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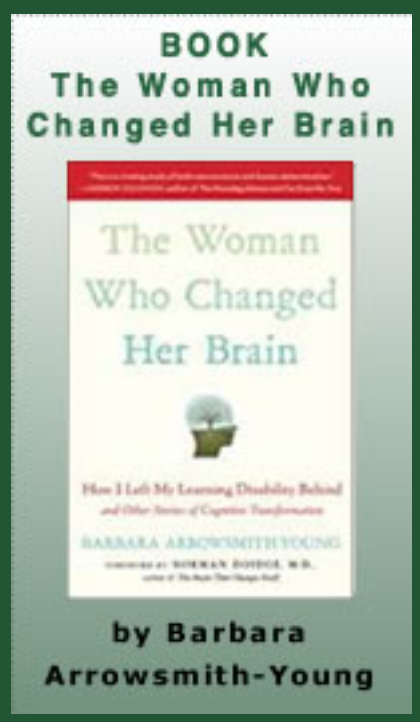

Treatment Outcome >

Correlates of a Test of Motor Symbol Sequencing Performance
Treatment Outcome for a Motor Symbol Sequencing Dysfunction

Correlates of a Test of Motor Symbol Sequencing Performance

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ABSTRACT

This study investigated the relationship between a test developed to measure the rate of learning a repeated sequence of symbols as an automatic motor pattern and standardized tests of writing and copying. Performance on the motor symbol sequencing test, for a group of 12 learning disabled individuals and a control group of 35 adults, correlated significantly with standardized tests of copying and handwriting. Performance on the test significantly discriminated between the two groups. Further research is needed to see if this test could be used to identify individuals at risk of having difficulty with the motor act of the writing process.

SUMMARY

Statement of Problem

Difficulty in motor planning and in executing a motor symbol sequence have been implicated in learning disabilities involving writing (Levine, 1987). Luria (1966, 1970, 1980) describes a characteristic breakdown of writing associated with damage to the premotor region that appears similar to that described for learning disabled individuals. If there is a relationship between learning a motor symbol sequence and writing, then a test developed to measure the rate of learning a motor symbol sequence would be expected to be correlated with tests of writing and copying.

Subjects

The test was administered to two groups: 12 subjects aged 15 to 24 years identified as having a learning disability involving writing; and a control group of 35 subjects, aged 17 to 46, who had completed high school.

Procedure

A test was developed (Young, 1994) to measure the rate of learning a repeated sequence of symbols as an automatic motor pattern. The test is based on Luria's (1966, 1970, 1980) description of experiments conducted on individuals with traumatic damage to the left premotor region and the effects of this damage on the development of a motor automatism, for example, learning a random ordered matching task of signs to symbols. Using a coded guide numbered one to nine with a symbol under each number, the nine numbers were presented to each subject in a random order. Subjects were required to copy the correct symbol in the space provided below the number. For each subject, the same random pattern was repeated 40 times: five times per page for eight pages. The subject recorded the length of time it took to complete each pattern. For this study the average time for the last five repetitions on page eight was used as a measure of learning of the symbol pattern. In all cases the sequence was completed correctly for each of the 40 repetitions.

This test was administered to a sample of 12 learning disabled individuals and a random sample of 35 adults. Two to five measures over a one to three year period were available for the learning disabled subjects and will be the subject of further papers. For this presentation, only the data for the first administration are reported.

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The following standardized tests were administered: Monroe Sherman Achievement Test textual copying and crossing out letters; Differential Aptitude Test clerical speed and accuracy; Test of Written Language handwriting test; and Nelson Denny Reading Test.

The learning disabled subjects also performed a test of motor reaction time with each hand involving a double tap to start and stop a stopwatch to see if there was any relationship between simple reaction time and performance on the motor symbol sequencing test.

Results

Performance on the motor symbol sequencing test significantly discriminated between the two groups

($t = 5.42$, $df = 45$, $p < 0.001$).

Correlations between the motor symbol sequencing test and the standardized tests are displayed in Table 1.

Table 1: Correlations between Motor Symbol Sequencing Test Performance and Standardized Tests

	Learning Disabled & Control Group***	Control Group**	Learning Disabled*
Textual copying	-.86	-.79	
Crossing out letters	-.61	-.65	-.89
Clerical speed & accuracy	-.81	-.77	
Handwriting	-.75	-.76	
Reading speed	-.71		

Notes: ** $p < .001$, two-sided, for all correlations reported. * $p < .05$, two-sided.

All correlations were negative: the longer it took the subjects to complete the motor symbol sequence pattern, as measured in seconds, the fewer words they could copy in a timed condition, and the fewer letters they could cross out or match in a timed condition, the lower the handwriting score, and the slower the reading speed.

The correlation between stopwatch reaction time and performance on the motor symbol sequencing test for the learning disabled subjects was not significant.

Scatterplots corresponding to the correlations are presented in the following figures:

Figure 1 - Correlation with Monroe Sherman copying text test
Figure 2 - Correlation with Monroe Sherman crossing out letters test
Figure 3 - Correlation with Differential Aptitude clerical speed and accuracy test
Figure 4 - Correlation with Test of Written Language handwriting test
Figure 5 - Correlation with Nelson Denny reading speed test

Discussion and Conclusions

Performance on the motor symbol sequencing test, for the control group alone, and the control group combined with the learning disabled group, correlated significantly with standardized tests of copying and handwriting. The correlations were less significant in the learning disabled group, due in part to the smaller sample size and in part to the restriction of the range in the variables under investigation for this group. This preliminary evidence with a small sample suggests that a test of learning a motor symbol sequence discriminates between a group identified as learning disabled and a control group. Further research is needed to see if this test could be used to identify individuals at risk of having difficulty with the motor act of the writing process.

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