SSW *** REPORTS

SSW: MEMORY, IQ, PHO-SYN & ACKIE

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RELATIONSHIP BETWEEN MEMORY AND DICHOTIC LISTENING IN NORMAL CHILDREN

Brunt, M.A.[1], Besing, J.M. and Monoson, P.K.

Dichotic listening studies using verbal signals generally show a more accurate report of material presented to the right ear, that is, a right ear advantage (REA). REAs have been shown for both adults (Kimura, 1961; Brunt & Goetzinger, 1968) and children (Brunt, 1965, 1987; Katz, 1985; Berlin et al., 1973; Porter & Berlin, 1975). Explanations of the REA phenomenon include: 1) cerebral dominance for speech; 2) selective attention and 3) memory.

Two dichotic tests which have shown the REA are the SSW and Berlin's dichotic CVs. The purpose of this study was to determine the relationship of these tests to memory tasks.

METHODOLOGY

Subjects

Thirty-eight right handed, normal hearing children were drawn from the general population of Peoria and Normal, IL. They ranged in age from 5-0 to 13-11 (mean= 9.1) years of age. They had negative histories for otologic and neurologic disorders and were free from middle ear pathology for at least one month prior to testing. All children were reportedly functioning at or above grade level and had normal articulation for the sounds on the CV procedure.

Each child passed a hearing screening (25 dB HL) for frequencies 250 through 8k Hz and had SRTs <26 dB. Mean SRT was 4.3 and 4.5 dB HL for the right and left ears, respectively.

Test Materials

The 4 tests that were administered were the SSW (Katz, 1962), list EC; Berlin's dichotic CV (dCV) (Lowe et al., 1970), WISC-R (1974) memory and a CV memory task. The dCV test consisted of 30 pairs of CV syllables (made up of pa, ta, ka, ba, da, ga), recorded at 0 msec lag time.

For standardization, the memory tests were recorded by the authors. The WISC-R memory task requires the child to repeat increasing numbers of digits. The CV memory task that was devised for this study followed the same format using the CV syllables.

Procedures and Scoring

The four tests were presented in a randomized order. The SSW and dCVs were delivered to the headphones at the prescribed levels. The memory tests were presented at 40 dB SL re; SRT and each ear was tested individually. The two memory tests were scored according to the WISC-R test manual. Scores on the dichotic tests were as follows:

1. Ear Score- percent correct (dCV) or % error (R-SSW[2]) for each ear (R/L)
2. Average Performance- average of R and L scores

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[1] Based, in part, on "Relationship between memory and dichotic listening in children" ASHA Convention, 1980.

[2] WDS was not assessed in this study. Therefore C-SSW was not available for these subjects.

3. Total Dichotic Score- defined as [(R-L)/(L+R)] X 100%, looks at ear advantage (Berlin & Lowe, 1972).

RESULTS

Ear Performance and Ear Differences

There was no significant difference between the scores for males and females and therefore the results were pooled. Table 1 presents the mean performance for each ear on the four tests and t-tests between ears. The raw scores are shown for the memory tests. The dCVs and SSW are presented in % correct and % error respectively.

TABLE 1

TASK	RE	LE	t-value
Digit Memory	9.5	9.7	-0.588
CV Memory	1.3	1.1	1.154
Dichotic CV	47.5	31.6	3.970*
SSW	10.0	12.5	-2.060*

* Significant @ .05 level, 37 df

As expected for the simple monaural memory tasks, no significant differences were found. However, the REA was noted on both dichotic tasks (as seen in previous studies). The negative t-value for the SSW simply reflects that error scores were used on this test.

Correlational Data

The Pearson r's between memory, dCV, SSW and chronological age are shown in Table 2. Digit and CV memory were significantly correlated (r= .72). The Average Performance (Total R-SSW) was significantly related to both digit memory (r= -.77) and CV memory (r= -.61), suggesting that as memory increases, SSW errors decrease (or performance improves). dCV scores did not correlate significantly with either of the memory tasks.

The dichotic tests were less highly correlated with one another than one might suspect. Only the average for the two ears on the SSW and dCVs were significant. All 6 measures were significantly correlated with chronological age. Thus, all of the dichotic and memory tasks used in this study varied as a function of age, as expected.

TABLE 2

	MEMORY		DICHOTIC CV		SSW TEST		CA
	CV	Syl	AvP	TDS	TOT	TDS	
MEMORY TESTS							
Digit Span	.723*		.294	.158	-.772*	.054	.622*
CV Syllable span			.357	.231	-.610*	-.205	.597*
DICHOTIC CV TEST							
Average Performance (AvP)					-.482*	.097	.502*
Total Dichotic Score (TDS)					-.121	-.276	.581*
SSW TEST							
Total R-SSW							-.770*
Total Dichotic Score (TDS)							-.581*

* Significant @ .01 level ($r \geq 0.418$), 36 df

Correlations were run comparing RE and LE dichotic test scores with the memory tests and CA. All comparisons for the SSW were significant @ .01. None were significant for dCVs.

Data on mental age were available for 21 of the 38 subjects. Mental age was significantly correlated with the SSW: RC (r= -.66), LC (r= -.57), and Total score (r= -.68) and with the memory tasks: Digits (r= .78), CVs (r =.74) (for r= .549 with 19 df, p <.01). There were no significant r's between mental age and any of the three dCV scores: RE (r= .32), LE (r =.12) and Average Performance (r= .10).

DISCUSSION

It was not surprising that our data analyses revealed significant differences for performance on dichotic tasks favoring the right ear (REA). Also, finding that the simple memory tasks showed no difference between the ears was predictable.

For the dCVs, the REA displayed by the children in this study was comparable with the results on similar groups in previous research (Berlin et al., 1973; Mirabile et al., 1978). Our results revealed a consistent difference between the ears with increasing age as well as an increase in the CV percent correct.

As in the case of dCVs, the SSW results were similar to previous studies for comparable groups. As expected there was a REA and the Total SSW score was negatively correlated with chronological age (Brunt, 1965; 1987; Berrick et al., 1985).

The r's between the SSW and the memory tests might suggest that memory factors influenced the SSW performance. Because the SSW involves 4 words and the hearing of each item is spread over a period of seconds, it is a reasonable finding (although, not previously reported). However, there is no clear indication that memory plays a part in the right ear advantage on the SSW because the significant correlations were obtained for the left ear as well as for the right. This is not strong support the suggestions of Porter et al. (1974). In addition, the lack of significance in the correlation with the REA for the dCV is also contrary to that expected if the Total Dichotic Score is used as the measure of REA (Berlin and Lowe). Many factors might explain this discrepancy.

Another finding of interest relates that Miller's (1956) concept that lengthening the string to be remembered and increasing the similarity of the materials contribute to the difficulty level of a memory test. Indeed, the CV memory task that we devised was much more demanding of the children than was the digit task of the WISC-R. The CVs were apparently so similar that the subjects performed very poorly. Nevertheless, the two memory tasks were quite highly correlated with one another, suggesting that they were evaluating a common or general factor. One variable that we found to be significantly correlated with the memory tasks was the IQ score.

SUMMARY AND CONCLUSIONS

The two major findings of this study were 1) chronologic age was significantly correlated with both dichotic tests, and 2) memory skills were correlated with SSW results but not with performance on the dCV test. One implication of this finding is that while dichotic listening skills develop with age, they may be related to some other underlying function(s) that were not measured directly.

The SSW has been, and is used for evaluation of children suspected of having auditory processing disorders/ learning disabilities. The present results suggest that one consider both age and memory skills in making a diagnostic decision regarding poor SSW performance. Fortunately, the SSW has a strong normative base which neutralizes the age concern. However, often a measure of the child's memory skill is missing. If a youngster demon-

strates poor memory skills as well as poor SSW performance, one is left in a quandry as to whether the poor memory skills produced the poor SSW results or whether both the poor memory scores and the poor SSW findings are associated with some common factor. That is, undelying the problem there might be a G(eneral) auditory processing disability or perhaps mental age. Such is the difficulty of correlational statistics - which is cause and which is effect.

REFERENCES

Berlin, C. & Lowe, S. (1972). Temporal dichotic factors in central auditory testing. In Katz, J. (ed) Handbook of Clinical Audiology. Williams & Wilkins

Berlin, C. et al. (1973). Dichotic right ear advantage in children 5 to 13. Cortex, 9, 393-401.

Berrick, J. et al. (1985). Auditory processing tests for children: Normative and clinical results on the SSW test. J Speech Hear Dis, 49, 318-325.

Brunt, M. (1987). Auditory processing problems: A selective test battery for children. ASHA Convention, New Orleans

Brunt, M. (1965). Performance on three auditory tests by children with functional articulation disorders. Unpublished M.A. Thesis, U of Pittsburgh.

Brunt, M. & Goetzinger, C. (1968). A study of three tests of central function with normal hearing subjects. Cortex, 4, 288-297.

Katz, J. (1985). Combined national sample - 1985 norms: Ages 5-60 years. SSW REports, 7, 1-6.

Katz, J. (1962). The use of staggered spondaic words for assessing the integrity of the central auditory system. J Aud Res, 2, 327-337.

Kimura, D. (1961). Cerebral dominance and the perception of verbal stimuli. Canad J Psychol, 15, 166-171.

Lowe, S. et al. (1970). Perception of simultaneous dichotic and monotic monosyllables. J Speech Hear Res, 13, 812-822.

Miller, G. (1956). The magical number seven, plus or minus two: Some limits on our capacity to process information. Psychol Rev, 63, 81-97.

Mirabile, P. et al. (1978). Dichotic lag effect in children 7 to 15. Devel Psychol, 14, 277-285.

Porter, R. & Berlin, C. (1975). On interpreting developmental changes in the dichotic right ear advantage. Brain Lang, 2, 186-200.

Porter, R. et al. (1974). Memory and the dichotic right ear advantage for stop-consonant vowel syllables. J Acous Soc Amer, 56, 253.

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Dear Ackie:

If you can recall, memory is ... uh, well you know. I was impressed by the fine paper presented in this issue by Brunt, Besing and Monoson, but want to know if the audiologists in the readership are really going to do memory and IQ tests. Are these procedures unethical for us to administer?

Hamish

Dear Hamish:

I could never define memory so it's not that my ability to store and retrieve are impaired. It's just that I don't care.

Yes it certainly was a good article and gives us much food for thought. I do not think that the authors were actually asking us to do the added measures (and the many others that might relate to test performance), but point out the fact that we could make further inferences if this information was available. I especially liked the recorded memory tests and the fact that they were so highly correlated.

Audiologically yours,

Ackie

REFLECTIONS OF PHONEMIC SYNTHESIS THERAPY ON SSW AND OTHER TESTS

Sonya M. LaBauve, M.C.D.
Children's Hospital, New Orleans, LA

INTRODUCTION

JM is a 6 year old male who was referred for CAP testing by his pediatrician. After 2 years of pre-kindergarten and 1 year of kindergarten, JM's mother was concerned about his continued lack of development in phonic skills. The child had a significant history of recurrent otitis media during the critical ages of one to three years. It was interesting to note that when JM was asked at the initial evaluation if he knew why he was here, he responded "because my ears don't always work right".

Behaviorally, JM was active, quick, impulsive and distractable, but he was not uncooperative and seemed to maintain controls when needed. On a speech-language evaluation his major difficulty was with sound-symbol association and he was generally poorer on verbal than non-verbal tasks.

TRAINING

JM went through the Phonemic Synthesis (DLM) program to aid him in his phonic and decoding skills. He completed the 15 lesson program in 17, one-half hour sessions that were given over a period of approximately 2 months. He enjoyed the therapy and demonstrated significant progress at each session.

JM proceeded quickly to the criterion levels during the early lessons. He did not require repetition of material until he reached lesson 5.

AUDIOMETRIC RESULTS

Initially, JM was found to have normal puretone thresholds in each ear (RE ranged from 0 to 5 dB and the LE from 5 to 15 dB). The tympanograms and acoustic reflexes were entirely normal. Table 1 shows his live voice discrimination scores in both quiet and with a +5 dB S/N (speech spectrum noise masker that was presented ipsilaterally). Note the very poor performance for the LE in quiet and noise.

TABLE 1

	QUIET	NOISE (S/N +5)
RE	96%	88%
LE	56%	8%

Table 1. Pretest WDS results in both quiet and noise for each ear.

He was retested 6 months after completion of the therapy program to note any residual improvements. WDS was markedly different on the two test administrations (discussed below) and therefore the R-SSW was used to compare the pre- and posttherapy SSW scores. In this way the variability or improvement in WDS (to 100% in each ear) did not influence the comparison of SSW performance, *per se*.

Table 2 shows that on the pretest, the right ear was within normal limits, on the SSW, but that the left ear was outside of these limits (using the R-SSW norms for 6 year olds). The LC Condition was especially poor.

TABLE 2

	PRETEST	POSTTEST	NORMAL LIMITS
RNC	5	5	14
RC	18	25	33
LC	95	65	51
LNC	22	10	15
PS-corr	5	20	
PS-%-ile	6	88	

Table 2. Pre- and posttherapy scores for R-SSW and Phonemic Synthesis.

No response biases (including reversals) were noted on the initial SSW test, or on the retest for that matter. The right ear scores on retest remained normal, but the LE was dramatically improved, showing a difference of 21% fewer errors. It is valuable to note that the LNC Condition fell well within normal limits on retest. The LNC is one of the Conditions that is closely associated with decoding skills. The LC Condition, though vastly improved, remained outside of normal limits.

On the Phonemic Synthesis test, JM initially had a score of 5 which put him below the 10th percentile for his grade. On retest however his score of 20 showed his great improvement. This put him well within normal limits, or possibly better than normal for his age.

SUBJECTIVE REPORTS

Support for JM's improved scores came from subjective sources as well. JM's mother said that she was clearly able to see improvement in his ability to identify sounds presented auditorily. Near the end of the program JM spontaneously commented that he was now good at putting sounds together to make a word. He indicated that he could now sound out a word that he didn't know when he was reading.

JM's first grade teacher was contacted after completion of the therapy program. She reported that he is progressing quite well and is, in fact, near the top of his class. Nevertheless, she notices that he still has some confusions with final consonants and with pronouns having similar endings (e.g., he/she). His teacher is aware of JM's auditory deficits and said that he informs her when he does not hear or understand information that was presented verbally. It appears that the remedial program which we instituted has given JM a far better opportunity to benefit auditorily at school and at home. Although JM has been dismissed from therapy, active consultative services are ongoing.

DISCUSSION

Two problems should be noted regarding this case report which presumably may affect other similar ventures. The first is the influence of variations of the WDS, whether because of improved central functions or because of anxiety, unreliability or an ear problem at the time of testing.

WDS is administered as a baseline to offset the influence of peripheral distortion. However, if this score is not reliable then the retest will be altered. In JM's case, if we assume that the vast improvement of the LE WDS was in some way due to the phonemic training (as there was no hearing loss to account for it and there were good scores in the RE), then the C-SSW scores would appear to have remained unchanged or gotten poorer, when indeed there was a vast improvement centrally. In order to make the SSW comparison a fair one it was necessary to use the R-SSW score.

We would like to think that we made a significant effect on JM's ability to get along in school and in other life situations. Indeed, we have some glowing annecdotes to support our data. Nevertheless, it should be recognized that a retest may contain a significant practice effect, and thus inflate the improvement score.

Unfortunately, it is hard to predict which child will have identical retest results (as we have seen in some children) and which one, without intervention will show much improvement on the SSW test (we have seen this too). Sometimes (though rarely), an individual may do more poorly on retest because of deterioration or for no obvious reason. Therefore, it is important to get information from the parents, teachers and the children themselves to put the objective data into a better perspective. Typically the objective data provide the best evidence of any benefits from therapy, and usually subjective reports support them.

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