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REPORTS

THE NOE ANALYSIS OF TYPE-A:
THE MISSING FACTOR

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NEW CRITERIA FOR TYPE-A

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The SSW Number of Errors (NOE) analysis has worked out very well. It is used specifically for CAP evaluations and not for site-of-lesion information. Unlike the original Type-A criteria, that were developed in the 1960's, the NOE is entirely statistical. It has been described, in detail, in previous issues of SSW Reports (Nov. 1994; Feb. 1995). The present article deals with the final analysis, the NOE criteria for the Type-A pattern.

THE PROBLEM WITH TYPE-A

Type-A NOE criteria took longer to figure out than the other features of the SSW test. The main problem has been that the calculation of Type-A is much more complex than the other aspects of the test. For example, we are concerned with one of two columns of errors (column F, usually, but column B, if it has the larger number of errors). It requires that column F (or B) be compared to the column with the most errors of the remaining 7 cardinal numbers. The criterion is based on the two relationships being positive. Column F must have at least 2 times as many errors as the comparison column and there must be a difference of at least 3 points between these 2 columns, for adults. For children, the absolute difference criterion, varies with age.

Because of the complexity of the calculation, it has taken some time to figure out how to do an NOE analysis of Type-A. The decision was to try a calculation based on the absolute difference only. For this, the +2 SD level of significance was used. We did not use the "2 times" criterion.

A number of studies were carried out to determine if the new criterion was testing the same functions as the original Type-A calculation and whether the sensitivity or specificity were adversely affected.

THE NOE TYPE-A CRITERIA

NOE criteria are based on the National Sample (1985) data for control subjects. All available data were analyzed, using the following procedures. The 8CNs were considered, first comparing column-F and -B. Whichever was the

greater, was considered "column-F", for purposes of the analysis. Next, the remaining 7CNs were analyzed and the one with the largest number of errors was considered "column-X". The calculation was (col-F) minus (col-X). When F > X the result is a positive value. In those cases in which X is the larger number, the value is negative.

Means and standard deviations (SDs) were calculated for the various age groups. Because the criterion should be based on normal cases, the data were analyzed for "outliers". Those subjects whose difference scores exceeded +2 SD were considered as not behaving normally, and removed from the sample.

The table below shows the results for the remaining 269 control subjects.

Age	n	mean	+2SD	NL
5	24	0.79	4.47	4
6	23	1.78	6.86	7
7	14	1.71	4.99	5
8	29	0.66	3.06	3
9	39	0.18	3.26	3
10	32	-0.44	2.84	3
11	15	-0.20	2.44	2
Adult	93	0.29	2.43	2

Table 1. Type-A NOE criteria norms. The age group, sample size, mean score, the +2 SD point and the normal limit (NL) are shown. Type-A differences in excess of the NL value are considered significant.

It can be seen that the values are coherent and logical. The norms for 5-year-olds is based on 20 items. This explains the small NL value.

SPECIFICITY OF NOE TYPE-A

Now days, the most difficult population to get is the normal controls. Often we must assume that children and adults from the general population are completely normal (even though we believe that roughly 20% of the population has a significant CAP problem). Ten of the subjects were eliminated (< 4% of the sample).

To check on the specificity of the NOE Type-A criteria, we employed the 269 subjects of the National Sample (1985). Table 2 shows the original and NOE absolute difference criteria as well as the positive findings.

	NL Criteria		Sig. Type-A	
Age	Orig	NOE	Orig	NOE
5	4	4	0	0
6	4	7	3	0
7	5	5	0	0
8	5	3	0	1
9	4	3	0	0
10	4	3	0	0
11	2	2	0	0
Adult	2	2	0	0
			3	1

Table 2. Comparison of original Type-A 2-criterion system with the new NOE absolute difference only criterion, for the various age groups.

Table 2 shows that the absolute difference criteria for the original and

NOE analyses and their respective failure rates (number of false positives).

Overall, the two sets of criteria are quite similar. Interestingly, the 3 point increase for 6-year-olds eliminated the largest group of false positives, using the original criteria. The false positive rate was 1% for original criteria and < 1% for the NOE. This suggests a high level of specificity for the procedures (99%).

SENSITIVITY OF NOE TYPE-A

The sensitivity of a procedure is based on its hit rate. Children who are seen for CAP evaluations are high risk for difficulty, not necessarily Type-A problems. Perhaps a sample of dyslexic youngsters would be the best group to test for determining the specificity of the Type-A pattern. Unfortunately, we do not have a sample of dyslexics, so children who have learning disabilities, seen for CAP, were used.

Two separate samples of children who were seen for CAP evaluations were analyzed to determine if one approach was any better in identifying Type-A in this population. The 2 samples demonstrated very similar results and therefore were combined for this analysis.

The SSW test forms for 90 children in one sample and 94 children in the other, were analyzed. These children, ages 6 to 13 years, are part of an ongoing study to determine the relationships between SSW performance and academic or other characteristics. Table 3 shows the results for all 184 presumed CAP subjects.

		ORIGINAL CRITERIA		
		Type-A	No Type-A	
NOE	Type-A	22	15	= 37
NOE	No Type-A	0	147	=147

Table 3. Hit/miss results for 184 children who were seen for CAP evaluations.

Table 3 shows that when the CAP Ss had significant Type-A results by the original criteria, in each case, the NOE criteria obtained the same results (for all 22 children). However, for 15 Ss who passed the original Type-A criteria, they failed using the NOE analysis. This increases the hit rate from 12% to 20% and appears to be an improvement in the identification of Integration cases. It remains for us to show that these cases were not false positives.

ABOUT THE TYPE-A AND ITS SUPPORTING SIGNS

Before we tackle the question of sensitivity, we should first explain what the Type-A tells us, and what are the supporting signs.

Type-A -- Integration

The Type-A is one of the less frequent SSW signs. However, when it is seen, it is indicative of a CAP Integration problem. Integration difficulty appears to be a limitation in the ability to combine the efforts of the 2 hemispheres of the brain, or the 2 sides of the of the

lower centers. We have theorized that this is a failure of the corpus callosum. However, this hypothesis has not been tested out in the CAP population[1].

Not only is Type-A seen infrequently, but it also has at least 2 subtypes. Therefore, it has been difficult to establish strong relationships between the Type-A and other characteristics. Nevertheless, we have been able to ferret out some useful information.

Type-A is the only major indicator of an Integration problem. Integration type-1, refers to an individual who has a severe CAP problem at the phonemic (speech sound) level. Those children who have this type, are often labeled, "dyslexic".

The type-2 Integration cases are generally somewhat less severely disabled academically, and their disability lies much more in the area of speech-in-noise difficulty (instead of with phonemic processing).

Both subtypes of the Integration group may demonstrate a rarely seen qualifier on the SSW and/or the Phonemic Synthesis (PS) test. This characteristic is the inordinate delay, which is shown on the test form by XX circled (XX). Though rarely seen, this sign is the one qualifier that supports the Type-A as an Integration problem.

[1] We have studied the Type-A in patients with corpus callosum tumors and found that one-third of them met the Type-A SSW criteria. The crossed pattern on SSW and CES tests was found in those with lesions of the anterior and posterior portions of the corpus callosum, but not in those with lesions in the mid region.

For most items on the SSW, a patient will respond in 1 to 2 seconds. A simple delay generally requires a pause of more than 2 seconds. However, when the delay is 5 to 10 seconds, or more, it could be an inordinate delay. The second requirement is that there be no struggle shown. That is, the person was not trying to figure out what was presented and there was no obvious strain. It is facinating that after so many seconds, the person gives the correct response as naturally as if there had been no delay.

The CES crossed pattern may be considered further support for a Type-A or Integration problem. However, we have not tested this out in any large-scale study.

In addition to the above, one could expect severely depressed PS performance for the type-1 cases and severely depressed speech-in-noise scores for the type-2 cases.

NOE TYPE-A ANALYSIS: MORE SENSITIVE OR SIMPLY MORE FALSE POSITIVES?

When a single criterion is used, we increase the sensitivity of a test at the expense of specificity. That is, as we get more hits, we also increase the number of false positives. In this case, we do not necessarily face this problem. Here we are using 2 different criteria, so one could be a better measure than the other. Thus, we could increase the number of hits without significantly increasing the false positives.

Only the data for the first 90 Ss were available for this post hoc analysis. In this sample, there were 13 children

who had Type-A, using both the original and the NOE criteria. When their data were scrutinized we found that 8 of them showed supporting signs for the Type-A. Two of them had XX qualifiers; 4 had severely depressed PS scores (i.e., 0, 7, 9, and 12 correct out of 25 items for children 6, 9, 10, and 12 years of age), and 3 had severe speech-in-noise scores in one ear (difference scores of >70%).

Although support for Type-A is hard to come by (compared to Decoding and Tolerance-Fading Memory CAP categories), we did find confirmation in 8 of the 13 cases, for whom both scoring procedures agreed. The next question was, whether there was also support for Type-A in the children who were identified on the NOE and not by the original Type-A criteria.

Three children, of the 90 in the sample, were found to have a Type-A using the new criteria. One had XX and 2 had severe PS performance (i.e., 5 and 7 correct out of 25 items for 2 children who were 7 years of age). Thus, all three of them had support for the Type-A!

Among the 90 children in the sample, there were only 5 who had XX qualifiers. Three of the 5 were found in 16 cases (i.e., 19%) that had Type-A patterns using the NOE procedure. In the remaining 74 cases there were only 2 children who had XX (3% of the group).

This lends support to the notion that the NOE is more sensitive to the Type-A sign, as a measure of poor integration. We have already seen that among normal control Ss, the NOE does not increase the number of false positives and, in fact, there were fewer.

GIVE ME AN "A" ... OR NOT !

We are impressed that the new criteria (1) increase the hit rate by 1/3 in cases seen for CAP evaluations, (2) have no more false positives in a normal control population (actually, fewer), and (3) that the procedure is simpler and quicker than the original method.

Now that's all we need to do is show you how easy it is to learn and you can be on your way. For this reason we have a few Type-A's for you, below. I will do the first one (the easy one, as I am old and frail) and then you can check you skills on the second case.

For the NOE Type-A analysis we need to use Table 2 (on page 2). The third column shows the normal limits (+2 SD) so any difference greater than the table value is significant. My case is John Able, yours is Mary Baker.

John Able, age 11, has a severe reading and spelling disability. He is in a self-contained LD class. His teacher reports that he is functioning at a first grade level in reading, is very poor in phonics, and his spelling ability is nil. In addition, his handwriting is extremely poor (illegible).

John's SSW showed the following 8 CNs: 1 2 1 0 1 5 2 0 (given REF).

Procedure

1. Compare columns F & B, and choose the larger value [ans: F].

2. Examine the remaining 7 CNs and choose the largest value [ans: 2] and call this value "X".

3. Subtract F minus X [ans: 3].

4. Check Table 2, to see if 3 is significant for an 11 year old [ans: a difference of 2 is within normal limits, therefore a difference of 3 is significant.

So John has a Type-A. He also had extreme difficulty, as expected, on the PS test (7 out of 25 items correct). He had mild-moderate difficulty in speech-in-noise in both ears (often seen in those with poor Decoding skills (but not as severe as those with TFM problems or type-2 Integration. He seems to have many of the hallmarks of an Integration case with the bulk of the evidence pointing to type-1.

What would you do about that? Well, to our way of thinking, we would address the auditory problems that we see. If they are not addressed, they are unlikely to be resolved. So Phonemic Synthesis training is a very strong recommendation, followed by some noise desensitization training. We have no good data to show for audio-visual training, but believe that it is a good method to improve ones skill in crossing over to combine right and left hemisphere functions.

Briefly, in this training, words are directed to one ear at a time. In the first series, the words are to the right ear and the child points to pictures with the right hand. When this is quick and accurate, the child points with both hands. Then, with the words still going to the right ear, the response is with the left hand. Next the same approach is used starting with the left ear and the left hand. When the child has mastered each of these conditions in succession, then speech is used as the response. Words are presented first to the right ear and later to the left.

Let's see what you can learn about Mary. She's your case.

Mary Baker, age 7, gave the following 8 CNs: 4 13 5 2 3 7 5 1 (given REF)

Procedure

1. Compare columns F & B, and choose the larger one [ans:]. Column B is the larger than F a small percent of the time, but can happen.

2. Examine the remaining 7 CNs and choose the largest value [ans:]. Call this value "X". In this case it was column F that was used.

3. Subtract B minus X [ans:].

4. Check Table 2, to see if a difference of 6 is within normal limits for her age [ans: ok Type-A]. A quick look at page 2 shows that for a 7-year-old, a value of 5 is within NL. Therefore, a difference of 6 or more is need for a Type-A. Oh, that's exactly what Mary had! So she did have a Type-A.

5. Looking at the 8CN above, do you think Mary would have been identified by the original criteria (as the difference required is the same by the two methods)? [ans: Y N]. The answer is no. The original Type-A analysis requires that column F/B be two times column X, or greater. This was not the case here.

We like the new NOE approach a lot. The Type-A installment completes the features of the SSW.