SSW Reports

Important Please Read

• Integration Signs - New Addition - Further Support

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Some Initial Remarks
Jack Katz

In the last few days I have learned that I have not been a good communicator. We have updated the Buffalo Model (B-M) tests, but have not communicated effectively with those who use the tests. I am not sure how to do it in the future, but hopefully the **Important** above will alert the readers to a change. In this case it is an addition.

I have been told that some audiologists are using the CSSW scores for CAP when they would benefit greatly from NOE. This will be the topic of an upcoming issue. Please let me know if you would like discussion of any other part of the battery, so we could provide background and details!

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INT & the Challenge in Identifying It
Jack Katz

Integration (INT) is an important category of CAP, but it is more difficult to identify than other categories. Fortunately we have the Type-A pattern, but it can be contaminated and therefore fail to show the problem. One problem is that the Type-A is fragile. It is a comparison of column-F of the 8CN with the largest number of errors for the remaining 7 columns (called column-X).

Therefore, too many other errors or other factors can minimize the difference between column-X & -F or can obliterate the Type-A. We have lots of chances to see evidence of DEC and TFM categories, but we do not have any strong indicators of INT besides Type-A. Previously we did indicate 2 supportive measures. Let me review.

Two-By-Three (2B3): Because INT is such a powerful disorder (e.g., Dyslexia) it is not surprising that some scores on the B-M tests are likely to be very poor. Which ones depend on the person's individual challenges. If $\geq$2 of 9 measures on the tests are outside of normal limits by $\geq$3 SDs this yields a significant 2B3. The 9 measures are: SSW's 4 Conditions & Total scores, PS's Quantitative & Qualitative scores, and SN's RE & LE Noise scores.

Integration Delay (IX): An IX is very similar to an Extreme Delays (XX) in length, but theoretically has a different etiology. The cause of most XXs is likely that the person has a hard time figuring out the item and does not give up (therefore DEC is most likely). But, I believe the IX is waiting for the person to be able to say the response. Perhaps it is due to a slow down in getting the word/s from the R-hemisphere to Broca's area in order to say the words.

I have seen this type of effortless delay many times. The first inkling was when a parent of a child with a Type-A told me that she asked her child what she wanted for lunch. The child did not answer and showed no affect so after a few moments the mother turned around and was almost back to the kitchen when she heard the child say what she wanted and spoke in a soft voice as though the mom was still there. Wow.

This distinction may not be easy to discern, but often when in doubt I ask the person if the delay was because it took a long time to figure out or if he/she was waiting to be able to tell me. With some thought a child might respond that they were waiting to be able to say it. The other day I had such a situation and the first time the youngster said she was trying to figure it out. Later on there was another long delay that also looked like an IX. This time she said she was waiting to say it. Ordinarily, with a mixed response I would question the second answer, but in this case I felt that she was being accurate. However, this is not an easy INT sign to identify. When in doubt I show XX.

Because these are good, but not easy signs to identify, I keep looking for new methods to give us more information. Please read on for the newest addition.

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Standard Integration Ratio (SIR)

Jack Katz & Larry Medwetsky

Larry Medwetsky was also looking for support for INT from the SSW test. He noted quite often the Type-A was not significant because of the many errors in column-C (the other LC column), so he looked at Type-A cases and this further supported what he was looking for. Then he tried it on other cases that he felt had INT but did not have significant Type-As and sure enough the procedure worked.

Influence of Central Lesions: The SIR method compares the errors on all 40 LC words with the 40 RC words. If the LC errors are 1 SD, or more, greater than the RC errors; it is a significant SIR finding, supporting INT. We will illustrate the procedure using data from an 8-year-old youngster. The next table is taken from the front sheet of the SSW form. We start with the total RC and LC scores.

RNC	**RC**	**LC**	LNC
4	**8**	**15**	5

SIR would compare the 8 RC errors with the 15 LC. Will the difference be enough to indicate INT? The normal RC mean for 8 year olds is 3.0 and the SD is 2.0. So we calculate 8 - 3 = 5 / 2 = 2.5. That is, the RC score of 8 is 2.5 SDs above the mean. Let's see how many SDs above the mean the LC score of 15 is. The LC mean is 4.5 and SD 2.8. So 15 - 4.5= 10.5 / 2.8= 3.75. This gives us scores of 2.5 and 3.75 SDs to see if LC errors are at least 1 SD greater than the RC. 2.5 - 3.75 = 1.25 SDs. So the ratio is significant for SIR showing support for INT.

If the ratio was less than 1 or if it was negative, then it would not support INT. I did a little study to see how different groups performed with SSW and how likely it was that they had INT issues. SIR looked good and of the 3 ratios considered (1, 1.5 and 2.0); indeed a ratio of 1.0 or more gave the best hit/false positive rate.

Independently for several years, or more, we both have been using SIR successfully. Looking at a group of 8 children who did not have Type-As before therapy but did have it after therapy 6 of them who were 9 to 14 years of age had positive SIR scores on their pretest. That would have given us some evidence of INT that we later found after one round of auditory training. This SIR insight is what we are looking for. Unfortunately the 2 youngest ones 7 & 8 years of age were the only ones who didn't have positive SIR scores. For all 8 of them SIR ranged from 0.83 to 6.77 with a mean of 3.10. I made a crude XL SIR scoring program (ages 5 to 69). That just requires the RC & LC errors to quickly get the ratio.

False Positives and False Negatives
Because we have no 'gold standard' for CAP we surely have none for Integration. For this reason we have been careful in recommending the use of these procedures. While no technique is perfect, we feel confident in this one. However it is important to

note potential interference with SIR/SSW although this would be very infrequent.

One potential problem would be having a hearing loss. If it was unilateral it might be more problematic than bilateral. In bilateral cases with similar WRSs we could assume about equal effect for each ear. Or, perhaps a WRS correction factor might work. If the loss was in the left ear it would be unclear how this affected the results. A right ear loss could cause masking of a Type-A and insecurity regarding the SIR score.

Possible Influence of Central Lesions
Another potential problem would be a central disorder. We know from working with auditory reception (AR) lesion cases that damage to this region produces many errors on the SSW test for the competing condition in the opposite ear. Thus, if there is a left AR lesion there will be a great many RC errors that could easily neutralize the Type-A, but elevate SIR.

A right AR lesion will produce lots of LC errors on the SSW which might look like a CC (INT) peak. But in this case the Type-A would not be positive (i.e., both column-C and -F), but SIR probably would be positive with or without CC (INT) involvement. This would be a good time to use the CES test as it can help to distinguish CC from AR.

If a person had both R-AR and CC; both of these lesions would cause a peak in the LC condition. Likely this would produce a huge LC peak. Figure 1 shows the SSW-gram for just such a case. This person was diagnosed with a tumor involving both the R-AR and CC. Unfortunately, there was no CES at that time we don't know how that would have turned out. In that case the SIR was 23.13, (a huge score) and the SSW TEC was Mo, S, S, = S indicating an auditory reception disorder. Type-A wasn't correct because all 40 LC words were in error (column-C and -F, but SIR was positive. It might be a good idea to determine how severe a SIR score is likely to be with an INT problem to question very high peaks.

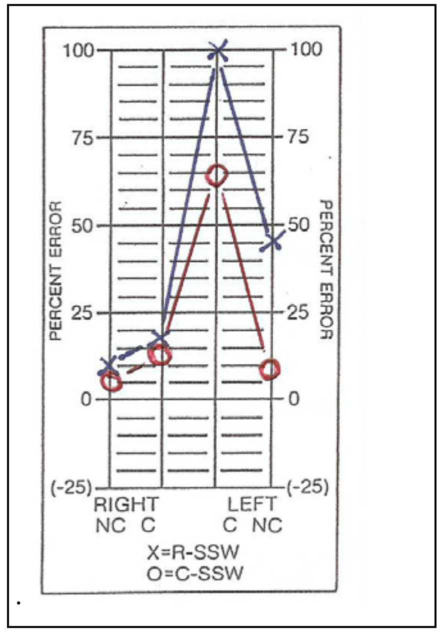

Figure 1. SSW-gram for a 60-year-old man who had a lesion of both a left auditory reception and a posterior corpus callosum lesion.

The previous scenarios are uncommon but we feel worth mentioning. The more likely interference is errors associated with CAPD. Errors produced by Decoding and TFM problems can reduce the LC/RC difference and what we often see is that one or both of these categories combined can bury the fragile Type-A sign. As we noted; 6 of 8 children improved after auditory training which then uncovered the Type-A. This demonstrates again the potential importance of SIR.

We think we have thoroughly checked out SIR and feel that it is time to share this excellent procedure with our colleagues.

An Informative Study: Clearly Larry has devised a very important measure to support the Type-A. Unlike the other procedures I've used it might be strong enough to stand alone, much like the Type-A. I think that before we take that step we should be confident that we have a good idea about its hit and false positive results.

I just finished a little study of 10 Type-A cases (7 to 12 years old) vs. 20 (6 to 18 years olds) with No Type-A. The reason for the Type-A group is to get an idea of SIR's sensitivity for INT problems (based on the SSW). Hopefully, SIR will be in pretty close agreement with the significant Type-As. 9 out of 10 cases with Type-A had significant SIR scores as well, so that looks great! We looked at the No Type-As to see if SIR could add cases that likely had INT issues. Surely, some of the No-Type-As did have INT issues that were not so powerful to show up; or simply had the Type-A masked by other errors.

We cannot know for certain who has INT issues so we have to work with probability. Initially, I looked at the data for SIR score, XX, IX (Integration Delay), 2B3 (discussed above) and the BMQ for each subject. Clearly two potential indicators could be deleted. We used 2 BMQs as significant for the INT category. The mean 'yes'-INT items was identical (2.4) for the Type-A/No Type-A groups (15 of the 20 No-Type-A's had 2 or more 'yes'-INT on the BMQ). So BMQ was poor at differentiating these 2 groups.

We also looked at IX, but there were only 2 of them for this sample of children. While both were for kids in the Type-A group this was not sensitive enough to contribute importantly. The IX scores can be added to the XX which was a better measure. So we were left with 4 INT measures.

This left us with Type-A and SIR as our strong measures and XX and 2B3 as our supportive measures. The tables below show these helpful data.

We will continue to monitor SIR for a while, but it sure looks good so far. The Type-A and XX are relatively quick are simple to compute. SIR takes a bit longer, but if you email me I will send you my crude program. The 2B3 analysis took me the most time to compute. The last page is a table that will help you to speed up the 2B3 process. I was pleased to see that there were twice as many mean 2B3 errors for the Type-A cases. Our premise is that INT is a potent form of CAPD and therefore overall they should have more measures that are $\geq$3 SDs above the mean.

Let's go over the data; I think you will find them interesting. The SSW and SIR agreed for all but one subject and you will see that the mean scores for the 2 groups is impressive. At first I thought there might be an important age factor, but if there is one it does not appear large. I was suspicious that the SSW would not catch many young ones because of the large SDs from 5-7 years old, but this seems not a big factor. 6 of the No Type-As also had significant SIR scores. Some may be false positive, but some are likely other INT kids that Type-A did not catch. Table 2 will give us a chance to examine that.

Only 1 child with Type-A did not meet the criterion for 2B3. But he failed the remaining measures and so would have been picked up anyway as INT. However, 12 of the No Type-As also had significant scores. Thus, 60% with No Type-A and 90% of the Type-A group had some 'INT behaviors'. As we had found in the past 2B3 was of some help, but definitely can't stand alone.

One XX was required for a positive sign of INT. 9 of the 10 Type-As had that sign, so that was quite good. 7 of the No Type-As had 1 or more XX, but 13 did not. So XX may have been a little better than 2B3 based on the Type-As and fewer hits for the No Type-As. 90% of the Type-As and 35% of the No Type-As.

It looks like we can count on XX and 2B3 to help support INT if Type-A and/or SIR also support it.

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For a table that simplifies 2B3 measurement check out page 7. The table shows the 2B3 calculations by age for the 9 measures that are consided.

			Criterion=	Age Norm	1.0	2	1
#	**age**	**RC**	**LC**	**Type-A**	**SIR**	**2B3**	**XX/IX**
1	7	8	23	Y	2.36	6	4
2	7	9	20	Y	3.61	4	13
3	9	6	17	Y	3.55	5	2
4	9	3	12	Y	3.04	2	13
5	11	4	9	Y	1.1	3	1
6	11	2	8	Y	2.33	1	1
7	11	2	13	Y	5.27	4	0
8	12	7	11	Y	-1.04	5	2
9	12	9	23	Y	6.11	8	0
10	12	4	17	Y	8.25	5	21
mean	**10.1**	**5.4**	**15.3**		**3.46**	**4.3**	**5.7**
SD	**1.97**	**2.76**	**5.52**		**2.62**	**2.00**	**7.30**
			Criterion=	Age Norm	1.0	2	1
#	**age**	**RC**	**LC**	**Type-A**	**SIR**	**2B3**	**XX/IX**
1	6	20	22	N	-1.19	5	0
2	6	8	25	N	2.73	4	0
3	7	9	14	N	-0.56	4	3
4	7	7	13	N	0	0	0
5	8	8	11	N	-0.14	0	4
6	8	4	9	N	-1.1	1	0
7	8	3	4	N	-0.18	0	0
8	8	7	9	N	-0.39	1	0
9	8	6	11	N	0.82	1	0
10	9	8	7	N	-1.91	2	16
11	9	1	7	N	1.98	0	0
12	10	8	18	N	3.43	4	5
13	10	16	10	N	3.1	4	1
14	10	6	6	N	-1.23	2	4
15	10	7	12	N	1.1	4	0
16	11	5	10	N	0.78	4	0
17	11	2	5	N	0.56	0	0
18	13	2	2	N	-1.39	2	2
19	14	0	2	N	1.46	2	0
20	18	0	2	N	1.46	2	0
mean	**9.55**	**6.35**	**9.95**		**0.47**	**2.1**	**1.75**
SD	**2.89**	**4.94**	**6.30**		**1.55**	**1.71**	**3.74**

Table 1. Type-A and No Type-A subject's age, SSW RC & LC scores. On the right '**Y'** shows if subject had a Type-A and '**N'** if not. Also shown are SIR scores, 2B3 and XX results. Criterion for significance shown for each measure (in purple) used to calculate the Combined Integration Score (CIS). CIS form in on last page.

age	Type-A	SIR	XX	2B3	+ INT Signs
7	2	2	1	1	**6**
7	2	2	1	1	**6**
9	2	2	1	1	**6**
9	2	2	1	1	**6**
11	2	2	1	1	**6**
11	2	2	1		**5**
11	2	2		1	**5**
12	2		1	1	**4**
12	2	2		1	**5**
12	2	2	1	1	**6**
10.1					**5.5**
(1.97)	**20/40**	**18/36**	**8/16**	**9/18**	**55/110**

age	Type-A	SIR	XX	2B3	+Signs
6				1	**1**
6		2		1	**3**
7			1	1	**2**
7					**0**
8			1		**1**
8					**0**
8					**0**
8					**0**
8					**0**
9			1	1	**2**
9		2			**2**
10		2	1	1	**4**
10		2	1	1	**4**
10			1	1	**2**
10		2		1	**3**
11				1	**1**
11					**0**
13			1	1	**2**
14		2		1	**3**
18		2		1	**3**
9.55					**1.65**
(2.89)	**0**	**14**	**7**	**12**	**33**

Table 2. Combined Integration Score (CIS) used to determine if results indicate the INT category. Tentative Norm: Strong indicators are 2 points and supportive signs are 1 point. A combined score or 3= Questionable INT and 4 or more indicate INT.

We have discussed what we think is an exciting diagnostic measure for identifying those who very likely have CAP Integration problems. The final step is putting them all together. Strong indicators have 2 points and supportive indicators 1. If a person has 3 points there is a good chance or INT and 4 or more points INT is very likely. Let's see if that is too strict/lenient. For the 10 Type-A cases you can see that all of them have 4 or more points. So that is 100% would have been identified. It also shows good consistency among the various signs. [Frankly, I was surprised to see how well these independent signs agreed with one another]. In fact, all but one subject had a score of 4 or more clearly showing INT. The average was 5.5 out of a possible 6.

In the bottom row for Type-As there are 2 numbers per box. The first number is the total number of points and the second number (in black) is double the first one just to remind you that there are twice as many subjects in the No Type-A group.

I was surprised that only 2 of the 20 No-Type-A subjects had significant scores (4). I suspected more with INT who did not have Type-As. But there were 4 for whom INT was questionable. Each of those had a positive SIR score, which gives us further confidence that there are more INT kids and very importantly SIR made this identification possible.

Summary

I am grateful to Larry that he told me about the SIR procedure because it is clearly the best addition to the Type-A pattern in identifying Integration problems. I suspect these 2 measures will be comparable in identifying the problem and will enable us to find some of the INT that we have missed. Now we also can employ the 2 weaker measures more effectively to support either of more powerful measures using CIS.

Below is the 2B3 conversion table that will save you a lot of time looking up and calculating these findings. Of course, the SSW is # errors, so look for larger #s as positive but the other 2 are #/% correct, so look for smaller numbers. * * * * *

Two-By-Three Measure (2B3) Table - To Compute Combined Integration Score (CIS)

Significant Scores By Test-Measure and Age

Test	Measure	5yr		6yr		7yr		8yr		9yr		10yr		11yr		adult		60yr		Meas
		3SDs		*3SDs*		*3SDs*		*3SDs*		*3SDs*		*3SDs*		*3SDs*		*3SDs*		*3SDs*		
SSW	**Total**	**36**		**44**		**34**		**28**		**18**		**18**		**16**		**8**		**18**		**Total**
Larger-Poorer	**RNC**	**4**		**8**		**4**		**12**		**3**		**2**		**1**		**1**		**3**		**RNC**
	RC	**17**		**17**		**11**		**9**		**7**		**6**		**4**		**3**		**6**		**RC**
	LC	**17**		**24**		**20**		**13**		**10**		**9**		**8**		**5**		**11**		**LC**
	LNC	**5**		**10**		**5**		**7**		**2**		**3**		**3**		**1**		**3**		**LNC**
		3SDs		*3SDs*		*3SDs*		*3SDs*		*3SDs*		*3SDs*		*3SDs*		*3SDs*		*3SDs*		
Pho Syn	**Quantitative**			**13.2**		**11.5**		**11.5**		**12.8**		**17.6**		**17.6**		**21.4**		**----**		**Quant**
Smaller-Poorer	**Qualitative**	**----**		**4.1**		**6.8**		**6.8**		**10.4**		**16**		**16**		**19.4**		**----**		**Qual**
		3SDs		*3SDs*		*3SDs*		*3SDs*		*3SDs*		*3SDs*		*3SDs*		*3SDs*		*3SDs*		
Sp-in-Noise	**RE Noise**	***53*****		**55**		**56**		**62**		**62**		**65**		**65**		**68**		**----**		**RE N**
Smaller-Poorer	**LE Noise**	***45*****		**48**		**56**		**56**		**58**		**58**		**60**		**68**		**----**		**LE N**

Instructions

2B3 is one of the 4 measures used to identify auditory integration (INT) problems. INT is often the most severe category of CAPD in the Buffalo Model. This table will enable you to reduce the time and effort required to look up the scores (means and SDs for each measure by age) and then carry out the calculations (3 times the SD plus the mean) to determine which are significant. Let us assume that it is an 8-year-old child. To be most efficient; start with the SSW test. Check the 5 SSW scores that we consider (i.e., Total, RNC, RC, LC, and LNC) to see which one/s, if any, are at, or beyond, 3 SDs poorer* than the mean. Let's assume the child had 30 total errors vs. NL of 16, so you look down the 8yr column of the table for Total SSW and you see that ≥ 28 will meet the *B3* criterion. So this is one of the 2 *B3s* that are needed for a significant 2B3.

Now LC is the next most likely SSW score (the child had 9 errors) so you check down the same column for the LC value and see that 10 represents *B3*, so in this case it is not severe enough. This also suggests that it may not be necessary to check the less likely ones on the SSW. However, be aware that older children and adults have smaller SDs, especially for NC Conditions. But, check if you are not sure. Next consider the 2 main PS scores Quantitative/Qualitative and then finally the 2 noise measures RE and LE. If, in addition to the Total SSW score, there was one more measure that reached or exceeded *B3*; then 2B3 would be significant. You need not check beyond the second positive *B3* score except if it is for a measure of severity.

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* SSW ≥ B3; for PS/SN ≤ B3

** Speech-in-Noise B3 scores for 5-year-olds are estimated.

5/9/15