# SSW REPORTS . . .

1. Site-of-Dysfunction Findings
2. CAP Insights
3. Both in One Case

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## Site-of-Dysfunction & CAP Evaluation: A Case Study

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Usually a patient is referred for either a CAP or a site-of-dysfunction/lesion evaluation, but not both. The dichotomy is useful because it tells us what the referral source needs to know. However, the dichotomy is an artificial one.

Whatever befalls the brain represents a certain site and impairs certain functions. The disorder is somewhat unique to that particular place in the brain because that's where certain functions reside. When we administer a site-of-dysfunction battery the question is, "Where is it?" and if it is a CAP battery the question is, "What's the matter?".

Because some of our tests, the SSW for one, provide both types of information, we may be able to provide not only the site for the referral source, but perhaps some insights into the auditory disabilities as well as some ideas for ameliorating them.

A very nice Speech-Language Pathologist referred an aphasic patient for a site-of-dysfunction demonstration. At that time no information was available to indicate where the lesion was.

**Background**

The patient was a 41 year old man named Donald. At age 38 he experienced a cerebral vascular accident (CVA), which was classified as a nonhemorrhagic infarct, apparently due to an embolus. This caused extensive involvement of the posterior portion of the left temporal lobe and left parietal lobe. Eleven months later he had heart surgery to increase his blood circulation and in order to avoid the formation of future emboli.

Donald received speech-language therapy at a local medical center. Three months prior to the audiologic evaluation he was referred to the University at Buffalo Speech-Language and Hearing Clinic. The therapy focused on improving his functional communication, including his auditory comprehension, word retrieval and reading comprehension.

Improvements have come slowly for Donald. He continues to have difficulty with auditory comprehension for on going speech, has problems monitoring himself in conversation, as well as utilizing compensatory strategies, improving reading comprehension and note-taking.

Donald had been a construction worker, but was unable to continue, as a result of his medical problems. He wishes to return to school to become an auto mechanic. This necessitates improved communication and reading comprehension. Therefore, when the invitation came to serve as a demonstration case, it was opportune. He readily

agreed to the evaluation, if it could help others with similar problems.

**Interview**

Prior to the assessment, we talked for a few minutes with the patient about himself and his difficulties. Donald indicated that although he is able to hear fairly well, he has great difficulty grasping what he hears. His explanation made us feel that the words went by too quickly (poor phonemic decoding), but also that he felt that he understood what was said, at some level, but was unable to say what it was (some sort of disconnection).

We gave Donald an informal phonemic discrimination test. He was asked to name the letter associated with the following sounds. For /b/ he said "B"; for /s/ he imitated the sound correctly and said it was "a snake sound"; for /r/ he said it was "a roar" then made the sound and said it was "a motor". Finally, for the /l/ he responded "O" (a common mistake by those with CAPD). It is not clear if the last one was an attempt to imitate the sound or to indicate the letter.

His responses were rather revealing. He gave evidence of pretty good discrimination for phonemes, except for the /l/. Only the first one did he match up with the appropriate letter. The other phonemes were imitated and associated with "environmental" sounds, as if analyzed by the right hemisphere, rather than the left.

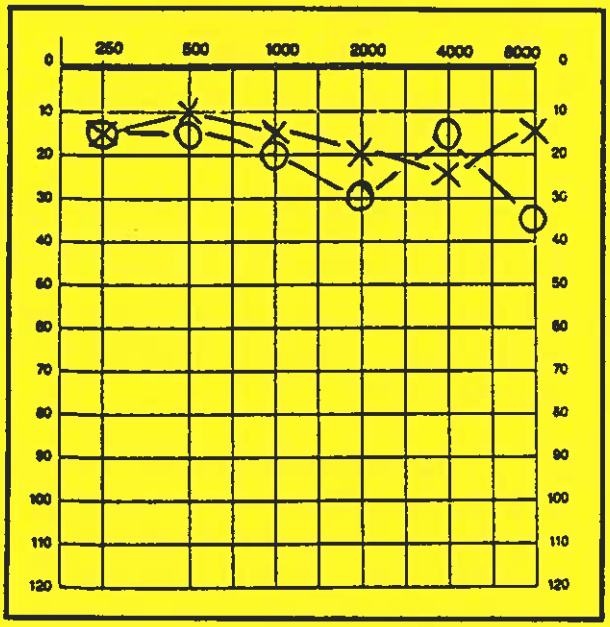
In addition, he pointed out that, although he is able to hear fairly well, he has great difficulty grasping what he hears. His explanations suggested that the words went by too quickly (poor phonemic decoding). There was also the sense that he often understood what was said, at some level, but was unable to express it (as if there was some sort of disconnection).

Thus, an auditory reception (AR) or at least a phonemic decoding problem was suspected in this case. In addition, a disconnection was quite possible. That is, that part of his brain was aware of the information, but that he was unable to express it verbally.

**Basic Hearing Evaluation**

Donald indicated that although he has worked in a noisy industry, that he did not feel that he had a significant hearing loss.

Puretone thresholds were essentially normal in each ear (see Figure 1). This supported the patient's contention.




We attempted to evaluate him using W-22 on a new CD, however, the words zipped by him so quickly that he had no idea of what the words were. Therefore, the audiologist delivered the words live voice in a rather slow fashion. Now the patient could catch the words, but was unable to indicate what he heard. For example for the word 'carve', he said, "it's like the word 'car', but it's not" and gestured with his hand to indicate the ending was different. He was asked if the word was 'cars' to which he replied 'no'.

No multiple choice tests were available and therefore gross over estimations of his discrimination difficulty were obtained with scores in the 60 to 80% range. His word recognition ability is likely to be in the 80 - 96% range, especially when retested

## INSTRUCTIONS FOR AUDIOLOGIST

### SSW MULTIPLE CHOICE TEST
(items 1 - 20)

### SETUP

1. Test conditions as usual, except a helper would be useful and
2. the test chamber should be properly lit and the patient wearing glasses as needed.
3. If no helper, have patient sitting at table in test room so he and the items (on opposite side of this page) can be viewed.

### INSTRUCTIONS

1. Give standard instructions as on tape, except that patient should point and/or say the words.
2. Answer should be chosen from the choices given for the item.
3. To help the person keep on the line a blank sheet should be used to underline the item.

### RESPONSES

1. If helper is available, have this person say the words if the patient simply points, or
2. if the patient points and says a different answer the helper should so indicate to the audiologist.
3. If there is no helper and the patient is pointing only, then the audiologist will need to monitor the answers (generally through the windows of the control room.

### INTERPRETATION

1. We have no special norms for this version of the SSW test. In some ways it is certainly an easier task as each of the words (plus two) are given (don't tell this to the patient!).
2. However, it is a greater challenge for the patient's memory, especially if reading or vision are not too good.
3. Using a WIPI or another multiple choice discrimination test would seem most appropriate if you plan to use the C-SSW score.
4. Because the patient may point to the word that is recognized, but not necessarily in order, some of the items may be out of order and look like sequencing error when they may not be such.

** Thanks to our fine student Claudia M. Villaman for typing up the multiple choice test.

SSW MULTIPLE CHOICE TEST

| Item | Choices | | | | | |
|---|---|---|---|---|---|---|
| a. | wet | milk | plane | air | shake | paint |
| b. | cow | soap | bread | white | flakes | boy |
| c. | west | way | juice | stair | fruit | north |
| d. | dog | light | meal | oat | bull | flash |

| Item | Choices | | | | | |
|---|---|---|---|---|---|---|
| 1. | stairs | town | brush | up | tooth | down |
| 2. | in | cup | side | cake | law | out |
| 3. | tin | light | time | can | day | lunch |
| 4. | wash | light | board | tub | night | black |
| 5. | meal | chain | corn | oat | key | bread |
| 6. | mush | ground | play | spread | room | bed |
| 7. | light | starch | gate | corn | flood | flash |
| 8. | day | side | birth | shore | sea | out |
| 9. | meat | lamp | light | sauce | base | ball |
| 10. | board | door | black | air | knob | mail |
| 11. | wood | house | cage | work | fly | bird |
| 12. | end | green | land | week | home | bean |
| 13. | book | shoe | day | shelf | shine | sun |
| 14. | house | walls | dog | white | wood | work |
| 15. | hand | ground | play | door | back | ball |
| 16. | fish | church | bell | net | boy | school |
| 17. | snow | man | ball | foot | milk | white |
| 18. | saw | aid | sheep | first | band | skin |
| 19. | black | blue | race | bird | jay | horse |
| 20. | cream | string | sweet | ice | bean | land |

with multiple choice materials (not yet carried out).

**Central Test Battery**

Because Donald was seen for demonstration purposes for site-of-dysfunction testing the main tests of interest were the SSW and CES. The SSW was just as hard for the patient to respond to as the WDS. Therefore, multiple choice items were presented instead of the open-set format. This approach has been used many times with good success. However, it was a major undertaking to make up items.

The multiple choice format was composed of the four test words and a spondee foil, shown in a random array in front of the patient. The experience was so stressful that the next day a formalized multiple choice SSW test was constructed on a single sheet of paper, so it would be available next time such a patient is seen. It is enclosed here for you, when next you have such a patient.

Only 16 items of the SSW were administered because of lack of time and the fatigue of the patient (and tester). Sixteen items were quite enough to show his pattern of response. He pointed to and said no more than 3 words of any item. He said later on that he knew that there were 3 words per item. He was oblivious of the RC word. It is not uncommon for patients with auditory reception lesions to say only 3 words, as the competing word in the ear opposite the lesion is generally 'extinguished'.

Fifteen of the 16 RC words were in error as well as about 1/3 of the other words. Figure 2 shows the R-SSW scores.

Response bias generally requires a full 40-item test. However, the pattern of error for Order Effects seems quite clear in this case. The Order Effect ratio was 11/19. An Order L/H is indicative of a posterior temporal involvement in brain lesion patients.

The SSW showed clear signs of an L-AR involvement. The large (severe) peak of errors was in the RC condition. TEC was MO, MO, S, which yielded a Combined TEC of MO. In addition the patient demonstrated support with a posterior temporal Order Effect L/H.

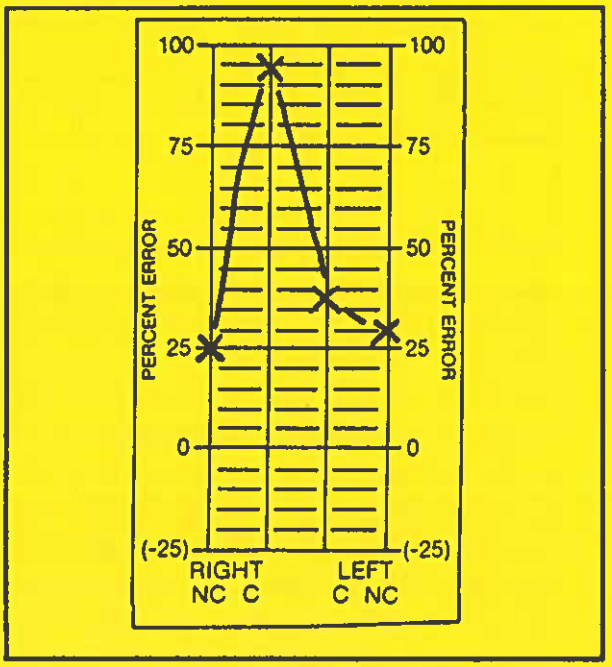



Figure 2

The Competing Environmental Sounds (CES) test was also administered. Fortunately, this was already in a multiple choice format. Thus no modification was needed for Donald.

On the CES test Donald had 45% error for the RE and 10% error for the LE. The CES results are plotted on the SSW-gram in Figure 2. As can be seen the pattern of errors follows that of the R-SSW scores. This is, the expected outcome in AR cases (but not necessarily in just posterior temporal cases).

**Recommendations**

Given these findings, we recommend that the following approaches be considered for aiding the patient:

1. The SSW shows Donald to have one good channel leading from his left ear and a poor one from his right ear. This raises the

possibility that his right ear hearing is degrading his left. He did indicate during the test that his left ear was much clearer than his right (during the word recognition test). This would be one of those occasions when it would be well for him to try the use of an earplug in his right ear, to see if it improves his ability to understand.

2. In this AR case, it seems that the auditory entrance to the left temporal lobe is essentially blocked (very little information gets through). This might result in Donald's difficulty in processing as well as his limitation in saying the words he obviously understands. This represents two therapeutic problems. Improving his perception, probably in the right auditory cortex, because he seems to be working primarily from that side, and then helping him to learn to get the information over to Broca's area on the left (?the parietal disconnection).

3. Building up the phonemic perception (probably of the right hemisphere) is much like working with a person who has a *severe* phonemic decoding deficit. Emphasize phonemic discrimination and memory for speech sounds, then phonemic synthesis and analysis. As he builds his phonemic base, begin to use familiar words, spoken slowly at first. When he shows good perception for them, they can be speeded up to a more normal rate. This should help to building up his perception in the right auditory cortex. If the right ear plug is better for listening than the binaural condition, I would do the therapy with the plug in.

4. Getting words primarily from the right auditory cortex to Broca's on the left is a challenging question. For this I would start out with words to Donald's left ear, presumably processed in the right hemisphere, for the most part. The task would be pointing to multiple choice words on cards, with his left hand. When he can do this quickly and accurately, then have him point with both hands. This may be more difficult than the left-only. Once he can do this quickly and accurately, the next task is to do it with the right hand only (so he's hearing it in the left ear and pointing with the right hand).

This could facilitate crossing the corpus callosum. After a few weeks of the above, assuming that it was successful, try the same procedure with speech. If he is able to respond as quickly and accurately as he did with pointing then no pointing is needed, just say the words. Eventually take away the cards using the same words and have him say his response. As he builds up speed, add new words. Then would work on giving him questions orally, and having him answer, using the words he has worked with previously.

5. We will be glad to help out with analysis of the earplug. We would also like to recheck his word recognition using a pointing task. It would be worthwhile also to check is auditory system's (evoked) responses (ABR, middle latency and P300) to see where they are normal and where they are not.

**Comments**

Back in the 1960s, the application of central tests were for site-of-dysfunction/ lesion. This information helped us in interpreting CAP test results by providing assessment schemes, and concepts. Interestingly, what we have learned from the CAPD work helps us now when we see a patient for site-of-lesion. We can combine the clinical insights and categorical knowledge we have amassed to make statements about the person's functioning in communicative and learning situations.

This was the case with Donald. His site-of-lesion results (i.e., SSW and CES) made it appear that the left AR region was essentially non functioning. The poor decoding consequences of this follows and the difficulty in getting the information from the right hemisphere for a verbal response can be inferred. Given this scenario, we may then try auditory processing approaches for remediation.