SSW REPORTS

LET'S TRY IT AGAIN

RESPONSE BIAS & MORE: THE ELDERLY

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SYNOPSIS: This issue is divided into four short sequential articles by Jack Katz and those who kindly helped to gather these cases. They concern the use of the SSW test with the elderly. The first one involves Response Bias (RB) measures in "normal listeners", 60-79 years of age. It shows that the criteria for young adults are inappropriate, because there is a very large rate of failure. For this reason criterion modifications for older individuals are suggested. The information in this article parallels the C-SSW Conditions material that was presented in the previous issue of SSW Reports.

The second article looks at both C-SSW Condition and RB failures using the revised criteria. At this point we meet TOM (the two or more rule for failure). This rule for 60 year olds helps out a great deal by reducing the number of normal elderly that would fail the SSW test.

All is well and good until we come to the third article. Here we find that when a hearing impaired group (with normal CNS) is analyzed, the SSW gets confused between peripheral and central auditory problems. We see that those with significant hearing losses (35dB) in the speech frequencies or significant differences between ears (20dB) are likely to have abnormal SSWs and failures on two or more sections. This might limit the use of the SSW in certain cases.

The fourth article brings it all together. It introduces a group of subjects (Ss) that have CNS lesions. The question is, how effective are the proposed modifications in identifying CNS cases. In this group, the hit rate was very high, although about a quarter of them could not be assessed because of significant hearing deviations.

The new criteria are offered tentatively and require verification. * * * * * * * * *

I- RESPONSE BIAS IN ELDERLY SUBJECTS ASSUMED TO HAVE NORMAL CENTRAL AUDITORY FUNCTIONS

In the last issue (Nov. 1989), statistical data were presented for the four C-SSW Conditions, in 5-year age groups from 50-79 years and for a small sample of subjects 80-96 years. These subjects were contributed to the National Sample for the Elderly (NS-Elderly-1989) by students at the University at Buffalo, as well as kind colleagues throughout the country.

Of the 97 subjects that were submitted, 6 were eliminated on a statistical basis (because at least one Condition was 3 or more SDs above the mean for the 5-year subgroup). Each of the 6 was highly deviant (e.g., +5 SD). Thus, their removal from this normal group was justified. It should be noted that hearing levels per se were not considered when selecting normal subjects. Contributors were simply asked to test individuals who were not highly deviant in hearing for their ages.

The purpose of the present article is to provide information about response bias for the 55 NS-E-89 subjects in the age groups 60-79. Our first approach was to consider the normal adult criteria for response bias. The permitted deviations for those 12-59 years are: 1 reversal; Order/Ear Effect differences of 4; Type A/B, being 2 times the next highest column as well as a difference of 2 points. Thus, we would consider significant deviations that are greater than these (i.e., 2 reversals, Order/Ear Effect differences of 5 and a Type A that has the errors in columns B or F equal to twice the next highest column and a difference of 3, and for Type B the same criteria would hold for columns C or G).

Table 1 shows the number and percentage of error for subjects 60-79 years for the

RESPONSE BIAS FAILURE IN ELDERLY SUBJECTS USING STANDARD YOUNG ADULT CRITERIA

AGE GROUPS	n	REV	ORDER H/L	ORDER L/H	EAR L/H	EAR H/L	TYPE A/B	Ss/SIGNIF FINDINGS
60-69	35	10	2	2	3	0	1	15
%		(29)	(6)	(6)	(9)	(0)	(3)	(43%)
70-79	20	4	1	0	1	1	5	10
%		(20)	(5)	(0)	(5)	(5)	(25)	(50%)

TABLE 1. Number and (%) of subjects with response biases using standard adult criteria for significance.

various response biases using the standard adult (ages 12-59 years) criteria. It can be seen that a high percentage of subjects failed on the response bias measures. Nearly half of the 55 subjects had significant findings for one or two out of a possible three failures (note that we are looking at four RBs, but Type A/B nullifies any significant Order or Ear Effects and thus the greatest number of failures possible is 3).

Before we jump to conclusions that central processes deteriorate rapidly after the 50's, as evidenced by the high percentage of RB failure (especially reversals), we need to consider whether it is the S's hearing impairment that might be the culprit, and not central dysfunctions.

McCoy et al. (1977) studied the SSW in the elderly. They found poorer SSW scores in men than women. When they accounted for hearing loss, there was no gender difference on the test.

Arnst (1982a) has pointed out that the SSW may be contaminated as a central test when a person has a hearing loss of 40 dB or more. He found similar results in the elderly (Arnst, 1982b). His groups appear to be VA hospital cases and were described as having bilateral hearing losses.

To summarize, it appears that those 60-70 years should not be evaluated using young adult criteria (not surprising). The next three articles will focus on the 60-69 decade. They will consider more appropriate SSW criteria, the influence of hearing and discrimination losses, as well as a comparison of central cases with controls.* * *

II- TENTATIVE CRITERIA FOR SIGNIFICANCE OF CONDITION AND RESPONSE BIAS SCORES: AGES 60-69 YEARS

The purpose of this brief article is to report on new standards that may be used more appropriately with 60-69 year olds. We lack sufficient data to carry out a similar analysis for the 70 year decade.

Two approaches were used to reduce the failure rate in the normal 60 year old group that came from the NS-E-89 study (n=35). We considered, 1) more lenient criteria to pass the SSW. When faced with a similar problem in assessing the data for children, White (1977) suggested that modified (age-appropriate) SSW standards be used. Age-based modifications were also incorporated into the C-NS-85 criteria for children. 2) Because of the considerable variation in how people age, it was felt that a single failure on one aspect of the SSW might not be so "abnormal", after all. This approach seems to make sense and worked out well in practice.

Response bias criteria were modified to minimize the failure rate in the NS-E-89 subjects. The new normal limits for 60-69 year olds are: **4 reversals and Order or Ear Effect differences of 5. No changes were deemed necessary for Types A/B.** Thus, in this age group it requires 5 reversals, Order or Ear Effect differences of 6 points and Types A/B having at least a 3 point difference, as well as twice the error rate in columns B or F (or C or G) to show abnormality.

Using the new criteria, the number of presumably false-positive cases was reduced from 43% to 34% (see Table 2). This reduced

RESPONSE BIAS FAILURE IN ELDERLY SUBJECTS USING NEW OLDER ADULT CRITERIA

AGE GROUPS	n	REV	ORDER H/L	ORDER L/H	EAR L/H	EAR H/L	TYPE A/B	Ss/SIGNIF FINDINGS
60-69	35	6	1	1	4	0	0	12
%		(17)	(3)	(3)	(11)	(0)	(0)	(34%)

TABLE 2. Number and (%) of subjects with response biases using new criteria for significance for individuals 60-69 years of age.

the number of RBs that were outside of normal limits for particular individuals, but did not have a great effect on the failure rate itself. To reduce failures a second criterion modification was added. When we permitted one score to be outside normal limits for RB, there were no failures.

The use of new criteria for reversals, Ear and Order Effects lowered the number of cases that had more than one abnormal diagnostic indicator. When we added to this the rule that one deviant score was permissible, then there were no RB failures.

The next question was, can we use this same approach when assessing both the four Condition scores as well as RB. If so, then likely we would have a clinical procedure with a small probability of falsely identifying control Ss, such as these, as abnormal.

First, let's review the Condition score information from the last issue (Katz et al., 1989). The means and SDs for 60-69 year olds were:

RNC	RC	LC	LNC
-2.9	1.3	4.4	-3.5
(5.0)	(7.4)	(9.3)	(5.8)

The hearing of 60 year olds is often poorer than that noted in young adults. This tends to produce overcorrected scores especially on the non-competing words. The negative C-SSW scores make this elderly group look "too good" when compared to individuals 12-59 years of age. Therefore, some minor compensations were made when figuring the +1 SD cutoffs for normal limits:

NORMAL LIMITS FOR 60 - 69 YEAR OLDS
C-SSW CONDITION SCORES (MEAN +1 SD)

RNC	RC	LC	LNC
3	9	14	3

Employing these criteria for significance of the four C-SSW Conditions and the criteria for response bias from page 2 (or page 6), the data for the 35 normal subjects were reassessed. Three of the 35 Ss had 2 or more abnormal scores, making a passing rate of 91% (with only 9% failures). This rate is fine for clinical purposes! But, before passing judgment (in article three) we will consider the influence of hearing problems on the SSW. In the fourth article we will determine whether all of these compensations for aging weaken the test by permiting too many older pathological cases to pass the SSW.

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III- INFLUENCE OF HEARING/DISCRIMINATION ABILITY ON SSW PERFORMANCE IN THE ELDERLY (60-69 YEARS)

Unlike the assessment of young children, the central evaluation of the elderly is plagued by the contamination associated with hearing loss. That is, at the same time that we expect to see the influence of central aging, there is a good probability that hearing will be reduced in some measure, as well. How can we distinguish these factors when dealing with older age groups?

Let us assume for the moment that hearing loss and word discrimination problems represent a peripheral breakdown. When we determine what influence they have on the SSW test, then we can see whether the central disorders have a further influence, and perhaps how the two sources of error may be differentiated.

It should be recognized that the above assumption may be wrong. That is, hearing

loss may be associated with certain central problems. If this is true (in large measure) in the present cases, then we will not be very successful in separating hearing loss patients from central ones.

The first step in this study was to select out those "normal" NS-E-89 subjects that had hearing or discrimination problems. Because hearing loss cases might have been excluded due to our selection criteria, eight additional cases were obtained from my SSW files. These were all the individuals in their 60's who were referred for hearing evaluations, having no medical evidence of CNS disorder, but did indeed have significant hearing problems and/or word discrimination difficulty. The sample size was 43 (35+8).

I started out with some arbitrary hearing and discrimination criteria, without reference to these particular Ss. These values seemed reasonable for such a study (but turned out to be too conservative). Two criteria were established for Hearing abnormality based on the three frequency speech average (500, 1k, 2kHz)--

1) Hearing Level (HL): $\geq$ 26dB, and
2) Hearing Difference (HD): $\geq$ 10dB between ears.

The two criteria for Discrimination problem criteria were--

1) Discrimination Level (DL): $\leq$ 80%, and
2) Discrimination Difference (DD): $\geq$ 10% between ears.

Based on these criteria we could discern 3 groups from the 43 subjects with no known central nervous nervous system disorder. Group-A was from NS-E-89 without hearing difficulty, Group-B was from the same pool but reached/exceeded the above values, and Group-C was the additional 8 cases that were combined to provide a better test of the effects of hearing impairment (see Table 3).

Using the tentative criteria for SSW Conditions and RB for 60 year olds (see Table 3), we find 8 (or 35%) of the 23 in Group-A to have one or more failures out of 7 (4 Conditions and 3 RBs). When we add the second consideration, the two or more (TOM) failure rule, only 2 cases (9%) fail the test. This is surely an acceptable failure rate.

For Group-B, 9 (or 75%) out of 12 Ss were outside of normal limits on one or more factors, even though 60 year criteria were used. However, when the TOM rule was also considered for significance, then only two (or 17%) failed. In Group-C, with even greater hearing problems, 7 (or 88%) out of 8 Ss had one or more abnormalities. When TOM was used, there was no additional benefit in eliminating supposedly normal elderly Ss from the group that had abnormal SSW test results.

If we continue to assume that Group-C is normal with regard to central functions, then the SSW does not distinguish between peripheral and central problems using our tentative criteria. Nor does the "2 or more rule" improve the situation as found with with the Ss having lesser hearing problems.

We examined the data to see if we could relate the SSW failures to any specific audiometric difficulty, or if it was a general problem. Generally speaking hearing loss (HL) and difference between ears (HD) appear to correspond to the SSW failures more so than the discrimination findings.

Although B & C group cases that had SSW problems also tended to have losses of 40dB or more, as previously described by Arnst (1982b), the asymmetry in hearing between ears appears to be equally potent in this sample.

The top section of Table 4 shows the performance of the 43 Ss in Groups A, B & C. The HL criteria had to be reduced to 35dB to accommodate two Ss (with speech averages of 37 and 39dB) who failed on TOM. HD was considered 20dB or more between the ears.

SUBJECTS 60-69 YEARS OF AGE
WITH NORMAL CENTRAL FUNCTIONS

n	HL ≥ 35dB	DIFF ≥ 20dB	FAILED "TOM"	% FAILED
34	NO	NO	1	3
3	YES	NO	2[1]	67
1	NO	YES	1	100
5	YES	YES	5	100

[1] they had HLs of 37 and 39dB

Table 4. Performance of 43 Ss with normal central auditory functions, but not necessarily normal hearing (.5-2K Hz).

Table 4 shows that those who had poor SSW performance could be predicted on the basis of HL (≥ 35dB in one or both ears) and/or a significant difference between ears (≥ 20dB) for the 3-frequency speech average. Of the 34 Ss with "normal hearing" (≤ 34dB in both ears) and relatively small differences in hearing between the ears (≤ 19dB) only 3% failed the SSW using the 60-decade criteria and the TOM rule. For those who had greater hearing losses or greater differences between ears, 89% failed.

In summary, test results were examined for a group of subjects that were considered to have normal central auditory functions, but not necessarily normal hearing. Of the 43 Ss, those with relatively normal hearing performed normally (i.ei, no more than one score outside of normal limits). The situation was very different for individuals who had hearing levels of 35dB or more in the poorer ear or a difference of 20dB or more between the ears. The question of whether these criteria will permit too many central cases to pass remains to be answered. This will be considered in the fourth article.

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IV- TENTATIVE CRITERIA FOR EVALUATING PATIENTS 60-69 YEARS OF AGE ON THE SSW

The 3 short articles above indicate that revised criteria may be useful for evaluating Ss 60-69 years of age without having many false positives. However, in the face of significant HLs or fairly large HDs, the SSW appears to be thrown off. This final article will address the question of whether the use of these criteria in known central cases will produce a sufficiently high hit rate to justify the use of the test with individuals in this age group.

I pulled from my SSW files all cases (n=43) in their 60s with known CNS lesions (regardless of the location of the lesions and their SSW performance). Most of them had cerebral lesions with relatively normal hearing and discrimination.

See Table 5 for the data based on the cases with CNS lesions. Group-D met the same hearing criteria as Group-A (in previous article), but were diagnosed as having CNS lesions. Group-E met the same hearing criteria as B, except that they had more loss than the NS-E-89 Ss. For this reason an additional hearing loss group (similar to Group-C) was not needed. In fact, Group-E was right in between the hearing performance for Groups-B and C.

GRP	n	AGE	SA-R	SA-L	WD-R	WD-L
D	20	63	13	12	92	92
E	23	63	28	33	85	81

Table 5. Sample sizes, and mean data for age, speech average (.5, 1, 2KHz) and word discrimination for two groups of Ss with diagnosed CNS lesions.

Table 3 shows the performance of all 5 groups on the SSW test. There is a very high percentage of failure for groups C, D and E. This supports the difficulty of differentiating between significant hearing impairments (i.e., ≥ 35 dB for the speech frequencies, or a difference between ears of ≥ 20 dB). However, with lesser losses, the distinctions seem very good.

Table 6 provides important information that encourages us that we can distinguish cases with normal vs. abnormal CNS function, given puretone speech averages of 35dB or better and less than a 20dB difference between ears. The table format parallels the data in Table 4 (on page 5). Of those who met the hearing criteria for assessment of central auditory function (more than 75% of our cases), 3% of the normals as well as 88% of those with known CNS lesions failed. If these statistics hold up, this would represent a very nice diagnostic difference for clinical purposes.

SUBJECTS IN 60s WITH CNS LESIONS

n	HL ≥ 35dB	DIFF ≥ 20dB	FAILED "TOM"	% FAILED
32	NO	NO	28	88
7	YES	NO	7	100
0	NO	YES	0	0
4	YES	YES	4	100

Table 6. Performance of 43 Ss that were considered to have normal central auditory functions, but not necessarily normal hearing.

SUMMARY AND IMPLICATIONS:

These 4 articles began with a study of 55 Ss between 60 and 79 years. It was followed by analyses of 43 Ss with no known CNS involvement and was compared with 43 Ss that had medically diagnosed CNS lesions.

The results of these studies show:

1. As in the case of C-SSW Condition scores (which were discussed in the previous issue), RB failure is unacceptably high in control Ss over the age of 59 years when using young adult criteria.

2. Age-adjusted criteria for C-SSW Condition scores and RBs for those in their 60s are not sufficient to lower the failure rate to an acceptable level without the "two or more (TOM)" rule. That is, one score outside of normal limits (e.g., the LC Condition or 5 reversals) does not constitute a failure on the SSW. Two or more do signify failure.

3. Using the new criteria (RNC=3, RC=9, LC=14, LNC=3, REV=4, ORD/EAR=5 as normal limits) and the TOM rule, we obtained quite low failure rates among the normal hearing and mildly hearing impaired NS-E-89 subjects.

4. Other individuals who were referred because of hearing losses (a 3-frequency speech average of ≥ 35dB in the better ear or a difference between ears of ≥ 20dB), but were not known to have CNS lesions, performed poorly on the SSW.

5. We could not distinguish these hearing loss cases from cases with known lesions if they had significant hearing problems. Thus, for cases in their 60s, the SSW is of questionable validity if there is a significant hearing impairment, as described above.

6. These results need to be cross validated.

REFERENCES

* Arnst, D. 1982a. SSW test results with peripheral hearing loss. In Arnst & Katz (Eds), The SSW Test, College-Hill Press.

* Arnst, D. 1982b. Performance of older adults on the SSW test. In Arnst & Katz (Eds), The SSW Test, College-Hill Press.

*Katz, J. with the help of many, 1989. National Sample for the Elderly-1989. SSW Reports, 11, 19-23.

* McCoy, C., Butler, M. & Broekhoff, J. 1977. Effects of age and sex on dichotic listening. JAR, 17, 263-8.

*White, E. 1977. Children's performance on the SSW test and Willeford battery: Interim clinical data. In R. Keith (Ed.) Central Auditory Function. Grune & Stratton.

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Dear Ackey:
Do you ever get a kick out of giving the SSW, or find the responses amusing? --A New User

Dear ANU:
You bet! The funniest "Are You Ready (AYR)" response I've gotten yet, was from a very bright, brain damaged guy who responded to the 20th AYR question with, "Would it matter?". --Ackey * * * * * * * * * *