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ABSTRACT

The paper examines use of a children's revision of the Luria-Nebraska Neuropsychological Battery (LNNB-CR) for three aspects of neuropsychologic assessment in children: the absence or presence of learning disability (LD), patterns in dysfunction, and rehabilitation potential and strategies. A review of research covers the use of the battery in the LD population and offers conclusions, including that LD children can be identified, but that the visual scale may be a weak one in terms of making discriminations. The paper describes a case study in which the LNNB-CR was helpful in determining whether an 11-year-old was primarily a learning disabled or a psychiatrically disordered patient. Test analysis indicated that the boy did appear to have LD, with deficits in the left parietal area, and that his rehabilitation potential was quite good given his adequacy in understanding situations and solving tasks of abstract reasoning. (CL)

Use of the Luria-Nebraska Neuropsychological Battery - Children's revision with Learning Disabled Children

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The goals of adult neuropsychologic assessment have traditionally been the determination of the absence or presence of brain damage, suggesting what type of pathologic process is transpiring (that is, is it an acute or a chronic lesion, and what type of lesion does it appear to be), and the localizing of the lesions. As you know, medical technology within the last years has provided noninvasive means, with a low morbidity, to make the determination of localization and establishing the type of process easily, accurately and rapidly. Consequently, the goals of neuropsychologic assessment in adult populations have shifted with the focus becoming more establishing the absence or presence of brain dysfunction in populations with subtle, nonfocal, and nonstructural brain-related changes. There has been a concomitant increase in interest in looking at patterns of deficits and strengths in individuals with brain damage, and these patterns have become increasingly important as neuropsychologists have been involved in the evaluation of rehabilitation potential and suggestions regarding strategies for rehabilitation. In many ways, the use of neuropsychologic assessment in looking at learning disabled children is more closely related to the goals in which adult neuropsychologists have more recently become interested. Neuropsychologists who deal with learning disabled children are often interested in 1) the absence or presence of a learning disability, 2) patterns of dysfunction, most especially as these patterns relate to what has been previously identified in large groups of learning disabled children and patterns that are seen in children who have known brain lesions, and 3) to rehabilitation potential and strategies.

This morning, I would like to discuss the utility of Luria-Nebraska Neuropsychological Battery as it has been revised for children in addressing what I see to be the three goals of neuropsychologic assessment in children; the absence or presence of learning disability, patterns of dysfunction, and rehabilitation potential and strategies.

The Children's Revision of the Luria-Nebraska Battery was introduced during 1981. Since that time, there have been a number of validity studies suggesting that relevant discriminations can be made. The initial validation study utilizing brain damaged and normal children yielded an overall hit rate of 82% using discriminant functional analysis, with 91% of the normals and 65% of the brain-damaged children correctly identified. The use of a critical level which allows for a clinical as opposed to the stastical discrimination yielded an overall hit-rate of 76%. Cross validation studies revealed essentially equivalent, though slightly higher levels of discrimination. A discrimant function analysis completed on the cross validation population yielded an overall hit rate of 87%, with 93% of the normals and 78% of the brain damaged children correctly identified. Use of the discriminant function formula from the first study on this cross validation population yielded an overall hit rate of 81%, with 68% of the brain-damaged and 90% of the normal children identified correctly. Use of the decision rule which had been established during the initial validation study indicated that 85% of the

children could be identified correctly, with 89% of the normals and 79% of the brain-damaged children identified accurately. I should add that in the initial validation studies learning disabled children were not included. Other groups have looked at the validity of the Children's Revision of the Luria-Nebraska Battery in discriminating learning- disabled children from other populations. Teeter, et. al. in 1984 reported a study using 38 children; 23 learning disabled and 15 normal children. The definition of a learning disability was made using the typical governmental formula that is completed within the schools, however, the types of disabilities that the children had were not specified within the study. Using the critical formula which has been suggested in earlier validation studies, two or more scales above the critical level which is determined on the basis of age in months, 96% of the learning disabled and 93% of the normals were correctly identified. T-scores of the learning disabled group were particularly elevated on receptive language, expressive language, writing, reading and arithmetic scales. All scales, however, were elevated except the visual scale. Use of the newly developed pathognomonic scale increased accuracy.

A related issue in the clinical study of children is the discrimination of brain-damaged from psychiatric patients. In many clinical situations one of the questions that we are being asked is whether the child who has been presented for evaluation is primarily psychiatrically disordered or primarily evidencing signs of a learning disability or other brain dysfunction. Carr, et. al. in 1973 looked at the ability of the Luria-Nebraska to make this discrimination. In a population comprised of 32 psychiatric and 32 neurologic patients, she found that using discriminant function analysis the battery was able to classify subjects with 81% accuracy overall. Eighty four per cent of the psychiatric patients and 78% of the neurologic patients were accurately identified. In this regard, one must keep in mind the study of Tramantona et. al. (1983) who looked at the relative accuracy of the Halstead Neuuropsychological Battery for Children versus the Luria-Nebraska Battery. This study was done in a population of psychiatrically hospitalized patients with no known neurologic history. When the diagnostic accuracy of these two batteries in this population were compared (with the Halstead Neuropsychological Battery interpreted utilizing the rules which were developed by Selzand Reitan (1979)), he found that the Luria Nebraska tended to over identify psychiatric patients as having some brain disturbance when the Halstead Reitan was used as the external criteria. What this suggested was that although the Luria-Nebraska Battery was able to make relevant discriminations within the psychiatric population, the use of more stringent criteria in a behavior-disordered population would be appropriate.

There have been several studies looking at patterns of performance of learning disabled children on the Children's Revision of the Luria-Nebraska Battery. Snow, et. al., 1984 suggested that one way of looking at the utility of the battery in a learning disabled population would be to evaluate its ability to make discriminations between severity levels of learning disabled

children. He and his co-workers looked at 40 learning disabled children 20 of whom had required placement in a self contained program for learning-impaired children, and 20 learning disabled children who only required resource room assistance. The presumption was that the children who required only resource room assistance were mildly learning disabled, and that those who required enrollment in a self-contained classroom were severely impaired. The mean Full-Scale IQ of the severely impaired children, that is, those who were enrolled in self-contained programs for treatment of learning disabilities was 83, the Full-Scale IQ of the resource room group was 91. They found that the children who were enrolled in the self-contained program, that is, the more severely disabled children performed more poorly than the resource room children on the receptive, writing, reading and arithmetic scales of the Luria-Nebraska Battery. When IQ and WRAT scores were used as covariates, however, these differences disappeared. The authors interpreted this as suggesting that this data did not support the utility of the Luria-Nebraska Battery in dealing with learning-disabled students. One might argue, however that if children are placed in programs for the treatment of severe learning disabilities they are probably placed on the basis of academic achievement such that they are unable to function in a regular classroom. This, in fact, is what should discriminate severely from mildly handicapped children, as it did. In fact, using this presumption, their study supports the ability of the battery to make relevant discriminations in this population.

Nolan, Hammeke and Barkley, 1983 looked at subtypes of learning disabilities, and the ability of the Luria-Nebraska Battery to make discriminations between these subtypes. The subtypes that they utilized were reading and spelling disabled children versus math disabled children, not the subtypes of learning disabilities within specific content areas such as those developed by Mattis, French, and Rabin, and Rourke. Nolan, et. al. evaluated 36 children, 12 normals and 12 reading-spelling disabled children, and 12 math disabled children. Disability was defined on the basis of performance on the WRAT, with reading disabled children having performance on the reading and spelling section of the WRAT that was below the 20th percentile, with arithmetic skills above the 40th percentile. Similarly, the math disabled children were defined by performance below the 20th percentile on the math section of the WRAT, and reading and spelling performances above the 40th percentile on the same test. WISC-R Full-Scale IQ's had to be above 80. None of these children had any indication of psychiatric, or emotional difficulties. No indication of cultural deprivation or primary auditory or visual handicaps was evident.

Age and IQ was used as covariates in analyzing performance on the Luria-Nebraska Battery. They found significant group differences on the expressive speech, writing and reading scales. The normals performed better than the reading and spelling disabled children on expressive language, reading and writing. The math disabled children were also superior to the reading-spelling disabled children on the same three scales. The normals were not different from the math disabled group on these three scales. Of

interest is that they also did not find the WISC-R pattern of differentiation of learning disability subtypes that one would have expected on the basis of Rourke's studies. Though the normals performed better than the learning disabled children on the WISC-R, there were no differences between the learning disabled subgroups. One hypothesis of the authors regarding these results was that their children were less severely impaired in general than the children who have been typically studied in populations of learning disabled children.

Though there has been only limited research on the use of the Luria-Nebraska Battery in the learning disabled population, there are a couple of conclusions we can draw from what has been done; (1) it seems that we probably identify learning disabled children using the battery, and one of the major focuses of the neuropsychologic assessment in this population can be adequately completed, 2) wher the discrimination of learning disabilities from psychiatric diagnoses is what is being required we seem to be able to make that discrimination adequately, however more stringent interpretive rules than traditionally used are necessary, 3) the visual scale may be a weak scale in terms of making discriminations. The visual scale in all of the studies that have been discussed has not demonstrated significant differences. That would be the scale that we would have anticipated to perhaps show some differences in the math disabled group in the Nolan et. al. studies, 4) although the Children's Revision of the Luria-Nebraska Battery seems to have some promise in terms of understanding learning-disabled children, the research that has been completed on other batteries in terms of looking at homogeneous subtypes of specific learning disabilities (e.g., subtypes of reading disability and math disability) has not been done yet, and we are unable to make comments about its utility in such ventures. Clinically, my sense would be that independently the Luria-Nebraska is not going to yield many positive results in this regard, although as part of a more extended battery, I think it would bear some fruit.

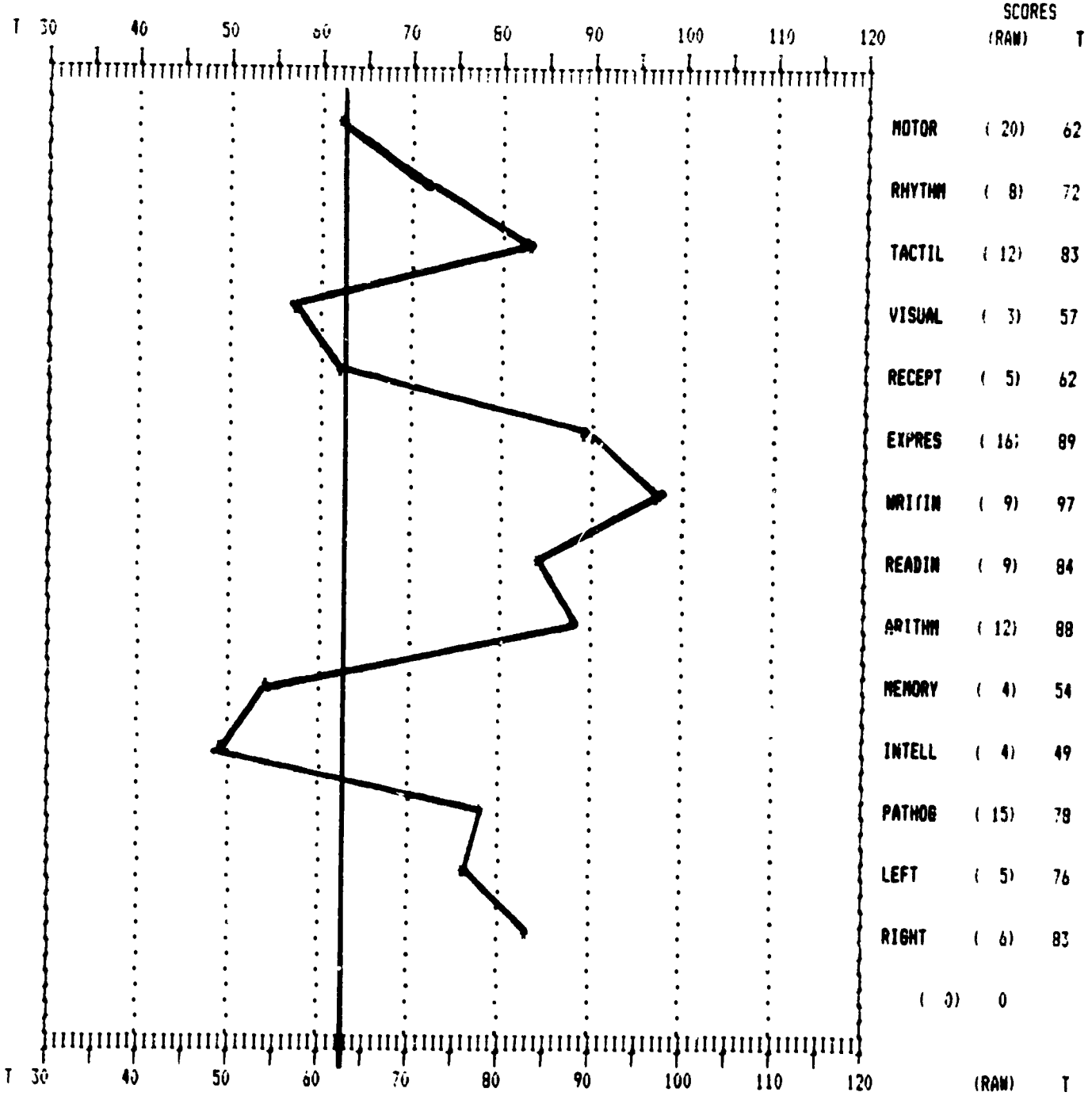
In terms of clinical utility of the battery as part of a larger assessment, I would like to quickly present a case where I think the LNNB-CR was helpful.

The patient who I would like to present is known as A.J. At the time I saw him for evaluation, he was 11 years five months of age. The diagnostic question was one of determining whether he was primarily a learning disabled or a psychiatrically disordered patient. He was the result of an eight-month gestation complicated by toxemia and delivered via C-section. Some difficulties in feeding were noted during the first year of life. He has had no serious illnesses, no head injuries nor hospitalizations. Early development was reported to have been within normal limits.

Psychosocial history is remarkable for the father's history of alcoholism with some abuse towards the mother but not the children. There is a family history of learning difficulties with a paternal uncle unable to read but quite successful in business.

Performance on the WISC-R yielded a Full-Scale IQ of 95, with a verbal IQ of 87 and a performance IQ of 105, suggesting the presence of a learning disability. However, the remainder of his neuropsychological battery as completed using the Luria-Nebraska Neuropsychological Battery, the Judgment of Line Orientation Test, the Wide Range Achievement Test, and the Finger Tapping and Grooved Pegboard Test is quite clearly consistent with developmental Gerstmann's syndrome. As you can see, his performance on the Luria-Nebraska Battery is quite clearly indicative of academic deficits. This was corroborated by school-administered performance on the Woodcock-Johnson Psychoeducational Battery, where reading, writing, and arithmetic were all significantly below his grade placement. He had clear tactile deficits including bilateral finger agnosia. Clear evidence of spatial confusion including difficulty copying large motor movements and drawing figures was demonstrable. His spatial confusion was most evident in writing, where as a 11 year four month old he continued to make errors in directionality, and in writing numbers where he was unable to be sure which number came first in a multi-digit number. Spatial confusion was also evident in automatic expressive language with A.J. able to count forward but unable to count backwards. Similarly, he had difficulty in repetition of syllables with confusion in order. Other signs of dominant parietal lobe function included a mild dysnomia and some difficulty understanding complex grammatical structures.

In this case, I think we can answer the three questions in which neuropsychologists are most involved in terms of assessing learning disabled children; 1) A.J. does appear to have a learning disability, and his performance on the battery suggests that despite his adequate level of intellectual functioning, he really does have some quite clear cognitive deficits, 2) the pattern of his deficits is consistent with what traditionally has been associated with deficits in the left parietal area. This is a pattern that has been seen in individuals who have sustained brain damage from known sources, and also has been seen in groups of learning disabled children, and 3) suggests that his rehabilitation potential is quite good given his basically adequate ability to understand situations and to solve tasks of abstract reasoning. His performance on the Luria-Nebraska Neuropsychological Battery suggests that his memory skills are adequate and his problem solving skills are good. Our knowledge about children who demonstrate the same pattern of performance neuropsychologically suggests that his prognosis for learning academic skills is not good. It also suggests that his prognosis for adequate outcome, if he is allowed to use supportive devices, is quite good and that his ability to learn information from hearing it and using his good abstracting abilities to solve problems should be emphasized and supported.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