Chapter 6  
Neuropsychological Domains of Functioning

Chapter 8 discusses various approaches to neuropsychological testing including the Reitan batteries and Boston Process techniques. The goal of this chapter is to provide a brief overview of the various domains generally associated with a neuropsychological evaluation. These domains include traditional components of a psychological evaluation such as cognitive ability, achievement, and social-emotional functioning. In addition, domains such as attention, executive functioning, fine motor skills, and visual-perceptual abilities are also presented as typically contained in a neuropsychological evaluation. This chapter is not an exhaustive review of the available measures; such a discussion is available in many sources, primary of which is Strauss, Sherman, and Spreen (2006).

**Cognitive Ability**

Selected instruments for measuring cognitive-intellectual functioning are reviewed including the following: (1) the Woodcock-Johnson Cognitive Battery-III (WJ-III); (2) the Weschler Intelligence Scale for Children-IV (WISC-IV); (3) the Differential Ability Scale-2 (DAS-2); (4) the Kaufman Assessment Battery for Children-2 (K-ABC-2), and (5) the NEPSY 2.

### Woodcock-Johnson Tests of Cognitive Ability-III

The Woodcock-Johnson Tests of Cognitive Ability (WJ) was developed by Woodcock and Johnson (1977), revised (WJR) in 1989 by Woodcock and Johnson (1989) and again revised in 2001 (Woodcock, McGrew, & Mather, 2001a). The WJ-III is based on the intellectual model of crystallized and fluid intelligence (Cattell & Horn, 1978) and has been found useful for measuring cognitive ability, scholastic aptitude, and achievement (Woodcock, 1990). There are scales that measure intelligence (a brief and general scale) as well as measures of attention, executive functioning, working memory, verbal ability, thinking ability and cognitive flexibility. Although it is sometimes difficult to abandon the verbal-perceptual organization model of intelligence underlying the Weschler scales, the WJR offers a conceptual alternative to this framework that might be extremely useful for some childhood disorders, particularly learning disabilities. The WJIII has strong psychometric properties and offers a method of gathering benchmark measures of visual and auditory processing, memory and retrieval, and reasoning abilities in children and adolescents.

### Wechsler Intelligence Scale for Children-IV

The Wechsler scales have enjoyed a long history of use for measuring intelligence in children and adolescents (Sattler, 2001), and the Wechsler Intelligence Scale for Children-IV (WISC-IV) is the latest revision for children (Wechsler, 2003). The WISC-IV departs from the previous revisions and provides four indices of performance: Verbal Comprehension, Perceptual Reasoning, Working
Memory, and Processing Speed as well as a Full Scale IQ (FSIQ). Though not originally developed as a measure of brain functioning, the Wechsler scales are almost always used as part of a neuropsychological evaluation (Baron, 2004). The WISC-IV or the WJIII: Which is best?

In general, neuropsychologists do not incorporate both the WISC-IV and the WJIII in an evaluation of children, primarily due to time constraints. However, deciding which cognitive-intelligence instrument to use may be a difficult choice. In making this determination, consider using the WISC-IV

1. when the impact of injury or CNS disease on the child’s intelligence is of concern
2. when long-term intellectual competencies are in question, and
3. when identifying functional sequelae of focal injury is of interest (i.e., verbal comprehension deficits related to injury of temporo-parietal regions or perceptual-organization weaknesses following injury to parieto-occipital regions).

The WJIII may be more useful

1. when perceptual processing and memory functions are of primary interest (i.e., phonological core deficits)
2. when deficits of concept formation and abstract reasoning are of concern (i.e., injury to frontal regions)
3. when there are signs of visual agnosia, aphasia, or significant academic deficits in language-related or math skills (i.e., dyslexia), or
4. when the WISC-IV or other cognitive measures do not seem to adequately reflect the child’s ability, as evidenced by adaptive behavior levels.

There also seems to be historical precedence for selecting the WISC-IV, although important data can be gleaned from the WJIII that are quite distinct from those obtained with other intelligence measures. The WJIII was developed with multiple intelligences as the theoretical framework, which may prove to be very useful for more clearly articulating the complexities of specific cognitive abilities as they relate to specific brain function. Further research exploring the relative contributions of the WISC-I11 and the WJR to neuropsychological evaluation is needed to clarify these issues.

**Differential Ability Scal-2 (DAS-2)**

The Differential Ability Scale (AS) comprises a cognitive and an achievement scale and was developed for children and adolescents between the ages of 2½ and 17 years (Elliott, 2007). The Cognitive Battery has a total of 20 subtests for the Preschool and the School-Age Level. The Preschool Level measures the following cognitive abilities General Conceptual Ability (GCA), which comprises Pattern Construction, Vocabulary Comprehension, Picture Similarities, and Naming Vocabulary for children aged two to six, to three to five. The GCA is divided into Verbal Ability and Nonverbal Ability for children three to six, to five to 11. For children between the ages of six to 10, and 17 to 11, the GCA consists of Verbal Ability, Nonverbal Reasoning Ability, and Spatial. In addition it provides a scale for children who have English as a second language or who are hearing impaired.

The normative sample for the DAS-2 includes children who are learning disabled; speech- and language-impaired, cognitively retarded, gifted and talented, severely emotionally disturbed, and mildly impaired on visual, auditory, or motoric functions. The DAS-2 was designed to measure profiles of cognitive abilities as well as differences between cognitive and achievement abilities. The DAS-2 is new and there are few validity and reliability studies that have been conducted beyond what is reported in the manual. Studies with the DAS, however, indicate its utility for describing subgroups of LD (McIntosh & Gridley, 1993) and ADHD students (Gibney, McIntosh, Dean, & Dunham, 2002). The extent to which the DAS-2 becomes a useful tool for clinical neuropsychologists is undetermined at this time, but the DAS-2 appears to have minimized some of the weaknesses inherent in less psychometrically sound batteries.

**Kaufman Assessment Battery for Children (KABC II)**

The Kaufman Assessment Battery for Children (K-ABC) (Kaufman & Kaufman, 1983) was developed on the basis of neuropsychological theory (i.e., Sperry and Luria) as a measure of simultaneous and
sequential processing. The KABC-2 was revised in 2004 (Kaufman & Kaufman, 2004). The KABC-2 was designed to measure how a child processes information, where simultaneous processing is thought to be holistic in nature and consistent with right-hemisphere processing, whereas sequential processing is linear and analytic, reflecting left-hemisphere processing. The battery has five global scales: Sequential, Simultaneous, Planning, Learning, and Knowledge. It provides a Mental Processing Index as well as a Nonverbal Index for global scores.

The KABC-2 is currently being studied. Initial factor analysis findings indicate that the factor structure is consistent with the five broad abilities hypothesized in the manual (Reynolds, Keith, Fine, Fisher, & Low, 2007). This measure is somewhat different than the original KABC and further study is needed to determine whether the previous weaknesses of the measure (low ceiling for some tests, problems with test interpretation, and factor structure) remain. The manual for the KABC-2 indicates attention to theory and research in the revised version.

The NEPSY II (Korkman, Kirk, & Kirk, 2007) is a neurocognitive measure for children aged three to 16. It requires approximately 45 minutes to administer the general assessment and 90 minutes for preschoolers for the entire battery, and 2–3 hours for older children. Depending on the age of the child there are six domains provided with 32 total subtests possible. The six domains include:

- Attention and Executive Functioning
- Language
- Memory and Learning
- Sensorimotor
- Social Perception
- Visuospatial Processing

Compared to the previous version of the NEPSY there are measures added for theory of mind, affect recognition, animal sorting, inhibition geometric puzzles and picture puzzles. In addition, tests can be used alone or in combination to evaluate certain areas of difficulty for a particular child. Psychometric properties are reported to be good. Clinical studies of children with various types of disorders have also been reported to strengthen the NEPSY II’s ability to discriminate difficulties in these populations.

### Academic Functioning

Most psychological evaluations include a measure of academic achievement in a comprehensive evaluation of children. Generally the Wide Range Achievement Test III (WRAT-III) (Wilkinson & Robertson, 2005) is used as a screening measure. To obtain more comprehensive measures of achievement, the Woodcock Johnson Tests of Achievement-Revised (WJA-III) (Woodcock, McGrew & Mather, 2001b) or the Wechsler Individual Achievement Tests (Psychological Corporation, 2002) (WIAT-II) are recommended.

#### Woodcock-Johnson Tests of Achievement-III

The WJIII Tests of Achievement Standard Battery include Reading, Mathematics, Written Language, Oral Language, and Knowledge. Each of the main academic areas now contain a measure of fluency. Three discrepancy scores can be generated comparing intra-cognitive discrepancies (e.g., Auditory versus Visual Processing), intra-achievement discrepancies (e.g., Reading versus Mathematics), and cognitive-achievement discrepancies when the WJ-III cognitive and achievement batteries are both employed. There are several advantages to incorporating these tests into a neuropsychological battery. First, the WJIII Tests of Achievement have strong technical properties. Second, these measures are conormed with the same population as the WJIII Tests of Cognitive Ability. This reduces the weaknesses inherent in comparing a child’s intellectual and achievement abilities on tests with different standardization groups and norms. Finally, the discrepancy scores provide a method for making normative comparisons and for determining individual strengths and weaknesses across various measures.

This measure also possesses some strengths that are particularly important for a neuropsychological examination. There are measures for understanding directions, verbal memory as well as naming that are also present in separate tests, but having them in one measure is helpful for the clinician. Strauss et al. (2006) found the validity of the cluster scores to not
be established at this time, particularly for groups of individuals often seen in a neuropsychological practice.

**Wechsler Individual Achievement Test-II (WIAT-II)**

The Wechsler Individual Achievement Test-II (WIAT-II) was developed and linked with the WISC-IV. Linking intelligence and achievement tests on the same population decreases statistical and measurement error that may be present for tests that are not linked. The WIAT-II provides measures of reading, math, oral language, and written language. It was designed to identify children and adults with problems with achievement and has sufficient floor to do so. For gifted individuals there is not sufficient ceiling on some of the subtests, thus limiting how effective this measure is for high achieving individuals. Psychometric principles are reported to be sound with strong norms, easily administered measures and good materials (Strauss et al., 2006).

Although the Wide Range Achievement Test III (WRAT-III) is often used for screening purposes, these measures are not sufficient for diagnosing learning disabilities in children. The WJ-III or the WIAT-II should be included to fully assess the academic performance of children.

**Executive Functioning**

Executive functioning is a construct describing behaviors that are associated with skills in planning, cognitive flexibility, response inhibition, organization, and working memory (Semrud-Clikeman, 2007). They have been defined as “those capacities that enable a person to engage successfully in independent, purposive, self-serving behavior” (Lezak, Howieson, & Loring, 2004, p. 42). Barkley (2000) further defines executive functions as the “when or whether aspects of behavior, whereas nonexecutive functions involve the what or how” (p. 1065).

As such these skills are believed to be an integral part of a “supervisory” system that works to control behaviors and allows the individual to engage in goal-directed behaviors (Gioia, Isquith, Guy, & Kenworthy, 2000). In addition, these skills are particularly important when faced with a novel situation or problem which requires the development of appropriate strategies and solutions (Strauss et al., 2006). Difficulties in executive functioning generally are seen to be present in organizational problems, difficulties following through with tasks, prioritizing tasks, remembering what one was about to do or following directions (working memory) and in cognitive flexibility. These problematic areas often create difficulty in the school setting with completing assignments, having materials that are needed to finish a project, and with organizational skills in writing. In social settings they can translate into problems with sharing, taking turns in conversation and in play, and in having difficulty with inhibiting a response (i.e., saying the first thing that pops into one’s head).

Executive functions have generally been associated with frontal lobe functioning. Patients who have frontal lobe damage often have difficulties with behavior regulation and response inhibition (Gazzaniga, Ivry, & Mangun, 2002). As described in Chapter 2, the frontal lobes are responsible for movement, planning, organization, and behavioral regulation. In addition, the frontal lobes play a major role in working memory skills. Working memory is the ability to retain information while solving a problem. A simple example of working memory is the ability to recall a phone number after looking it up in the phone book within the time it takes to reach the phone. Working memory is a skill that allows one to keep information for a short period of time in order to facilitate a task.

The ability to inhibit responding to a stimulus is an important skill that has also been associated with the frontal lobes. In order to inhibit a behavior one needs to establish control over the behavior. Such inhibition allows one to “filter” out extraneous stimuli in order to solve the problem at hand. For example, if you attend to all stimuli at the same time you can be easily overwhelmed. Inhibition includes a filter that allows one to attend to the most important aspect of a task and then complete it. When inhibition fails, working memory is affected; you get distracted, lose your place, and then forget what you were doing. Different neuronal networks activate to assist in inhibition and studies have found that these networks differentially activate, depending on the task at hand (Shimamura, 2000).
Goal-oriented behavior ability has also been linked to the frontal lobes (Gazzaniga et al., 2002). In order for a person to succeed at a goal the task generally needs to be broken down into smaller steps or behaviors that need to be completed before the overall goal can be obtained. For a child to succeed on an exam it is likely required that he complete the reading, have sufficient sleep and food, and be relaxed enough to think clearly. All of these aspects can be further broken down. People who are successful at completing tasks are able to prioritize these tasks, break down the steps that are needed to complete the tasks, and then see the task through to completion.

In addition to the frontal lobes, the anterior cingulate cortex (ACC) may be an executive attentional system; that is, it directs attention to the task at hand by marshalling various areas of the brain needed for the successful completion of the task. Thus, there are many connections between the ACC and other brain regions often accomplished by signals transported across long white matter tracks that connect the anterior and posterior systems of the brain (the superior longitudinal fasciculus, the inferior longitudinal fasciculus, and others). This system, when working properly, is highly efficient and provides coordination between knowledge and skills that have been previously learned and a problem that requires solving. Neuroimaging studies have found that the ACC is highly activated when the person is facing a difficult or novel situation or when behavior requires correcting or inhibiting (Posner & Rothbart, 2007).

One issue that is found in many neuropsychological reports is the erroneous use of the word “frontal lobe” tests. The tests that may measure executive functioning require many different regions of the brain to solve the issue, not just the frontal lobes. These tests have not been found to be diagnostic of a frontal lobe lesion, and to use the frontal lobe task synonymously with executive functioning is incorrect (Strauss et al., 2006).

Table 6.1 provides a listing of the major measures of executive functioning. These tests can be used with various aged children and most require additional training in order to correctly administer, score, and interpret.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Age range</th>
<th>Administration time</th>
<th>Tasks</th>
<th>Ability measured</th>
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<tbody>
<tr>
<td>Executive function tests</td>
<td>8–89</td>
<td>90 minutes for entire battery</td>
<td>Child must connect letters and numbers as quickly as possible</td>
<td>Trails: visual scanning working memory, motor speed</td>
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<tr>
<td>Delis-Kaplan executive function system (Delis, Kaplan, &amp; Kramer, 2001)</td>
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<td>Subtests may be used separately</td>
<td>Child provides words in different categories quickly</td>
<td>Verbal Fluency: working memory, word retrieval</td>
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<td>Child copies figures as quickly as possible</td>
<td>Design Fluency: working memory, visual-motor</td>
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<td>Child reads words, colors, and then words printed in contrasting colors</td>
<td>Color-Word Interference: Response inhibition, cognitive flexibility</td>
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<td>Child is asked to sort objects using differing rules</td>
<td>Sorting: Problem-solving, concept formation, cognitive flexibility</td>
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<td>Child is asked to answer questions to figure out the answer</td>
<td>Twenty Questions: concepts, use of feedback</td>
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<td>Child must supply the word to fit the situation</td>
<td>Word context: Reasoning, abstraction</td>
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<td>Child must place rings on sticks with as few as possible to match a model</td>
<td>Tower Test: Planning, response inhibition</td>
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<td>Child must tell what a proverb means</td>
<td>Proverb Test: higher order reasoning</td>
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Table 6.1 (continued)

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<tr>
<th>Measure</th>
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</tr>
</thead>
</table>
| Stroop test (Golden, 2003)                   | 4–16               | 15 minutes          |                                                                                         | 3 conditions
<p>|                                              |                    |                     | Word reading: speed of reading                                                           |                                                                                                 |
|                                              |                    |                     | Color reading: speed of color identification                                             |                                                                                                 |
|                                              |                    |                     | Color-Word reading: response inhibition                                                 | Several forms available as well as contained in the DK-EFS, NEPSY, WJIII, and CELF-4             |
| Verbal fluency (FAS)                         | 7–90+              | 5 minutes           | Child provides words that begin with specific letters as quickly as possible. Other forms require categories such as fruit, furniture, etc. | Measures word retrieval ability                                                               |
|                                              |                    |                     |                                                                                         | Measures of cognitive flexibility as well as working memory                                      |
| Wisconsin card sorting test (Heaton, 2003)   | 5–89               | 25 minutes on average | Child must sort deck of cards to match one of 4 cards presented in some manner and is given immediate feedback |                                                                                                 |
| Tower of Hanoi (Simon, 1975); Tower of London (Culbertson &amp; Zillmer, 2000); Tower from NEPSY (Korkman, Kirk, &amp; Kemp, 1997) | Various forms ages 7/8-adults | 15 minutes on average | Child must place rings on pegs to match a model as quickly as possible following several rules | Measure of planning, cognitive flexibility                                                       |
| Behavior rating inventory of executive function (Gioia et al., 2000) | 5–18               | 10–15 minutes       | Parent and teacher provide ratings as to the child’s behavior                           | Parent and Teacher Rating Forms: Factors are for behavioral regulation, emotional regulation, and metacognition (working memory, initiation, planning) Self-report (ages 11–22) |
|                                              |                    |                     |                                                                                         |                                                                                                 |
| Attention                                    |                    |                     |                                                                                         |                                                                                                 |
| Brief test of attention (Schretelen, 1997)   | 6–14 Adult form also | 10 minutes          | Child must repeat numbers and letters and then must reorder the numbers and letters in order | Auditory divided attention                                                                 |
|                                              |                    |                     |                                                                                         |                                                                                                 |
| Children’s color trails test (Llorente, Williams, Satz, &amp; D’Elia, 2003) | 8–16               | 10 minutes          | Child must connect colors in alternating order (yellow and pink) for part A Part B requires the child to connect numbers 1–15 alternating between pink and yellow circles | Measures Attention, visual scanning, and working memory                                          |
|                                              |                    |                     |                                                                                         |                                                                                                 |
| Comprehensive trail making test (Reynolds, 2002) | 8–75               | 5–10 minutes        | 5 conditions: connecting numbers 1–25; connecting numbers 1–25 with 29 empty circles as distractors; | Attention, visual scanning, visual processing speed, working memory                             |</p>
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<tr>
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<tbody>
<tr>
<td>D2 Test of attention (Brickenkamp &amp; Zillmer, 1998)</td>
<td>9–59</td>
<td>20 minutes</td>
<td>Child must quickly cross out all d’s with 2 marks of any kind—each line is given 20 seconds and then the child is asked to move to the next one</td>
<td>Selective and sustained attention, visual scanning speed</td>
</tr>
<tr>
<td>Test of everyday attention for children (Manly, Robertson, Anderson, &amp; Nimmo-Smith, 1999)</td>
<td>6–16</td>
<td>30–45 minutes</td>
<td>Several subtests that measure different aspects of attention</td>
<td>Selective, sustained, divided and alternating attention, cognitive flexibility</td>
</tr>
<tr>
<td>CHIPASAT (Johnson, Roethig-Johnson, &amp; Middleton, 1988)</td>
<td>8–14</td>
<td>15–20 minutes</td>
<td>Instructions are on tape. The child is asked to add the numbers together that he/she hears. For example, 2 3 Answer is 5, next number is 1, answer is 4 (3 + 1) and so on</td>
<td>Divided attention, sustained attention, working memory, processing speed</td>
</tr>
<tr>
<td>PASAT (Diehr, Heaton, Miller, &amp; Grant, 1998)</td>
<td>16–74</td>
<td>15–20 minutes</td>
<td>Same as CHIPASAT only more complex</td>
<td>Divided attention, sustained attention, working memory, processing speed</td>
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<tr>
<td>CPTs</td>
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<tr>
<td>Conners’ Continuous Performance Test (Conners, 2000)</td>
<td>6–55+</td>
<td>14 minutes</td>
<td>Child must press the space bar to all stimuli except when X is shown</td>
<td>Measures sustained attention, inhibition, impulsivity and response speed</td>
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<tr>
<td>IVA + Plus (Sanford &amp; Turner, 2004)</td>
<td>6–99</td>
<td>15 minutes per condition</td>
<td>Two stimuli are presented alternating between visual and auditory stimuli. The child must respond to the targets when they appear either visually or orally</td>
<td>Measures response control, attention, impulsivity, response speed</td>
</tr>
<tr>
<td>TOVA (Greenberg, Kindschi, &amp; Corman, 2000)</td>
<td>4–80</td>
<td>22 minutes per condition</td>
<td>Child must push the button when the small square is at the top of the large square but not when it is at the bottom. For the auditory TOVA the child must respond to high tones but not low tones</td>
<td>Measures sustained attention, inhibition/impulsivity, response speed and variability of responding</td>
</tr>
</tbody>
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Executive Functioning
<table>
<thead>
<tr>
<th>Measure</th>
<th>Age range</th>
<th>Administration time</th>
<th>Tasks</th>
<th>Ability measured</th>
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<tbody>
<tr>
<td><em>Language</em></td>
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<tr>
<td>Auditory analysis test (Rosner &amp; Simon, 1971)</td>
<td>5–12</td>
<td>8–10 minutes</td>
<td>Child repeats a word after deleting specific sounds (say the word belt without the ‘t’).</td>
<td>Measures phonological processing and awareness—the ability to segment words and understand the sound structure of words</td>
</tr>
<tr>
<td>Comprehensive test of phonological processing (Wagner, Torgesen, &amp; Rashotte, 1999)</td>
<td>5–24</td>
<td></td>
<td>Includes 13 measures including sound blending, sound matching, digit naming, repetition of words and nonwords, rapid color naming and segmenting words and nonwords</td>
<td>Used to identify children who have problems with phonological processing</td>
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<td>Provides scores in phonological awareness, phonological memory, and rapid naming.</td>
</tr>
<tr>
<td>Boston naming test-2 (Kaplan, Goodglass, &amp; Weintraub, 2001)</td>
<td>5-adult</td>
<td>15 minutes</td>
<td>Child names a picture that is presented. The pictures increase in difficulty. If the name is not provided, a semantic cue is provided (it is something you eat). If still not successful a phonemic cue of the first letter is provided.</td>
<td>Measure of word knowledge, word retrieval and confrontational naming</td>
</tr>
<tr>
<td>Rapid automatized naming (Denckla &amp; Rudel, 1974)</td>
<td></td>
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<td>4 cards are presented with 50 stimuli on each card. Cards have colors, numbers, letters or objects. The child must quickly name the stimuli</td>
<td>The child’s ability to name colors, letters, numbers and objects quickly has been tied to problems with reading as well as with attention. The test requires visual and verbal connections as well as processing speed</td>
</tr>
<tr>
<td>Peabody picture vocabulary test III (Dunn &amp; Dunn, 1997)</td>
<td>2 ½–90+</td>
<td>15 minutes</td>
<td>Child must chose a picture from 4 presented that most closely describes the examiner provided word</td>
<td>Measure of Receptive vocabulary—conormed with the Expressive Vocabulary test</td>
</tr>
<tr>
<td>Expressive vocabulary test (Williams, 1997)</td>
<td>2–90</td>
<td>10–12 minutes</td>
<td>The test has 38 labeling items and 152 questions requiring a synonym for a supplied word</td>
<td>Measure of expressive vocabulary as well as naming for the first 38 items</td>
</tr>
<tr>
<td>Expressive one-word picture vocabulary test-3 (Brownell, 2000a)</td>
<td>2–18</td>
<td>10–15 minutes</td>
<td>The child must verbalize a one-word response to a picture</td>
<td>Conormed with Receptive One-Word Picture Vocabulary Test-Third Edition Tests expressive ability as well as naming skill</td>
</tr>
<tr>
<td>Measure</td>
<td>Age range</td>
<td>Administration time</td>
<td>Tasks</td>
<td>Ability measured</td>
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<tr>
<td>Receptive one-word picture vocabulary test-3 (Brownell, 2000b)</td>
<td>2–18</td>
<td>10–15 minutes</td>
<td>The examiner orally presents a stimulus word, and the examinee must identify the illustration that depicts the meaning of the word</td>
<td>Conormed with the EOWPT-3 it provides a measure of receptive language as well as listening comprehension</td>
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<tr>
<td>Token test (De Renzi &amp; Vignolo, 1978)</td>
<td>2-adult</td>
<td>10–15 minutes</td>
<td>The child is asked to point to different colored disks of various shapes. The examiner asks the child to follow increasingly more difficult directions. (show me a circle; show me the yellow square, etc.</td>
<td>This is a measure of listening comprehension, working memory, concepts, and attention</td>
</tr>
<tr>
<td>Clinical evaluation of language fundamentals-4 (Semel, Wig, &amp; Secord, 2003)</td>
<td>5–21</td>
<td>30–60 minutes</td>
<td>There are several subtests to measure various aspects of language. The receptive tests require the child to repeat sentences, answer a question about a read paragraph, choose pictures that represent the same category, and select a picture that tells about a sentence. The expressive tests require the child to formulate sentences from presented words, define words, assemble a grammatically appropriate sentence, and relate two similar words</td>
<td>This test provides information as to how well the child is able to understand and recall information, express him or herself, and to hold information in mind while solving a problem</td>
</tr>
<tr>
<td>Preschool language scale-3</td>
<td>Birth-6</td>
<td>20–45 minutes</td>
<td>Child is asked to point to pictures, name pictures, and follow directions</td>
<td>Provides a measure of expressive, receptive, and total language ability in preschool children</td>
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<tr>
<td><strong>Memory</strong></td>
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<tr>
<td>California verbal learning test-children’s version (Delis et al., 1994)</td>
<td>4–16</td>
<td>15–20 minutes</td>
<td>Child is asked to repeat a list of words from memory. The list is read 5 times and the child repeats the list after each reading. Then a distractor list of words is read. 20 minutes later the child is asked to recall the list read 5 times first</td>
<td>Provides a measure of learning initially and over trials. Also provides a measure of the child’s response to cues as well as recognition ability. Measures are for initial recall, delayed recall, learning slope and for recognition. In</td>
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<tr>
<td>Measure</td>
<td>Age range</td>
<td>Administration time</td>
<td>Tasks</td>
<td>Ability measured</td>
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<tr>
<td>Rey auditory verbal learning test (Bishop, Knights, &amp; Stoddart, 1990)</td>
<td>6–89</td>
<td>10–15 minutes</td>
<td>15 words are provided to the child and the child is asked to recall as many as possible with 4 additional trials provided. A distractor list is then read. Free recall of the first list is then required and 30 minutes later another recall of this list</td>
<td>This test provides information as to how the child learns with information repeated. In addition, it provides a measure of learning and of delayed recall. It has been reported to be simpler than the CVLT-CR (Bishop et al., 1990)</td>
</tr>
<tr>
<td>Children’s memory scale (Cohen, 1997)</td>
<td>5–16</td>
<td>30–45 minutes</td>
<td>There are several subtests on the CMS. The child is asked to recall stories, word pairs and word lists (auditory/verbal). Also to recall spatial location, recognize human faces, and recall pictured scenes (visual/nonverbal). Finally there are measures of digit span, recall of information (reciting the days of the week backwards) and recalling where pictures are on a page once it is removed (attention/concentration)</td>
<td>The rest provides measures of general memory. In addition there are measures of immediate and delayed verbal memory, immediate and delayed visual memory, learning, and attention/concentration</td>
</tr>
<tr>
<td>Test of memory and learning-2 (Reynolds &amp; Voress, 2007)</td>
<td>5–60</td>
<td>30 minutes for core; 60 minutes for core and supplementary</td>
<td>Test has several subtests including memory for stories, facial memory, word selective reminding, visual selective reminding, object recall, abstract visual memory, digits forward, visual sequential memory, paired recall, memory for location, manual imitation, letters forward, digits backward, and letters backward</td>
<td>This test provides measures of verbal memory, nonverbal memory, and a composite memory. The supplementary battery provides measures that tap the child’s ability to recall information after a delay, a learning index, an attention/concentration index, and a free recall index. There is also an index for recalling information when provided a cue</td>
</tr>
<tr>
<td>Measure</td>
<td>Age range</td>
<td>Administration time</td>
<td>Tasks</td>
<td>Ability measured</td>
</tr>
<tr>
<td>---------------------------------------------</td>
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</tr>
<tr>
<td>Wide range assessment of memory and learning-2nd edition (Sheslow &amp; Adams, 2005)</td>
<td>5–90</td>
<td>Core Battery requires less than one hour; screening battery requires</td>
<td>Provides measures of the adolescent’s ability to listen and retell stories, recall pairs of words, complete letter-number sequencing, learn word lists, mental control (count backwards from 100 by 7, say the alphabet from Z to A, etc.) provide general information and orientation, reproduce designs from memory, reproduce a sequence of moves based on an examiner provided model, and repeat digits</td>
<td>This test provides measures of auditory and visual immediate memory, an index of working memory, and delayed recall memory that contributes to a general memory score</td>
</tr>
<tr>
<td>Wechsler memory scale III (Wechsler, 1997)</td>
<td>16–89</td>
<td>30–35 minutes</td>
<td>Provides measures of the adolescent’s ability to listen and retell stories, recall pairs of words, complete letter-number sequencing, learn word lists, mental control (count backwards from 100 by 7, say the alphabet from Z to A, etc.) provide general information and orientation, reproduce designs from memory, reproduce a sequence of moves based on an examiner provided model, and repeat digits</td>
<td>This test provides measures of auditory and visual immediate memory, an index of working memory, and delayed recall memory that contributes to a general memory score</td>
</tr>
</tbody>
</table>

**Visual perception**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Age range</th>
<th>Administration time</th>
<th>Tasks</th>
<th>Ability measured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Judgment of line orientation (Benton, Varney, &amp; Hamsher, 1978)</td>
<td>7–96</td>
<td>15–20</td>
<td>Child views an array of lines and then must match 2 lines to the correct lines in the array</td>
<td>This test measures visual perception without a motor component</td>
</tr>
<tr>
<td>Facial recognition test (Benton, Sivan, Hamsher, Varney, &amp; Spreen, 2004)</td>
<td>6- adult</td>
<td>Long form 10 to 15 minutes; short form 7 to 10 minutes</td>
<td>Child is shown a face(s) and then must recall the face when shown an array of faces</td>
<td>This test measures the child’s ability to recall unfamiliar faces</td>
</tr>
<tr>
<td>Hooper visual orientation test (Hooper, 1958)</td>
<td>5–91</td>
<td>Long Form 10 to 15 minutes</td>
<td>Child is shown drawings which are cut into 2 or more pieces. He/she is asked to name the object. Norms were updated in 1994(Seidel, 1994)</td>
<td>This is a measure of spatial relations—the ability of the child to put together pieces of a picture to form a whole. It also requires working memory</td>
</tr>
<tr>
<td>Motor free visual perception test-3 (Colarusso &amp; Hammill, 2002)</td>
<td>4–95</td>
<td>25 minutes</td>
<td>Child is asked to match figures, find figures that are hidden, identify figures that are incompletely drawn, recall visual information, and discriminate forms</td>
<td>This is a measure of visual perception that utilizes different modalities to evaluate the child’s perceptual skills. It does not include a motor component so it is good for children</td>
</tr>
<tr>
<td>Measure</td>
<td>Age range</td>
<td>Administration time</td>
<td>Tasks</td>
<td>Ability measured</td>
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</tr>
<tr>
<td>Test of visual-perceptual skills-3 (Martin, 2002)</td>
<td>4–19</td>
<td>30–40 minutes</td>
<td>Child must discriminate forms, recall what has been seen, look at pictures that have been cut apart and determine how they would look if reassembled, recall what has been seen in the same order, and complete incomplete figures</td>
<td>This is a measure of visual perception without motor involvement. It works with preschoolers as well as older children with motor difficulties as a measure of visual perception</td>
</tr>
<tr>
<td>Visual-motor</td>
<td></td>
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<tr>
<td>Beery developmental test of visual-motor integration (Beery, Buktenica, &amp; Beery, 2006)</td>
<td>3–18</td>
<td>30 minutes for whole battery</td>
<td>The child is asked to trace a stimulus form with a pencil without going outside of the lines, to choose which of 3 forms are identical to the stimulus, and to copy 24 increasingly more complex geometric forms</td>
<td>This is a measure of motor coordination, visual perception, and visual-motor skills</td>
</tr>
<tr>
<td>Wide range assessment of visual-vmotor abilities (Adams &amp; Sheslow, 2005)</td>
<td>3–17</td>
<td>4–10 minutes per subtest</td>
<td>The child is asked to copy figures of increasing complexity. The child is also asked to match pictures and to complete a pegboard</td>
<td>This is an omnibus measure of visual perception as well as visual-motor ability.</td>
</tr>
<tr>
<td>Developmental test of visual perception-2</td>
<td>4–10</td>
<td>45 minutes</td>
<td>The child is asked to put pegs in a board as quickly as possible, to copy figures, to show eye-hand coordination, to understand position in space, to find hidden figures, and to identify pictures that are incompletely drawn</td>
<td>This is an omnibus measure of visual perception, eye-hand coordination, visual-motor ability, and understanding of spatial relations</td>
</tr>
<tr>
<td>Rey-Osterreith complex figure (Meyers &amp; Meyers, 1995)</td>
<td>6–93</td>
<td>10–15 minutes</td>
<td>Child is asked to copy a complex figure, then draw it within 3 minutes from memory, and then draw it again 30 minutes later</td>
<td>This is a measure of visual-spatial skills as well as organization and planning. As the child draws the figure it is important for the examiner to evaluate the order drawn (i.e., does the child draw the overarching parts of the figure or start with details)</td>
</tr>
</tbody>
</table>
Attention

Attention is a construct that can be very difficult to define. It includes the ability to sustain attention, to selectively attend to a specific stimulus, to divide one’s attention among two or more items, and to alternate attention. Memory and attention are related in that if you don’t pay attention to an item, you generally will not recall that item. We have a limited capacity for attention and thus can become overwhelmed when too much is asked at one time. When the capacity is overloaded, some people will shut down while others will become agitated and overstimulated. The brain has the ability to prevent this from happening through filtering of stimuli (generally thought to be a thalamic-cortical process). When such filtering is not operational, you may see attentional deficits for some individuals (ADHD) while others will show agitation or experience actual pain from being overwhelmed (autistic spectrum disorder).

Children and adolescents with ADHD may show difficulties in one or more areas of attention. Some believe that children with ADHD: combined subtype show problems in selective and sustained attention while those with ADHD: predominately inattentive type show problems with overfocusing or with sustained attention (Barkley, 1997). Complicating the picture, most tests that measure attention will often evaluate more than one aspect of attention, as well as executive functions such as working memory and response inhibition. Strauss et al. (2006) argued that many tests are a combination of attention and executive functioning and that the differentiation between tests of executive functioning and attention is artificial.

Attention is believed to require several areas for processing depending on the task at hand. For

<table>
<thead>
<tr>
<th>Measure</th>
<th>Age range</th>
<th>Administration time</th>
<th>Tasks</th>
<th>Ability measured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finger tapping (Reitan, 1969)</td>
<td>5–85</td>
<td>10 minutes</td>
<td>Child is asked to tap on a tapper as quickly as possible with each hand</td>
<td>This is a measure of finger speed. It is generally expected that the dominant hand will be faster but unless there is a highly significant difference across measures, this is not diagnostic</td>
</tr>
<tr>
<td>Grip strength (Reitan &amp; Wolfson, 1985)</td>
<td>6–85</td>
<td>5 minutes</td>
<td>The child is asked to squeeze a dynamometer as hard as he/she can</td>
<td>This is a measure of strength. Again it is expected that the dominant hand will be stronger but unless there is a highly significant difference across measures, this is not diagnostic</td>
</tr>
<tr>
<td>Grooved pegboard (Matthews &amp; Klove, 1964)</td>
<td>6–85</td>
<td>5 minutes</td>
<td>The child is asked to place pegs in a pegboard with each hand as quickly as possible. The pegs only fit in the holes one way</td>
<td>This is a measure of manual dexterity and motor speed</td>
</tr>
<tr>
<td>Purdue pegboard (Tiffin, 1968)</td>
<td>5–89</td>
<td>5 minutes</td>
<td>The child must place the pegs in holes as quickly as possible first with his/her dominant hand, then nondominant hand, then both hands together</td>
<td>This is a measure of fine motor dexterity and motor speed. It is also a measure of how well the child can coordinate hands</td>
</tr>
</tbody>
</table>
visual attention, the occipital lobe has been implicated while the parietal lobe works with the occipital for visual-spatial analysis. Attention to auditory stimuli requires the temporal lobe, particularly in the language centers of the brain. Coordination of these systems appears to be an important function of the ACC, the frontal cortex, and subcortical structures such as the basal ganglia and the thalamus.

Imaging work with children with ADHD has found that the caudate, a structure important for dopamine production, differs in volume depending on diagnosis (ADHD vs. non-ADHD) (Liotti, Pliszka, Perez, Glahn, & Semrud-Clikeman, in press; Pliszka et al., 2006) and medication status (treated vs. non-treated) (Semrud-Clikeman, Pliszka, Lancaster, & Liotti, 2006). Such variations in structure may also be related to differences in neuropsychological functioning on measures of attention and executive functions (Semrud-Clikeman, Pliszka, & Liotti, in press). It is believed the commonly prescribed stimulant medications work on the subcortical as well as frontal lobe regions to normalize neurotransmitters and activity level in these regions (Pliszka, 2003).

Attention is also an area that is highly susceptible to damage. Many children and adolescents with traumatic brain injury experience significant problems with attention in the early stages of recovery (Semrud-Clikeman, 2004). For some children, particularly those with severe head injuries, the attentional problems continue following recovery. Children with seizure disorders, those with long-term effects from cancer treatment, and those with several genetic disorders (neurofibromatosis, tuberous sclerosis, etc.) also show attentional problems (Semrud-Clikeman, 2007).

Table 6.1 lists the major attentional tasks most frequently utilized with children. There are four basic types of attention evaluation. The first type is a structured interview with the parent to determine the presence of sufficient symptoms to warrant a diagnosis of ADHD. The second are parent and teacher behavior rating scales. These scales are generally utilized to determine the presence of symptoms, and how the child compares to others his/her age in severity and frequency of the symptoms. Some of the measures are designed to solely measure attentional skills (i.e., Connor’s or Brown’s ADHD scales) while others are omnibus measures such as the BASC or CBCL.

The third type uses computerized measures. These tests require the child to select a target from other targets and provide measures of attention, inhibition, reaction time, and variability of response. The child’s performance is compared to others his/her age as well as to a sample of children with ADHD. Finally, there are paper and pencil measures that directly evaluate the child’s skills on selective, sustained, and divided attention. Other measures of attention are present in most of the ability measures, as well as in some of the memory skills. As cautioned by Strauss et al. (2006), measures that are not solely designed to evaluate a child’s attentional skills may be one-dimensional and, thus, will not fully evaluate the child’s ability. It is strongly suggested that a neuropsychological evaluation include measures of attention as well as a good interview and the use of behavior rating scales to provide a full picture of the child’s functioning.

Memory

Memory and learning go hand in hand. Learning is acquiring new information while memory is retrieving this information for later use (Gazzaniga et al., 2002). In order to remember an item it must first be encoded, then stored, and then available for retrieval to be used. At any point, difficulty may occur and cause problems with learning and, hence, memory. As mentioned in the attention section, attention is an important aspect in memory—if something isn’t paid attention to, it will not be stored.

There are various forms of memory. The fastest type of memory is sensory memory—this is when you are looking, hearing, or feeling something and you are processing it in milliseconds to seconds. Sensory memory is not stored—it is registered by the brain without processing. Short-term memory is information that is stored for just a few minutes and is also not placed into permanent memory stores. Working memory and short-term memory are related constructs. For items that may be later stored, the initial input is through short-term memory. Not all information is converted into long-term memory—it depends on the nature of the
information as well as the goals of the individual. A phone number that is used only once is unlikely to be stored while one that is needed several times will eventually be stored in long-term memory.

Baddeley (2003) has a model of working memory where there are three parts that interact depending on the task at hand. The phonological (articulatory) loop processes speech-based material while the visual-spatial sketchpad stores visual information. These are controlled by the central executive that controls these inputs. Finally there is an episodic buffer that integrates the information. This is basically a limited-capacity memory and attentional system that helps with strategy selection as well as coordination of higher order cognitive processing. Digit Span from the Wechsler measures is an example of the phonological loop working memory, while spatial memory from the TOMAL (Reynolds & Bigler, 1994) is an example of the visual sketchpad form of working memory.

Long-term memory is generally divided into implicit (unconscious/procedural) and explicit (language/situational) memory (Schacter, Wagner, & Buckner, 2000). A typical task for implicit memory is the ability to read words from incomplete fragments (s _ oe = shoe). This task requires the person to make the connection between a word that has been previously seen and fill in the blank. These are skills that have been previously learned but are now applied to a new situation. Some subtests of the WJ Cognitive III battery test this skill. Explicit memory is generally learning new information and then later queried as to these words. An example would be the California Verbal Learning Test-Children’s Version (CVLT-C) (Delis, Kramer, Kaplan, & Ober, 1994) where the person is asked to learn a list of words over five trials and then later queried as to how many he/she can remember. Most neuropsychological measures tap explicit memory but not implicit memory. It is recommended to include both types in a comprehensive neuropsychological evaluation. Table 6.1 provides a sampling of memory tasks.

Areas of the brain that have been implicated in memory are widespread and dependent on the type of memory that is being tapped. The initial sensory memory includes the hardwired areas of the brain that receive visual (occipital), auditory (temporal), tactile, or kinesthetic (parietal) information. Working memory has been linked to systems in the dorsolateral regions of the frontal lobes for monitoring of the information, and the ventrolateral regions for maintaining the information (Schacter et al., 2000). In addition, the limbic system may be active in the transfer of experiences into memory with the emotional coloring that is attached to such memories and to language (Markowitsch, 2000). The left hemisphere has been implicated in retrieval of language and facts while the right is important for episodic and social interaction memory (Markowitsch, 2000).

Long-term memory requires a consolidation of information. Such consolidation is a chemical process that can take place over hours, days, or months and lays down neural traces of the memory for later retrieval (Moscovitch et al., 2005). The localization for this process for storage of explicit memory items begins in the hippocampus and then storage occurs throughout the brain; somewhat like files in a storage cabinet that can be accessed as needed (Nadel, Samsonovich, Ryan, & Moscovitch, 2000). Moscovitch (2004) suggests that this process is automatic and requires hippocampal involvement even for retrieval of previously learned material. He further hypothesizes that the frontal lobes work in concert with the hippocampus in the selection of what memories are retrieved and subsequently organized into information. In this view the frontal lobes basically organize and control the information and mediate memories brought to mind by the hippocampus and thalamic nuclei involved in the initial laying down of these memories.

Implicit memory is believed to be related to what the task involves. For perceptual tasks the brain regions responsible for processing of these skills are generally in the parietal and occipital lobes. When language is also present, then the temporal lobes are brought into the loop. The recall of the word horse can be done through perceptual priming (a picture of the horse) as well as through the language connection of the picture to the word.

Many of these higher level cognitive processes overlap and are linked and are a challenge for the neuropsychologist to separate (if possible) areas of strength and weakness. Memory tests are sometimes difficult to interpret due to interference with attention, and at times with language. The following section briefly discusses language from a neuropsychological viewpoint.
Language

Language involves precepts that include spoken (expressive) and listening (receptive) aspects as well as the ability to name objects. Expressive language involves that which one uses to communicate to another person or to oneself. Receptive language is the ability to listen, comprehend, and appropriately form a response. The basic part of language is the word. These words are stored in the brain in what has been termed a mental lexicon. This lexicon includes the word’s meaning as well as the sound, spelling, and usage of the word. It has been estimated that the average adult has 5,000 words in his/her lexicon and can understand two to three times more than that. This lexicon, to be usable, needs to be organized and efficient. Thus, words that are frequently used are stored in an area that is more accessible while those that are more unusual may not be as readily available.

Each word is also made up of phonemes—small units of sound such as the sounds for the letters m and n. These sounds are characteristic of a particular language and will change depending on the language and culture of the user. Theorists have suggested that the lexicon is arranged not by letter or sounds like the dictionary, but by information-specific networks (Levelt, Roelofs, & Meyer, 1999). These networks are organized through the relationship of the words to each other as well as sound families. Words such as freight and eight rhyme, have similar sounds and would be arranged near to each other on a conceptual node, but not directly to each other as they mean very different things. When learning words, those that sound similar also assist in learning as well as words that are in the same category. The pair of raccoon and acorn is a bit easier to recall than clown and truck for this reason. Many measures of memory also have these pairs together and are confounded by language difficulties when these problems arise.

Expressive language uses many of these phonemes and acoustic signals to communicate to others. The area of the brain most implicated with expressive language is also called Broca’s area. This region lies in the ventral lateral left frontal cortex in an area known as pars triangularis and pars opercularis. When a patient has a lesion in this area and the underlying white matter, problems are seen in pronunciation of words (also referred to as Broca’s aphasia). Their language is very difficult to understand and often sounds like gibberish.

Listening comprehension and receptive language requires decoding of the aural signal. This signal is then translated into a phonological code that has previously been stored in the mental lexicon. This information is then decoded into the word and subsequently the meaning of the word. Reading also involves these steps as the reader must analyze the word’s sound to understand what the word is saying. Perceptually the reader first utilizes the visual system (discussed in Chapter 2), the auditory system, and then the lexical system. The listener has another challenge because there is no visual feedback, so words that may be pronounced similarly require the listener to decipher the meaning based on context. Words such as lettuce and let us are very different but when slurred together can sound remarkably the same. Speech rhythm and pitch as well as intonation generally help the listener to discern what is being said. Prosody, another terms for speech intonation, is an important communication device to assist in understanding the speaker’s intent.

Structures that are important for receptive language lie in the region of the temporal lobe also frequently referred to as Wernicke’s area. This area is generally in the superior temporal gyrus and near the auditory processing regions surrounding the lateral sulcus. Studies have found that for true difficulties in this area (also called Wernicke’s aphasia) damage must be present in these regions as well as in the posterior temporal lobe or in the white matter that connects Wernicke’s area to the other language areas. Patients with these kinds of difficulties generally have problems with language comprehension either from the spoken or written language (also referred to as Wernicke’s aphasia). They can speak fluently, but often their speech is meaningless.

In situations where damage is present to the connections between Wernicke’s and Broca’s areas, problems are seen in speech production as well as in word repetition and word usage (Gazzaniga et al., 2002). This difficulty is referred to as conduction aphasia. In this case, the patient is able to understand and produce language, but has difficulty with repeating words and word usage.
Naming ability is another important aspect of language. Children with learning problems as well as language difficulties may experience problems in naming objects. Some tests provide phonetic prompts to assist the child in word retrieval while others provide pictures or semantic prompts. Naming is a skill that can be affected by traumatic brain injury, brain tumors/cancer, or learning problems to name a few areas. At times word retrieval problems can be identified through awareness of how the child completes the Picture Completion subtest of the WISC III. In this case, the child may be able to point at what is missing but not supply the name. Additional testing of these skills is certainly warranted when the examiner finds the child unable to complete these types of tasks.

Measures of language functioning often include receptive and expressive language as well as naming ability. For children and adolescents, unless there is a direct brain insult or a stroke, aphasia is not frequently seen. However, difficulties in receptive and expressive language can pose significant problems for many children and have been related to difficulties with learning. Chapter 12 discusses these issues in more detail. Table 6.1 lists the major measures of receptive and expressive language and many of these are utilized by speech pathologists as well as by psychologists.

**Visual-Spatial and Visual-Motor**

Tests of visual-motor ability are important parts of a neuropsychological assessment. These tests allow the examiner to determine whether difficulties in perception or an integration of motor and perception are creating difficulties in the child’s ability to put items together or to copy figures or complete a handwriting task. Visual-motor tasks require integration between what is seen and how it is represented.

There are two systems involved in visual perception. The inferior longitudinal fasciculus (ILF) carries information as to “what” the object is named. This pathway runs from the visual region of the brain to the naming areas of the brain in the temporal lobe. The “where” pathway connects the visual regions of the brain to the parietal lobe via the superior longitudinal fasciculus (SLF). Some children experience difficulties with naming (discussed earlier in the language section), while others have difficulty understanding objects in space as well as being able to copy these objects appropriately. Problems with spatial analysis can be seen in the child’s ability to complete the block design task or other tasks that require spatial analysis. Table 6.1 lists the main tests used to evaluate perceptual abilities.

In addition to visual perceptual tasks, children are often asked to copy figures in order to understand how they are able to translate visual information into written form. For these types of tests there is integration between visual perception and motor skills. The previous section discussed some of the main motor tasks. For an assessment, it is often good to attempt to sort out the differing types of skills contained within a task that are visual-motor in nature. If a child experiences problems on visual-motor tasks, one must rule out the contributions of

**Motor Abilities**

Tests of motor ability are important to determine how well the child can complete tasks evaluating his/her motor speed, motor coordination, and strength. Comprehensive neuropsychological examinations need to include a screening of motor abilities ranging from simple motor speed to more complex measures involving pegboards. These skills are also related to visual-motor abilities which are described in the next section.

Motor tasks generally evaluate the child’s ability to use his/her preferred (or dominant) hand as well as working with both hands together. Tapping tests measure the child’s ability to quickly tap on a board while pegboards measure the child’s ability to quickly put pegs in first with the dominant hand, then the nondominant, and for some tests, with both hands together. These tests are generally quick to administer and many children enjoy them. They can be used as an ice-breaker particularly with a reluctant or shy child. Motor skills are important for daily living skills such as buttoning and tying as well as for feeding and taking care of one’s needs. Table 6.1 lists the main motor tasks.
motor difficulty as well as perceptual problems. Children may experience integration of these skills and these problems may be related to integrated difficulties as well as executive functions of planning and organization (Baron, 2004). If perceptual and/or motor problems are ruled out and the child continues to experience problems with copying and handwriting, then analysis of the child’s executive functioning as well as integration abilities needs to be evaluated.

**Psychosocial Functioning**

Assessing a child’s psychosocial adjustment is best accomplished using behavioral rating scales, clinical interviews, and observational techniques. These techniques are useful to determine comorbid psychiatric problems and to rule out other disorders that may result in reasoning, problem solving, and social interaction difficulties that affect overall adjustment and impact on treatment plans. Clinicians may opt to start with instruments that measure broad-band personality disorders, and then utilize tests designed for specific problems such as ADHD, depression, and/or anxiety. Several instruments will be described briefly.

**Child Behavior Checklist (CBL)**

The Child Behavior Checklist (CBCL) is a well-developed, psychometrically sound instrument measuring two broad-band personality syndromes: externalizing and internalizing disorders (Achenbach, 1991). The CBCL can be used for children and adolescents across a wide age range (6–18 years) and includes rating scales for parents and teachers and a self-report form for older children (Achenbach, 1991). Structured Interview and Observation forms have also been developed for the CBCL. Externalizing disorders measured by the CBCL include aggressive, hyperactive, schizoid, delinquent, and sex problems. Internalizing disorders comprise depressive, anxious, and social withdrawal problems. Teacher ratings are highly correlated with observations of the child, and parent ratings are associated with other well-established measures of behavior problems (Achenbach & McConaughy, 2003). The CBCL offers a comprehensive method for obtaining data from a variety of sources to identify comorbid personality disorders in children and adolescents.

**Behavior Assessment System for Children**

The Behavior Assessment System for Children-2 (BASC-2) (Reynolds & Kamphaus, 2004) was developed as a "multimethod, multidimensional approach to evaluating the behavior and self-perceptions of children aged 4–18 years" (Reynolds & Kamphaus, 2004, p. 1). The BASC-2 includes five methods for assessing the child’s behavior:

1. A self-report for children aged 8–18 years, which allows the child to answer "true" or "false" to questions about feelings and perceptions of the self and of others
2. A teacher behavioral rating scale
3. A parent behavioral rating scale
4. A structured developmental history that can be used as an interview or questionnaire format
5. A system for systematically observing and recording the child’s behavior

The BASC-2 measures both adaptive and clinical dimensions of the child’s behavior. The wording on the BASC-2 rates observable behavior, thus decreasing subjectivity on the part of the rater. The system measures the child’s behavioral and emotional functioning from a variety of sources to provide a more comprehensive picture of the total child. The BASC-2 is not intended to provide a diagnosis, placement decision, or treatment plan. It is, rather, designed to compile information about the child’s behavior from many sources and to help design and determine the most appropriate intervention. The BASC can provide useful data to be used as a follow-up for further interviews and evaluation.

**Social Skills Questionnaire**

**Social Responsiveness Scale** (Constantino, 2002) Rutter, Bailey, and Lord (2003) developed the Social
Responsiveness Scale to systematically measure social skills problems in children and adolescents. The SRS contains rating scales for parents, and teachers, and provides a method for determining the child’s social interaction skills, social awareness, reciprocal social communication ability degree of avoidance of social situations, and preoccupations that are present. It is appropriate for ages 4 to 18. This is a relatively new instrument and may prove to be a valuable addition to a comprehensive evaluation of child and adolescent disorders. Particularly in the areas of autism and Asperger’s disorder. This scale provides a measure of the degree of impairment across numerous items. It also provides the ability to measure severity of the disorder. There are 5 scales in addition to the Total score that are included in this scale; receptive, cognitive, expression and motivational aspects of social behavior are included as well as the level of preoccupation the child shows to objects or topics that may interfere with social functioning. Ratings are not only provided for the two settings (school and home) but are also divided by gender.

Social Communication Questionnaire

The Social Communication Questionnaire (SCQ) (Rutter, Bailey, & Lord, 2003) is a parent report measure that evaluates the possible presence of autistic spectrum behaviors. This measure can be used to screen out the possibility of autistic spectrum disorders. Positive scores indicate that a further evaluation is necessary. The SCQ was designed as a screening tool that is followed up by the Autism Diagnostic Interview-Revised (ADI-R) (Rutter, Le Couteur, & Lord, 2003). The age range for the SCQ is from four years of age to adulthood and has two forms: lifetime and current. The lifetime form should be used if the measure is for screening while the current form should be used to measure therapeutic progress.

The items are designed to reflect the items on the ADI-R that were most predictive of an ASD diagnosis. This measure utilizes a cut-off score of 15. The SCQ is sensitive to social communication problems and, emerging research suggests, children with ADHD, LD, and other types of neurodevelopmental disorders. For this reason the measure may be very helpful in designing treatment plans for children that have social difficulties.

Conclusion

While this chapter cannot possibly provide a guide for every test that may be used in a neuropsychological examination, the major ones that are used in several clinics with which we have worked are discussed or presented in the table. It is important to provide a screening of the major areas in a neuropsychological exam at the very least and to follow-up the screening with a more intensive evaluation when difficulties are identified. The main domains include cognitive, academic, executive functioning/attention, memory, perceptual/sensory/motor, and social and emotional functioning. A good neuropsychologist has a very good psychological background and provides a link between the two areas. Given that many neurological problems have psychiatric consequences, as well as some masquerading as psychiatric diagnosis, it is important for the neuropsychologist to be aware of this duality particularly when working with significantly complex cases.

The next chapter discusses three main approaches to neuropsychological assessment. One of these approaches uses a set battery such as in the Reitan Neuropsychological Battery. The Austin Neuropsychological System and the Boston Process system use a combination of measures to evaluate children and adolescents.

References


