Verbal Learning Strategies of Adolescents and Adults with the Syndrome of Nonverbal Learning Disabilities*

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ABSTRACT

Although many psychometric studies of individuals with the syndrome of nonverbal learning disabilities (NLD) have been conducted, one relatively neglected area has been the study of their performance on explicit verbal memory measures. We examined the performance of adolescents and adults with NLD on the California Verbal Learning Test, a measure allowing analysis of self-initiated learning strategies, and compared their performance to age- and Full Scale IQ-matched verbal learning-disabled (VLD) controls. Mean performance of the NLD sample on the semantic clustering index fell one standard deviation below the normative mean, whereas their serial clustering score was within normal limits. Additionally, the serial clustering score for our NLD sample was significantly greater than their semantic clustering score, suggesting that these individuals are more likely to spontaneously employ serial verbal learning strategies as opposed to those that are semantically driven. This difference in serial versus semantic clustering scores was not seen in our VLD controls, who performed equally well, and within normal limits, on both indices.

Adolescents and adults with the syndrome of nonverbal learning disabilities (NLD) display a well-documented pattern of neuropsychological strengths and deficits (Rourke, 1982, 1989, 1995; Rourke & Fisk, 1992). Most notably, such individuals display highly developed rote verbal skills within the context of poor psychomotor, tactile-perceptual, visual-spatial, organizational, and nonverbal problem-solving abilities (Harnadek & Rourke, 1994). Previous studies have shown deficient incidental nonverbal memory (i.e., in terms of Tactual Performance Test Memory and Location scores [Harnadek & Rourke, 1994] and number of errors on the memory subtest of the Halstead Category Test [Fisher, DeLuca, & Rourke, 1997; Strang & Rourke, 1983]) and deficient nonverbal as opposed to verbal memory (e.g., Fletcher, 1985) among those with the syndrome of NLD. However, detailed analysis of individuals with NLD on specific clinical memory measures such as those assessing explicit memory as distinct from attentional and incidental learning abilities is lacking in the literature. Among child and adolescent samples, these distinct dimensions of memory functioning have been identified in the literature as independent modalities (Sillanpaa & DeLuca, 1995, 1996).

We examined the performances of adolescents and adults diagnosed with the syndrome of NLD on the California Verbal Learning Test (CVLT-C [Children’s version]; Delis, Kramer, Kaplan, & Ober, 1994; CVLT [Adult version]; Delis, Kramer, Kaplan, & Ober, 1987), a well-known explicit learning measure. This instrument is a great contribution to the neuropsychologist’s arsenal of measurement tools as it allows: (1) assessment of the component skills required for successful retention of verbal material in a rote learning context; and (2) analysis of

* A preliminary version of this paper was presented at the 8th Annual Meeting of the American Neuropsychiatric Association. Orlando, FL. February 4th, 1997.

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Accepted for publication: May 16, 1997.
spontaneous, self-initiated verbal learning strategies, among other dimensions. On the basis of the NLD model (Rourke, 1982, 1989, 1995), we hypothesized that due to poor organizational but well-developed rote skills, a serial clustering strategy as opposed to a semantic clustering learning strategy would predominate for our NLD sample. Indeed, in outlining the linguistic assets and deficits of the NLD syndrome, Rourke and Tsatsanas (1996) note well-developed verbatim encoding, or automatization skills, but reduced appreciation of contextual/conceptual semantic cues. Consistent with these features of the syndrome, we expected that our NLD subjects would demonstrate impairment in terms of their semantic clustering score, yet perform within the average to high-average range in terms of their serial clustering performance. To provide control in testing these hypotheses, we compared our NLD sample with an age- and Full Scale IQ-matched verbal learning-disabled (VLD) control group. Based on past CVLT research involving VLD children (Shear, Tallal, & Delis, 1992), we predicted that, unlike our NLD sample, the VLD group would evince no significant difference between their use of serial and semantic verbal learning strategies, performing in a manner analogous to cognitively normal individuals on these two indices.

METHOD

Subjects
Archival CVLT data (i.e., CVLT-C or CVLT) from 7 individuals with NLD (4 children/adolescents, 3 adults) and 7 individuals with VLD (4 children/adolescents, 3 adults) were utilized in this investigation. All subjects were diagnosed by the same licensed clinical neuropsychologist (J.W.D.), between the years 1987 and 1996, after having been administered an extended Halstead-Reitan neuropsychological test battery. All had been referred to one of three metropolitan outpatient clinics for evaluation regarding academic/cognitive, behavioral, and/or socio-emotional difficulties. Sixty-four percent of the participants were male and right-handed. The NLD and VLD groups did not differ significantly in terms of mean Full Scale IQ (WISC-R, WISC-III, or WAIS-R; Wechsler, 1974, 1981, 1991) \(t(12) = .572, p = .578\) or age \(t(12) = .189, p = .854\).

All NLD participants met the majority of neuropsychological test performance criteria for classification of potential NLD subjects outlined by Harnadek and Rourke (1994) (see Table 1). All displayed a Wechsler Intelligence Scale (WISC-R, WISC-III, or WAIS-R; Wechsler, 1974, 1981, 1991) VIQ > PIQ pattern; the mean VIQ > PIQ difference was 11.57 (SD = 9.31). Additionally, all demonstrated inferior performances on academic achievement tests of arithmetic as compared to their performances on achievement tests of spelling and reading (i.e., Wide Range Achievement Test–2nd or 3rd version; Jastak & Wilkinson, 1984; Wilkinson, 1993).

The VLD controls were diagnosed with language, speech, reading, or other primarily verbally-based learning or output disorders. They were specifically selected to match the NLD participants in terms of Full Scale IQ and age. All VLD subjects displayed a PIQ > VIQ pattern; the mean PIQ minus VIQ difference was 11.71 (SD = 4.61). (See Table 2 for descriptive demographic and neuropsychological data of interest.)

Measures
The California Verbal Learning Test for Children (CVLT-C; Delis et al., 1994) involves two shopping lists of 15 items each (i.e., List A and List B). List A is composed of five different types of fruit, toys, and articles of clothing; List B comprises five different types of fruit, desserts, and household items. On neither list are items from the same semantic category ever presented consecutively. In administering the test, the child is first told that s/he will be read a list of items to buy on a pretend Monday shopping trip, and instructed to listen carefully and try to remember as many items from the list as possible, in any order. The examiner then proceeds to read List A at a speed of one word per second. Following this, the examiner records the child’s responses verbatim; no reminder cues are given. Next, List A is reread, and once again the child is asked to recall as many items from the list as s/he can in any order, including those reported on the first trial. Again the examiner records the child’s responses verbatim. This procedure is repeated for three more learning trials. On each of the five learning trials, the items are read in the same order.

Following the above List A free recall learning trials, the child is informed that s/he will now be read a new shopping list of things to buy on Tuesday (i.e., List B). Again the examinee is instructed to listen carefully while the list is read, and to try to remember as many of the items on the list as
Table 1. Criteria for Potential NLD Subjects (Harnadek & Rourke, 1994) Met by the Current Sample.

<table>
<thead>
<tr>
<th>Harnadek &amp; Rourke (1994) Criteria for Potential NLD Subjects</th>
<th>Subject Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>WISC VIQ &gt; 79</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>SSPT&lt;sup&gt;a&lt;/sup&gt; or Auditory Closure&lt;sup&gt;b&lt;/sup&gt; ≤ 1 SD below the mean</td>
<td>+ + + + + + +</td>
</tr>
<tr>
<td>WRAT Reading &amp; Spelling &gt; Arithmetic by 10 or more SS</td>
<td>+ - + + + + +</td>
</tr>
<tr>
<td>Target Test&lt;sup&gt;c&lt;/sup&gt; ≥ 1 SD below the mean</td>
<td>N/A N/A N/A N/A N/A N/A N/A</td>
</tr>
<tr>
<td>VIQ &gt; PIQ by 10 or more points</td>
<td>-2 + + - - - +</td>
</tr>
<tr>
<td>Grooved Pegboard (# errors, either hand) ≥ 1 SD below the mean</td>
<td>+ + + + + + N/A</td>
</tr>
<tr>
<td>Dysgraphesthesia, finger agnosia, or astereognosis (# errors) ≥ 1 SD below the mean</td>
<td>+ + - - + + N/A</td>
</tr>
<tr>
<td>Percent of available criteria met</td>
<td>67 83 83 67 83 83 100</td>
</tr>
</tbody>
</table>

Note. N/A = not administered; NLD = Nonverbal Learning Disabled; PIQ = Performance Intelligence Quotient; SD = Standard Deviation; SS = Scaled Score; SSPT = Speech Sounds Perception Test; VIQ = Verbal Intelligence Quotient; WISC = Wechsler Intelligence Scale for Children; WRAT = Wide Range Achievement Test; + = meets criterion; - = does not meet criterion; <sup>1</sup>VIQ = 78; <sup>2</sup>VIQ > PIQ by 9 points; <sup>3</sup>Reading = 105, Spelling = 129, Arithmetic = 96.
<sup>a</sup>Reitan & Davison, 1974. <sup>b</sup>Kass, 1964. <sup>c</sup>Kløve, 1963.
Table 2. Descriptive Demographic and Psychometric Data.

<table>
<thead>
<tr>
<th>Variable</th>
<th>M(SD)</th>
<th>Range</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NLD</td>
<td>VLD</td>
<td>NLD</td>
</tr>
<tr>
<td><strong>Demographics (Raw)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>19.00</td>
<td>(10.89)</td>
<td>20.43</td>
</tr>
<tr>
<td>Male</td>
<td>5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Right-Handed</td>
<td>5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Left-Handed</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>CVLT (T scores)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semantic Clustering</td>
<td>40.00</td>
<td>(7.64)</td>
<td>47.14</td>
</tr>
<tr>
<td>Serial Clustering</td>
<td>48.57</td>
<td>(7.48)</td>
<td>44.29</td>
</tr>
<tr>
<td><strong>WISC-R/WISC-III/WAIS-R (SS)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSIQ</td>
<td>79.43</td>
<td>(3.60)</td>
<td>80.57</td>
</tr>
<tr>
<td>PIQ*</td>
<td>74.14</td>
<td>(5.67)</td>
<td>88.14</td>
</tr>
<tr>
<td>VIQ*</td>
<td>85.71</td>
<td>(5.65)</td>
<td>76.43</td>
</tr>
<tr>
<td><strong>WRAT-R/WRAT-III (SS)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>99.29</td>
<td>(6.18)</td>
<td>82.57</td>
</tr>
<tr>
<td>Spelling*</td>
<td>101.00</td>
<td>(16.73)</td>
<td>79.86</td>
</tr>
<tr>
<td>Arithmetic</td>
<td>76.86</td>
<td>(16.84)</td>
<td>74.29</td>
</tr>
</tbody>
</table>

*Note. FSIQ = Full Scale Intelligence Quotient; NLD = Nonverbal Learning Disabled; PIQ = Performance Intelligence Quotient; SS = Standard Scores; VIQ = Verbal Intelligence Quotient; VLD = Verbal Learning Disabled; WAIS-R = Wechsler Adult Intelligence Scale Revised; WISC-R = Wechsler Intelligence Scale for Children; WISC-III = Wechsler Intelligence Scale for Children 3rd Revision; WRAT-R = Wide Range Achievement Test Revised; WRAT-III = Wide Range Achievement Test 3rd Revision. 

*p < .05 (indicates significant between-group [i.e., NLD vs. VLD] differences).

possible, in any order. After the list is read, the examiner records the child's responses verbatim.

Immediately upon completion of the List B free recall trial, the child is asked to list as many items as possible from the Monday list (i.e., List A), without List A being reread in the interim. Following this, a List A category cued recall trial is given, in which the child is asked to list all the items on the Monday list that were “things to wear,” then “things to play with,” and finally “fruit.” After this trial, other nonmemory or nonverbal tests are administered for a 20-min period. Then, without the list being reread, the child is again asked to list as many items from the Monday shopping list as s/he is able. Next, a List A long delay cued recall trial is administered with the same category cues given as in the short delay cued-recall trial. Finally, the child is read a list of shopping items comprised of the List A items, some List B items, and new (yet sometimes phonemically or semantically similar) distractor items, and asked after each item to say “yes” if the object was on the Monday list and “no” if it was not on the Monday list.

The adult version of the CVLT is analogous to the children's version, except there are four semantic categories of four items each, rather than three categories of five items (see Delis et al., 1987, for a complete description). The variables of interest in this study are the serial and semantic clustering scores.

The **serial clustering** score refers to the number of instances in which the examinee reports two consecutive items in the same order as they had appeared on the word list. This score is calculated as the ratio of observed serial clustering instances to those expected by chance (Delis et al., 1987, 1994).

The **semantic clustering** score refers to the number of instances in which the examinee reports two consecutive responses from the same semantic category. This score is the ratio of the observed versus expected number of semantic category related
pairs reported, taking into account the total number of responses for each trial and the number of categories from which the examinee has given responses (Delis et al., 1987, 1994).

RESULTS

Scores on the CVLT-C and CVLT semantic and serial clustering variables were converted to $T$ scores ($M = 50, SD = 10$; higher scores indicating better performance) using normative data generated by the CVLT and the CVLT-C scoring assistant software (Fridlund & Delis, 1987, 1994). The performance of the NLD group in terms of mean serial clustering $T$ score was within normal limits ($M = 48.57, SD = 7.48$), whereas their mean semantic clustering $T$ score fell within the mildly impaired range ($M = 40.00, SD = 7.64$). On the other hand, the performance of the VLD group in terms of both mean serial ($M = 44.29, SD = 4.5$) and semantic ($M = 47.14, SD = 8.59$) clustering $T$ scores were within normal limits.

Within-group paired samples $t$ tests comparing serial to semantic clustering scores indicated significantly greater use of serial as compared to semantic clustering in the NLD group [$t(6) = 3.286, p < .05$], but no significant differences between the serial and semantic clustering scores of the VLD group [$t(6) = .703, p = .51$] (see Figure 1).

A one-way ANOVA with diagnostic group serving as the independent variable and the mean difference between the serial and semantic clustering $T$ scores (i.e., mean of serial clustering $T$ score minus semantic clustering $T$ score) serving as the dependent variable, revealed a significant main effect of group, with the NLD group showing a significant discrepancy between the two scores, and the VLD group showing only a minimal mean difference score [$F(1, 12) = 5.606, p < .05; \eta^2 = .318$]. The effect size, $f$, obtained for this difference was .683 which is.

![Figure 1](image-url)  
**Fig 1.** Mean serial and semantic clustering $T$ scores for the NLD and VLD groups. NLD = Nonverbal Learning Disabled; VLD = Verbal Learning Disabled.
according to Cohen (1977, p. 284), considered to be a "very large" effect size for an ANOVA result. Given our small sample size, the power for this ANOVA was calculated by reference to tables provided by Cohen (1977) and Howell (1992) (and subsequent linear interpolation) to be approximately .654, indicating a 65.4% probability of correctly rejecting a false $H_0$. Of note, assuming the effect size remains constant, simply increasing the current sample size to 18 (i.e., adding 2 subjects to each group) would give us a more substantial power figure of .80 (Cohen, p. 384).

**DISCUSSION**

Within the context of the CVLT, we investigated the verbal learning strategies spontaneously employed by those with the syndrome of NLD, predicting on the basis of the Rourke (1982, 1989, 1995) model that due to poor conceptual/organizational but well-developed rote skills, a serial clustering strategy as opposed to a semantic clustering strategy would predominate. We also expected that our NLD subjects would demonstrate impairment in terms of their semantic clustering score, yet perform within the average to high average range in terms of their serial clustering performance.

As predicted, the mean serial clustering $T$ score for our NLD sample was significantly greater than their semantic clustering $T$ score, suggesting that individuals with this type of learning disability are more likely to spontaneously employ serial verbal learning strategies and less likely to utilize those that are semantic in nature. This difference in mean serial versus semantic clustering $T$ scores was not present for our VLD controls.

With respect to our second hypothesis, the mean performance of our NLD group on the semantic clustering index fell one standard deviation below the normative mean, although their serial clustering score was within normal limits. This pattern of performance differed from that of the VLD group, which performed equally well and within normal limits on both the serial and semantic clustering indices.

The results of this study imply that individuals with NLD are more likely to spontaneously employ serial verbal learning strategies as opposed to those that are semantically driven, suggesting a passive approach unrelated upon organizational abilities (Delis et al., 1994) or the appreciation of contextual cues (Rourke & Tsatsanis, 1996). These findings provide support for Rourke's (1982, 1989, 1995) NLD model, suggesting that those with the syndrome of NLD are not apt to utilize semantic content as a memory aid. Our VLD findings are consistent with those of Shear, Tallal, and Delis (1992) who employed the earlier research version of the CVLT and found no difference in terms of serial or semantic clustering performance between cognitively normal children and those with developmental verbal learning disabilities.

Given the small sample size, the findings reported herein are preliminary and investigations employing larger samples are encouraged. Enlarging the sample size in this manner would allow greater power, reducing the chances of Type II error. Nevertheless, the large effect size we obtained suggests that despite our limited sample, the results reported here are of significant magnitude, likely reflecting substantial serial versus semantic performance differences in the NLD population at large.

**REFERENCES**


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