On August 24, 2014, Ralph M. Reitan, PhD, passed away in his home in Mesa, Arizona. He is survived by his wife, Deborah Wolfson, and his five children, Ellen, Jon, Richard, Ann, and Erik. Ralph was born in Beresford, South Dakota, on August 29, 1922. He was the third of five children; his father was a clergyman, and his mother was trained as a teacher. His parents were of Norwegian descent, and the family spoke Norwegian at home. In fact, Ralph did not learn English until after starting school. He would often relate stories about his upbringing and the very strong influence of his family and, especially, of his father’s moral teachings. These influences had a significant impact on his outlook, his interpersonal interactions, and his career.

The Early Years

Ralph grew up during the Depression and had to work during his school years to help out the family. He worked full time while attending college. After 2 years of college, during World War II, he attempted to become an officer in the U.S. Marine Corps. He was deemed medically ineligible because of a pre-existing condition. With his original plan thwarted, he enlisted in the U.S. Army in 1942. While waiting to be called up, he was able to complete his third year of college. When he entered basic training, his shoulder was repeatedly dislocated (from an earlier injury), and so, fortunately for neuropsychology, he had to be discharged from the service. At that point, he returned to college, earning his Bachelor of Arts degree in Psychology in 1944 from Central YMCA College in Chicago.

Because of financial circumstances, he was unable to immediately attend graduate school but was qualified to work as a psychometrist in the Armed Forces Induction Station in Chicago, assessing the basic abilities of inductees. He was recommended for a job as a psychologist, and in 1945, he started work at the Mayo General Hospital in Galesburg, Illinois. It was in this position that he was first exposed to soldiers with brain injuries. He considered this experience to be his introduction into the area of neuropsychology. Through this experience, he came to appreciate the effects of brain injury on adaptive behavior. In addition, he quickly realized the inadequacy of the scientific literature and assessment procedures available at the time. For example, Ralph often recounted his experience testing an injured physician who scored within normal limits on the tests he was using. Yet the physician clearly understood that he could not return to his former practice of medicine. In recounting this episode, Ralph described his feeling of helplessness in being unable to address the doctor’s impairments. It is likely that this experience, in concert with his upbringing and natural intellectual drive, led him to challenge the current techniques and try to find a better solution to the understanding of the psychological effects of brain injury.

Along with Dr. John Aita, a neurologist and section head, and other colleagues, Ralph developed a battery of available tests that were routinely administered to patients. Ralph and these colleagues published three papers concerning brain injury in 1947 and 1948 (Aita, Armitage, Reitan, & Rabinovitz, 1947; Aita & Reitan, 1948; Aita, Reitan, & Ruth, 1947). Interestingly, they reported that, using the Rorschach, they found that some of Piotrowski’s 10 signs and several additional signs were helpful in diagnosing posttraumatic brain-injured patients (Aita, Reitan, & Ruth, 1947). In contrast, they found that the Shipley–Hartford Retreat Scale for Intellectual Impairment and the Hunt Minnesota Test for Organic Brain Damage were of little value in differentiating brain-damaged from control patients. On the other hand, the Wechsler Mental Abilities Scale, an Army analog of the Wechsler–Bellevue Scale, was shown to have “definite diagnostic value” (p. 34) in determining brain injury (Aita, Armitage, et al., 1947).
It is clear that, even at this early stage of Ralph’s career, he was already searching for clinical methods to measure brain function. If a test was purported to measure “organic brain damage,” he tested it out on real patients. This is the touchstone of his approach, exemplified by his attitude—“unless you’ve been there, you don’t know what you’re talking about.” This attitude sometimes offended experts and colleagues—in fact, he came close to being kicked out of graduate school after he offended a professor by pointing out—in front of the class—the limitations of the professor’s knowledge of brain injury and disease.

Ralph began graduate work at the University of Chicago in 1945. Ralph often related that he felt his admission to the graduate program was heavily dependent on his positive interaction with Louis Thurstone, PhD, in a pre-admission interview, and the strong influence of Ward Halstead, PhD. These benefactors also later rescued him from dismissal from the program. In addition to taking psychology courses within the department, Ralph also completed the equivalent of 2 years of medical school courses. He was trained as a physiological psychologist and completed his PhD in 1950. His dissertation was titled, “Relationships of Certain Rorschach Test Indicators to the Abstraction and Power Factors of Biological Intelligence.” His dissertation director was Ward C. Halstead, PhD.

Ralph met Ward Halstead while working as a psychologist at the Mayo General Hospital prior to his admission to graduate school. At that point, Ralph had been testing brain-injured soldiers from World War II, and he realized the limitations of the available procedures in identifying the effects of brain injury. Halstead had by then established his pioneering laboratory dedicated to the experimental study of brain function. He had developed a series of tests to evaluate the behavioral effects of brain injury in humans. These tests were initially based on many hours of personal observations of and interactions with brain-damaged individuals while they were engaging in real-life behaviors. Halstead’s 1947 monograph, *Brain and Intelligence: A Quantitative Study of the Frontal Lobes*, summarizes the results of more than a decade of his visionary research program. Reitan (1994) details Halstead’s commitment to understanding the behaviors of brain-damaged individuals; this paper also explicates Halstead’s contribution to neuropsychology. It is clear that Halstead had little regard for the techniques available at the time for understanding brain function. Given Ralph’s hands-on experience with psychometric testing of brain-injured soldiers and Halstead’s scientific and clinical knowledge of brain–behavior relationships, it is no wonder that the two “hit it off” immediately.

Halstead encouraged Ralph to apply to graduate school (which he immediately did) and offered him a position as a research assistant in his laboratory. Ralph became a student assistant to Ward Halstead in 1946 and stayed with him while attending graduate school at the University of Chicago until 1950. Interestingly, Ralph never earned any graduate credit for working in Halstead’s laboratory. Halstead’s laboratory was in the medical school, and he was not a full-time faculty member in the psychology department where Ralph was studying.

Ward Halstead’s legacy for clinical neuropsychology is his systematic research program on brain lesions in humans. By using an objective and replicable quantitative methodology, he was able to understand and explicate the behavioral effects of these lesions. His research program involved a unique and close collaboration with neurologists and neurosurgeons as well as other medical specialists. The eminent neurosurgeons, Percival Bailey, MD, Paul Bucy, MD, and A. Earl Walker, MD, provided well-characterized cases for examination in Halstead’s lab. The extensive information provided on each patient included the results of the physical neurological examination, clinical history, surgical notes regarding size, location, and type of pathology, surgical drawings, diagnostic studies (skull X-rays, EEG, pneumoencephalograms), and information on surgical outcome; demographic information included age, gender, education, ethnicity, religion, and occupation. In Halstead’s laboratory, these patients underwent an extensive standard battery of test procedures. As Halstead’s assistant, Ralph participated in administering the tests to the individual patients, a task which he found highly stimulating. In this role, he gained additional knowledge about the impairments and difficulties of brain-damaged patients.

Most importantly, Halstead and Reitan agreed that a systematic quantitative method should be used to study the psychological effects of brain lesions (Reitan, 1994). While this idea is not at all controversial today, there was, at that time, a strong emphasis on the importance of qualitative information in the understanding of brain-related behavior. Ralph addressed this issue in several papers including Reitan (1957) and Reitan (1958). Both Halstead and Reitan clearly acknowledged the value and importance of qualitative information; however, they felt that the study of the behavioral effects of brain lesions required a standardized and quantitative approach to allow for replicable and reproducible findings—the foundation of science. As an illustration of this attitude, Ralph was evidently successful in using the Rorschach to understand the psychological effects of brain lesions (Reitan, 1955b), but he found that his method could not be successfully applied by other clinicians (personal communication). As a result, he abandoned this method in favor of using Halstead’s tests.

**The Technique**

In 1951, Ralph took a position at the Indiana University Medical Center within the departments of Surgery and Neurology. His position was as an Assistant Professor of Surgery, and, in fact, he was the only psychologist on the medical center’s faculty. He developed close collaborations with faculty members in neurology, neurosurgery, and neuropathology, in particular,
Robert F. Heimburger, MD, and Leslie Willard (Bill) Freeman, MD. Ralph had prior contact with both Heimburger and Freeman when they were students of Dr. Paul Bucy at the University of Chicago.

Armed with Halstead’s theoretical orientation and quantitative methodology, Ralph was able to establish a unique research laboratory focused on understanding brain–behavior relationships. It was at IUMC that he began what he called “the grand experiment” and conducted some of his most seminal work. This work, characterizing the effects of brain lesions on behavioral function, serves as the basis for much of clinical neuropsychology.

With the advice of Halstead, Ralph designed a unique research program using the “blind approach.” This research program involved the complete separation of criterion information from the psychological test data; using only test data, detailed written conclusions would be formulated regarding the individual patient without knowledge of the criterion information. The conclusions were then compared with the criterion information. Through this blind interpretation approach, Ralph was able to elucidate many of the now accepted relationships between brain and function. The criterion information he used for each patient was provided by his collaborators and included detailed clinical history, medical and surgical findings, diagnostic studies, neurosurgical drawings and notes, as well as specific brain findings from autopsy. Once Ralph had formulated his conclusions from the test data on an individual patient, he would then review the criterion information and assess the accuracy of his formulation. He would thus painstakingly learn what he did not know and then pursue ways to learn from his mistakes. Ralph often commented on how humbling and challenging this experiment was. He often recounted a story where he got it wrong. On this occasion, the referring neurosurgeon, Bill Freeman, told Ralph, “You don’t know a damn thing about the brain.” Ralph, realizing that he was about to be told what he did not know, asked Bill Freeman what he was talking about. Bill Freeman stated that Ralph did not even know that a patient he had tested did not have a right temporal lobe (because it had been removed during surgery), and Ralph’s conclusions about the patient did not reflect this fact. Ralph then went back to the test data to find out what he had missed and how to correct this mistake. Through this method, applied on many thousands of patients, he was able to elucidate foundational information regarding the behavioral consequences of brain lesions on human function.

Ralph continued to use this method through the years, insisting on interpreting the test data and drawing his conclusions before reviewing clinical or background information. This methodology was the primary source for many of Ralph’s experimental hypotheses that he subsequently studied through group comparisons. He describes it as “...a wonderful procedure for generating research hypotheses. We were able to conduct and publish a large number of individual studies quite efficiently, mainly because our hypotheses for investigation had already been strongly supported by our findings on individual subjects. Thus, we did not have to pick hypotheses for research either out of the blue sky or from some type of theoretical formulation. Instead, our research hypotheses were based on observations of natural phenomenon. We dug very few dry holes, with nearly every research study producing publishable findings” (Stringer, Cooley, & Christensen, 2002, p. 232).

Throughout Ralph’s program of research studies, he was extremely meticulous in his process of subject selection. He demanded unequivocal evidence of neurological and/or neuropathological findings before including a patient in a study. While he tested every patient referred to his laboratory, the majority of these patients did not meet his exacting criteria to be included in his research study. In his description of his research program (Reitan, 1966), he gives several instances of patients who, though otherwise well classified, were excluded from research studies because of his exacting requirements. He realized that this selection procedure would limit the patient pool, making it a slow process to assemble a satisfactory sample size. His technique was to gather the cases which clearly exemplified the variables under study. The limitation of this subject selection process was greatly alleviated by his close collaboration with his neurological colleagues, which provided an extensive and well-characterized patient population from which he could assemble subject groups. Further, he was similarly careful in his selection of control subjects. The control patients were selected based on neurological criteria and so as to eliminate possible confounding effects of hospitalization, stress, chronic illness, or possible affective disturbances. That is, he used a very conservative approach by selecting hospitalized patients with non-brain-related conditions, rather than selecting community controls.

Among the first studies laying this foundation is Ralph’s 1955a study, “An investigation of the validity of Halstead’s measures of biological intelligence,” where he showed the ability of psychological measures to differentiate between patients with brain damage versus non-brain-damaged controls. In this study, he demonstrated that 7 of 10 of Halstead’s measures differentiated the performances of a group of heterogeneous brain-damaged patients from the controls at a highly significant level (p < .001). The Impairment Index, a composite score from Halstead’s 10 tests, was found to be poorer in 44 out of the 50 brain-injured patients compared with their matched controls (and the scores were equal in the remaining 6 patient/control pairs). The best single measure sensitive to brain damage was the Category Test where 47 of 50 non-brain-damaged controls did better than their matched brain-damaged pair.

The Reitan (1955a) study laid the groundwork for Ralph’s future investigations. This study showed that cerebral damage affected a broad range of general neuropsychological functions including abstraction, reasoning, and logical analysis, attentional capabilities to both verbal and nonverbal stimuli, psychomotor problem-solving, incidental memory, and motor performance.
Many researchers at the time were theoretically wed to a unitary concept of brain damage, and they focused on finding the best single measure that would identify brain damage.

While Halstead’s measures successfully differentiated groups of heterogeneous brain-damaged subjects from non-brain-damaged controls, Ralph realized that they were not sufficient to determine the neuropsychological effects of other brain-related factors such as the laterization of the brain lesion. Reitan (1955c) demonstrated that patients with left cerebral hemisphere lesions almost always showed lower mean scores on Verbal than Performance subtests on the Wechsler–Bellevue Scale (13 of 14 left-lesion patients). Conversely, patients with right cerebral hemisphere lesions showed lower mean scores on Performance than Verbal subtests (15 of 17 right-lesion patients). In comparison, patients with diffuse lesions did not demonstrate these dramatic Verbal–Performance differences; in fact, the means of Verbal-weighted scores versus Performance-weighted scores for the diffuse group differed by only one point. This was one of the first studies in neuropsychology documenting the ability of psychological tests to reflect differential effects of lateralized brain lesions.

Ralph explored, in a number of studies, the consequences of left versus right cerebral lesions on language and spatial distortions. A brief aphasia screening examination, a modification of the Halstead–Wepman Aphasia Screening Test (Halstead & Wepman, 1949) was found to be very useful in this regard (Heimberger & Reitan, 1961). Wheeler and Reitan (1962) showed that this examination was able to correctly identify 80% of individuals with left-hemisphere damage and 85% of individuals with right-hemisphere damage. Moreover, they had a correct classification rate of 84% for patients with diffuse or bilateral damage.

Reitan (1966) described the differential effects of lateralized lesions on motor and psychomotor performances. Clear and significant differences were found on the Tactual Performance Test and the Finger Oscillation Test. Left cerebral lesions resulted in poorer psychomotor problem-solving performances and finger tapping speed with the right hand compared with the left hand. Conversely, patients with right cerebral lesions demonstrated poorer performances with the left hand on these tasks. Similarly, with measures of sensory–perceptual function, lateralized brain lesions were found to result in impaired function of the contralateral side (Reitan, 1966; Wheeler & Reitan, 1962).

Ralph identified other factors important to the understanding of the effects of brain lesions on psychological function. He found that the nature of the lesion (e.g., acute vs. static or progressive vs. chronic) impacted the psychological test results (Fitzhugh, Fitzhugh, & Reitan, 1961, 1962a, 1962b, 1963). For example, Fitzhugh and colleagues (1961) examined the effects of acute vs. chronic brain lesions on psychological performances. Four groups of patients, matched on age, education, gender, and race, were composed based on the nature of the brain lesion—patients with acute neurological illnesses (“acute”), patients who had slowly progressive neurological conditions or who had recovered from an earlier acute condition (“relatively static”), patients with long-standing brain dysfunction (“chronic static”), and a control group of patients who were found to have no evidence of brain damage. The Wechsler Bellevue (WB) and 7 of the 10 Halstead tests (plus the Impairment Index) were compared among the groups. As would be expected, the control group consistently exceeded all of the brain-damaged groups on all of the measures, with the Halstead tests showing greater differences than the WB. The two static groups were found to be very similar to each other—the Relatively Static group performed better than the Chronic Static on each of the measures, but only one of these comparisons was statistically significant. The Acute group performed worse than both of the Static groups on all of the measures except one (WB Information, which was especially poor among the Chronic Static group). This study, as well as the other Reitan studies on this topic, shows the impact of lesion variables on psychological deficit.

Ralph’s initial studies used heterogeneous patient samples with diffuse, lateralized, or focal cerebral lesions to define the psychological effects of the various neurological dimensions. He learned from his initial studies that the specific neurological dimensions he was studying were affected by the type of lesion. Different types of cerebral lesions produce quite different and definite neurological and pathological effects. From a neurological and neuropathological standpoint, tumors are different from strokes, and both are different from head injuries. However, at that time, there was little information about the differential psychological effects of various lesion types.

Thus, Ralph began a series of studies on specific lesion types. He investigated the neuropsychological effects of a broad range of neurological diseases and disorders. This included cerebral tumors, cerebrovascular disease, traumatic brain injury, Parkinson’s disease, Huntington’s disease, multiple sclerosis, mental retardation, alcoholism, substance abuse, hypertension, epilepsy, and aging. In addition, he studied the neuropsychological correlates of psychiatric disorders, learning disabilities, aphasia, sensorimotor deficits, visual field defects, elevated serum cholesterol levels, myxedema, brucellosis, and agenesis of the corpus callosum.

Ralph’s studies on specific lesion types helped to describe the neuropsychological effects of the various conditions. These studies contributed to the understanding of the neurocognitive effects of many neurological conditions. For example, at the time of his series of studies on Parkinson’s disease (Boll & Reitan, 1970a, 1970b; Reitan & Boll, 1971), it was widely thought that patients with this condition did not experience significant intellectual or cognitive impairment. Any changes in adaptive abilities were considered to be accounted for primarily by the motor impairment, along with possible medication effects, motivational loss, or psychological distress. Reitan and Boll (1971) clearly demonstrated that, besides their motor deficits, Parkinson’s disease patients suffered from significant deterioration in a broad range of neurocognitive abilities including problem-solving, sensory,
memory, abstract reasoning, and other cognitive abilities. In addition to providing general information on psychological impact, Ralph’s lesion-type studies also provided the basis for subsequent studies on the differential psychological effects of the various lesion types.

The Battery

It is clear that Ralph’s blind interpretation methodology has yielded important foundational knowledge about the psychological effects of cerebral lesions. In addition, this blind interpretation methodology provided Ralph with crucial clinical information about the psychological impact of brain lesions on the individual patient. Over the course of reviewing thousands of individual test protocols on a case-by-case basis, Ralph was able to learn the applicability of the tests he was using for understanding an individual’s brain function. He quickly realized the limitations of the tests for this purpose and thus made changes so as to draw more accurate inferences about the individual patient. It became clear to him that he needed a more extensive battery of tests than Halstead’s 10 measures. As described, he found that 3 of the 10 Halstead measures showed an unacceptable degree of variability for clinical use, and thus, these three measures were discarded. This left him with a test battery that was successful in discriminating brain-damaged from control patients, but it gave inadequate information for determining specific neurological characteristics, such as side of lesion. To address this, he added measures that reflected the “hard wiring” of the central nervous system. He devised tests that were dependent upon sensory input (Reitan–Klove Sensory Perceptual Examination). In terms of motor function, Halstead had measured finger tapping but used only the dominant hand; Ralph simply added measurement of the tapping speed of the non-dominant hand, which allowed intra-individual comparison. The motor and sensory tests were helpful in determining lateralization of the lesion for each individual patient. He added the Aphasia Screening Examination in order to assess aphasia and apraxia. He also added the Wechsler scales to his battery of tests, because he felt that it was important to document the general intelligence of every patient. Numerous other tests were tried but were found not to add new or unique information about the individual patient’s brain function. This process of careful empirically based test selection allowed him to reach a point where the battery of tests sampled sufficient behavior domains and could lead to valid conclusions about the brain function of the individual patient. The current Halstead–Reitan Neuropsychological Test Battery (HRB) represents the result of this painstaking work.

Ralph considered that the HRB in its current form, while extensive, was a “bare-bones” battery. The component tests were selected on an empirical rather than a theoretical basis, and they were chosen so as to sample important areas of human ability and to allow inferences regarding the individual patient. Thus, the battery of tests includes measures of sensory–perceptual and motor tasks, psychomotor problem-solving procedures, attention/concentration, incidental memory and learning, symbolic and communicational aspects of language, visual–spatial relationships, and abstraction and concept formation. In developing and refining this battery of tests, he included measures that were both qualitative and quantitative in nature, and these required different approaches in interpretation. He used this battery of tests in conjunction with the Wechsler scales and the MMPI (and later the WRAT) in order to more fully understand the individual’s neuropsychological condition.

At the time, traditional psychological measurement had yielded somewhat limited methods for inferring patient function from test performances. The most common method was the patient’s level of performance on a task. Another method relied on descriptive characterizations of the patient’s test behavior and/or signs of dysfunction. Ralph employed these inferential techniques in his battery but also added other methods of inference in order to achieve an integrated and complementary approach to understanding the biological condition of an individual’s brain. Ralph’s method of interpretation for the individual patient was to consider the level of performance, evaluate the patterns of test performances among various areas of neurocognitive function, compare the function of the left and right sides of the body, and look for pathognomonic signs of brain dysfunction. These are the four basic methods of inference that he employed in order to draw valid conclusions regarding the biological condition of an individual’s brain as well as the neuropsychological implications of these results. These methods allowed him to determine whether or not brain damage was present, the nature of the damage (chronic or acute), whether it was lateralized or diffuse, as well as the type of cerebral lesion.

The validity of the HRB was tested in Ralph’s seminal 1964 study in which individual patient test protocols were found to be differentially predictive of neurological condition (Reitan, 1964). The study included 112 patients gathered over the course of a decade. The first step of the study involved selecting patients who had well-characterized cerebral lesions based on complete neurological, neurosurgical, and neuropathological information. Patients were selected who had either diffuse or focal lesions. For those with focal lesions, they were selected so as to represent lesions of one of four quadrants of the brain—left or right anterior or left or right posterior. Patients had one of the following neurological diagnoses: MS, head injury, cerebrovascular disorder, and tumor. Within the tumor group, there were patients with either extrinsic or intrinsic tumors.

Once the patients were selected, the blind interpretation of the HRB test results, done at the time the patient was originally tested, and written by Ralph, Homer Reed, or Hallgrim Klove, were reviewed. Based on these contemporaneous reports, ratings were
assigned regarding the patient’s presumed neurological condition—whether the lesion was diffuse or focal; if focal, then decisions were made as to whether the lesion was anterior or posterior, left or right; finally, a decision was made as to lesion type—MS, head injury, cerebrovascular disorder, or tumor. Additional judgments were made within some of the lesion types; for example, if the lesion was judged to be a tumor, then a judgment was made as to whether it was intrinsic or extrinsic.

Once the judgments, based on blind interpretation of the test data, were completed, these judgments were then compared with the actual neurological information. Results showed that 57 out of 64 focal lesions were correctly identified as such by the blindly interpreted test results. Forty-six out of 48 lesions were correctly identified as being diffuse. With regard to location of lesion (left anterior, left posterior, right anterior, right posterior, or diffuse), judgments were more accurate for posterior than for anterior lesions—26 out of 32 posterior lesions were correctly identified, while only 16 out of 32 anterior lesions were correctly identified. Right posterior lesions were most frequently identified correctly (15 out of 16 cases correctly labeled); left posterior lesions were correctly identified in 11 out of 16 cases. Judgments by lesion type showed impressive accuracy for all types except extrinsic tumors. Correct judgments included 13 out of 16 intrinsic tumors, 28 out of 32 cerebral vascular disease, 30 out of 32 head injuries, and 15 out of 16 multiple sclerosis cases. Extrinsic tumors were correctly classified only 50% of the time. The overall “hit rate” for making a correct judgment of lesion type on the basis of test data alone was 94 out of 112 cases (84%).

With this study, Ralph clearly demonstrated the ability of the Halstead–Reitan battery to measure the psychological effects of cerebral lesions; this study also demonstrated that an individual’s neuropsychological condition can be accurately measured with neuropsychological tests. In many ways, this study secured the reputation of neuropsychology as a clinical science.

Ralph’s 60+ year career was spent in the pursuit of understanding brain–behavior relationships utilizing his empirically based methodology for both research and clinical application. Initially, he reported on his findings within the adult population. However, he was testing both adults and children from the beginning of the Neuropsychology Laboratory at the Indiana University Medical Center, and he conducted studies similar to those with adults in order to study the effects of cerebral lesions in children. Again, his research efforts required the understanding of the variables contributing to the biological condition of the brain in children. He composed large and diverse groups of children with well-described brain lesions to learn about the psychological effects of these lesions. He employed the same methodology that he used with adults in his studies of children.

In the first published study on children (Reed, Reitan, & Klove, 1965), he and his colleagues studied 50 matched pairs of children, ages 10–14, one of each pair being brain-damaged and one being a normal control. As with his studies of adults, the brain-impaired children were well characterized by neurological examination. The test methods were modified to some degree in order to be appropriate for children. For example, the Trail Making Test was shortened by 10 circles; the Category Test and Tactual Performance test were also shortened, and the answer form was simplified for the Speech Sounds Perception Test. All comparisons between the groups were statistically significant with the brain-damaged group performing poorer. They found that, in general, the children with brain lesions were more frequently impaired on measures that relied on language function than on measures that were less dependent on language. In a subsequent re-analysis of the data from this study, the test measures were ranked according to the size of the group differences (Boll, 1974), and it was found that many of the Wechsler measures showed the greatest group differences. This is in contrast to the findings of the studies on adults where measures requiring more immediate problem-solving abilities were more sensitive to the effects of cerebral lesions. The Reed and colleagues (1965) study was replicated with a different sample of children (Boll, 1974) and showed similar results.

In order to test even younger children, Ralph made some additional modifications to the test procedures and also developed some new tasks that would be developmentally appropriate for children in the age range of 5–8 years. He called this battery the Reitan-Indiana Neuropsychological Test Battery. As an example of one of the additional modifications that he made, the Category Test was changed so that the answers were based on color rather than number. One of the new tasks, called Color Form, involved a cognitive switching task (as in Trails B) but with the child switching between shape and color. Reitan (1974) reported on the results of a study which compared the performances of a group of brain-damaged younger children with a group of normal controls matched on a pairwise basis on age and gender. The results showed that each of the 41 test scores (including results from the WISC and WRAT) showed statistically significant group differences with the exception of one (dominant hand grip strength). He also analyzed the results by computing the percent of overlap between groups on various categories of function (e.g., motor, academic, etc.). This analysis showed that the categories of Incidental Memory and Concept Formation/Reasoning were among the least sensitive in terms of discriminating the two groups of subjects. As with the results for older children, the Wechsler measures were found to be particularly sensitive to the effect of brain damage. He concluded that the findings of these studies on children “...suggest that the general effects of brain damage in infancy or childhood limit the potential for normal development, resulting in some generalized depression of behavioral abilities” (p. 70).

On a note of historical interest, Ralph had developed some additional test modifications as well as some new test procedures designed for even younger children. This test battery was to be used with children ages 3–5. The 5-year olds had been included in the Reitan-Indiana, but he had observed the large differences between the results of the 5-year olds compared with the 6-year olds,
and so had decided to move the 5-year olds down to the “Baby Battery.” However, when this battery was devised, he was already at the University of Arizona, where he planned to write and teach, and so he never had the opportunity to test out this battery.

The body of research that Ralph completed on children included a number of studies in the area of learning disabilities. At the time, there were many theories about the origin of learning disabilities (as well as many names for this type of disorder), although many of the theories had little research data to support them. Ralph reviewed the literature and decided to study the problem empirically. In a series of studies, he and his colleagues examined three groups of children—a group with brain damage, a group with normal neurological exams but significant academic delay (and IQ at least in the low-average range), and a group of normal controls. In one report, Selz and Reitan (1979a) found that the performances of the learning disabled children fell quite consistently midway between the performances of the normal controls and those of the brain-damaged children. In fact, this was the case for all of the 13 measures reported except for two—on the Rhythm Test, the LD children performed worse than both other groups, and on TPT Memory, the LD children performed the same as the Controls. They observed that the LD group tended to resemble the controls on tests that had a “substantial motor component,” while they tended to resemble the brain-damage group on tasks with “stronger cognitive or attentional demands” (p. 301). Ralph sometimes commented that LD children could more accurately be described as “conceptually handicapped” rather than one of the more-common terms at the time: “perceptually handicapped.”

In another study, Selz and Reitan (1979b) described a set of “rules” to sort test performances into four categories—normal/superior, slightly below-average, “probably impaired,” [not the term used in the paper], and definitely impaired; these categories were assigned the scores of 0, 1, 2, and 3, respectively. They applied these rules to 13 test scores on a level-of-performance basis, 7 scores that represented right–left differences, one score that considered scatter on the IQ test, and 12 pathognomonic signs from the Aphasia Screening Test; the scores were then summed. Applying these rules to the three groups of children described above resulted in a summary score for the controls that ranged from 1 to 25 with a mean of 10.6 (SD = 6.62); the LD children scored from 8 to 43 with a mean of 24.44 (SD = 9.61), and the brain-damaged children scored from 11 to 74 with a mean of 40.6 (SD = 18.51). Using cutoffs that resulted in the fewest misclassifications, the rules correctly classified 73% of the subjects into their respective group. This approach to the classification of test performances was subsequently refined and applied to adults as the General Neuropsychological Deficit Scale (GNDS; Reitan & Wolfson, 1988). The GNDS was extended down to both the older children’s (Reitan & Wolfson, 1992) and young children’s (Reitan, 1987) batteries. The GNDS scores are indexes that summarize the comprehensive neuropsychological examination of an individual using the four methods of inference.

From the beginning of his career, Ralph was concerned with the well-being of his individual patients. While he was “hard-nosed” in terms of his science, he became a real “softie” when talking about some of the patients he had worked with. For example, at his workshops, he would often speak fondly of “little Billy,” a young boy he had examined many years earlier who was helped significantly by a proper diagnosis of his neuropsychological condition. Once this was accomplished, Ralph and the family were able to institute remedial procedures to help the boy develop and progress and ultimately become successful.

Ralph realized that once neurocognitive deficits were accurately assessed, the neuropsychologist could apply that information to the remediation of the patient’s deficits. His approach to remediation is exemplified by the REHABIT program which he began developing in the late 1970s. REHABIT (Reitan Evaluation of Hemispheric Abilities and Brain Improvement Training; Reitan & Wolfson, 1988) is based on the framework of a meaningful conceptualization of brain–behavior relationships. As such, the first step in planning a rehabilitation program for an individual patient is to conduct a comprehensive evaluation of the patient’s neurocognitive function via the HRB. The findings from the evaluation are then used to prescribe the remediation program. REHABIT is organized along five tracks, with abstraction abilities having a central role in the training process. Besides the track for abstraction, there are two tracks that focus on verbal/language processing, and two that focus on visual–spatial processing. Track A involves relatively pure language/speech activities and skills, while Track B involves language with a problem-solving component. The central track, Track C, is relatively pure abstraction, planning, and problem-solving. Tracks D and E involve visual–spatial processing, with Track E involving relatively pure visual–spatial processing and Track D involving visual–spatial skills with problem-solving and reasoning. The entire program covers a broad range of abilities and contains over 600 individual tasks for remediation. In assembling the materials for this program, Ralph reviewed thousands of available training/educational materials and chose those that, from his experience, would have specific relevance to brain function. This program is a labor-intensive, highly individualized program. As such, relatively few research studies have been carried out on its effectiveness. However, David Sena carried out several studies in his outpatient head injury rehabilitation program, showing the program’s efficacy (Reitan & Sena, 1983; Sena, 1985; Sena & Sena, 1986a, 1986b).

Conclusion

This paper covers only a fraction of Ralph’s enormous productivity and output during his 60+ years of professional work. Throughout his career, he has directly influenced scores of well-recognized clinical neuropsychologists and thousands of practicing psychologists through his teachings and writings. He provided continuing education programs and workshops for many
years in order to share his knowledge of brain–behavior relationships. Many of our field’s leaders started their careers in one of his training sessions.

His work also had an impact beyond the field of psychology. He promoted collegial relationships with neurosurgery, neurology, and neuropathology. As a result, clinical neuropsychology is a well-recognized and essential contributor to research studies carried out in these fields. Our field is indebted to his foresight in establishing these inter-disciplinary relationships.

While Ralph may be best known for his development of the Halstead–Reitan batteries, these batteries merely reflect his scientific and empirically based orientation and methodology. In fact, his contributions to the field of clinical neuropsychology are broad-reaching and unequalled. His application of sound scientific principles to the problem of human brain–behavior relationships represents his true legacy to the science of clinical neuropsychology. His vision and insight led to contributions that would be considered absolutely fundamental to the advancement of clinical neuropsychology. In fact, without his work, this field’s very existence would be hard to imagine.

The field will miss him. We miss him as a friend, colleague, and mentor.

Conflict of Interest

Drs Hom and Nici are employed by The Neuropsychology Center which has a financial interest in the sale of Halstead-Reitan Neuropsychology test materials.

References