

TONAL RESPONSES OF MENTALLY RETARDED BRAIN-INJURED CHILDREN

by

BETTY HUNT BRADLEY

COLUMBUS STATE SCHOOL, COLUMBUS, OHIO.

In recent years there has been an increased interest in auditory disorders of children and this has been extended to include the problem of auditory disorders in mentally retarded brain-injured children. The mentally retarded brain-injured child may reveal some difficulties in responding to auditory stimuli or may exhibit communication problems, but there may be other children with similar etiological backgrounds responding to auditory stimuli or may exhibit communication problems, but there may be other children with similar etiological backgrounds who do not have these problems, but rather encounter difficulties in other areas such as visual perception.

PROBLEM

It is the purpose of this study to present auditory stimuli, tones played on an autoharp, and to determine if mentally retarded brain-injured children respond in terms of specific perceptual difficulties, or if there is a similarity of performance related to other factors such as mental age.

This investigation is related to attempts for experimental validation of certain descriptive classifications used in educational research classes with mentally retarded brain-injured children as a basis for differential teaching methods rather than employing a teaching curriculum based on the categorization of so-called typical behaviour of "the organic child."

The theoretical background for this diagnostic teaching approach has been based on the formulations of Dr. Lise Gellner who has stated that learning handicaps as well as mental retardation result from specific perceptual losses due to biochemical damage somewhere in the cerebral systems of vision and audition. A summary of her position stated in her booklet entitled, "A Neurophysiological Concept of Mental Retardation and Its Educational Implications," is as follows:

"Mental retardation is due to different kinds of learning handicaps resulting from structural or biochemical damage somewhere in the cerebral systems of vision and audition. There is a dichotomy of the visual and auditory pathways in the brain which accounts for the existence of two central systems of vision and audition.

One of these systems serves the integration of visual and auditory impulses emanating in the retina of the eye or the cochlea of the ear, with kinesthetic impulses from the somatic structures (muscles, joints, etc.) of the body; the other system serves the integration of such visual or auditory impulses with impulses emanating from all autonomic structures (inner organs, blood vessels, etc.). Each of these four cerebral systems extends from the respective sense organs, via some important specific ganglia in the midbrain to specific projection area in the cerebral cortex. If these systems are intact, the result is normal seeing or hearing, but impairment anywhere in one or several of these four systems results in disturbance of function (Gellner, 1959)."

Each of these disturbances is termed a disability since there is a direct negative effect on the performance of the child. It is Gellner's contention that classroom materials and methods of presentation should be based on the child's highest ability area rather than forcing responses to materials which are frustrating to him because of perceptual disability.

This does not imply that Gellner does not recognize that there are some auditory disorders caused by cortical lesions, but she feels these are not as severe in their effect on learning as brain stem lesions due to the fact that many times they do not affect both sides of the brain and adjustments and retraining can be introduced.

METHODS

For this study 70 mentally retarded children

who were residents of the Columbus State School at Columbus, Ohio, were selected. The Ss were divided into two groups:

(a) thirty five-mentally retarded children diagnosed as brain-injured and classified as having severe difficulties responding to auditory tasks such as language comprehension and verbal fluency, and

(b) thirty-five mentally retarded children diagnosed as brain-injured and classified as having minimal difficulties responding to auditory and language materials. As far as can be determined these children do not have sensory hearing loss.

Medical diagnoses indicated that brain damage was the primary cause of retardation. These diagnoses as to etiology were made by a classification committee of the Receiving Centre of the Columbus State School.

The 70 mentally retarded brain-injured children were selected from a larger group of children who had a diagnosis of brain-injury and who had also received classifications on the basis of criteria in her behavioral descriptions of the four disability groups. The perceptual abilities were determined by performance of the children on certain tasks or materials that Gellner states are indicative of a disability area, for example, perseveration, echolalia, poor vocabulary, speech defect, and withdrawn behavior.

The groups were matched with respect to MA, CA, and IQ obtained on the Stanford-Binet Intelligence Scale. Table 1 presents identifying infor-

mation concerning the two groups. Neither by matched groups nor by matched pairs are the group differences on CA, MA and IQ statistically significant.

The assumption of homogeneity of variance was met.

Electroencephalogram findings yielded additional evidence concerning factor of brain-injury within this group. The social histories indicated no other mentally retarded members of the immediate families. There was one exception to this whereupon other factors were felt to be responsible for injury to two members of one family. In many cases, although not all, there was a personal history of illness or injury to which the subject's condition was attributed.

The basic procedure consisted of obtaining judgements on the difference of tones and tonal patterns played on the "New Golden Autoharp". The tones were presented three seconds apart and were of 2.6 seconds duration. The Autoharp was selected because of its availability and the lack of familiarity with the instrument by the children.

Instructions for Section A.

"Listen, I am going to play one sound on this harp." (Examiner points to the instrument and demonstrates.) "Now, I will make another sound. You tell me if these two sounds are the same, alike, partners, or if they are not the same, do not sound alike, are not partners. After the tones were demonstrated, the E. said, "See, the sounds

TABLE 1.
DESCRIPTIVE STATISTICS ON Ss.

Group	N	CA			MA			IQ		
		Range	M	SD	Range	M	SD	Range	M	SD
BI-AD	35	9.1-21.3	15.30	2.8	5.7-11.3	7.75	1.5	38-79	55.91	9.4
BI-NAD	35	9.6-22.6	14.90	3.0	5.5-10.8	7.77	1.5	37-75	57.34	11.0

* AD - Auditory Disability

** NAD - No Auditory Disability

are the same." This was reversed for the opposite example and there were two examples administered for each section, one exemplifying the same tones or tonal patterns, one differences.

Instructions for Section B.

"I am going to play a little song on this harp. It has three sounds. Listen." E. demonstrates. "Now, I am going to make a song with three more sound. You tell me if the songs are partners, alike, the same, or if they do not sound alike, are not the same, are not partners." As in previous sections, two examples were given.

Instructions for Section C.

"Listen, I am going to play some big sounds that go together. They are called chords." E. demonstrates. "Now, I will play them again. You tell me if they sound the same, are alike, partners, or if they are not the same or partners." Examples were given.

If the Ss failed to grasp directions, they were repeated one time.

Description of Instrument.

One test involving identification of tones and tonal patterns consisting of three sections was administered to each subject individually. Section A was composed of 55 separate items each involving identification of two tones. Twenty-five of these tones were identical or repeat tones and 30 tones were different involving tone differentiations of one tone as well as tones spanning

two octaves. There were five items differentiated by one tone; nine items including tones within the same octave; ten items involving tones in concurrent octaves and six items involving tones separated by more than one octave. Seventeen tones were directed upward in scale, i.e. from low to high, 13 downward, high to low. There were no tones given that were separated by exactly one octave. Repeat items involved two bass tones, seven tones in lower octave, seven in middle octave, and nine tones in high octave range.

Section B consisted of identification of three tones. Three tones were played, an interval, three more tones. Five of these tones were repeated on second administration. All but one item involving differences included some tones of at least one octave separation.

Section C consisted of 10 chords, five involving repeat chords and five different chords. These were chords available on the autoharp and produced by pressing down on labeled key. Two of the five chords were very similar involving fine discriminations, i.e. G major and G minor.

Results.

Results have been analyzed and presented in tabular form. Table 2 shows the t ratio based on related samples for two paired groups of mentally retarded brain-injured children.

The difference in scores between the mentally retarded brain-injured children with minimal auditory handicaps and the mentally retarded brain-injured children with severe auditory handicaps

TABLE 2.

Performance of the Matched Pairs of Mentally Retarded Brain-injured Children on Tone Judgements.

Group	Mean	SD	t
Brain-injured NAD **	57.94	10.11	2.70 ***
Brain-injured AD *	52.03	8.3	

* AD designates auditory disability.

** NAD designates no auditory disability.

*** P .05. The probabilities used are for a two tailed test of significance.

was significant beyond the .05 level. This allowed for a rejection of Hypothesis I which stated in null form that: "Mentally retarded brain-injured children without sensory hearing loss classified as having minimal difficulties in responding to auditory stimuli will not receive higher scores at a significant level (.05) than mentally retarded brain-injured children without sensory hearing loss having severe difficulties in responding to auditory stimuli. A Bartlett's test revealed variances between the two groups to be homogeneous. Correlations between performance of the groups and CA, MA and IQ were insignificant, ranging from -.12 to .29. When a separate analysis was made in accordance with performance on each section, there were significant differences at the .05 level on identification of two tones, Section A; and identification of chords. Section C, favoring the non-auditory group. Differences were not significant for Section B, three tones, but the trend was in the expected direction of higher scores for non-auditory mentally retarded brain-injured children.

As was expected, the tone differentiations involving judgements of one tone separation were more difficult for both groups than tones involving differences of an octave or more.

Discussion.

As Gallagher has indicated in his book, the area of auditory perception has been almost neglected in terms of experimentation with brain-injured and non brain-injured groups. Werner and Bower, in 1941, compared three groups of children: endogenous, exogenous, and normal, on their ability to reproduce melodic patterns. (CA: 6 years - 10 years.) Each child was asked to reproduce vocally a pattern played on the piano. There were no differences noted in rate of errors but some subjective differences were noted in terms of organization of patterns.

There have been some studies regarding presentation of auditory material to mentally retarded brain-injured children, but these seem more directly related to language development rather than judgements of tonal attributes.

Results of this experiment indicated differences in matched pairs of mentally retarded brain-injured children beyond the .05 level favoring the children with minimal problems res-

ponding to auditory materials. There has been more discussion recently as to the need for individual tutoring of mentally retarded brain-injured children based on their individual problems rather than relying on stereotyped behaviour patterns of these children. Barnett, Ellis and Pryer suggest description of children in terms of behaviour measures with the elimination of the term, "brain-injury." These results may indicate that the type of materials and the methods of presentation and stimulation may be a factor in their performance level rather than complete reliance upon etiological factors. However, in Gallagher's sample the general mental ability factor accounted for approximately four times as much variance as did the perceptual factors.

The results from this study in connection with other related studies seem to concur with Gellner's suggestions that there is no one "organic" type of behaviour which is elicited from mentally retarded brain-injured children. If hyperactivity, motor restlessness, mental age level, and clinical pictures, as described by Strauss and Bender, were primary factors in performance of mentally retarded brain-injured children, one would predict similar scores from children matched on basis of etiological factors, CA, MA and IQ. This did not occur.

Gellner thinks the problem of children who are described often as having difficulties with echolia, chattering, poor spontaneous speech, perseveration, word finding difficulty and difficulty in communicating especially with unfamiliar material and good speech patterns may have difficulty with musical tones due to injuries involving nuclei serving loudness and pitch. This assumption requires more experimentation and refinement with the present experiment, serving as an exploratory study involving identifications of tones rather than discrimination of pitch and loudness.

Summary.

Auditory stimuli, tones played on the Autoharp were presented to two groups of mentally retarded brain-injured children. These children were paired on the basis of CA, MA and IQ. They were differentiated into two groups:

(a) thirty-five classified as having severe difficulties responding to auditory tasks such as language comprehension and verbal fluency, and

(b) thirty-five children classified as having minimal difficulties responding to these materials.

These groups were differentiated on the basis of criteria stated by Dr. Lise Gellner as indicative of auditory disabilities.

Results showed differences significant beyond the .05 level suggesting higher performance level for mentally retarded brain-injured children with minimal auditory handicaps. There was little positive relationship shown between performance on tonal judgements and mental age as obtained on the Stanford-Binet Intelligence Scale and chronological age. The implications in terms of curriculum planning are discussed.

Opsomming.

Gehoorstimuli, tone gespeel op 'n outoharp is aan twee groepe van breinbeseerde, verstandelik-vertraagde kinders gebied. Hierdie kinders is vergelykbaar volgens kronologiese, ouderdom verstandsouderdom en I.K. Hulle is in twee groepe verdeel.

(a) Vyf-en-dertig is geklassifiseer volgens ernstige probleme i.v.m. reaksie op ouditiewe take bv. taalbegrip en verbale vlotheid en

(b) Vyf-en-dertig is geklassifiseer omdat hulle minimale probleme op hierdie gebiede vertoon.

Hierdie groepe is gedifferensieer op gronde van kriteria wat deur Dr. Lise Gellner gestel is as 'n aanduiding van ouditiewe onvermoens.

Die resultate dui op beduidende verskille vanaf die .05 peil wat weer op 'n hoer graad van optrede dui by die verstandelik-vertraagde kind met minimale gehoorsgebreke. Daar is blykbaar geen positiewe verband tussen reaksie op toon-

beoordelings, verstandsouderdom, soos deur die Stanford Binet Intelligensieskaal vasgestel en kronologiese ouderdom nie. Die gevolg van hierdie bevindings ten opsigte van die beplanning van 'n kurrikulum word bespreek.

References.

Barnett, C., Ellis, N.R., and Pryer, Margaret. "Learning in familial and brain-injured defectives." Amer. J. Ment. Defic. 1960, 64, 894.

Gallagher, J.J. "A comparison of brain-injured and non-brain-injured mentally retarded children on several psychological variables." Child Dev. Pub., 1957, Monographs of the Society for Research in Child Development, Inc., Vol XXII, Serial No. 65, 1957, No. 2, 17.

Gellner, Lise. "A guide to the differential diagnoses of the four organic roots of mental deficiency," Personal Communication.

Gellner, Lise. "A neurophysiological concept of mental retardation and its educational implications." Chicago: Levinson Research Foundation, 1959.

Hunt, Betty. "Differential responses of mentally deficient brain-injured children and mentally deficient familial children to meaningful auditory material." Amer. J. Ment. Defic., 1960, 64, NO. 5.

Patterson, Ruth and Hunt, Betty. "Performance of brain-injured and familial mentally deficient children on visual and auditory sequences. Amer. J. Ment. Defic., 1958, 63, 72-80.

Werner, H., and Bowers, M. "Auditory motor organization in two clinical types of mentally deficient children." J. Genet. Psychgo., 1941, 59, 85-99.