06 - 5.6 Neuropsychological and Cognitive Assessme

5.6 Neuropsychological and Cognitive Assessment of Children

Other Behavioral Personality Approaches. Many other behavioral approaches to assessment are available in addition to behavior rating scales, as discussed in the earlier part of this section. Direct observations of child and adolescent behavior can be a useful adjunct to other assessment procedures, whether the observation is unstructured or structured according to a specific format. REFERENCES Adams RL, Culbertson JL. Personality assessment: Adults and children. In: Sadock BJ, Sadock VA, Ruiz P, eds. Kaplan & Sadock's Comprehensive Textbook of Psychiatry. 9th ed. Philadelphia: Lippincott Williams & Wilkins; 2009:951. Bram AD. The relevance of the Rorschach and patient-examiner relationship in treatment planning and outcome assessment. J Pers Assess. 2010;92(2):91. DeShong HL, Kurtz JE. Four factors of impulsivity differentiate antisocial and borderline personality disorders. J Pers Disord. 2013;27(2):144–156. Hentschel AG, Livesley W. Differentiating normal and disordered personality using the General Assessment of Personality Disorder (GAPD). Pers Mental Health. 2013;7(2):133–142. Hoff HA, Rypdal K, Mykletun A, Cooke DJ. A prototypicality validation of the Comprehensive Assessment of Psychopathic Personality model (CAPP). J Pers Disord. 2012;26:414. Hopwood CJ, Moser JS. Personality Assessment Inventory internalizing and externalizing structure in college students: Invariance across sex and ethnicity. Pers Individ Dif. 2011;50:116. Israel S, Moffitt TE, Belsky DW, Hancox RJ, Poulton R, Roberts B, Thomson WM, Caspi A. (2014). Translating personality psychology to help personalize preventive medicine for young adult patients. J Pers Soc Psychol. 2014;106:484. Samuel DB, Hopwood CJ, Krueger RF, Patrick CJ. Comparing methods for scoring personality disorder types using maladaptive traits in DSM-5. Assessment. 2013;20(3):353–361. Schuppert HM, Bloo J, Minderaa RB, Emmelkamp PM, Nauta MH. Psychometric evaluation of the Borderline Personality Disorder Severity Index-IV—adolescent version and parent version. J Pers Disord. 2012;26:628. Strickland CM, Drislane LE, Lucy M, Krueger RF, Patrick CJ. Characterizing psychopathy using DSM-5 personality traits. Assessment. 2013;20(3):327–338. 5.6 Neuropsychological and Cognitive Assessment of

Children Although cognitive and neuropsychological assessments might overlap, these approaches analyze behavior according to two different paradigms. Cognitive assessment is undertaken without reference to the possible neurobiological underpinnings of overt behavior, and it describes the patient very much as others might observe him or her in the world. Neuropsychological assessment is undertaken in the context of growing knowledge about brain–behavior relationships, and it has the additional possibility of describing the child in terms of unseen neural pathways. These approaches provide ways of conceptualizing how children integrate information (and their thinking, learning, and responding) at different levels. General cognitive assessment focuses on understanding behavior at a cognitive level and in descriptive terms. Focused

neuropsychological assessment introduces the additional possibility of understanding behavior at neural levels and in neurobiological terms. However, regardless of the theoretical differences among the psychologists undertaking these evaluations, in a practical way it is the patient's referral issues that shape the assessment process and focus the interpretation of results. BASICS OF PSYCHOLOGICAL ASSESSMENT Psychological assessment involves more than testing. Although measurements are useful, testing involves more than scores. The Testing Process In addition to testing, assessment procedures include examining past records (medical examinations, prior testing, report cards), interviewing the client and his or her family (in structured and unstructured formats), obtaining information from home and school (and, sometimes, onsite observations), and obtaining rating scales that have been filled out by the child's parents and teachers (regarding developmental, behavioral, emotional, and diagnostic issues). The diagnostic aspect of the process involves an attempt to determine the psychiatric and educational categories for which the client meets the criteria. Cognitive and neuropsychological testings are only two aspects of an attempt to get a broad view of the way a child solves problems in the world, to understand his or her unique interaction with any diagnostic category, and to provide recommendations for interventions. Measurements in Testing Although many techniques might be used to help understand a child client and his or her referral question, the emphasis here is on standardized testing (based on regularized procedures as well as normative data). The point of testing is to create a way of comparing one individual to a population of such individuals, as well as the strengths and weaknesses within one individual. The psychologist will select an instrument that is valid (it measures what is intended) and reliable (it measures it consistently). The testing involves establishing a basal level (the level at which all items are passed) and a ceiling (the level at which no items are passed). The testing process involves converting a raw score to a standard score that can be compared with other scores along what is thought of as a normal distribution with predictable statistical properties. The standard deviation (SD) is a measure of dispersion around the mean; the farther scores are from the mean and each other in terms of the SD, the more meaningful is the discrepancy. It is accepted that a measurement is an approximation and not exact. This approximation is recognized by the concept of standard error of measurement (SEM), which is the naturally occurring (random) error that takes place in the real world as one attempts to measure anything. The fact that measurements are not exact is also recognized by the concepts of confidence intervals (the probability that the true score falls within a range

of scores) and statistical significance (the probability of finding a result by chance). Beyond Scores and Tests It should be noted that the testing process involves more than scores. Although scores are important, how the patient goes about solving cognitive problems is also carefully observed. The examiner is interested not only in test performance, but also in the patient's reaction. It is

important to the psychologist to note how the patient arrives at right as well as wrong answers and to explore the patient's cognitive strategies on tasks. In general, it is important to note whether the patient responds in a deliberate or impulsive way. The testing process is not separate from the therapeutic process. If well handled, the testing can become an extension of the treatment. Feedback about results and their relationship to the presenting problems can be presented as the evaluation unfolds. COGNITIVE AND NEUROPSYCHOLOGICAL ASSESSMENT The general cognitive assessment tends to be a descriptive and practical event with an eye to the policies and possibilities in the outside world. As a result, the cognitive tests tend to be "comprehensive" instruments. The very factors that make them useful for general assessment limit them when it comes to understanding neurobiological functioning. The neuropsychological instruments tend to be more "precision" tests that attempt to assess very specific behaviors that represent neural constructs in an inner world. Even when the results are explored at more descriptive levels, functioning within the domains is not seen as separate or independent of their neurobiological underpinnings. Tables 5.6-1 and 5.6-2 list the current cognitive and neuropsychological tests. Table 5.6-1 Cognitive Tests

Table 5.6-2 Neuropsychological Tests

Description of Cognitive Tests Although psychologists use diverse tests, three kinds of cognitive testing are described in this subsection: intellectual, achievement, and processing instruments. Generally, intellectual tests measure overall mental ability, achievement tests assess past learning, and processing tests measure discrete cognitive functions.

Intellectual Testing. Intelligence is defined as the ability to learn from and adapt to the environment and the ability to think abstractly. Intelligence tests are used to determine the patient's general intellectual functioning. The intelligence quotient (IQ) is a measure of present intellectual functioning. Although intelligence tests yield one IQ score (or several IQ or index scores), they are, in fact, devices for "sampling" many tasks in a variety of verbal and nonverbal areas. Intelligence testing is often part of a variety of psychological assessment batteries, including psychoeducational and neuropsychological evaluation, along with more general developmental and clinical evaluations. Although there is some disagreement, IQ scores tend to be relatively stable starting as young as 5 to 7 years of age. In general, the older the child is when tested and the smaller the interval between test administrations, the greater is the correlation between two IQ scores. Although using an IQ score can be useful as a way of assessing the client's basic trajectory through life, the prudent practitioner must be aware that there are a number of factors that can affect intellectual functioning and, thus, IQ scores. Factors associated with a disorder and illness can suppress scores, particularly in psychiatric practice. These can include situational factors, such as lack of motivation, as well as transient factors, including inattention, depression, and psychosis. Despite conceptual and practical complications, high intelligence is associated with better prognosis in a wide range of psychiatric conditions; lower rates for behavior, conduct, and emotional problems in children; and lower rates of referral for psychiatric problems in adults. In the case of any kind of brain damage (neuronal death), intellectual level accounts for a great deal of variance in predicting outcome, with lower IQs associated with poorer outcomes and higher IQs associated with better outcomes. ASSESSMENT. Although IQ is what is obtained with an IQ test, there are a variety of intellectual tests, as well as other ways of calculating intellectual level. There are a number of instruments from which to choose, and psychologists must make their selection

based on the specific characteristics of each test (e.g., normative sample and construction of the instrument) as they relate to the characteristics of the client (e.g., age and referral question). Once the test has been administered, the clinician must make interpretations based on the analysis of overall and subtest scores and their pattern in the context of the diagnostic process. Comprehensive Intellectual Tests. The two best-known intellectual tests are the Wechsler Intelligence Scales and the Stanford-Binet Intelligence Scales (SB). The current editions of both are divided into separate subtests, and the data are analyzed in separate spheres. There are three separate instruments within the Wechsler tests that are designed for three different age groups over the life span: Wechsler Preschool and Primary Scale of Intelligence (WPPSI), Wechsler Intelligence Scale for Children (WISC), and Wechsler Adult Intelligence Scale (WAIS). One SB instrument covers a lifetime. Both instruments have made attempts to assist in decision making regarding attentional problems. The WISC has made particular attempts to link its findings to memory, adaptive, and giftedness scales. The SB includes a routing system so that the examiner

can “adapt” the administration to the functioning level of the examinee. Table 5.6-3 provides the intellectual classifications systems for the SB and the Wechsler tests. These categories are also relevant to the cognitive results of other psychometrically similar tests. Table 5.6-3 Comparison of Wechsler Intelligence Scales and Stanford-Binet Intelligence Scales–5th Edition (SB5) Intellectual Rangesa Achievement Testing. Achievement testing is used to determine a student’s level of functioning in basic academic areas (i.e., reading, mathematics, and writing). The purpose of the assessment is to identify learning problems and usually to rule out other psychological factors that might be complicating learning. Unlike intellectual testing, achievement testing is not necessarily expected to be stable over time because it measures the child’s success in formal learning and is highly dependent on the home environment and the school curriculum. Learning disability is commonly defined in terms of “unexpected underachievement”—that is, the child has the potential and opportunities to have learned more. When achievement testing is undertaken along with intellectual and processing testing, the overall evaluation is commonly referred to as a psychoeducational assessment. ASSESSMENT. Psychologists commonly begin an assessment of academic achievement by giving a comprehensive test in order to get a sense of a client’s areas of weakness in contrast to his or her strengths in reading, math, and writing. These findings are compared with school records. Because reading problems are a relatively common reason for referral and their causes are increasingly understood, where indicated, this comprehensive test is commonly followed by other tests of reading skills that separate out accuracy, fluency, and comprehension. Comprehensive Achievement Tests. Each of the tests assesses a range of academic areas,

so that they can be compared with each other for any individual or to academic achievement according to more external standards (age/grade expectations). The Wechsler Individual Achievement Tests (WIAT) and the Woodcock-Johnson Tests of Achievement (WJ-ACH) allow for the systematic assessment of reading (basic word recognition/decoding and comprehension), mathematics (calculation and reasoning), and writing (brief to extensive composition), as well as spelling and other academic spheres. FOCUSED NEUROPSYCHOLOGICAL ASSESSMENT Neuropsychology is dedicated to the study of brain–behavior relations and has matured into a clinical discipline for the diagnosis and characterization of brain function and dysfunction. Assessment of Functioning Neuropsychological assessment was originally developed for the assessment of adult patients and was not generally applied to child assessment until later. This

functional assessment was important because the effect of trauma to the brain is highly variable across individuals, even when the precise location and size of the lesion is known. In these situations, neuropsychological tests could provide specific functional information that take the child's age and developmental status into account. This continues to be a prominent point of referral for pediatric neuropsychology because it discusses not just the existence of the brain disruption but also its meaning in terms of the child's ability to function. This use of neuropsychological assessment is important with gross injury to the brain, but it is also valuable in situations in which sequelae are subtle and at risk of being attributed to psychological factors such as grief or poor motivation. Technical Advances Recent advances in neuroimaging have added to the use of neuropsychology in child assessment. One reason that neuropsychology was later in being applied to children was that technology for learning about children's normal brain development was not available. Given that neuropsychology studies the relationship between behavior and the brain, this gap in knowledge meant that inferences about brain function could not be applied to children. Because techniques such as positron emission tomography (PET) were prohibited in research with children, it was not until the introduction of functional magnetic resonance imaging (fMRI) in the early 1990s that full-scale research of child brain development could begin. Since that time, there has been an unprecedented explosion of knowledge that has expanded the scientific understanding of child brain development exponentially every year up to the present. Developments in Test Instruments Other advances in pediatric neuropsychology include the introduction of tests

specifically designed for use with children. These instruments assess similar behaviors as do their adult counterparts but use paradigms that are more engaging to children and better measure developmental transitions throughout childhood. These instruments are used in clinical assessments but are now also part of many research protocols examining childhood diseases and genetic conditions. Given its precision in measuring behavior, neuropsychological assessment is now involved, not just in the assessment of function after an injury but also in the initial diagnostic processes. Another example of this specificity is the now-routine use of neuropsychological testing in genetic research of developmental disorders of childhood, given the precision that it adds to questions of endophenotype expression. Neuropsychology's Application to Diagnosis and Treatment Planning These new technologies have greatly enlarged our understanding of both normal and atypical brain development in children, affecting our knowledge of childhood brain–behavior relationships, as well as diagnosis and treatment planning in pediatric groups. This increased understanding of typical as well as atypical brain development has made neuropsychological assessment useful, not just for children with acquired disorders but also in cases of developmental disorders. In this context, the term developmental disorders is used in reference to a child who is not developing in step with peers but who for unknown reasons struggles greatly or fails to develop specific abilities. Examples are difficulty in learning to read in an otherwise intact child (referred to as the developmental disorder of dyslexia) and problems with developing social or selfregulatory skills (seen in, respectively, autism spectrum and attention-deficit disorders). These disorders stand in contrast to "acquired" disorders, in which a known event, such as injury or illness, has affected the child's developmental trajectory. Integration of Neuropsychological, Educational, and Psychological Paradigms in Testing The effect on testing that these breakthroughs have made has also been significant. Most of this subsection focuses on test instruments that are foundational when assessing developmental differences in children. These measures (including tests of IQ or academic achievement) are central when youngsters are not

keeping up with their peers in one regard or another and are the backbone of testing, regardless of whether the assessor is trained as a psychologist or a neuropsychologist or has a background in education. These instruments are pivotal because they measure the major paradigms of both education and psychology, paradigms that govern both diagnosis and the provision of services. More recently, however, these established paradigms have been joined and affected by new information emerging from cognitive and neuropsychology in concert with the aforementioned breakthroughs in neuroimaging. The integration of these findings has led to relatively rapid changes in educational law and in the instruments used to test

children for learning disabilities. Applications of Neuropsychological Assessment The functional and diagnostic assessment of children and adolescents often begins (and ends) with the kinds of evaluations described in the “General Cognitive Assessment” subsection. There are situations, however, in which the use of educational or psychological or cognitive testing alone is not able to clarify the diagnosis and determine the most appropriate treatment plan. In those cases, the psychiatrist should consider additional neuropsychological testing. Descriptions and Assessment of Typical Neuropsychological Domains Typically, in addition to assessing IQ, academic achievement, and social and emotional functioning, neuropsychologists assess domains of memory, attention, executive functioning, language, visual perception, and sensory-motor development. Tests have been developed to examine specific aspects of these domains in isolation so as to increase diagnostic clarity. Although these domains are discussed as different constructs in this subsection, in truth they overlap with one another in many different ways. For example, the term working memory is often conceptualized as being an aspect of attention as well as a necessary component of good planning (which is part of executive functioning). It is also a component of memory in that, when it is not well developed, it leads to the phenomenon of forgetfulness. Memory. Memory is defined as the ability to reproduce or recall what has been learned or retained through activities or experiences. The process of memorizing includes two steps: encoding and retrieving. One metaphor for this two-step memory process is a filing cabinet. Encoding, then, is when a person puts information into the “filing cabinet drawer.” Someone with a true amnesic disorder (such as Alzheimer’s disease) never gets the information into the drawer. No amount of cueing or reminders later on will help the person to recall the information because it never “got into the drawer” in the first place. This type of impairment can be seen in some children, most often those with seizure disorders that adversely affect the temporal lobes. For most children, however, the problem described as “poor memory” is actually a difficulty with retrieval. Retrieval is the ability to get information out of the “file cabinet drawer” once it has been put in. Poor retrieval is associated with problems of organization (the folders are missing labels) and is more often the issue when children are described as being forgetful. To differentiate between encoding and retrieval, children are asked to memorize material and then, 20 to 30 minutes later, to recall it. If they are unable to remember it spontaneously, the examiner does not know whether they have not encoded it or are having problems with retrieval. If the child can remember the material with cueing (e.g., “In the story I read you, was the boy’s name Johnny or Sam?”), retrieval is implicated. For the child who cannot encode, however, cueing will not help.

ASSESSMENT. In assessing memory, several guidelines should be followed. Both visual and verbal memory tasks should be given. Visual memory tasks (such as learning the location of dots or memorizing faces) are usually aided by the right hemisphere. In most people, verbal memory tasks (such as memorizing a shopping list or a story) are supported by the left hemisphere. In addition,

material to be memorized should include rote tasks (such as word lists) as well as material that is presented in context (such as stories). Some memory tasks assess learning, or the child's ability to benefit from several presentations of the material. It is expected that, after three exposures to a picture of dots, the child's memory of it will be stronger than it was after the first exposure. If not, encoding may be implicated. A 20- to 30-minute delay should also be part of the memory assessment, and cues should be available to differentiate between encoding and retrieval difficulties. Other terms in the neuropsychological literature appear to describe memory but are actually probably better classified as part of the attention system. These include short-term memory and working memory. These terms are discussed in the following subsection on attention. Attention. The attention literature is large and includes many different conceptualizations. The following illustration demonstrates some elements of good attention. Suppose you arrive at a lecture hall, open your notebook, and rather than scanning the room indiscriminately, turn your attention to the instructor, who is just beginning to speak (selective attention). The lecture is mildly interesting, and you are able to pay attention for the full 20-minute presentation (sustained attention or vigilance). At the same time that you are listening to the instructor, you are taking handwritten notes incorporating headings and subheadings. It appears that you are able simultaneously to listen, write, and organize rather effortlessly, although you are probably shifting your attention among these competing tasks (divided attention). A fire engine goes by the lecture hall and you look up (distraction) but are then able to ignore the dimming noise of the siren (inhibition) and continue to listen to the lecture (again, sustained attention). Suddenly, the fire alarm rings, and you smell smoke. These distracters capture your full attention (disengagement from lecture), and their importance causes you to change your attention and behavior (set shifting) as you hurriedly head for the door. A breakdown in any one of these areas can lead to a breakdown in attention. ASSESSMENT. Assessment of attention requires a number of approaches. Children with attention problems exhibit them at home and at school whenever a task becomes less interesting to them. They function better when working one-on-one with a person or when working on a new activity because it is more stimulating. For this reason, the testing environment may not elicit the inattentive behavior (especially on the first day). To assess the child's attention "in real life" and across settings, attention questionnaires should be completed by both parents and teachers. Many researchers consider this aspect of the assessment of attention to be the most important. Some neuropsychological measures have been found to be sensitive to attention as well. Computerized measures of sustained attention that are designed to be long and boring can capture the loss of attention described here. In addition, specific kinds of

performance patterns on these measures have been shown to differentiate different types of attention problems. Assessment of verbal short-term memory might include the repetition of digits or of short sentences. Assessment of visual short-term memory can be achieved by having the child point to dots or circles on the page in the same order in which the examiner has just pointed to them. Working memory is usually assessed as the second part of a shortterm memory test. It requires that the material that has been stored in short-term memory be manipulated in some way. Verbal working memory can be assessed by having the child repeat digits backward or by doing mathematics in his or her head. Saying the months of the year backward can also assess verbal working memory (as long as the child is able to give them in their usual order without difficulty). Having the child point to the dots on the page in the reverse order in which they are shown can assess visual-spatial working memory. Executive Functioning. Executive functioning could be considered to be the mature product of good attention. Although not developed in earnest until

children reach adolescence, many aspects of executive functioning begin to appear when children are younger and, thus, can be measured. Executive functioning refers to the person's ability to organize his or her behaviors to perform a specific goal. Good executive functioning allows a person to identify problems, generate solutions, choose among them, follow through on the chosen strategy, and evaluate its effectiveness as the work progresses. Without good executive functioning, children who are bright have difficulty demonstrating their abilities. Their parents often report school underachievement that cannot be explained by learning problems. The issue is not about "knowledge" but rather the application of that knowledge to everyday functioning. ASSESSMENT. Assessment of executive functioning requires several tests, given its many facets. Good attention and working memory, already discussed, are crucial to goaldirected behavior. Inhibition can be tested by giving the child a task in which he or she must control an automatic response. Fluency can be assessed by having the child generate category words under a time limit. For example, a child might be asked to name as many kinds of toys as he or she can in 1 minute. A variant of this task requires the child to create as many designs as he or she can in a 1-minute period, according to strict guidelines. Cognitive flexibility is often tested with the Wisconsin Card Sorting Test (WCST), a measure of problem solving. On this test, the child is not told how to solve the puzzles; rather, he or she must use feedback that his or her attempts are "right" or "wrong" and is then expected to use this information to generate strategies. During the course of this test, the rules often change without warning, requiring that the child "regroup" and develop a new strategy. This measure generates information about the child's ability to initially figure out the task, his or her tendency to perseverate on wrong responses, and his or her ability to use feedback to generate new responses. Planning is another aspect of executive functioning. Variants of a "tower" test are

often used to assess this ability. On a tower test, the child is shown a picture with colored balls or disks stacked on top of one another on wooden pegs in a specific configuration. The child is told to move the balls or disks on the pegs for an actual model on the table to match the configuration shown in the picture. The child is instructed to move only one ball or disk at a time and to use as few moves as possible. To perform the task well, the child must first "hold back" and not make impulsive moves that may get him or her "cornered." The child must also visualize the first few steps of the problem. Thus, both impulse control and visual working memory are required to exhibit good planning on this rather entertaining test. Language. Human language organizes, supports, and communicates knowledge, memories, and ideas. Beyond just allowing us to communicate with others, language organizes both thoughts and emotions, as well as helping us sequence our actions. Although traditionally discussed in terms of left hemisphere functioning, much of the human cortex is involved in various aspects of language. Communication includes both speech, the rapid and complex motor movements involved in talking, and language, the code used to express thoughts and ideas. Linguists conceptualize language as being composed of four separate parts: phonemes, defined as the smallest units of sound in a language; morphemes, the smallest units of meaning; syntax at the level of the sentence (e.g., use of direct or indirect pronouns); and discourse, the stringing together of sentences to create a narrative. In considering language, perhaps the most common distinction made is between expressive and receptive language. Expressive language requires the production of language, including articulating clearly, finding the right word, and applying grammar and syntax to one's ideas, in addition to vocal fluency and voice tone (prosody). Receptive language involves the ability to comprehend and remember what is said. Children with expressive language problems may appear to have little to say and considered to be

shy. In fact, however, their difficulty may be with self-expression. Some children who are very talkative (fluent) may also have difficulty with finding the word they want or organizing their sentences to make them clear. The paradox of a fluent child with an expressive language disorder may cause his or her problems to be overlooked. Receptive language, or the ability to understand what is being said, represents another aspect of the language system. Children with poor receptive language have difficulty in processing information that is spoken to them and may have difficulty learning in the classroom or appear to be inattentive. Sometimes they appear to be oppositional because of their difficulty with understanding (and therefore doing) what they are told. Secondary problems of children with language disorders include difficulties with social interactions and processing of emotions. Language is what humans use to interact and communicate their ideas to one another. When this ability is compromised, children may isolate or try to find less language-intense activities to occupy their time. Emotional problems may ensue from the child's difficulty with using language to express and,

therefore, process his or her inner world. ASSESSMENT. Assessment of language should include several measures meant to identify the child's specific language profile. Tests should assess all levels of language, including phonemes, single words, simple phrases, complex sentences, and conversation. Measures of both expressive and receptive language should be included. In the assessment of receptive language, children are asked to distinguish between similar sounds and words, remember and repeat word lists and related strings of words, point to a picture that depicts a vocabulary word, and follow increasingly complex directions presented only once. In the assessment of expressive language, children are asked to perform tasks such as listing as many round objects as they can within a time limit, naming a depicted or described item, defining words or concepts, or creating a syntactically complex sentence according to strict guidelines. In addition, the psychologist might explore pragmatics, which is the child's ability to participate in conversation and use social language. This involves interpreting nonverbal aspects of communication, as well as observing basic social rules, such as turn-taking in conversation. Although neuropsychologists often evaluate pragmatics in addition to receptive and expressive language, they also work in concert with speech and language specialists when additional assessment is indicated. Visuoperceptual Functioning. There are several associated constructs in neuropsychology that reflect people's ability to make sense of what they see, to organize it, or to copy it. These abilities are referred to as visuoperceptual–visuoconstructive abilities. Problems with visuoperception are distinct from problems with vision. A person with acute eyesight can struggle with perceptual difficulties, such as identifying which of several figures are exactly alike. Some children have difficulty seeing exactly where something is, and these children may have trouble localizing a point in space or judging the direction of a line. Visuoconstruction abilities allow a child to join parts to make a whole. These skills require the integration of the motor system with the visual system. Examples include the ability to put together blocks to form a design or to draw three lines to form a triangle. Problems with visuoperceptual development have academic, as well as social, ramifications. Academic areas, such as mathematics, that are less reliant on verbal support are at risk. In addition, concepts such as time and monetary values may not be clearly understood. Students with these difficulties often exhibit a poor sense of direction, and problems with integrating complex visual arrays may lead to feelings of being overwhelmed. They may also have difficulty "reading between the lines," thereby making comprehension of less tangible reading concepts (such as theme) more elusive. Social problems are also often seen in students with these delays. Many elements of good social interactions are nonverbal, including the ability to notice and interpret gestures, facial expression,

body posture, and tone of voice. Students with visuoperceptual delays may be overreliant on verbal information and may not understand when people are being sarcastic or when something is said in jest. ASSESSMENT. Assessment of visual processing must address each of the specific elements of this system. The visuoperceptual abilities should be tested using tasks that do not

require the child to use his or her hands to produce the response—for example, activities that require the child to identify designs that match or differ from the target, as well as measures of mental rotation (determining which design is the same as the target, only rotated). Visuoconstruction tasks add the demand of integrating the hands and eyes in producing the response—for example, having the child draw copies of designs or use blocks to create a replica of a model. Sensory/Motor Functioning. The sensory/motor system is also assessed as part of the neuropsychological examination. Lateralized sensory or motor problems suggest neurological problems on the opposite side of the brain and are often correlated with cognitive processes localized to the right or left hemisphere. Tasks requiring the perception of visual or auditory fields or specific actions with right or left sides of the body are part of this domain. In addition, integration of perceptions or movements is also assessed. Motor assessment is further categorized into the assessment of handedness and tests of large versus fine motor development, as well as the ability to plan motor responses (praxis). ASSESSMENT. The sensory exam usually includes assessment of visual fields using clinical methods, such as having the child look at the examiner's nose and then determine whether the assessor is moving the right or left extended hand. Similarly, assessment of bilateral auditory perception might include the assessor standing behind the child and rubbing his or her fingers near the child's right or left ear. Other perceptual tests might assess the ability to name unseen objects placed in the child's right or left hand. Finger agnosia is tested by touching a finger when the child's hand is hidden behind a screen and then having him or her indicate which finger was touched. Integration of perception might include having the child follow directions involving a picture that is shown. Agebased normative data are available for all of these tasks. Both fine and large motor tests are usually assessed on both the right and left sides of the body. Lateralized fine motor tasks include quickly placing pegs in holes with each hand or squeezing a hand dynamometer with each hand to assess grip strength. Fingertip tapping is one way of testing motor sequencing, as are activities that require the child to repeat sequences of movements from memory. Handedness is best assessed by having the child do a number of tasks with one hand (e.g., "Show me how you use this spoon," "Hand me the dime," and "Throw me the ball.") in random order. Assessment of difficulties with motor planning can be done using pantomime. Large motor testing involves having the child demonstrate gait while walking forward and backward, running, skipping, walking a straight line, and balancing on one foot. In cases in which the findings of motor screening are significant, the neuropsychologist might refer the child to an occupational or physical therapist for further, more specific, evaluation. Neuropsychological testing is commonly undertaken according to several discrete domains that reflect areas of brain functioning. Typically, these include attention and

executive functioning, memory, and language as well as visuoperceptual and sensory/motor functioning. In considering neuropsychological issues, the following factors should be kept in mind: After early brain injury, language and motor functioning are the most likely to benefit from "plasticity." Some research suggests that, with this process of reorganization, other functions (most notably, visuoperceptual abilities) may be "crowded out," yielding scores that are lower than expected. Interventions for neurologically driven developmental delays have their most profound effect on younger children. Recent studies have shown that, in children with reading disabilities,

bilateral representation of language identified with fMRI before intervention shifted to the left hemisphere by several orders of magnitude in every subject after only 80 hours of reading intervention. These changes in the brain were accompanied by improved reading skills. Thus, the philosophy of delaying intervention until a deficit is fully expressed may keep children from receiving the full benefit that early intervention provides. Risk factors for reading disabilities include family history, early language delays, poor articulation, chronic ear infections, poor early rhyming abilities, inability to recite (not sing) the alphabet by the end of kindergarten, and early brain injury. Ambidexterity (consistently using the right hand for some specific tasks and the left hand for other specific tasks) often runs in families in which several members are left handed. In contrast, ambiguous handedness (or the use of either hand for the same task; sometimes writing with the right hand, sometimes writing with the left hand) can be a pathognomonic sign suggesting poor cerebral organization for specific behaviors. Attention-deficit/hyperactivity disorder (ADHD) more adversely affects abilities typically associated with right hemisphere functioning (such as fine motor skills and visuoperceptual abilities) and affects attention and executive functioning. Psychostimulant medication has been shown to improve functioning in all of these domains in children with ADHD. REFERENCES Cleary MJ, Scott AJ. Developments in clinical neuropsychology: Implications for school psychological services. J School Health. 2011;81:1. Dawson P, Guare R. Executive Skills in Children and Adolescents: A Practical Guide to Assessment and Intervention. 2nd ed. New York: Gilford; 2010. Fletcher JM, Lyon RG, Fuchs LS, Barnes MA. Learning Disabilities: From Identification to Intervention. New York: Guilford; 2007. Jura MB, Humphrey LA. Neuropsychological and cognitive assessment of children. In: Sadock BJ, Sadock VA, Ruiz P, eds. Kaplan & Sadock’s Comprehensive Textbook of Psychiatry. 9th ed. Philadelphia: Lippincott Williams & Wilkins; 2009:973. Korja M, Ylijoki M, Japinleimu H, Pohjola P, Matomäki J, Kusśmierek H, Mahlman M, Rikalainen H, Parkkola R, Kaukola

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