

# May 2014 -SSW Reports

Dear Colleague:

I am pleased to report that after 36 years of publication we have not run out of material to share with you. Especially now, with so many cases of Traumatic Brain Injury (TBI) the importance of the SSW as a measure of organic disturbances has surfaced again. The insights provided by the SSW regarding auditory cortex, corpus callosum, brainstem and other regions of impairment are available to you without additional testing.

In addition to the 2 brain lesion cases shown in this issue of Reports we are planning an Advanced SSW/CAP Workshop that will review the procedures and interpretations using the Original SSW Analysis (for site-of-lesion). Understanding these basic SSW functions makes the Buffalo Model categories more meaningful in understanding CAPD as well as CNS disorders.

I will be presenting a 2 day workshop to cover basic, advanced and other interesting information regarding the SSW and the Buffalo Model that will be especially suited for those who are experienced with the SSW (and hopefully the supporting tests as well).

## Advanced SSW/CAP Workshop

**When: September 12 & 13, 2014**

**Where: Atlanta, GA**

The cost for 2 days is \$375. We will apply for 15 hours of CEUs (1.5 AAA). This fee includes: [SSW Workshop Manual](#), breakfast, lunch, and snacks both days. Dinner will be on your own, but we will make a reservation at a nearby restaurant for Friday's dinner for those interested in eating with the group. *Jack will also provide a very nice surprise for each attendee.*

The workshop is limited to 15 attendees. To register contact: Christa Reeves  
[christa@littlelistenersclinic.com](mailto:christa@littlelistenersclinic.com) or call her cell [770-235-1536](tel:770-235-1536)

Hope you enjoy this issue and hope to see you in Atlanta!

Best wishes,

**Jack**

# SSW Reports

## • Brain Damage & CAPD: Comparing Results

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### Brain Damage & CAPD

Jack Katz

Those who work with people who have CAPD know how hard it can be for many of those children and adults. But having CAPD, plus another significant problem, makes the challenge so much harder. In this issue we discuss such a youngster and her SSW results both for site-of-lesion and CAPD. If you are not too familiar with the analysis for brain damage, this will serve as an introduction.

At one time we did a lot more work with those who had damage to the CNS. We used the terms *Central Auditory Processing Disorder* as we do now as a developmental problem, but we also had *Central Auditory Function Disorder* to signify impaired auditory function due to an actual lesion or physical impairment.

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*At another time there was a small push to ignore the etiology and to consider them both as CAPD especially for determining hit rate of CAP tests. This would have meant that one could determine how effective a processing test was in predicting a CAPD with results based on patients with actual brain lesions. Clearly, brain damage is more severe than a developmental issue so we cannot use a group with a severe disorder to predict the efficiency for a milder group. You probably know that this is not a matter of bias/opinion, it is the rule of test development that the normative group must be the same as the intended group. As my grandchildren would say, "Duh".*

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Because of the many cases of Traumatic Brain Injury (TBI) that are coming for help we may need to find a way to distinguish these disorders despite its challenges. One big problem is that we generally don't know, for sure, what part is developmental and what is damaged. I have not seen anywhere a comparison of the two groups to see what the similarities and the differences might be. I hope with all the cases coming forward that we could see the difference between brain damage and CAPD. In this issue we will compare 3 individuals with and without brain damage. First let's consider Mary, age 10.

### Case Study - Brain Damage & CAPD

Just before I left Buffalo we tested a youngster who had a stroke at 6 months of age that left her paralyzed on the right side. She has a history of early middle ear problems and had PE tubes at age 4. Mary had 3 years of speech-language therapy and 2 years of remedial reading. Mary presently has articulation difficulty as well as phonics, oral reading and spelling issues. She also has reading comprehension problems, forgets what is told and speaks slowly. Two family members also have CAPD. Mary's puretone

thresholds were normal in each ear. Word recognition scores were 76% in the right ear and 80% in the left.

Table 1 shows the results on 2 of the central tests. The Speech-in-Noise Difference (between the quiet and noise score) for the right ear was not only significant, but was 5 SDs poorer than the mean for her age. The left ear was within normal limits. The difference between the ears was significant as well. On the Phonemic Synthesis Mary had just 6 correct Quantitatively which is 9 SDs poorer than the mean. The Qualitative score was also significant. These are considered profound scores that are rarely seen with CAPD alone. Also, it is unheard of to have one ear in SN +5 SD and the other normal with CAPD.

	<i>Right Ear Diff</i>	<i>Left Ear Diff</i>	<i>Inter- Aural Diff</i>
<i>Speech- in-Noise</i>	<b>46*</b> NL=21	<b>16</b> NL=22	<b>+30*</b> NL=+9
	<i>Quantita- tive</i>	<i>Qualita- tive</i>	
<i>Phonemic Synthesis</i>	<b>6*</b> NL=21	<b>3*</b> NL=21	

*Table 1*

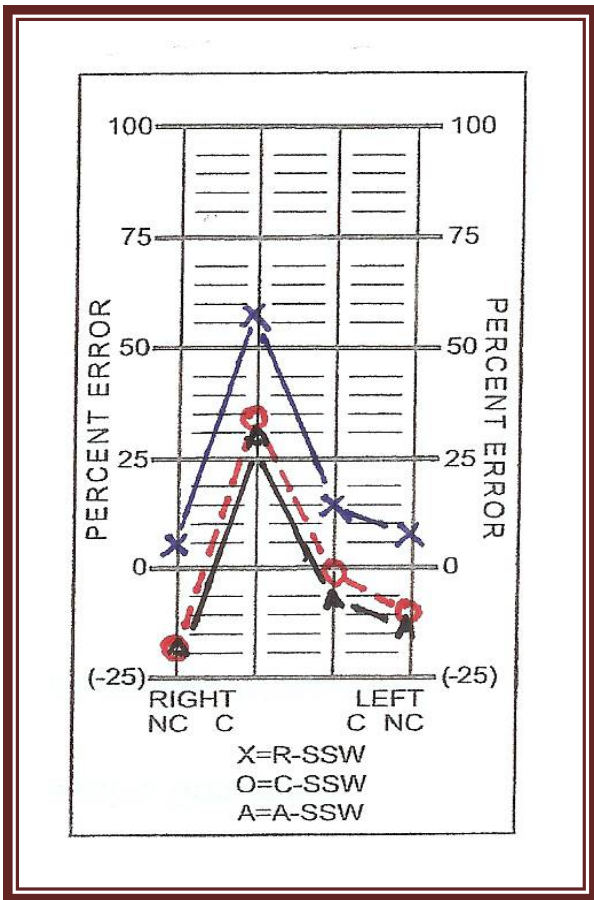


Figure 1. Mary's SSW results. Please note that these are not simply Number of Errors that we use for CAPD, but for R-SSW, C-SSW and A-SSW used for the Original (site-of-lesion) Analysis.

In Figure 1 the SSW-Gram for Mary shows the 4 Conditions for 3 measures: Raw-SSW (percent error, blue), Corrected-SSW (R-SSW minus % error for Word Recognition, red) and Adjusted-SSW (A-SSW = C-SSW adjusted for best Conditions of Ear/Order Effect) score. These will be discussed further below.

Note that the 3 RC scores are much more severe than the other Conditions. This does not look like most CAPD results because the peak of errors is in the right competing and not the left condition. This is especially true for right handers who are from right handed families. Also the correction for WRS suggests a slightly greater percent of WRS errors than we usually see with just CAPD. Let's compare this with the results that are fairly typical for someone with a lesion to the left auditory cortex.

## Case Study – Brain Damage

The results for Mary are quite similar to this patient with left posterior temporal lobe damage. There are a few differences but overall the similarity stands out.

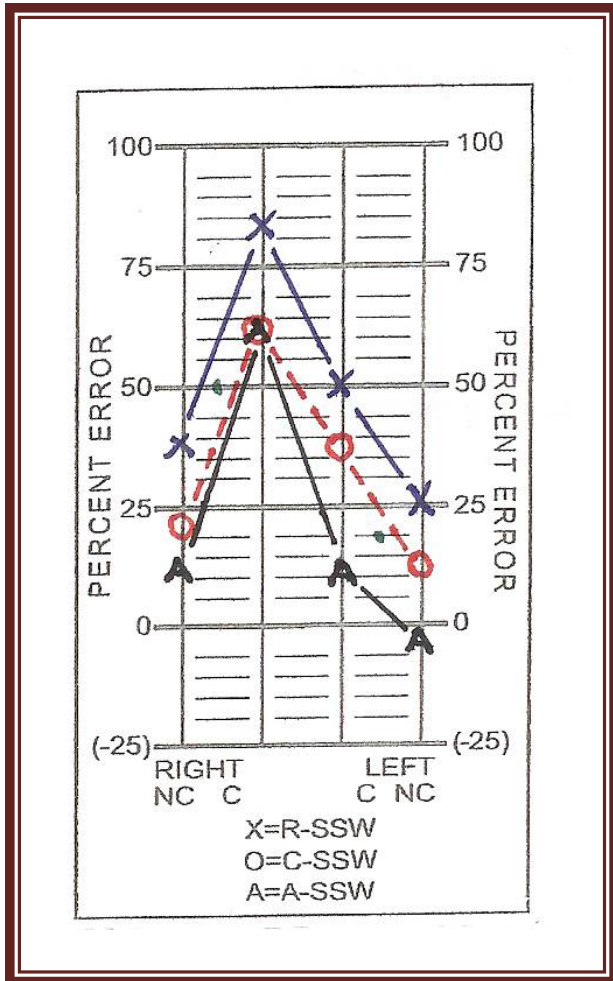


Figure 2. This SSW-Gram shows the results for a man who had a stroke involving the primary (Heschl gyrus) and secondary auditory cortices. (From SSW Workshop Manual [1995] p. M-3)

Figure 2 shows the SSW-Gram for 60 year old patient who had a left temporal CVA that involved Heschl gyrus and much of the temporal cortex. Therefore, both the primary auditory reception center (AR) and the secondary cortex including area 22 of Brodmann (the phonemic zone of Luria) were involved. Mr. N had a mild cochlear hearing loss in each ear in the high frequencies, unrelated to the stroke.

As you can see the error patterns for Mary and Mr. N are quite similar. \*\*Please note that the selection of Mr. N had nothing to do with the similarity. It was because his results are typical of left-AR lesion cases (as indicated in the SSW Workshop Manual) from which I borrowed it for this comparison.

The very large right-competing peak of errors is the predominate sign for a L-AR lesion. However, there were some interesting SSW differences between these 2 cases as well as subtle site-of-lesion differences. These will be discussed below.

### Which Analysis to Use for Mary?

Because Mary is known to have a CNS disorder the Original Analysis for site-of-lesion can be used (those scores are shown in Figure 1). But she was also seen for her academic and communicative problems. So in that case we would need to use the NOE.

Briefly, in the site-of-lesion analyses we first divide the cases with brain lesions into Auditory Reception (AR) and Non-Auditory Reception (i.e., anywhere else in the brain). The indicator we use to determine if the AR region is impaired is a moderate or severe Total-Ear-Condition (TEC) C-SSW score. If TEC is normal or mild, it indicates that

Heschl gyrus is completely spared. For Mary we found a moderate TEC, suggesting AR. However, in such cases we must take the analysis one step further to increase our certainty. For this purpose we calculate an A-SSW score. An A-SSW is just like a C-SSW score except that before we subtract the WRS error we guard against a false positive that is due to other factors (e.g., due to Integration).

For the A-SSW we examine the Ear and Order Effects. In Mary's case she had Ear Effect 22/12 and Order Effect 19/15. Because we want to see the person in their best light we look at the 4 Conditions we find the least bias (called Least Biased Errors). In this case LBE =12 from the Ear Effect. If it is truly AR we should see at least a moderate TEC for the A-SSW scores. To arrange these scores from RNC-to-LNC we have to reverse these LEF scores (i.e., to 1, 9, 2, 1). When we recalculated percent errors and subtracted WRS percent error; the TEC was mild (no longer moderate) so that tells us 2 things. It is not a true AR disorder, but it is likely near by.

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If you want to see how Mr. N performed on TEC ...

Just like Mary; Mr. N's TEC (for C-SSW) was moderate. To be sure that it was not due to a lot of response bias we rechecked the TEC using A-SSW data. This adjustment is based on the LBE. So we look at his Ear Effect which was 45/35 and Order Effect which was 33/37. In this case the Order Effect gave the lowest score of 33 errors. We took the RNC and RC scores for REF and then the LNC and LC scores for LEF (note: in order to have the scores from RNC-to-LNC we had to reverse the 2 left ear scores to display in Figure 2). In Mr. N's case his TEC remained moderate, which indicates that AR was heavily involved.

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When scored by NOE Analysis Mary had all 4 types of CAPD. There were 12 signs of Decoding, 7 of TFM, 2 signs of Organization (out of 2) and the one major sign of Integration (Type-A, R-C) and 2 supporting signs. Based on the Buffalo Model Questionnaire her parents indicated 6/8 Decoding, 7/14 TFM, 3/6 Integration and 3/3 Organization. Thus, the family noted the behaviors associated with the same 4 CAP categories. This gives us further confidence in our assessment.

It is interesting to note, for Mary, that all 4 SSW Conditions were outside of normal limits, but 3 were mild while RC was 10 SDs poorer than the mean. That is, the Condition that we look for when there is a L-AR lesion was enormous. The other Conditions appear just run-of-the-mill problems. Have you ever wondered why the RC Condition is associated with DEC? It's because it faces the auditory cortices of the left hemisphere. One other SSW score was considerably poorer than the mean. That was the Ear HL difference of 10 points, which is more than 4 SDs poorer than the mean. This is a DEC sign that is rather infrequent in CAP cases.

If we look at Mary's Phonemic Synthesis Quantitative score it too is 10 SDs poorer than the mean. That makes sense, if the phonemic zone of the brain is affected, it would follow that the PS score would be quite severe. For Speech in Noise the right ear difference score was 4 SDs poorer than the mean while the left ear was within normal limits. Thus, even the other tests seem to reflect a severe/profound problem in the right ear system that was milder or normal in the left ear system. These huge binaural differences would be most uncommon in most people with CAPD.



## Case Study – 10-year-old who has CAPD

I tried to find a random 10 year old that was tested for the first time. After going through 20 or 25 files I found the first one. But I must admit the results were so mild that I figured you would not believe that it was random. So I went through some more and found a 10 year old, but it was too severe. I decided to find just a more 'typical' case. After 15 or so more cases I found John, a 10 year old, and gave up on finding a perfectly typical case. But at least it is between the 2 others so I guess that it is as typical as I can find.

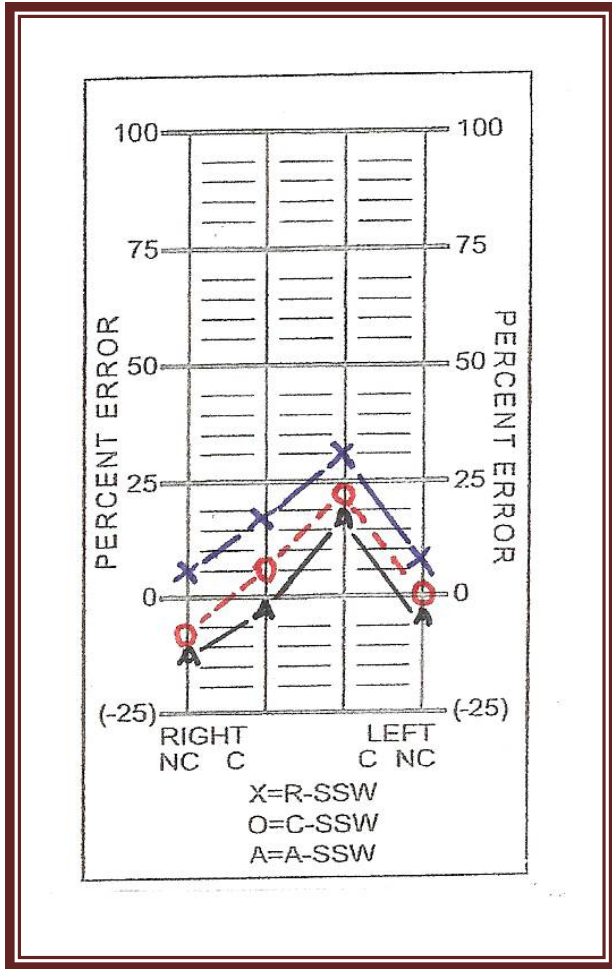


Figure 3

Figure 3 shows the result for a 10 year old boy who was found to have a CAPD. Of course, we do not plot SSW-Grams for most kids with CAPD. You can see they might not be all that interesting. For purposes of comparison, John's NOE data were converted to Original Analysis scores (% error) including C-SSW and A-SSW scores so you could see what they would look like.

I did a TEC for comparison, although that has no meaning for CAPD. He had a mild C-SSW result and it was also mild for A-SSW. If it was someone with a CNS disorder the mild score would say that the result was NAR (not involving Heschl gyrus). Since it was not moderate or severe we would not need to do an A-SSW, but I did for consistency.

Later on we will compare this to the other 2 cases with left temporal lobe involvement. And, of course, this peak is on the left side as we usually find. Occasionally, we get a right sided peak for those with CAPD but if it is not a left hander or a Type-A then it is likely a major decoding problem.

## Buffalo Model Questionnaire for Mary and John

These cases were seen before the revised BMQ was developed. Table 2 shows the results.

### Results on Buffalo Model Questionnaire

	DEC	Noi	Mem	Var	TFM	INT	ORG	CAP	Total
Mary	6/8	1	3	1	7/14	3/6	3/3	3/7	21
John	5/8	1	1	3	5/14	3/6	1/3	3/7	17

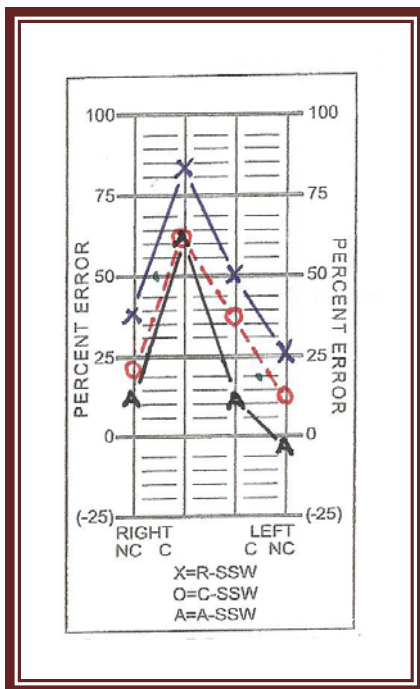
Table 2

Surprisingly, the Buffalo Model Questionnaire results were not very different as were noted on the SSW. Perhaps this is because the form provides only yes/no options and in most cases not the severity of the problems. An important factor to consider in this case is that Mary had quite a bit of therapy that can improve CAPD performance on our tests and our questionnaires while John had none.

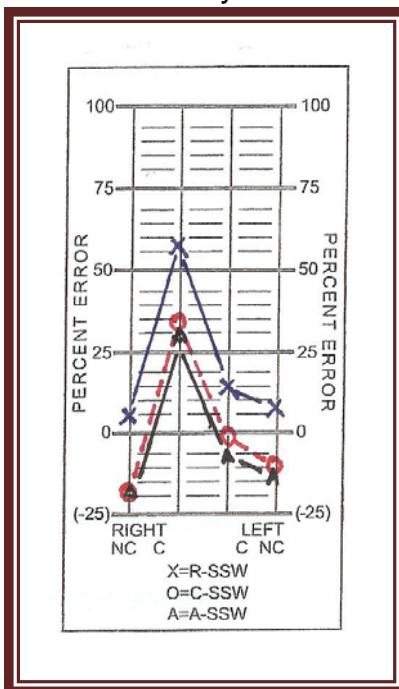
### Looking at the SSW-Grams

Looking at the first 2 graphs it appears as though brain damage likely caused major influences on the SSW test. When the known AR damage is on the left side of the brain we do see the influence in the right ear, especially the right competing condition. But when the weakness of left hemisphere function is compared to someone with strength of left hemisphere function then you typically see the better function on the right.

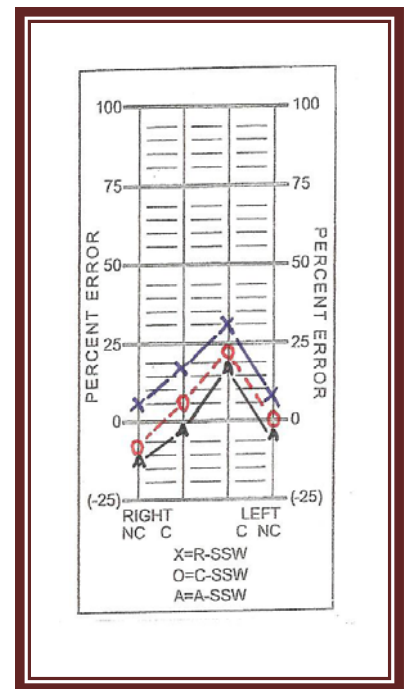
Mr. N



Mary



John



### Summary and Conclusions

It appears that the SSW is a pretty sensitive test for site-of-lesion testing too. Of course, even with the multiple measures on this test it is wise to use a battery of tests as some factors may alter one test but not the whole test battery.

I believe the important thing is to consider rehabilitation. For that we need to think about the NOE insights or at least we need to do tests that will reveal what should be done to help the individuals to get along better.

In the upcoming Advanced Workshop in September we will be discussing site-of-lesion procedures among other advanced topics. \* \* \* \* \*