4. Interpretation of SSW Results

The SSW test is a powerful APD test, but should not stand alone. It is part of the 3-test Buffalo-Model battery (SSW, Phonemic Synthesis and Speech-in-Noise). Part of the strength of the battery is that the tests are very different, so when characteristics of the 4 categories are shown by different tests, it strengthens the diagnosis. Although the SSW is usually the most sensitive test, occasionally we have someone who does not show so many signs on this test, as on one or both of the other tests.

Normal controls do well on the Buffalo Model tests. However, in 75 consecutive patients seen for APD (6-19 years of age, with normal hearing), the average number of positive findings on the SSW was 7.6 and the average for all three tests was 16.1. Usually, we look for two or more positive signs to indicate a particular APD category. The one exception is for ORG, because there is only one SSW sign for that category. Fortunately, the Phonemic Synthesis (PS) test has another ORG sign, but this is not as sensitive. So, we do see cases with just one positive sign. We can get further support for this category from the 3 ORG questions on the Buffalo Model Questionnaire-Revised (BMQ-R) (Katz and Zalewski, 2013). They can give you additional confidence of this category, if one or more of them is indicated. "Keeps things in proper sequence" is the strongest support of the 3. Because the questionnaire is filled out by the family or teacher the information is from a completely independent consideration. When $\geq$1 categories agree with our tests, it is generally the necessary support needed for ORG. Now we have 2 strong signs for INT and 2 support signs. Two strong signs, or one strong plus one support sign, are needed to indicate INT.

When we find that a person has two, or surely more, test indicators of a category it gives us confidence (which we then compare with the BMQ-R for further reassurance). Table 4-1 shows the 25 signs on the SSW and the categories with which they are related. The presence of these significant behaviors is, also important, because it usually gives us additional information about the person.

The authorities seem to agree that one or two central tests are not sufficient to confidently assess the different types of auditory factors, to establish APD. The B-M has three main tests with a total of 45 different looks at a person's auditory skills. Therefore, it adds considerable confidence when the tests support one another, regarding APD and its categories. We have no trouble indicating APD, and we use 1 SD for normal limits for children. The average child we see has 16 positive indicators of APD. The SSW is unique, because of its complexity that enables us to assess of each of the 4 B-M categories. ASHA (2005) and AAA (2010) indicate that 2 significant scores at 2 SD poorer than normal, makes the finding significant. We have many measures just on the SSW test, so if our purpose was just Yes-APD or No-APD, we would likely have an easier task than some other test batteries. However, the B-M purpose is much more than Yes-No. We want to know what is wrong so we can address the person's weaknesses.

We don't want to misdiagnose anyone, and we surely don't want to miss some of those, really smart kids that we see, who have learned to compensate for their difficulties, but have not improved them. In addition, there are so many children with APD, who have years of speech and reading therapy, as well, as other services that have helped to improve APD, somewhat, but has made these children much more sophisticated on our tests than the control children. See side-bar on page 3.

Twenty-Five Diagnostic Indicators of the SSW Test

#	Indicator	Category	Comments
1	Total NOE (Tot NOE)	Various	DEC, TFM and INT contribute to it
2	Right Non-Competing (RNC)	Various	DEC and/or TFM contribute to it
3	Right Competing (RC)	DEC	With Left AR lesions big RC peaks- not APD
4	Left Non-Competing (LNC)	DEC	Infrequently memory
5	Ear Effect H/L (EE HL)	DEC	*Probably not void if Type-A is significant
6	Order Effect L/H (OE LH)	DEC	*Probably not void if Type-A is significant
7	Delay (X)	DEC	Most common qualifier- unless few correct
8	Perseveration (P)	DEC	Not (P) if it is in the same item
9	Quiet Rehearsal (QR)	DEC	Even silent movement of lips
10	Smush-2 (SM-2)	DEC	New signs. Often noted in intellectually challenged adults and then some of those with CAPD. Not extensively checked out.
11	Back-to-Back (BTB)	DEC	
12	Intrusive Word (IW)	DEC	
13	Left Competing (LC)	TFM	But if INT case, LC largely INT as well
14	Ear Effect L/H (EE LH)	TFM	Void if Type-A is significant
15	Order Effect H/L (OE HL)	TFM	Void if Type-A is significant
16	Quick (Q)	TFM	Memory or impulsivity – both TFM
17	Smush (Sm)	TFM	Combine RC & LC not necessarily a word
18	Yes (Y)	TFM	Responds to AYR (see AYR)
19	Are You Ready (AYR)	TFM	Responds to all heard, trouble omitting it
20	Tongue Twister (TTW)	TFM	? APD (motor planning) but sits in AP area
21	Type-A (Tp-A)	INT	Most important INT sign
22	Standard Integration Ratio (SIR)	INT	More common INT sign (newest sign)
23	Extreme Delay (XX)	INT	Supports INT, though sometimes DEC
24	Integration Delay (IX)	INT	Waiting to say, infrequent sign but strong
25	Reversals (Rev)	ORG	Some may be a strategy with/without ORG
	All Three B-M Tests		≥2 indicators by ≥3 SDs out of 9 important indicators. A measure of APD severity
	Two-By-Three (2B3)	INT	

Table 4-1. Summary of 25 CAP indicators on the SSW and one sign based on all 3 B-M tests. Two signs are associated with more than one category (Various). More signs are associated with Decoding (DEC), Tolerance-Fading Memory (TFM), and Integration (INT). Finally, there is one new sign on the SSW for Integration (INT). Also shown, is one sign of INT that is obtained from 9 measures derived from all 3 B-M tests. * All 4 of the Ear/Order Effects were void if there was a significant Type-A. The 2 DEC signs would not be produced by a Type-A LC.

The BMQ-R has been shown to be a reliable companion of the Buffalo-Model tests (Justras, Loubert , Dupuis et al, 2007; Pavlick, Zalewski, Gonzalez, Duncan, 2010; Reeves and Lucker, 2017). It is filled out by parents, teachers and/or significant- others regarding characteristics that would suggest APD categories and APD, in general. This provides a completely independent assessment of the patient's progress. Despite the assessment by parents with various levels insight and willingness to identify auditory weakness etc. the SSW (and other 2 tests) shows impressive correspondence with the BMQ-R.

The B-M Uses 1-Standard Deviation

I am more concerned by false-negative, than false-positive responses. If someone comes for an APD evaluation; because of a problem, and their BMQ-R signs are ample, then there is an excellent chance that APD will be present. In 75 children, seen for an APD evaluation (discussed below), the person with the fewest positive findings on the B-M test battery was someone with 5 positive findings at 1 SD (that I typically, use except for those 12 – 59 years). The next fewest errors were for someone with 7 significant indicators. On the other end there were 3 children with 23 or 24 positive findings. The support for APD was not only from the specific Buffalo-Model tests (with the ≥8 criterion, I use), the parents taking their children out of school and paying good money for the assessment. We are not satisfied with just getting significant test results. We then want to compare the significant categories on the tests with those categories shown on the BMQ-R. We are extremely confident in our diagnosis of APD and yet we have 2 more checks when we do therapy. We expect not only significant improvement on the tests, but the parents/ teachers are asked to rate if there was any progress in the areas of initial concern that were associated the therapy. The mean improvement is rated as moderate (Katz, 2009). Clearly, we do not over-diagnose APD.

Contributions of Observations and Qualifiers for the SSW Test

In addition to the benefits of the 5 major Quantitative scores on the SSW test and the B-M, important information is obtained from observations, Qualifiers and Response Biases. Most users of the SSW test are aware of the Response Biases but not so many may be aware of the Qualifiers and know their importance. Response Bias, that was uncovered over the first 5 years of SSW when it was used with site-of-lesion cases. It refers to basic comparisons of different SSW scores as well as word reversals. The six Res-ponse Biases include two Ear Effects, two Order Effects, the Type-A pattern and Reversals. Now we can add Standard Integration Ratio. Those that were uncovered after that are called Qual-ifiers. Qualifiers refer to analyses of the person's response. These are more subtle signs of how the person responded. These 13 indicators deal with the quality of the response. The Qualifiers are Delays (X), Quick (Q), Perseveration (P), Smush (Sm), Smush-2 (Sm-2), Quiet Rehearsal (QR), Are You Ready (AYR), Yes (Y), Back-to-Back (BTB), Intrusive Word (IW), Extreme Delay (XX), Integration Delay (IX) and Tongue Twister (TTW).

When people look tired or their responses become goofy, it is time to take a break, rather than adding fatigue or attention errors to the true auditory processing problems. In this way we can have more confidence that we are studying the person's APD. Of course, those we work with have more fatigue and inattention due to their APD, so their performance (e.g., late in the school day) can look like something even more severe than what we see. When we note eyes glossing- over or weird responses, we should give the person a break. I like to do Jumping-Jacks, or let them draw, have small talk, or whatever.

However, even during their good performance, we can gather valuable information from Qualifiers. Qualifiers cost nothing and yet they provide valuable insights into AP deficits. When a person shows these signs, often forms of compensation, or revealing their type of auditory challenge (e.g., delays, quick response, smush-2) this can give further insights into the person's challenges. Otherwise, sometimes smart and hardworking individuals will not get the services they need. I think it is unfortunate that other APD tests, and for that matter, other hearing tests, do not benefit from Qualifiers.

When a person has delays (X), usually on more than one test, it suggests that it takes them longer to decode speech. Although we have no norms, with experience, we can note delays on speech-in-quiet and speech-in- noise tests as well as the other B-M procedures. Even a quick response (Q) can reveal processing related issues. Quick responses are associated with either short-term memory difficulty and/or impulsivity. Both of these deal with anterior brain dysfunctions and are considered TFM related problems. Likely, if they had replied more slowly, they might not remember all that they meant to say.

Unfortunately, when we normed the Buffalo Model tests I did not include Qualifiers for speech-in-quiet and speech-in-noise: e.g., Xs, Ps and You Will Say (YWS), as the first two are likely to support DEC and the third one TFM. I do note these for my own information although there are no norms.

Guidelines for Determining Significance

Why am I so confident that those that I get to evaluate have significant APD? 1) So many communities, schools, professionals, audiologists and SLPs (especially in the past), did not believe there was such a thing as APD, or said that it was not important. 2) So, many of the people who reached us for help, had to fight, or at least, ignore all the chatter (and dire warnings) about auditory processing. 3) So, many people, finally discovered that there was something called APD, after other approaches failed, and their child was still suffering. 4) Other people lived in places where there were no services for APD and so they had to travel long distances, and struggle to come up with the hundreds of dollars for an evaluation. They came from Canada, Hawaii and other states to get the evaluation. 5) In addition, before we schedule an evaluation we review all the information sent regarding the person including the BMQ/-R and our case history form. The materials are reviewed to see if there are any questions, or if the person does not seem to have APD. 6) I use 8 positive items on the BMQ for sufficient confidence of APD. This was because I had not had a person with APD who had less than 8 items on the BMQ. A few years later we gathered norms for BMQ and 8 positive items turns out to be 5 SDs poorer than the mean for those normal-control children (see Table 4-2). Despite the likelihood of the person having APD, my final determination, to evaluate, is on a case by case basis.

On rare occasions, after an evaluation, when APD was not clearly present, but likely we weren't seeing the whole problem, I erred on the side of caution. I would tell the parents what we found, or didn't find, and why I have decided that it is <u>better</u> to err on the side of inclusion rather than exclusion. If a person is told that they do not have APD, the chances that they will ever get help in the future are slim. The harm that is done to a child with mild APD, or no APD, getting therapy, is far less than a child with APD not getting therapy.

A Little Study for this Manual

We looked at 75 consecutive patient files, from the last few years, for children ages 6 to 19 years, with normal hearing. Their mean age was 9.9 years and about one-third (36%) of them were females. See Figure 4-1 for the mean performance and ±1 or 2 SDs, on the 3 B-M tests.

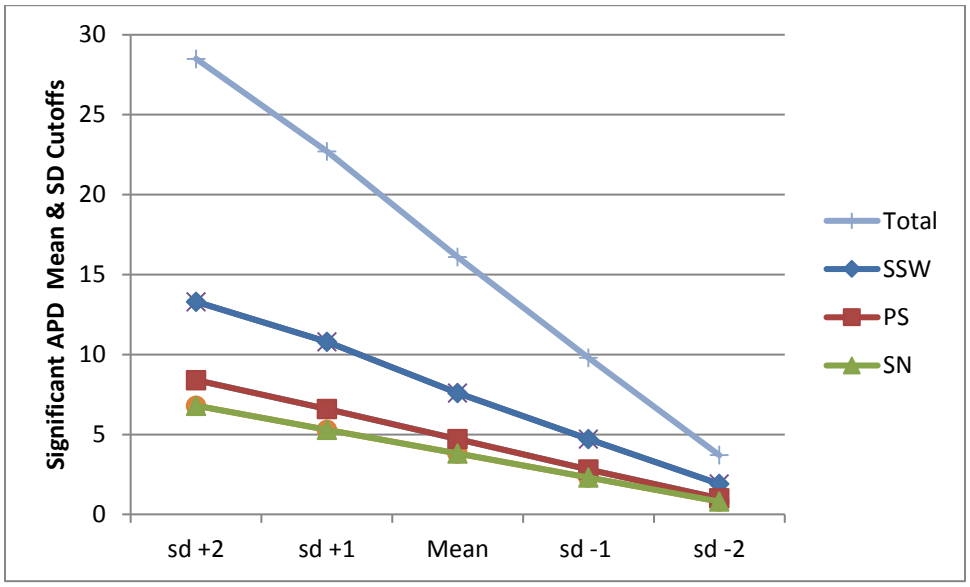

Figure 4-1. This shows the number of significant findings on the Buffalo-Model tests (SSW, Phonemic Synthesis and Speech-in-Noise), and Total, based on group (6-19 years) means and standard deviations. This can suggest the severity of group performance for children who take the Buffalo-Model tests.

If one is curious about severity of a person's scores this chart might be helpful. I don't usually indicate the apparent severity of the problem in my reports etc. I don't think that it helps the family or the child, but of course, it is often important to let the school know when they are not providing sufficient help for the child. Regardless, of the relative scores, the children will benefit from therapy. The purpose is to help the person improve as much they can, regardless of where they are on the scale.

Buffalo Model Questionnaire/ – Revised (BMQ/-R)

The BMQ/-R has 39 items dealing with characteristics of those with APD divided into each of the B-M categories and sub-categories. There are also 9 other items that deal with related problems. Table 4-2 is based on data from the BMQ (Katz, 2011, Table 1-A2). It shows the results for 35 normal-control children and 170 children with APD (6 to 19 years). Normal Limits (+1/+2) are shown for each APD score, category or sub-category, that could be considered significant for a child.

BMQ	A. Normal Controls (NL)					B. CAPD - Severity			
	A. Control Children					B. Children With APD			
Factor - # Items	M	SD	NL @ +1	NL @ +2		M	SD	Severity (+1 SD)	Severity (+2 SD)
DEC- 9	**0.1**	**0.4**	**0**	**1**		**4.4**	**1.9**	**6**	**8**
Noise- 4	*0*	*0.2*	*0*	*0*		*2.1*	*1.2*	*3*	*5*
Memory- 6	*0.5*	*0.7*	*1*	*2*		*2.8*	*1.3*	*4*	*5*
Various- 4	*0.2*	*0.4*	*1*	*1*		*2.1*	*1.2*	*3*	*5*
Sum TFM- 14	**0.7**	**1.0**	**2**	**3**		**7.0**	**2.7**	**10**	**12**
INT- 6	**0**	**0.3**	**0**	**1**		**1.6**	**1.4**	**3**	**4**
ORG- 3	**0.3**	**0.5**	**1**	**2**		**1.7**	**1.1**	**3**	**4**
CAP- 7	**0.2**	**0.4**	**1**	**1**		**3.1**	**0.8**	**4**	**5**
Total APD- 39	**1.4**	**1.3**	**3**	**4**		**17.8**	**5.4**	**23**	**29**

Table 4-2. Positive results, for 35 control children (temporary normal limits) and those with APD (severity compared to 170 with APD), on the Buffalo Model Questionnaire (based on Katz, 2011). Categories and sub-categories shown with number of items for each. Means (M), Standard Deviations (SD) and Normal Limits (NL) for +1 and +2 SD are shown for normal controls. (B) These results are for those with APD, to suggest how severe compared to a sample of that population.

Statistically, (based on this small sample) a total CAP score of 4 would be significant at 1 SD and a score of 5 would be significant at 2 SD. However, since ~2007, I have used a score of 8 as a minimum, to assure me, that the child is appropriate for APD evaluation, using the Buffalo Model test battery. The reason why I still use, such a conservative criterion, is that years ago we studied a large sample of those who were found to have APD. The smallest number of items noted was 8. Because that has proven so successful, I continue to use this criterion. However, if someone, who is referred, has less than 8, I will make a closer analysis to be sure that this is not a false negative finding. A smart, hardworking person, and those who had great deal of speech and/or reading training, could appear to have little, if any, APD. They may well have significant APDbut, are much more sophisticated and able to manage in school, by extremely long, hard work and perhaps, tutor/parent help. Some of these students; even beat most of the quantitative aspects of our tests, but when combined with the Qualifiers we would have much stronger evidence.

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