SSW REPORTS

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DEAR ACKIE

Dear Ackie:

Last week I used the Central Test Battery - CD for the first time. It was great, not having to listen to all of those calibration tones and not worrying about the speech-in-noise score norms. But I found, if a kid missed an SSW item, they missed it, because I can't replay items on the CD, without going back to the beginning of the test. I'm not too "CD sophisticated". Is this true for everyone, or does my boss have a cheap CD player? Will this have much impact on scores?

The Vegetarian

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Dear Veg (please excuse the informality):

Glad you like the *Central Test Battery - CD*. It is surely a time saver. No popping in tapes and rewinding them. Once you learn the procedure you can zip quickly from one test to another.

Now for your question, my guess is that you have not learned about the micro-adjustment feature of your CD. If you click the CD back arrow once and it will go back to the beginning of the test (as you already mentioned), but if you keep your finger on the back arrow it will move back in time (like rewind on a tape deck). First check the meter for your position on the CD and then practice 'rewinding' a few times to see how long it takes to go back one item. It is less precise than a tape, for me (as I too am a novice at the CD), but teenagers assure me that I will get better with time.

I doubt that your boss has a cheep CD player (or if it is, that's probably not the problem) as I bought a portable CD player this week for $99 and it has the micro-adjustment feature (forward and backward). If my suggestion does not work after 10 minutes of terrible frustration and bitter unhappiness, ask the next teenager you see. If the teen can't get it to work, it's the cheep CD player your boss has provided.

You also ask, *if* you can't go back and repeat an item, how serious is the effect? Generally, it's a very small difference. A) I typically replay for fun. Out of curiosity I replay to see what the person will say, and then decide which of the two answers is more helpful (nothing scientific about it). B) Of course, on rare occasions, I will have to replay if the person is talking, coughing, or if the headphones are off (as errors at such times are meaningless).

How often do you replay an item? I probably replay on the average, one item per test, for fun. It makes a difference of perhaps one or two words (a small effect), *even* if you choose to calculate the retest instead of using the original answer.

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USING THE CTB-CD SPEECH-IN-NOISE FEATURES

The Speech-in-Noise test on the Central Test Battery–CD is extremely useful, 1) because it is normed on the specific words (W-22 list 3-D) as well as 2) on the specific (speech-spectrum) noise of the CD, and 3) for the different age groups! This is a great advantage, because you do not have to get your own norms. You are expected to get your own local norms for Speech-in-Noise tests, if there is no noise provided on the recording you are using. This is especially true for tape recordings, as they tend to show age effects, over time (not to mention stretching etc.).

Now, it will take a little time for you to get used to the test, because it is not set at the same difficulty level as the previous tests we used. But, this should not be a major problem, as the norms indicate both the normality/abnormality of the performance and the severity of each score. While the absolute number of the difference score is not the same as we used before, the relative score is, no doubt, the same. Using the new norms, you should get a lot of payoff for the inconvenience of learning the new norms.

A Case Study

Rosie, a 5-year-old girl, had a long and severe history of middle ear pathology, starting in the first few months of life. Not surprisingly, she was slow to develop speech and oral language. Rosie also tended to play alone and to be confused when people spoke to her.

Her parents sought help when she was 3-yr-old. Her hearing was essentially normal and although her tympanograms were not ideal, they did not show evidence of gross pathology. Because she was below the age norms of our CAP tests, we were not able to test her formally. Instead, her parents were given instructions on how to provide auditory stimulation that would encourage more normal processing. Because the problem appeared to be one of Decoding (DEC), we told the family to read to Rosie at close range, to read slowly and clearly. We recommended the use of speech-sound discrimination training and Phonemic Synthesis by the speech-language pathologist who was working with the child.

The family returned for a reevaluation, because Rosie appears to have difficulty "hearing" at school. She is also having listening problems at home. Thus, the family suspected that auditory processing might be a factor. For example, Rosie does not hear well from another room and it is difficult to get her attention.

Over the 2 year period since she was first seen here, Rosie's speech showed great improvement (during the testing only one PL-blend was misarticulated) and her language is appropriate for her age. Her puretone thresholds were similar to our earlier test and her word recognition scores in quiet were very good. The 20-item[1] SSW test results were normal for the 4 Conditions and Total NOE score. However, there were 2 abnormal Response Biases. She had an Ear Effect L/H, suggesting Tolerance Fading Memory (TFM) problems and 3 Reversals, consistent with Organization (ORG) difficulty. She also had Tongue Twisters (TTW), a Yes (Y) and an Are You Ready (AYR) response, all of which are TFM signs.

Because of her extensive phonemic training and the lack of DEC signs on the SSW, we decided to use her limited attention on the speech-in-noise task of the CTB-CD, rather than give her the PS test.

Unlike our previous Speech-in-Noise (SN) test, the CTB-CD requires a signal-to-noise ratio (S/N) of +5dB (not +10). This is explained by Dear Ackie on page 6.

[1] Recall that for 5-year-olds, only the first 20 items are scored.

Rosie's Quiet and Noise scores are shown in Table 1.

Ear	Quiet	Noise	SND	Norm	Sev
RE	96	68	28	27	MI
LE	96	40	56	30	S
IAD			-28	-11	S

Table 1. W-22 word recognition test results for both quiet and noise conditions using the CTB-CD. SND is the speech-in-noise difference score (quiet minus noise), the *Norm* is the 3/98 SN norm, and *Sev* indicates the severity level.

Rosie performance in noise fell sharply from her scores in quiet (96% in each ear) to significant scores in noise, especially for the left ear. Most authorities agree that the speech-in-noise difference (SND) score is the most important factor. To determine the SND scores, the score in noise is subtracted from the score in quiet for each ear.

We see that the SND in the right ear is 28% and in the left ear 56%. The larger the difference, the greater the apparent problem. For a 5-year-old, 27 and 30%, respectively, are the limits of normal for the right and left ears. Both scores exceed these limits.

The inter-aural SND (IASND) score is based on the common observation that two ears of about equal abilities are needed for localization of sound and for the binaural advantage in noise. We have treated this factor in the same way as we did the RE and LE scores. Based on the 3/98 norms, the mean IASND (SND_R minus SND_L = IASND) is –2.7 (SD = 8.3) for 5-year-olds. The normal limit is -11. Thus, smaller values, e.g., -12, are abnormal. Clearly, the -28 is considerably poorer than the norm.

We now have severity ratings for all three SN scores (i.e., SND_R, SND_L, and IASND). The 6/98 norm shows these severity ratings (see Table 1) as mild in the right ear, severe in the left, and severe for the IASND score.

For those of you who do not know where I am getting these numbers, recall the norms that were sent out to you with the Feb. issue of SSW Reports. These norms are only applicable for the CTB-CD. If other SN tests are used (or other signal-to-noise ratios, or lists other than the specified ones are given) the use of these norms will surely give misleading information. *If you are a new subscriber and have not received these norms, please let me know.

Discussion

This was a most interesting case, because it was a 3- year-old child with a high probability of CAPD, particularly DEC. Early attention to the problem appears to have had a positive effect on the DEC symptoms. Indeed, there was no evidence of a DEC problem on the SSW when she was retested two years later. What did appear when she was formally tested, are TFM and ORG signs. These types of CAPD help to account for most of the present difficulty she is experiencing.

Rosie seemed to have learned natural compensations for her difficulty. She comes close to the person she is talking with and is most attentive to their faces. Because she is a bright girl, she has gotten by in school and at home fairly well, despite the significant TFM problem that was demonstrated on the SSW, and more so on the SN test. At this time, it is not clear if she has a short-term memory problem (that is also required to label it an TFM disorder), but based on the parent's report, this is very likely.

We see from the SN test, that Rosie has one ear that is mildly affected in noise, one that is severely affected in noise, and a large difference between the ears that obviously reduces the binaural advantage.

+5 Signal-to-Noise Ratio

Please remember for this CD, we use only a +5 S/N, at the present time. In the future we

may have norms for other S/Ns; however, in the meantime the present norms appear to provide very good information about this aspect of CAP.

List W-22 3-D on this CD is the one that we have normed for the noise test (1-D for the quiet test). Be sure to:

- Use a +5 S/N
- Present at 40dB SL to the speech channel and 35dB SL to the noise channel.
- Use the speech spectrum noise on the second channel of the CD (and not the audiometer masking).
- Route both channels to the same ear

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ARE THERE SSW NORMS FOR 4-YEAR-OLDS?

Since 1982, audiologists have kindly sent SSW data for children below the age of 5, in the hope that someday we might have a norm for 4-year-olds. This would be most desirable because we can work therapeutically so much more effectively with younger children than older ones, or adults.

Consider, Rosie, the child in the previous article who overcame her Decoding problem to a great extent, as a result of early intervention. Had we known about her Speech-in-Noise difficulty, it is likely that she would have made significant gains in that area, as well, before she got to school and faced difficulties.

We now have data for 11 children, ages 3-7 to 4-11. You might be wondering how one could test a 3-year-old child, given your experience with testing 6- and 7-year-olds who were not so easy to test. This same question may have crossed the minds of the audiologists who submitted the data, as well. We were pleasantly surprised both by the ability of the children to take the test and how well they did. Be mindful that we only used the first 20 items of the SSW EC list for this testing. Because we use the first 20 items for 5-year-olds, we felt it was only fair to limit the number of test items for those who are younger than that.

It is too early to know if we have a reasonable norm for 4-year-olds. My one concern is that we have chosen children who are most likely to *take* the SSW test at these tender ages. They may not turn out to be the typical children that we seek out for a norm. The next question is, are these data meaningful?

To answer this question, let's look at the data. See Table 1, below, for the raw data.

Age	RNC	RC	LC	LNC	TOTAL
3-7	2	10	8	1	21
3-11	2	8	9	2	21
4-0	1	8	9	0	18
4-2	0	1	6	2	9
4-3	0	8	14	4	26
4-5	6	10	10	3	29
4-6	2	3	4	1	10
4-6	4	12	7	3	26
4-8	0	5	7	1	13
4-10	2	6	9	3	20
4-11	6	9	8	2	25

Table 1. Results for control children under 5-years-of-age, on the SSW test Conditions and Total NOE score.

You can see that the data are entered from youngest to oldest. The Total NOE score is the best single indicator of SSW performance. For this measure there appears to be no relationship between age and score for these young children. In fact, the two children under 4-years-of-age had Total scores of 21 errors on the 20 items (80 words) of the SSW test. This is almost identical to the 20-error mean for the entire group of children. It is reasonable to keep the 3-year-old data in the sample (also because of the difficulty we had in getting the data). The zero correlation (age vs. Tot NOE: r= .05) shows age to be an insignificant factor in this sample.

The data for the 5-year-old children are the best ones for comparison to see if the new 4-year-old data are coherent. That is, do the data for 5-year-olds logically follow from the younger group?

Table 2 shows the means, standard deviations and normal limits (set at +1SD) for the "4-year-olds" and 5-year-olds. As noted above, 2 of the 11 children were actually younger than 4.

Age		RNC	RC	LC	LNC	TOTAL	REV	EAR	ORD	TYP-A
4-yr	Mean	2.3	7.3	8.3	2.0	19.8	1.5	-1.8	0.2	0.0
	SD	2.20	3.26	2.53	1.18	6.74	1.44	2.86	4.79	2.49
	1-NL	**5**	**11**	**11**	**3**	**27**	**3**	**-5 +1**	**-4 +4**	**5***
5-yr	Mean	0.9	7.2	7.7	1.3	16.9	0.3	-1.1	0.2	0.8
	SD	1.0	3.3	3.2	1.3	6.2	0.4	2.3	4.1	1.8
	1-NL	**2**	**10**	**11**	**3**	**23**	**1**	**-4 +1**	**-4 +4**	**4**

* The normal limit for Type A is set at +2 SDs above the mean. This criterion is consistent for all age groups.

Table 2. The means, SDs, and normal limits (1-NL) for the present sample of children in the 4-year age group compared with the 11-98 norms for the 5-year-age group. The variables are, the four NOE SSW scores (number of errors), the Total NOE score, and Response Biases: Reversals (total number), Ear Effect (difference between REF minus LEF errors), Order Effect (difference between 1st spondee errors minus 2nd spondee errors), and Type A difference scores (errors for column F or B minus highest of remaining 7 columns).

It can be seen that for most of the 9 factors, the 4-year-olds have poorer mean performance than the 5-year-olds. The exceptions are Order Effect and Type A. For Order Effect the means are the same and for Type A the difference of 0.8 is of little importance. Not surprisingly, there was some variation in both directions for the SDs when comparing the two age groups.

The important normal limits (set at 1 SD from the mean for 8 variables and 2 SD for the Type A) were quite coherent, as well. However, the slightly smaller SDs for the 4-year-olds caused the LC and LNC Condition limits to be the same as for the 5-year-olds. We find lack of change for some factors in other age groups. Of the two LC 1-NLs the 4-year-old value seems more reasonable because it's slightly poorer than the RC. In young children the right-ear-advantage is usually much smaller than in older children, because the hemispheres are thought to be more equipotential.

I wonder if the difficulty specifying during the preschool years, who will be a great learner and who won't, played into our hands this time. My guess is that this sample contains children from a wider range of skills than I had originally thought

It is surprising how appropriate the norm appears to be. If you have any normative data to contribute to this 4-year-old norm, it would be greatly appreciated or if you test some children who have problems, this would be equally interesting.

If this works out to be a reasonable norm it will extend the SSW down one more year and make the testing, that we do, that much more valuable because of the likelihood of improving the system with therapy.

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DEAR ACKIE AGAIN??

Dear Ackie:

Some Speech-in-Noise tests call for +5dB S/Ns and others +10dB. Which is better? Which should it be?

Slightly Confused

Dear Slightly:

Slightly confused, I'm impressed. This is very confusing for many people. I will try to clarify the issue and the problem thusly,

1. Speech-in-noise is not a specific test, it is a task! There are infinite variations that aim to find out the person's ability to understand speech in the presence of noise.
2. Let's liken it to swimming. How many meters a minute can you swim? "Well I can swim xx in a swimming pool, but only about yy in the ocean. Of course, if the ocean is rough, I'm even slower, perhaps only zz.
3. Just like swimming time, speech-in-noise is not a specific test, but a general task. One has to specify the conditions before you can state an approximate number.
4. It is reasonable to assume that those who are the best swimmers will be faster than the poorer swimmers, even (or especially) under poor swimming conditions. But you can be sure the actual speeds they achieve will be different (i.e., poorer) under the difficult conditions.
5. In general, what makes word recognition tests more difficult? If the speaker does not pronounce the words clearly, speaks too fast, or uses words that are not as familiar. What else? The quality of the equipment to record and play; tape noise, as well as any damage such as aging or stretching of the tape. What else? The noise used, such as white or speech-spectrum noise, or speech babble, might differ from one test/audiometer to the next. Obviously, babble can differ, but so can the other noises. E.g., the level the acoustical engineer sets as zero on the VU can have a great effect on the S/N.

   In addition, we found when changing from an old GSI audiometer to the GSI-10, that the speech spectrum noise had changed. It was so much more challenging that we had to change from a +5 to a +10 S/N, and renorm the procedure.
6. If we use the old Rush-Hughes test for a speech-in-noise procedure, we would not be able to use even a +10 S/N, because the words are so difficult that too many people would be "scrapping the bottom", yielding a small range of scores for both the normals and those with true SN problems.
7. The Central Test Battery-CD specifies a +5 S/N, not for any lofty purpose, but just because it was not too difficult and not too easy. I felt that +10 was too easy and therefore would not identify people with milder problems.
8. In developing SN test protocols, I generally look for a combination of speech and noise that will show none of the 8 or 10 normal adult listeners to lose ≥20% from the quiet condition; however, produces about a 5 to 15% drop for each listener. This generally translates into a pretty good test for children, producing major shifts in noise for those with problems.
9. It is most desirable to limit the variables to narrow the SDs. In the CTB-CD specific words are used for $Quiet_{RE\&LE}$ and $Noise_{RE\&LE}$, S/N etc. Thus, the SDs are smaller and more meaningful than if a wide range of options were available.
10. Once the proper variables are chosen, the next critical step is to norm this specific test procedure for the various age groups.

That's it Slightly!

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