Essentials of Neuropsychological Assessment

Treatment Planning for Rehabilitation

SECOND EDITION
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Essentials of Neuropsychological Assessment

Treatment Planning for Rehabilitation

SECOND EDITION

RIK CARL D’AMATO, PhD

LAWRENCE C. HARTLAGE, PhD

Editors

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Love. Faith. Pride. These are gifts that, when freely given, can be returned in full measure. For all they have given to me, I dedicated this book to my two sons, Michael A. D’Amato, IV, and David D. D’Amato.

They have been my life blessings.

—Rik Carl D’Amato

This one’s for Jeff and Mary Beth who make me a proud parent.

—Lawrence C. Hartlage
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The first edition of this text was published 21 years ago in 1987. At that time, neuropsychology was a relatively exotic specialty whose practitioners were typically found only in neurology programs at medical schools and in tertiary hospitals. In 1987, the majority of these practitioners, who numbered a few hundred at most worldwide, were primarily involved in the assessment of patients with severe neurological impairments or in the differentiation of organic versus functional disorders. Generally, in the Western world, they used the *Halstead-Reitan Battery* as their major assessment tool. At that time, neuroimaging was crude by today’s standards, and the chief focus of most assessment activities was on lesion localization. That has all changed. The last two decades have heralded amazing discoveries, and we now understand the brain much better than ever before (Hartlage and D’Amato, 2008). This new understanding has led to novel neuroscience jobs in all sectors of society. Some would say that clinical neuropsychology has *come of age*. As a result of these new developments, a revision of this text was necessary.

Today’s neuropsychology is different in many ways. We now understand more clearly the truly biological base of our behavior and the biochemical foundation of human thought. The number of trained neuropsychologists has dramatically increased, with membership in the American Psychological Association’s Division of Clinical Neuropsychology currently at about 4,000. Membership in other organizations such as the National Association of Neuropsychology (with more than 3,300 members from 24 countries) and the International Neuropsychological Society (with more than 4,500 members) has also grown. The increase in the number of trained neuropsychologists has resulted in their greater availability, not only in hospitals, but also in private practices, community mental health programs, and universities.

Since the genesis of psychology, the brain has always been an area of interest. When we began studying the brain hundreds of years ago,
researchers and practitioners alike sought to generate new knowledge and disseminate what they had discovered (Hinshelwood, 1900; Morgan, 1896). More recently, we have refocused our beliefs and now seek to provide evidence-based neuropsychological services that are efficient and effective (Traughber & D’Amato, 2005). This means that practitioners must become practitioner-scholars who can research alternative therapeutic approaches and select neuropsychological interventions with data that supports their effectiveness. No longer should we base practice on how we have done it in the past. We must abandon activities that lack empirical evidence and work to develop a research base for current rehabilitation practices. For example, Shaywitz (2003) has demonstrated an empirically-driven systematic approach to teaching reading that changes the brain. Data shows that her approach does indeed work. The United States Department of Education (2008) has joined the fray developing and maintaining a What Works clearinghouse web site for practitioners.

In fact, the research in areas like individual differences, normal aging, hemispheric processing, and learning problems suggest that neuropsychology may be relevant to understanding behavior along a considerable age continuum, and along a continuum ranging from patients that seem apparently normal to patients who are severely impaired. The field of clinical neuropsychology has grown to the point where many practitioners have now developed neuropsychological subspecialties, including the areas of pediatric neuropsychology, school neuropsychology, geriatric neuropsychology, forensic neuropsychology, and neuorehabilitation. However, this growth has been curtailed by medical providers who have sought profit over the provision of comprehensive neuropsychological services. Thus, the field continues to face a significant quandary. New assessment procedures and rehabilitation techniques are available while at the same time neuropsychological services have been reduced. Clinical neuropsychologists have had to reconceptualize and trim assessment activities in ways that could lead to reduced but effective neurorehabilitation. Although these service reductions could have slowed the development of the field, this does not seem to have been the case. The areas of neuroimaging, psychopharmacology, and adaptive technology appear to be at the forefront, helping to expand current neuropsychological practices.

The focus of assessment, once limited to lesion localization in neurologically impaired patients, now encompasses broader issues, and focuses on the uniqueness of each individual patient and how cerebral processing can influence rehabilitation and later life. Research has shown
that we must focus on understanding individual differences in development, perception, temperament, and general cognitive ability, with neuropsychological substrates discussed as possible determinants of individual processes for each of these areas (Hartlage & D’Amato, 2008). The increased availability of neuropsychology practitioners has made neuropsychological services much more visible and viable. Understanding an individual’s neuropsychological processes can be relevant to learning how the normal brain develops as well as to understanding patient behavioral disorders and difficulties. For example, the age, race, and presenting problems of patients have changed considerably in the last decade. To meet these changes the model of neuropsychology services has also changed. The greatest change in our second edition relates to how assessment is linked to treatment planning for rehabilitation. The previous edition focused on how to assess individuals rather than on how to offer successful treatment. Our goal for this edition is to connect assessments to treatment planning in a seamless fashion. It is time to abandon assessments that do not help us understand an individual or improve intervention.

Currently, there is increased variability in approaches to assessment. The last decade has seen the development of a number of psychometrically sophisticated measures and the field no longer is focused on using one of two key neuropsychological batteries (i.e., the Halstead-Reitan, the Luria-Nebraska). Many practitioners now use recently developed batteries such as the NEPSY-II or the Dean-Woodcock Neuropsychological system. Additional measures that focus on specific brain-related areas such as memory (e.g., Test of Memory and Learning-II) and executive functioning (e.g., Delis-Kaplan) also have become quite popular. These updated instruments can help provide better rehabilitation activities. In this edition, you will find that we cover more instruments in greater depth than in the previous edition. Qualitative procedures have also grown greatly (see Witsken, Stoeckel, & D’Amato, in press) and are discussed in a number of sections in our text. Our hope is that a stronger neuropsychological foundation will lead to improved treatment outcomes for children and adults.

This volume is intended for the neuropsychology student or beginning practitioner as an introduction to the diverse aspects of clinical neuropsychology, with special reference to how neuropsychology may relate to the issues likely to be encountered in practice. We are attempting to offer you the essentials of what is needed to achieve neuropsychological success with patients. This volume should also enable
the non-neurologically trained practitioner to appreciate the range and type of clinical problems for which neuropsychology may make contributions toward diagnosis, management, and rehabilitation.

Chapter contributors were solicited on the dual criteria of recognized expertise in their respective areas and their ability to communicate this expertise in a clinically relevant form to professionals whose involvement with neuropsychology may just be beginning to develop. In order to achieve this goal, the editors have sought to present the richness of the individual clinical perspectives of the authors so that the practitioner will recognize that there is no one absolute standard, instrument, or approach that represents the essence of neuropsychology. Our hope is that our talented authors will have presented information in a way which will help readers understand and offer new and advanced neuropsychological services. It is important for us to acknowledge each author’s dedication and commitment to excellence. We believe that the goal of clinical neuropsychology services should be to improve interventions for individuals while offering preventive activities at the societal level.

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REFERENCES


Foundations of Neurological and Neuropsychological Practice
Within the last several decades, clinical neuropsychology has gained increasing recognition as a discipline with relevance to such diverse practice areas as family medicine, neurology, neurosurgery, psychiatry, and psychology as well as to such research areas as behavior, learning, and individual differences. Although the history of neuropsychological practice is rooted in its efforts to develop techniques to assist in differentiating organic (or neurological) causes of behavior from functional (or environmental) causes of behavior, contemporary neuropsychology has begun to redefine its role, seeking the scientific knowledge and tools to be able to answer more refined and practical questions (Hartlage, 1987; Hartlage & D’Amato, 2007). The growth of neuropsychology over the past several decades is evident in the branching off of numerous related subspecialties, including pediatric neuropsychology, school neuropsychology, geriatric neuropsychology, forensic neuropsychology, and rehabilitation neuropsychology. Neuropsychology’s application to rehabilitation in particular has emerged as a subdiscipline whose research base and practice have flourished in recent decades with advancements in cognitive rehabilitation and retraining. In fact, nearly half of practicing neuropsychologists report that they have engaged in some type of cognitive rehabilitation or retraining activities (Lee & Riccio, 2005; Seretny, Gray, Hartlage, & Dean, 1985).
According to the National Academy of Neuropsychology (2001), neuropsychology is the “applied science of brain-behavior relationships.” Neuropsychologists must apply a working understanding of psychology, physiology, and neurology to assess, diagnose, and treat patients with neurological, medical, neurodevelopmental, psychiatric, and cognitive disorders (D’Amato, Fletcher-Janzen, & Reynolds, 2005). In addition to using assessments of neurocognitive, behavioral, and emotional functioning to form hypotheses regarding a client’s central nervous system functioning, neuropsychologists carefully consider how these factors interact with the individual’s psychosocial environment (National Academy of Neuropsychology, 2001; Teeter & Semrud-Clikeman, 2007). Viewed from this perspective, neuropsychological assessment may serve a variety of purposes beyond an initial diagnosis. Assessments may be used to guide treatment decisions by identifying an individual’s strengths, weaknesses, and needs; to design individual treatment programs tailored to these findings; to evaluate changing treatment needs; and to monitor treatment effectiveness (Lezak, Howieson, & Loring, 2004; Root, D’Amato, & Reynolds, 2005).

In a number of ways, clinical neuropsychology can be viewed as representing a synthesis of the best features of neurological, psychiatric, and psychological examination procedures, whereby the systematic neurological assessment of functional cortical systems is combined with the precise scaling of psychometric measurement. Neuropsychological assessment allows the examiner to reduce the subjectivity in traditional neurological examinations by conducting assessments that lead to quantifiable standardized scores, thereby increasing the reliability of the assessment as well as allowing for a more sensitive baseline for comparisons across time. In contrast with traditional clinical measures such as a mental status exam, which allow for imprecise estimates of dementia, dyscalculia, or dysphasias, neuropsychological assessment more precisely identifies which functional system is impaired or to what extent it is impaired.

The critical difference between traditional psychological assessment and clinical neuropsychology is the presumed neurological substrates of behavior being measured. In contrast with neuropsychology, traditional clinical and school psychology instruments do not necessarily link assessment results to specific brain functioning. While traditional measures
in psychology can describe and in some cases predict behavior, this de-
scriptive or prognostic function does not focus on the determinants in
the form of biological substrates. Neuropsychology, on the other hand,
uses measures that presumably assess either (1) specific anatomic loci
(e.g., left posterior frontal lobe motor strip or right anterior parietal lobe
sensory strip functional systems) with respect to presumed anatomic
loci (e.g., rhythm sense) or (2) constellations of functional systems (e.g.,
short-term visual-spatial memory, long-term verbal memory) that have
implications for specific aspects of brain function.

Likewise, neuropsychologists and traditional clinical and school psy-
chologists may use many of the same diagnostic instruments, but the
purpose of their use and implications for diagnosis differ on the dimen-
sion of referral to neurological substrates of findings. A traditional psy-
chologist may use a test of dominant-hand fine motor coordination to
determine whether or not an individual could perform a given job re-
quiring such coordination, while the focus of the neuropsychologist on
this measure would more likely involve the functional integrity of the
contralateral cerebral hemisphere motor strip. So too, traditional psy-
chologists relying on cognitive domain testing often select tests provid-
ing normative comparisons. However, these tests may not provide data
that satisfy questions regarding brain functioning (Parrish, 2005). For
example, a low IQ score on a Wechsler scale may be indicative of any
number of factors (e.g., genetics, educational disadvantage, fatigue, lim-
ited attention, emotional functioning, brain functioning; Parrish, 2005).
While neuropsychologists may incorporate similar measures in their
evaluations, additional assessments that have been proved through rig-
orous scientific research to assess brain functioning are also frequently
part of a neuropsychologist’s tool bag (Parrish, 2005). Thus, the practice
of clinical neuropsychology could be defined as the scientific application
of psychological and psychometric measurement procedures to assess
and understand behaviors related to the central nervous system.

**TRAINING IN NEUROPSYCHOLOGY**

This level of interpretation requires specialized training. Although many
neuropsychologists are also trained as clinical or school psychologists,
the reverse is less common. The use of some clinical neuropsychology
assessment procedures in practice does not qualify one as a clinical neu-
ropsychologist. By analogy, although a cardiologist uses a stethoscope,
anyone who learns how to use a stethoscope does not automatically become a cardiologist (Hartlage, 1987). The fact that clinical and school psychologists and neuropsychologists frequently use similar tools has led to considerable debate surrounding neuropsychologists’ training and licensure requirements. Several professional organizations have arisen to represent clinicians and researchers in neuropsychology. These organizations have contributed to establishing training standards and regulating credentialing in neuropsychology. Among these are the International Neuropsychology Association, Division 40 (Clinical Neuropsychology) of the American Psychological Association, and the National Academy of Neuropsychology. Two national professional credentialing boards in neuropsychology emerged to specify and regulate practitioner qualifications. These include the American Board of Professional Psychology, which recognizes clinical neuropsychology as a specialty area of practice within psychology, and the American Board of Professional Neuropsychology, which exclusively recognizes specialists in neuropsychology. Currently, most clinical neuropsychologists have obtained a doctoral degree in psychology with coursework, research, and practicum experiences in neuropsychology, followed by postdoctoral training with a neuropsychology emphasis. The International Neuropsychology Association recommends a PhD program in clinical neuropsychology either through a psychology or medical department or sufficient coursework in neuropsychology through a PhD in clinical, counseling, or school psychology. In addition to core coursework in general psychology, clinical psychology, neurosciences, and clinical neuropsychology, International Neuropsychology Association internship guidelines require an 1,800-hour internship under supervision of a board-certified clinical neuropsychologist, with at least 50% of the time devoted to clinical neuropsychology. Table 1.1 displays the recommended coursework and training.

Practicing neuropsychologists are generally expected to obtain licensure from their respective state psychology licensure board prior to seeking board certification in clinical neuropsychology.

**THE PAST: INFLUENCES ON NEUROPSYCHOLOGICAL THEORY AND PRACTICE**

Neuropsychology represents a unique integration of several convergent disciplines, including neurology, neuroanatomy, neurophysiology, neurochemistry, neuropharmacology, and psychology—particularly cognitive
GUIDELINES FOR DOCTORAL TRAINING IN NEUROPSYCHOLOGY

EDUCATION

May be accomplished through a PhD program in clinical neuropsychology offered by a psychology department or medical facility or through completion of a PhD program in a related specialty (e.g., clinical, school, counseling psychology) that offers sufficient specialization in clinical neuropsychology.

REQUIRED CORE

A. Generic Psychology Core

1. Statistics and methodology
2. Learning, cognition, and perception
3. Social psychology and personality
4. Physiological psychology
5. Life span development
6. History

B. Generic Clinical Core

1. Psychopathology
2. Psychometric theory
3. Interview and assessment techniques
   1. Interviewing
   2. Intellectual assessment
   3. Personality assessment
4. Intervention techniques
   1. Counseling and psychotherapy
   2. Behavior therapy/modification
   3. Consultation
5. Professional ethics

(Continued)
**GUIDELINES FOR DOCTORAL TRAINING IN NEUROPSYCHOLOGY (Continued)**

**C. Neurosciences: Basic Human and Animal Neuropsychology**

1. Basic neuroscience
2. Advanced physiological and psychopharmacology
3. Neuropsychology of perceptual, cognitive, and executive processes
4. Research design and research practicum in neuropsychology

**D. Specific Clinical Neuropsychology Training**

1. Clinical neuropsychology and neuropathology
2. Specialized neuropsychology assessment techniques
3. Specialized neuropsychological intervention techniques
4. Assessment practicum with children and/or adults
5. Clinical neuropsychology internship of 1,800 hours, preferably in a university setting

**INTERNSHIP**

The internship must devote at least 50% of a one-year full-time training experience to neuropsychology. In addition, at least 20% of the training must be devoted to general clinical training to ensure competent background in clinical psychology. Supervisors should be board-certified clinical neuropsychologists.


and developmental psychology. In many respects, the advancement of neuropsychology has been intricately linked to developments in each of these fields (Boller & Grafman, 2000). For example, Broca’s identification of a link between left hemispheric damage and aphasia and Wernicke’s discovery of fluent aphasia disorders associated with left posterial temporal lobe damage significantly advanced the field’s understanding of the potential to identify locations in the brain responsible for specific behavioral functioning (Boller & Grafman, 2000; Broca,
Following the recognition of the possibility of localization of functioning in the brain, efforts to develop quantitative techniques for assessing brain damage emerged. The field of educational psychometrics and the work of researchers such as Francis Galton, Alfred Binet, and Charles Spearman contributed to neuropsychology's integration of the normative perspective to understanding mental abilities, as well as its recognition of the importance of utilizing reliable and valid measurement tools (Lamberty, 2002; Lezak et al., 2004).

**History of Rehabilitation in Neuropsychology**

Some researchers consider the field of rehabilitation older than neuropsychology itself (Boake, 2003). More than a century ago, Paul Broca documented his intuitive rehabilitation program to restore reading skills in an adult patient who was unable to read aloud (Berker, Berker, & Smith, 1986; as cited in Boake, 2003). Broca concluded from his work with this patient that the patient was likely learning to read through visual techniques rather than the process the patient used when learning to read as a child (Boake, 2003). Another prominent American neuropsychologist, Shepherd Franz, who was known for using scientific methodology to study motor learning in hemiparesis and the effectiveness of therapy with clients with aphasia, was also a pioneer in neuropsychology rehabilitation (Boake, 2003; Prigatano, 2005). Like Broca, Franz noticed that his aphasic patients appeared to look more like they were learning a new skill rather than relearning an old habit, establishing a precedent for using techniques that focus on learning new skills to compensate for skills lost due to brain damage.

Neuropsychological rehabilitation gained momentum during the first and second World Wars, when rehabilitation centers to treat brain-injured soldiers were established in Europe. The most reputable brain injury rehabilitation centers were in Germany and Austria. Several of these centers offered comprehensive services, including a residential program or hospital, a psychological evaluation unit, and vocational skill assessment and training classes (Boake, 2003). The well-known German psychologist Kurt Goldstein documented his treatment recommendations for speech, reading, and writing impairments. In doing so, he provided a template for rehabilitation efforts that draw upon preserved areas to compensate for lost skills and behavioral methods for shaping desired behaviors (Boake, 2003). He has also been credited with several facets of current rehabilitation theory and practice, including systematic
and long-term follow-up of patients, use and understanding of the limitations of psychometric techniques, and careful observation of clients’ natural preference for forms of compensation or substitution. Goldstein also recognized fatigue effects during therapy, respected the uniqueness of each patient and resulting variable performance, addressed cognitive and personality deficits, and connected cognitive rehabilitation to functional activities (Newcombe, 2002).

During World War II, the renowned Russian psychologist Alexander Luria synthesized his theories of functional systems based on his study of veterans with penetrating brain injuries (Boake, 2003). Although his emphasis on rehabilitation emerged later in his career, his work extended rehabilitation beyond working with patients with aphasia to include intervention with patients demonstrating motor planning, visual perception, and executive functioning disorders (Christensen & Castano, 1996; Prigatano, 2005). Luria is also credited with recognizing the importance of obtaining a detailed neuropsychological profile to understand underlying patient deficits. This information can then be used to draft appropriate rehabilitation plans, based on the use of intact systems to compensate for impairments. Before initiating efforts to restore impaired functioning, Luria used direct training to reorganize the underlying neuropsychological system (Prigatano, 2005). Thus, Luria established a precedent by recognizing the importance of conducting a thorough assessment to facilitate intervention planning, as well as to evaluate if the neuropsychological interventions implemented for each patient are appropriate.

**Historical Roots of Rehabilitation Approaches**

In the years that followed, psychologists such as Oliver Zangwill and Edna Butfield brought attention to the importance of an empirical approach to understanding rehabilitation, utilizing control groups to account for expectations based on spontaneous recovery rather than the effects of rehabilitation (Boake, 2003). Zangwill was also credited with recognizing that rehabilitation may follow one of three paths: restoration, substitution, or compensation (Prigatano, 2005). Restoration involves direct retraining of impaired areas. Substitution approaches involve efforts to train brain-injured patients to use alternate strategies in place of those affected by impaired functions. Compensation relies on use of alternative strategies to solve problems caused by impaired functioning.
Many psychologists working with veterans with brain injuries recognized the importance of comparing results from psychological tests with the clients’ vocational performance, foreshadowing the current emphasis on ecological validity of assessment practices to better predict practical functioning (Boake, 2003). Furthermore, rehabilitation following the work of Yehuda Ben-Yishay during the late 1970s and 1980s increasingly recognized the importance of systematically addressing the interpersonal and social needs of clients in order for them to successfully reenter their social environment (Prigatano, 2005). Based on the recognition that patients’ emotional and motivational disturbances must be addressed in addition to cognitive deficits, holistic approaches emerged that included psychotherapy as part of the treatment for individuals with brain injuries (Prigatano, 2005). Weinstein’s contribution of an understanding that many patients with brain injuries may, as a characteristic of the injury, demonstrate impaired awareness of their difficulties rather than perceived denial of their disability represented a breakthrough that has had important implications for rehabilitation (Prigatano, 2005). The history of the development of rehabilitation neuropsychology illuminates several common trends visible in today’s practice. First, rehabilitation neuropsychology has traditionally emphasized careful scientific assessment of the neuropsychological impact of a brain injury to lead to targeted interventions. This tradition emphasizes the use of cognitive retraining or efforts to identify compensatory or remedial techniques (Lee & Riccio, 2005). Recently the importance of treating the whole person by addressing the individual’s social and emotional needs and by identifying a practical rehabilitation program that will allow the individual to reintegrate into his or her social environment has been recognized (Prigatano, 2005).

THE PRESENT: APPROACHES TO NEUROPSYCHOLOGICAL ASSESSMENT AND INTERVENTION

Since the early work of researchers and practitioners such as Broca and Luria, assessment has played an essential role in the application of neuropsychology to rehabilitation, from identifying functionally impaired versus intact systems to assisting in developing appropriate treatment plans to evaluating their effectiveness. Neuropsychological assessment differs from traditional psychological assessment because it typically involves a comprehensive evaluation of several domains based on the recognition
that damage to the brain can affect the entire neuropsychological systems (Rhodes, D’Amato, & Rothlisberg, in press). Traditionally, domains assessed in pediatric neuropsychology and school neuropsychology include Sensory and Perceptual Systems; Motor Functions, Intelligence/Cognitive Abilities, Executive Functioning/Attention, Memory, Communication/Language Skills, Academic Achievement, and Educational/Classroom Environmental (D’Amato & Rothlisberg, 1992; Rhodes et al., in press). (Table 1.2 outlines areas commonly assessed within these domains.) Although neuropsychology has faced criticism based on a mistaken belief that assessment focuses exclusively on the client’s inherent deficits, neuropsychological assessment seeks to provide an understanding of how an individual’s neuropsychological profile and environmental systems interact (D’Amato, Rothlisberg, & Work, 1999). Perhaps nowhere is this more evident than within the field of rehabilitation neuropsychology, in which the goal of assessment is to identify interventions that will improve the independence and quality of life of individuals with neuropsychological impairments.

Neuropsychological Assessment for Intervention

Despite shared goals, neuropsychologists differ widely with respect to their approach to assessment. Two distinct orientations within neuropsychology have emerged, one emphasizing the use of quantitative techniques, and the other espousing the use of qualitative techniques (D’Amato et al., 1999). In reality, the practice of most practitioners likely falls somewhere between these approaches. Some have argued that the differences between the two approaches are minimal (Bauer, 1994) and that there is little data to support the usage of one approach over the other (Kamphaus, 2001). The quantitative approach to neuropsychological assessment relies on comparisons of an individual’s performance on standardized tests with those of a representative normative group to determine whether the individual’s performance falls below expectations (Rhodes et al., in press). The accumulated data across various domains is analyzed to determine the individual’s performance relative to normative standards, patterns of performance suggesting relative strengths and weaknesses, signs of right-left hemispheric differences, and indicators of possible brain damage (Jarvis & Barth, 1994; Reitan & Wolfson, 1985). Proponents of this approach typically recommend the use of a standard or fixed battery of tests, in which the same set of instruments is used for each individual tested, regardless of the referral question. By utilizing a
**Table 1.2**

**Brain-based areas that should be formally and informally assessed as part of a neuropsychological evaluation**

1. **Perceptual/Sensory**
   - Visual
   - Auditory
   - Tactile-kinestetic
   - Integrated

2. **Motor Functions**
   - Strength
   - Speed
   - Coordination
   - Lateral preference

3. **Intelligence/Cognitive Abilities**
   - Verbal functions
     - Language skills
     - Concepts/reasoning
     - Numerical abilities
     - Integrative functioning
   - Nonverbal functions
     - Receptive perception
     - Expressive perception
     - Abstract reasoning
     - Spatial manipulation
     - Construction
     - Visual
     - Integrative functions

4. **Executive Functioning/Attention**
   - Sustained attention
   - Inhibition
   - Shifting set
   - Problem solving

5. **Memory**
   - Short-term memory
   - Long-term memory
   - Working memory
   - Retrieval fluency

6. **Communication/Language Skills**
   - Phonological processing
   - Listening comprehension

   - Expressive vocabulary
   - Receptive vocabulary
   - Speech/articulation
   - Pragmatics

7. **Academic Achievement**
   - Pre-academic skills
   - Academic skills
     - Reading decoding
     - Reading fluency
     - Reading comprehension
     - Arithmetic facts/calculation
     - Social studies
     - Language arts
     - Science
     - Written language

8. **Personality/Behavior/Family**
   - Adaptive behavior
     - Daily living
     - Development
     - Play/leisure
   - Environmental/social
     - Parental/family
     - School environment
     - Peers
     - Community
   - Student coping/tolerance
   - Family interpersonal style

9. **Educational/Classroom Environmental**
   - Learning environment fit
   - Peer reactions
   - Community reactions
   - Teacher/staff knowledge
   - Learner competencies
   - Teacher/staff reactions
   - Classroom dispositions

**Sources:** Adapted from D’Amato et al. (1999); Rhodes et al. (in press).
standard test battery, practitioners ensure that all significant domains are addressed, thus avoiding the possibility of overlooking deficits that may better account for or contribute to the patient’s presenting problem. The use of standardized techniques allows for calculation of reliability and validity information for these batteries (Fletcher-Janzen, 2005; Rhodes et al., in press). Critics of the quantitative approach have cited its failure to collect information beyond normative comparisons. Such information could illuminate unique differences in how a patient approaches a task or provide rich information to guide intervention efforts. From a quantitative perspective, some have argued that the essence of the patient can be lost (e.g., Fletcher-Janzen, 2005; Rhodes et al., in press). Others have indicated that administering an entire battery may be excessive given specific referral concerns.

Traditional examples of the most commonly used fixed batteries include the Halstead-Reitan Neuropsychological Battery (HRNB) and the Luria-Nebraska Neuropsychological Battery. The HRNB was developed to address Halstead’s insight that the then-current measures of intelligence did not account for an organic basis of intelligence and failed to link assessments to brain functions (Davis, Johnson, & D’Amato, 2005). Years later, research indicating that measures of neuropsychological functioning overlap a meager 10% with traditional IQ tests supported his early theories that these tests fail to capture the full range of human cognitive functioning (D’Amato, Dean, & Rhodes, 1988; D’Amato, Gray, & Dean, 1988; Sattler & D’Amato, 2002). The current HRNB was designed to differentiate patients with and without brain injuries through 10 subtests that are intended to be used as part of a complete battery including the age-appropriate Wechsler scale and a comprehensive personality assessment. A more complete description of the HRNB can be found in chapter 5 of this text.

Early on, some have argued that the Luria-Nebraska Neuropsychological Battery (LNNB) was the second most common neuropsychological test battery, although it has received quite mixed reviews (Golden & Freshwater, 2001). The LNNB was developed for use with individuals 15 years of age and older. However, a children’s version, the Luria-Nebraska Neuropsychological Test Battery–Children’s Revision, was later developed for use with children ages 5 through 12 (Golden, 1987). Like the HRNB, this battery was designed to diagnose cerebral impairments often overlooked by other techniques. The battery claims to be grounded in Luria’s theories of brain functioning and yields
8 localization scales, 5 summary scales, and 28 factor scales providing information about specific sensory and cognitive functions (Davis et al., 2005). Some have argued that the LNNB does not accurately utilize Luria’s approach and is a failed attempt at best (Davis et al., 2005). Detailed information about the LNNB is provided in chapter 6.

More recently, two additional standardized batteries, the NEPSY-II and the Dean-Woodcock Neuropsychological Battery, have gained popularity (Davis & D’Amato, 2005). Although these batteries may be classified as fixed quantitative approaches, they may also be used as part of a flexible battery. The original NEPSY: A Developmental Neuropsychological Assessment was the first to attempt to measure neuropsychological functioning specifically for children, rather than slightly modifying or renorming adult measures (Kemp, Kirk, & Korkman, 1998). The NEPSY-II, the most recent revision to the original NEPSY, was designed to assess neuropsychological development in children and adolescents ages 3 to 16 (Korkman, Kirk, & Kemp, 2007). To suit a variety of diagnostic needs, examiners may select from subtests organized to assess functioning across six domains: (1) attention/executive functions, (2) language, (3) visual-spatial processing, (4) sensorimotor, (5) memory and learning, and (6) social perception. Titley and D’Amato provide a detailed review of the NEPSY-II in chapter 7.

The Dean-Woodcock Neuropsychological Battery consists of the Dean-Woodcock Sensory-Motor Battery, the Dean-Woodcock Emotional Status Examination, and the Dean-Woodcock Structured Neuropsychological Interview. These measures may be used alone or in conjunction with the Woodcock-Johnson Tests of Cognitive Abilities and the Woodcock-Johnson Tests of Achievement for a comprehensive measurement of an individual’s functioning. Used in this fashion, the Dean-Woodcock Neuropsychological Battery can provide useful data, including pathognomic signs of cerebral dysfunction as well as neuropsychological functioning across sensory, motor, personality, and emotional domains (Davis & D’Amato, 2005). Davis provides a detailed description of the Dean-Woodcock battery in chapter 8.

**Qualitative Approaches**

Advocates of the qualitative neuropsychological assessment approach recognize the range of diversity in individual performance on neuropsychological tests (D’Amato et al., 1999). Luria’s work relied heavily
on case studies representing a classic example of how informal and formal procedures can be used together to identify unique patterns and processes used by patients. Practitioners using this approach may be more interested in the process patients use to solve formal and informal assessment tasks than any resulting outcomes. For example, careful behavioral observations may identify whether factors such as the nature of the stimuli (e.g., visual, verbal, tactile), the method of presentation (e.g., visual, verbal, concrete, social), the type of response demand (e.g., verbal, motor, constructional), and the response time allowed (e.g., timed or untimed) contributed to the individual’s performance (Cooley & Morris, 1990; Luria, 1973, 1980).

It is assumed that analyzing clinical observations of the client’s process of approaching various tasks may provide valuable information to contribute to the development of appropriate interventions. Another popular qualitative approach developed by Edith Kaplan based on the Lurian tradition is known as the Boston Process Approach (Semrud-Clikeman, Wilkinson, & Wellington, 2005). In this and similar techniques described as the process approach, quantitative and qualitative performance on various tests are used to sample domains of functioning. These methods emphasize the importance of considering the process the client uses to solve the tests and the use of testing limits procedures to assess the client’s abilities given various response demands and conditions (Fletcher-Janzen, 2005). The emergence of tests such as the Wechsler Intelligence Scale for Children–Fourth Edition Integrated (WISC-IV Integrated) represents efforts to quantify this processing approach and may signify increasing recognition of its potential contribution to the assessment process.

Practitioners using the qualitative approach may opt to use a flexible battery to assess only select domains assumed to underlie the presenting concerns. Alternatively, a mixed battery approach allows practitioners to supplement a core set of subtests with additional techniques to address specific concerns. Skeptics of this approach note that it is heavily dependent on the examiner’s clinical skills in selecting and interpreting appropriate assessment techniques. Additionally, critics caution that one may easily place too much emphasis on the significance of observed behaviors (D’Amato et al., 1999). Some concerns have been raised regarding the reliability and validity of a battery assembled from multiple sources and the difficulty validating the use of a flexible battery approach to neuropsychological assessment that is inherently variable across practitioners and individual clients.
Approaches to Neuropsychological Rehabilitation and Intervention

Current approaches to neuropsychological rehabilitation are strongly grounded in the field’s rich history. The most commonly used intervention strategies generally target environmental modifications, compensatory strategies, or restorative approaches (Lee & Riccio, 2005; Mateer, 2005; Work & Choi, 2005). Because brain injuries often affect multiple systems, intervention most often includes a variety of these approaches. In all situations, engaging the client and his or her support system (i.e., family) in a collaborative relationship to develop meaningful, measurable functional goals is critical (Conoley & Sheridan, 2005; Mateer, 2005).

Environmental modifications typically are used to adjust elements of the client’s environment to reduce the impact of the impairment. Often these modifications involve strategies for making the environment safe or minimizing overstimulation (Ducharme, 1999; Mateer, 2005). Other environmental modifications may target reducing the effects of fatigue (e.g., a shorter school or work day) and memory impairment (e.g., labeling cupboard, using checklists). D’Amato et al. (1999) provide an example of a useful framework for modifying the educational setting to appropriately meet the needs of students with brain injuries. Their SOS model suggests that intervention for students with brain injuries returning to school settings should address structure, organization, and strategies.

Techniques utilizing a remediation approach typically emphasize reinforcing, rehabilitating, or strengthening previously learned skills (Lee & Riccio, 2005; Mateer, 2005). These strategies typically emphasize the use of direct, systematic instructional activities that target improvement of a particular cognitive skill underlying the functional behavior (Lee & Riccio, 2005; Mateer, 2005). Mateer (2005) outlines several strategies for teaching new skills that have some empirical support. Direct instruction relies on a number of sound instructional principles to systematically deliver an academic curriculum designed to teach and maintain academic skills (Mateer, 2005). Errorless learning, a technique providing correct answers or strong clues to guide clients toward correct answers to avoid memory confusion, has demonstrated effectiveness in work with clients with severe memory impairments (Wilson, Baddeley, Evans, & Shiel, 1994). In their treatment plans, clinical neuropsychologists also frequently incorporate the use of procedural memory, or memory for experiences or learning that occurs over time through repetition (Mateer, 2005).
Finally, compensatory approaches typically attempt to bypass damaged functions by emphasizing the use of unaffected skill areas or adopting strategies that will circumvent difficulties frequently encountered as a result of brain damage (Mateer, 2005; Work & Choi, 2005). For example, when confronted with memory impairments, clients are often taught to use compensatory memory devices such as handheld calendar systems, alarm clocks, or memory books for keeping track of essential information and task checklists.

There are several additional factors to consider when one is determining an appropriate rehabilitation approach. Research has indicated the value of gathering information regarding the client’s level of self-awareness regarding his or her current cognitive and physical functioning and its impact on the client’s life (Mateer, 2005; Prigatano, 2005). Understanding the client’s level of self-awareness can help gauge whether the client has enough self-regulation and capacity to initiate strategies for particular techniques to be effective and whether the teaching of these skills should be incorporated in the intervention plan (Mateer, 2005). In addition, assessing and designing a rehabilitation plan to address the client’s emotional needs may be critical to any plan’s success. In an innovative study, Gisi and D’Amato (2000) evaluated anger, social desirability, and forgiveness in individuals with traumatic brain injuries. They found that clients who had been forgiving showed a more positive mental health profile than those who had not. Even in cases when emotional ramifications are not predicted based on the client’s brain injury, many clients may develop fears, anxiety, and frustration related to the impact of a brain injury that should be addressed as part of the treatment plan.

**THE FUTURE: FACTORS DRIVING THE FUTURE OF NEUROPSYCHOLOGY**

Several influences will likely continue to shape the future of neuropsychology. Scientific advancements in neuroimaging and psychopharmacology have already dramatically affected the scope and role of neuropsychological practice. In addition, rehabilitation neuropsychologists are faced with increasing pressure to demonstrate that their practices are empirically based, valid for unique populations, and ecologically valid (Traughber & D’Amato, 2005). Advancements in psychopharmacology, neuroimaging, and adaptive technology have already had a tremendous effect on the practice of neuropsychology. These advancements
have altered our understanding of many psychological and behavioral disorders, such as autism and depression, that were once presumed to be environmental or functional. Neuroimaging and psychopharmacology have illuminated the neurodevelopmental and neurochemical basis of many of these disorders (Hartlage & D’Amato, 2007; Teeter & Semrud-Clikeman, 2007).

With this understanding of the neurological basis of many behaviors, our intervention options have expanded. New pharmacological advancements have emerged in the prevention and treatment of pathology. For example, a growing body of research has investigated the effectiveness of medication in slowing or preventing Alzheimer’s disease. In addition, more than ever before, medication is being used to mediate the effects of impairments in mood, attention, memory, and impulse control (Whyte, 2002). As a result, practicing neuropsychologists must remain informed about new psychopharmacological interventions and their expected effects (Dunn & Retzloff, 2005). This understanding is essential because psychopharmacological treatments generally interact in complex ways with the brain’s neurotransmitters and therefore may be expected to have varying impacts on functional behaviors that are often used to monitor the effectiveness of the drug treatment (Whyte, 2002). Clinicians must be capable of drawing upon their understanding of psychopharmacology as well as causal relationships with complex functional behaviors and an individual’s environment to develop hypotheses regarding why a particular psychopharmacological intervention was or was not effective (Whyte, 2002).

In addition to pharmacological advances, the advancement of neuro-radiological techniques since the 1970s has had a tremendous impact on neuropsychological practice. Since the advent of the CAT scan, this technology has become increasingly sophisticated, with notable advancements in both structural imaging techniques (i.e., magnetic resonance imaging, quantitative magnetic resonance imaging, and diffusion tensor magnetic resonance imaging) and functional imaging techniques (i.e., positron emission tomography, single photon emission computed tomography, and functional magnetic resonance imaging). These quick and effective techniques have enabled physicians and neurologists to diagnose many neurological impairments (e.g., lesions, aneurysms, strokes). Because of their widespread availability and relative cost-effectiveness, these techniques have supplanted the neuropsychological assessments that, prior to the advent of this technology, were frequently used to identify impairments. As a result, neuropsychological practice has shifted toward refining practices that allow neuropsychologists to
provide information that these tests cannot. For example, many of these neuroradiologic tests are still not as good as a comprehensive neuropsychological battery at recognizing diffuse axonal damage and identifying its potential impact on the client’s functional behavior (Long, 1998). In light of advancing technology, neuropsychology has adopted the challenge of seeking to understand the complex interaction between brain anatomy, cognition, and behavior to identify the potential functional impact of structural impairment as indicated by data collected through sources other than these functional and structural imaging techniques (Long, 1998; Provencal & Bigler, 2005).

In addition to shaping the role of neuropsychologists, these scientific advancements have provided researchers and practitioners with new techniques to study developmental changes in the brain and to understand plasticity and reorganization (Provencal & Bigler, 2005). This has led to the development of the Kennard principle. According to this principle, evidence supports the brain’s ability to reroute and develop even around a large lesion (Finger & Wolf, 1988) and has contributed to the new understanding that damage in infancy may cause more severe deficits than once thought by affecting the development of various systems (Duval, Dumont, Braun, & Montour-Proulx, 2002; Webb, Rose, Johnson, & Attree, 1996).

Technology has also provided new techniques for measuring the ability of the brain to reorganize in response to intervention. B. A. Shaywitz and her colleagues (2002) utilized imaging techniques to demonstrate neurobiological changes in the brains of dyslexic children, which were reorganized to activate areas more similar to normal readers’ brains following intervention targeting phonological processing. This use of technology may provide the most sophisticated and powerful indicator of the effectiveness of interventions. Some argue that the field is advancing toward diagnosing disorders by relying exclusively on behavioral imaging techniques (e.g., S. Shaywitz, 2003). In the future we will see further attempts to use imaging to identify neuroanatomical and neurofunctional markers of particular disorders and most probably to evaluate treatment efficacy (Provencal & Bigler, 2005).

**Ecological Validity**

Technological advancements have inevitably altered the role of neuropsychology to answer new referral questions regarding a client’s ability to function in different contexts. Clinical neuropsychologists are frequently
asked to provide information regarding the effectiveness of cognitive re-
training and to identify what compensatory strategies may be necessary
for a client to be successful in various environments (Lee & Riccio, 2005;
Long, 1998). In order to answer questions regarding their clients’ func-
tional skills or potential for rehabilitation, appropriate treatment options,
or living arrangements, neuropsychologists are required to draw multi-
faceted inferences from their data (Long, 1998; Sbordone, 1998). These
recommendations are often based largely on informed clinical opinion,
which means that neuropsychologists must recognize and appropriately
acknowledge the limitations of their competency and training. Further-
more, the ability to draw inferences regarding a client’s functional skills
mandates that practitioners remain well versed in research that might
be of assistance in drawing inferences based on similar clinical groups
(Long, 1998; Traughber & D’Amato, 2005).

The ability to evaluate the complex interactions between cognitive, 
emotional, social, and situational influences will be required for neu-
ropsychologists to make predictions regarding clients’ abilities to function
in a particular environment. The critical importance of these abilities or
disabilities highlights the new directions in rehabilitation neuropsychol-
ogy research that will be needed. Although informed clinical opinion
may never be entirely removed from this process, research must explore
and identify the boundaries of inferences that can be appropriately
drawn from available tests, and new tests must be designed to answer
these complex questions (Long, 1998). Research investigating the eco-
logical validity of assessments—that is, whether tests actually reliably
measure the intended functional skills and assist in making valid pre-
dictions about clients’ behavior within various environments—will likely
continue to drive the field of neuropsychological rehabilitation.

Cross-Cultural Aspects of Neuropsychological Services

The task of ensuring the ecological validity of neuropsychological as-
essment and intervention efforts proves even more daunting in the
context of a diverse client base. The population of the United States
has become increasingly culturally and linguistically diverse as a result
of surges in immigration over the past decade. The influence of this
diverse population has begun to affect assessment practices as well as
intervention approaches. Research has indicated that consideration of
ecological contexts is critical in work with clients from different cultural
backgrounds (Hess & Rhodes, 2005). Much of this understanding comes
from research with school-age children, which demonstrates the likely relationship between the overrepresentation of children from different cultural groups in special education and the disproportionate numbers of minority children who fall below the poverty line. These children are at risk for cognitive and emotional delays due to factors such as low birth weight, poor nutrition, and exposure to toxins (Hess & Rhodes, 2005; McLoyd, 1998; National Research Council, 2002). Rates of brain injury are also higher among minority youths and adults (Bruns & Hauser, 2003). In addition, fetal alcohol syndrome rates are excessively high among Native American populations (Myers, Kagawa-Singer, Kumaniyika, Lex, & Markides, 1995). It seems that individuals from minority cultural and linguistic backgrounds demonstrate greater variability in the quality of their educational experiences. Even those educated primarily in the United States, particularly those attending schools populated by large numbers of low-income minority children, may have distinctly different educational opportunities as a result of lower per-pupil expenditures that are common in these schools (Darling-Hammond & Post, 2000; National Research Council, 2002). This is significant when one considers findings that education can account for up to 15% of the variance in scores on particular neuropsychological assessments among adults (Dick, Teng, Kempler, Davis, & Taussig, 2002).

In addition to these contextual variables, cross-cultural assessment is complicated by cultural and linguistic factors. Neuropsychological assessment of language disorders among individuals from non-English linguistic backgrounds must take into account the individual's language facility in both English and his or her native language. Language proficiency should not be assumed based on the client's informal conversational skills (i.e., Basic Interpersonal Communication Skills), as several neuropsychological tests tap academic language (i.e., Cognitive Academic Language Proficiency), which may not be familiar to an individual educated in another country (Rhodes, Ochoa, & Ortiz, 2005). As the use of translated tests is contraindicated by research, neuropsychologists may be hard pressed to find suitable techniques for assessing the verbal skills of individuals from varying linguistic backgrounds (Artiola i Fortuny & Mullaney, 1997). There is a growing demand to develop reliable techniques for assessing language functioning among non-English-speaking populations.

Practitioners are encouraged to utilize culturally sensitive assessment techniques that take into consideration potential cultural differences that may account for behaviors otherwise perceived as unusual (Hess & Rhodes, 2005; Rhodes et al., 2005). In addition, because acculturation
has been shown to affect psychological functioning, it is important to assess the individual’s level of acculturation—the individual or family’s process of adapting to a new social and cultural environment (Berry, Trimble, & Olmedo, 1988; Rhodes et al., 2005).

Neuropsychologists have advocated a variety of approaches to appropriately serve individuals from different cultural and linguistic backgrounds. Some have advocated the practice of making demographic corrections to current instruments based on education and ethnicity (Lamberty, 2002). Others have asked for the creation of a neuropsychological test battery that may be useful across different populations, such as the Cross-Cultural Neuropsychological Test Battery (Dick et al., 2002). While the question of which tools and techniques are most appropriate for work with clients from different cultural and linguistic backgrounds continues to be debated within our field, the efforts of neuropsychology to meet the needs of an increasingly diverse population will likely continue to drive contemporary practice.

**Evolution of an Evidence-Based Science**

Neuropsychologists are faced with different referral questions than they were 50 years ago when the field was evolving and primarily dealt with questions regarding the ability to detect brain damage. Tests that were used to detect brain damage were empirically validated for that purpose. Today, neuropsychologists are under increasing pressure to demonstrate that their assessment tools and methods continue to be valid when addressing more complex questions such as predicting a client’s ability to function in a particular context. Given the increasing diversity of the population, neuropsychologists must also address whether particular techniques are valid for individuals from different cultural and linguistic backgrounds in various contexts.

Although most neuropsychologists agree that important information can be gleaned from observation and clinical skills, the field is placing greater emphasis on data-based decision making (Lamberty, 2002). At a time when neuroimaging techniques have in many ways surpassed the ability of neuropsychological assessments to accurately and economically indicate structural brain damage, neuropsychology’s livelihood may depend on its ability to demonstrate its effectiveness in accurately diagnosing subtle or diffuse impairments that cannot be detected by these techniques. Certainly, neuropsychology’s future also depends on its ability not only to accurately assess impairment but to
reliably identify appropriate, effective, and inventive interventions. Thus, neuropsychologists are striving to develop data-based practices that emphasize sound scientific methodology. Empirically based practices include selecting appropriate assessment tools for a given purpose, designing new assessment tools to face complex questions asked in today’s referrals, and demonstrating the efficacy of interventions (Traughber & D’Amato, 2005). As Prigatano (2005) pointed out, within the context of the economics of health care, not only must neuropsychologists demonstrate the efficacy of treatment, but practitioners must also be able to demonstrate the cost-effectiveness of treatment.

**Ethical Considerations**

Neuropsychology is a field that has grown rapidly, in part due to advancements in related fields such as neurology, medicine, and technology. Because of this rapid growth, neuropsychologists in various settings are faced with unique situations in which the correct course of action may not be clearly defined by professional ethics. As previously noted, rehabilitation neuropsychologists must maintain competency and practice only within the boundaries of their competence. In addition, practitioners must be aware of the limitations of their assessments; for example, they must understand an assessment’s validity for a particular population and limitations pertaining to its predictive utility. As noted in Bush (2005), factors unique to rehabilitation neuropsychology that may present professional and ethical challenges include the interdisciplinary nature of traditional rehabilitation settings, the severity of the clients’ brain injuries, the existence of multiple comorbidities, informed consent, the degree of family involvement, and confidentiality within multidisciplinary settings. In recognition of the unique situations that may commonly arise in particular neuropsychology specialties, some subspecialties such as forensic neuropsychology have opted to develop their own standards of practice to supplement the American Psychological Association’s code of ethics (Bush, 2005). The credibility of the field depends largely upon individual practitioners’ careful application of ethical standards to their unique settings and practices.

Neuropsychology is an applied science that studies brain-behavior relationships. The profession of neuropsychology is grounded in a rich history of empiricism and is constantly influenced by advancements in related fields. While technology seems to have virtually supplanted neuropsychology’s historical role in identifying localized brain impairments,
the practice of neuropsychology has greatly expanded to assume equally important new roles. Neuropsychologists with an understanding of the interactions between physical and psychological processes and individuals’ social environments are uniquely positioned to integrate information across disciplines in an effort to understand each client’s central nervous system functioning. Concomitantly, neuropsychologists must develop and monitor the effectiveness of individually tailored, functionally related treatment plans. The enduring contributions of neuropsychology into this century will likely remain contingent upon each individual’s commitment to ethically based, empirically focused practice; continuing education; and scientific discoveries. The challenge to clinical neuropsychologists will be to meet the needs of an increasingly diverse population by providing evidence-based ecologically valid interventions.

REFERENCES


Chapter 1 Understanding the Past, Present, and Future


**SUGGESTED READINGS**


