of unaffected areas. In the developing nervous system, however, early damage to specific structures can result in the development of alternate neural pathways that take on the affected function. In addition, the nature of these alternate pathways is determined by both the locus of the damage as well as the point of development in which the damage occurred. While the alternate pathways are less efficient, the child's behavior can appear far more normal than that of adults who have sustained similar damage. Not only is efficiency compromised, however, but the systems that have taken on the affected function are no longer solely carrying out the function for which they were originally intended. Thus, a child with neurological damage, whether it be genetic, environmental, or the result of some perinatal trauma such as hypoxia, can experience systemic changes throughout the brain. These systemic changes can then affect functioning in a variety of areas. Any compensating alternate pathways, while functional, can therefore be less efficient and compromise the functioning of other domains. A child who has sustained early damage to the language areas in the left hemisphere, for example, may develop speech through the use of systems localized in the right hemisphere. Right hemisphere structures being employed for speech, however, no longer would be as available for visual spatial functioning. Thus, many areas of neural functioning can be less efficient and affect the child's behavior in the realms of cognitive, social and emotional development. Any developmental assessment technique must take into account and reflect this developmental interplay between brain and behavior.

Purpose

What, then, is the purpose of neuropsychological assessment in the child? As described by Holmes-Bernstein and Weiler, "For us, the goal of assessment is optimal adaptation of the child to the demands upon him or her... In this regard, the child is not wandering around with 'holes' in his or her cognition; she or he functions as an integrated organism with different capacities for solving the varied challenges/ demands of his or her particular environment. His or her neuropsychological 'package' may limit the way in which these demands can be met, but may also permit compensation, either by use of alternative skills or by matching environmental demand to skills more effectively".¹ From this perspective, while the child is the unit of study in the assessment process, the evaluation must take into account the child within his or her environment. "The primary goal of the assessment process...is not to diagnose deficits in a child, but rather to construct a Child-World System that characterizes the reciprocal relationship of the developing child and the world in which that child functions. Construction of the Child-World System highlights areas of 'match' and 'mismatch' between the child's complement of skills and the demands placed upon them. Effective management strategies address both sides of the Child-World equation, seeking to optimize the match between child and world throughout the course of development".² Therefore, to construct this better match, neuropsychological assessment may be considered along three related dimensions:

1) **Diagnosis**- through the organization of all relevant data, one attempts to;

- differentiate psychiatric and neurological symptoms
- identify neurological disorders in non-psychiatric patients
- distinguish between different neurological conditions
- provide behavioral data for localizing brain lesions

2) **Care and Planning**

- cognitive status
- personality characteristics
- adjustment to disability

These measures are used to determine a pattern of relative strengths and weaknesses, the psychological impact of the disability and the individual's understanding of its impact within the context of the Child and the world.

3) **Treatment**- one attempts to improve the nature between the child and environment through the determination of relevant

services (e.g., medications, psychotherapy, occupational therapy, speech and language therapy, learning disability interventions, etc.)

Theoretical Areas of Functioning

Neuropsychological testing must consider not only the performance of the child on individual tests, but the overlap and interaction of a variety of functional behaviors as revealed by the performance on those tests while also taking into account the child's behavior in a variety of contexts. This represents a systemic approach that attempts to define behavioral clusters. Together, a description of these clusters contributes to the development of a child's neuropsychological profile - a child's specific pattern of relative strengths and vulnerabilities. For example, "low scores on a particular test may not be indicative of a discrete deficit, but may reflect the working of an alternative mechanism that is relatively less efficient than the one that is normally programmed by the genome. The task of the neuropsychologist, therefore, is not simply to highlight the areas of inefficiency, but to distinguish, where possible, the alternative mechanism used by the child and to pinpoint the source of the problem".³ As such, the assessment process must evaluate the child from a number of perspectives. Currently, neuropsychological assessments tend to examine three primary areas of functioning:

1 Holmes-Bernstein and Weiler, (2000) Pediatric Neuropsychological Assessment Examined, In Handbook of Psychological Assessment, 3rd Edition, Goldstein and Hersen (Eds) Pergamon pg.269,

2 Holmes-Bernstein and Waber, (1990) Developmental Neuropsychological Assessments in Neuromethods, Boulton, Baker, & Hiscock (Eds) Hamana Press pg 312,

3 Ibid. pg 327

1. Cognition

Over the latter half of the twentieth century, neuropsychological research has demonstrated that any measure of intelligence is really a measure of a number of different cognitive functions that, in normal functioning, tend to converge around the same level. For many people, however, looking at a composite score alone results in the loss of important information. Therefore, tests of cognitive functioning, such as IQ tests, are best interpreted not as a measure of overall intelligence, but rather as a pattern of relative strengths and weaknesses. Thus, most IQ tests will break down cognitive functioning into a number of discrete areas. Generally, the first level of distinction is made between verbal and nonverbal abilities. The remaining distinctions, as reflected in the variety of subtests found on most tests of intelligence, distinguish the following theoretical areas of cognition:

- a. Receptive Functions-** the entry of information into the central processing system proceeds from sensory stimulation (sensation) through the integration of sensory impressions into psychologically meaningful data (perception)
- b. Memory and Learning-** storage and retrieval (recall and recognition)
- c. Thinking-** any mental operation that relates two or more bits of information, e.g., computation, reasoning and judgment, concept formation, abstracting and generalizing, ordering, organizing, planning and problem solving.
- d. Expressive Functions-** functions such as speaking, drawing or writing, manipulating, physical gestures, facial expressions, or movements that make up the sum of observable behavior.
- e. Mental Activity Variables-** behavior characteristics that concern the efficiency of mental processes, e.g., consciousness, attention and processing speed.

While there is no one test that assesses each of these areas with a one to one correspondence, most tests of intelligence provide enough information on a specific individual's abilities to interpret that information within these theoretical constructs. There is also, necessarily, considerable overlap between these domains. Additional tests are also administered that look at specific areas in more detail and provide a convergence of findings that allow one to describe functioning in terms of behavioral clusters or systems.

2. Executive Functions

Executive functioning refers to "those capacities that enable a person to engage successfully in independent, purposive, self-serving behaviors".⁴ These include such things as approaching, planning and carrying out cognitive tasks and monitoring performance. These functions are believed to be subserved by the brain's frontal lobes and their connections. When there is damage or failure to develop in this area of the brain, functioning tends to be compromised more globally, affecting all areas of behavior, rather than discrete cognitive functions. The ability to sustain attention, switch cognitive set, monitor and regulate one's emotional landscape, initiate activity and sequence activities that lead to a goal are all managed through this system. Again, convergent information can be interpreted within this framework.

3. Emotionality

Individuals who have sustained brain damage or who have not had systems within the brain develop normally, will experience differences in the brain's ability to process emotional information. This may be a direct effect of the reduced capacity of a particular system or may be a secondary consequence. Tests of emotional functioning are therefore designed to provide information that is correlated with tests of cognitive and executive functioning. Together, they attempt to determine whether or not emotional differences are organically based or are the result of an individual's response, for example, to a cognitive vulnerability. In addition, such tests must also take into account environmental conditions that interact with or impinge on an individual's cognitive and emotional functioning. Therefore, tests of emotional functioning attempt to discern how a child is dealing with the demands of the environment as they relate to his or her pattern of cognitive and emotional strengths and weaknesses.

4 Lezak, M. (1995) Neuropsychological Assessment, 3rd Ed. Oxford U. Press. pg. 29

Conclusion

Neuropsychological testing can be a powerful diagnostic tool, but more importantly, it can be a tool to initiate understanding and change for a child who is struggling with his or her vulnerabilities. Understanding a child's relative strengths and weaknesses allows one to teach the child new strategies or to reconfigure the environment to accommodate the child's strengths. With a clearer understanding of those strengths, new strategies can allow a child to function more efficiently and not continually experience the fatigue and frustration that accompanies less efficient functioning. Making effective changes in the match between the child and the world is not an easily accomplished task, but it is crucial to the success and emotional well-being of the child.

The Neuropsychological Testing Process at CTDS

Any neuropsychological assessment of a child must be a multifaceted process, involving the collection of information from a variety of sources. The following is a hypothetical battery that attempts to represent the process of information gathering from which data is derived and analyzed. While certain aspects are somewhat fixed, such as the history taking and feedback session, the selection of particular tests must be tailored to the specific child and the questions one is asking about that child. What follows below, therefore, is meant to be merely descriptive and certainly not comprehensive.

1. History

- Interview
- Medical History
- Parent Behavioral Checklist
- Teacher Behavioral Checklist
- Previous Evaluation Reports

3. Neuropsychological Testing

- Wechsler Intelligence Scale for Children - Fourth Edition (WISC-IV)
- The California Verbal Learning Test (CVLT)
- Beery-Buktenica Developmental Test of Visual Motor Integration (VMI)
- Rey Osterreith Complex Figure Test
- Denckla Cancellation Test (or Mesulam)
- Halstead-Reitan Trail Making A and B
- Stroop Color/Word Interference Test

6. Report

- Sent to parents- includes History, Results from all testing and Recommendations.
The goal is to specify interventions that will improve the match between the child and the world.

7. School Consultation (optional)

- As a means to help implement the recommendations from the testing, a staff member would be available to consult to school systems. Consultation might include meeting with the team to further elucidate the report and its recommendations, but could also include ongoing consultation to the school to train staff and help monitor implementation of specific services and strategies.

2. Academic Testing

- Language
- Reading
- Written Expression
- Math

4. Projective Testing

- Roberts Apperception Test
- The Rorschach Inkblot Test
- The Conger Sentence Completion Test
- House-Tree-Person
- Kinetic Family Drawing (KFD)

5. Feedback Session

- Meeting with parents to present results of testing and reframe child's difficulty in the context of the child and the environment.

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