TONAL QUALITY DISCRIMINATION AND PREFERENCE OF NORMAL AND MENTALLY RETARDED CHILDREN

By

RICHARD NELSON DAY

Bachelor of Arts

Oklahoma Baptist University

Shawnee, Oklahoma

1960

Submitted to the Faculty of the Graduate School of
the Oklahoma State University
in partial fulfillment of the requirements
for the degree of
MASTER OF SCIENCE
August, 1962

TONAL QUALITY DISCRIMINATION AND PREFERENCE OF

NORMAL AND MENTALLY RETARDED CHILDREN

Thesis Approved:

Julia L. McHale
Thesis Adviser

Robert W. Scofield

Robert MacVicar
Dean of the Graduate School

ACKNOWLEDGMENTS

I should like to express my sincere appreciation to all those people who helped make this thesis possible. Each of them lent something special to this endeavor.

My special thanks to the following members of the Tulsa Public School System who gave me the opportunity to study children in their natural habitat--the school: Mr. Jack Paxton, Director of Special Education, Dr. Jim Goss, Director of Elementary Education, Miss Lola Toler, Superintendent of Elementary Education, Mr. Gerald Whitney, Director of Music Education; Mr. Curtiss Turner, Principal of Eugene Field School, and members of his faculty, Mrs. Betty Baughman, Special Education Teacher, and Mrs. Alice Treat, Elementary Teacher; also to Mr. Lee B. Arnold, Principal of Bryant School and members of his faculty, Mrs. Cleo Richardson, Special Education Teacher, and Mrs. Ruth George, Elementary Teacher.

Thanks also go to Mr. Stanley Green, Assistant Professor of Music at Oklahoma State University, for his technical assistance with regard to the musical elements of the study and to Mr. Roger Copeland, Oklahoma Baptist University, for his talent and good humor while recording at the organ.

Special recognition is extended to my thesis committee, Drs. Henry Cross, Larry Brown, Robert Scofield, all of the Department of Psychology at Oklahoma State University, and especially to the committee chairman, Dr. Julia McHale, whose cooperation, guidance, and encouragement for the study made me more acutely aware of the need for research with retarded children.

Finally, indebtedness is acknowledged to my wife, Ruth, who constructively criticized the entire paper and tolerated the demands of running the household during the study.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

CHAPTER I

INTRODUCTION AND BACKGROUND

The human organism is influenced to a very great extent in its behaviors, training, development, and interactions with society by the various sensory apparati. The intake of sensations, whether visual, auditory, olfactory, gustatory, or tactual, with subsequent combinations, is the basis for all responses and therefore learning.

In a study of discrimination and its applications to learning, a two-stage process is inferred; (1) the basic physiological intake of sensory stimulation and (2) the interpretation of the information for its utilization. It is this latter process that is being investigated in the present study. It is generally understood that the mentally retarded cannot "learn" as well as normals, yet it is obvious that they experience much the same stimulations through the various intake modalities. Somewhere between the sensory intake and the learning process an intervention occurs that inhibits or enhances learning.

Without turning attention on a learning problem and confining efforts to the discrimination abilities only, it should be possible to more clearly describe the discrimination process as it occurs for both normal and retarded children.

In such a learning-free experiment the indication of preferences can be utilized when degrees of consistency to a particular preference are considered. If one prefers a certain stimulus consistently, in the face of alternatives, a discrimination task has been completed. Furthermore, it is possible to ascertain degrees of discrimination abilities by the levels at which different individuals cease to be consistent in their responding to an established preference.

The review of the literature that follows will give evidence that this type of reasoning has not been used extensively and it is also intended to point up certain facts in learning that are important to the interpretation of this study.

Review of the Literature

Stimulus discrimination and generalization, generally being considered alternate sides of the same coin, can be discussed together, particularly with regard to the work of Mednick and Lehtinen (1957). Working with two groups of normal children and using the semi-circle arrangement of flashing lights to which the subjects were taught to respond to the center light it was shown that all ages used (7 to 12 years, CA) generated acceptable generalization gradients but that the older group (10 to 12 years, CA) had a steeper gradient. This gives evidence that increased age affords a higher degree of discriminatory behavior. Sakurabayashi, et al (1957) have shown by working with the blind in a discrimination task to auditory stimuli that IQ is positively related to the ability to discriminate pitch. Those subjects that were below an IQ of 90 failed to perform as well as those above 90.

House and Zeaman (1958) compared normal and mentally defective children on a visual discrimination learning task by equating the mental ages and found that the normals persisted in better performance. This supports the hypothesis that measured IQ is related to learning ability when mental ages are controlled between two groups. Obviously, something other than mental age influences behavior and it is suggested here that it may have been the differential visual perception of the problem which was not and could not be controlled due to a lack of information and investigation into its nature. The authors, in a sequel study (1958) using Harlow's sliding tray apparatus, showed further the inadequacy of the mental age concept for purposes of control. They found that mentally retarded subjects with a mental age of 2 to 4 1/2 years are inferior to monkeys while normal subjects of the same mental age are superior to monkeys. Again, controlling mental age, it is seen that mentally retarded subjects are inferior to normals and this must be attributed to something other than the mental age concept.

Grice (1955) has shown that with normal subjects intelligence rather than lack of anxiety significantly contributes to discrimination in a reaction time situation. This same study showed a negative correlation between response latency and intelligence. A similar study by Dember (1957) showed that as stimulus similarity increases the decision time or response latency also increases on a visual discrimination task.

The literature is replete with studies and surveys on the hearing abilities and characteristics of hearing among the retarded of which only one is taken here for purposes of illustration: (from Schlanger and Gottsleben, 1957),

35% Normal hearing

14% Slight deviations at extremities of frequencies

28% Moderate losses

6% Hard of hearing

1% Deaf

17% Non-testable N = 498, IQ = 50 and below.

Those subjects with a chronological age above 20 years were predominantly in the 14% "slight deviations at extremities of frequencies" category. Those children with mental ages below 5 years were further complicated by personality disorders and fell into the normal hearing category. It is interesting to note that four-fifths of the subjects in this survey were either mongoloid or organic. The occurrence of the organics with the generally overall encouraging results seems to suggest a second look at either the data or the organics. Or perhaps the usual confusion and distortion patterns commonly observed from brain damaged persons on visual stimuli are not so predominant with with auditory stimuli. This study is representative of the distribution of hearing abilities of retarded individuals in this IQ range.

The bulk of the studies on audition as pertains to different classifications of mental retardation has come from Peabody College. Spradlin, et al (1960) continue to find no significant results in their series of experiments dealing with activity level under auditory stimulation if they compare organics vs. normals and hyperactives vs. hypoactives. Apparently the classifications used are not meaningful in terms of activity level variations due to auditory stimulation.

In the study of audition there are frequent studies of a more applied nature involving rhythm, harmony, tempo, etc., the bulk of which is in rhythm. Cantor and Girardeau (1959) have shown that a motor response that accompanies an auditory stimulus (eg., tapping in rhythm with a metronome) does not facilitate better performance by mongoloids in identifying the characteristics of the stimulus. This study compared normals with mongoloids with an IQ discrepancy between the groups around 83 points. Simply describing the stimulus (the metronome beat "fast" or "slow") without tapping in rhythm produced significant results in favor of the normals for the naming of "fast" or "slow". The authors state that "the results must be interpreted in the light of the significant differences of mental ages." The study, however, questions the hypothesis that mongoloids have a "marked sense of rhythm," (Tredgold and Soddy, 1956).

Petzold (1960) has reported a study of normal school children of ages 6 to 12 years (CA) dealing with auditory perception and the vocal reproduction of sounds and phrases of pitch. The findings tended to support the hypothesis that chronological age increases are paralleled by finer pitch discriminations. It was also noticed that the presence of rhythm apparently does not influence the auditory perception of melodic items. The role of rhythm as it effects both normal and retarded children, then, is still yet in doubt.

One significant study by Murphy (1957) has shown by observation of children's responses to heavy rhythm that differing levels of functioning can be tentatively, at least, picked out in terms of rocking or clapping. It was noticed that those with higher MA and more advanced socialization clapped in rhythm with the music and those of lower MA and socialization rocked back and forth in response to the rhythm. It was also noticed that the "rockers" were not exclusive of brain injury. Apparently, brain injury can be present and not inhibit these rocking movements in response to the auditory stimuli.

A close parallel to this study is one by Alvin (1959) in which responses to music were categorized into three types of responses;

(1) physical - through rhythmical or imitative movements, (2) verbal responses - attempting to vocalize, and (3) emotional - such as joy or depression or fright. It was noted that over a period of time music of different types was conducive to increases in span of attention and socialization as well as finer sense perception.

A similar study (unpublished) was done by the author of this paper to test the feasibility of using march music as a positive reinforcer in a telegraph key pressing situation. If the telegraph key was depressed within four seconds following the onset of a red light, the march music would continue through headphones. If no key press occurred the music ceased until a response was made or the interval of two minutes lapsed. Of the 20 subjects used, 15 showed significant responding in terms of decreasing response latency. The response was also successfully extinguished, taking a longer period of time than did the acquisition. This study was done without consideration to diagnostic categories. It can be concluded that march music, an auditory stimulus, can be used as a reward in this situation with retarded children below an IQ of 50. Whether this is due to melody or to rhythm is impossible to state.

In the past few years one of the most fruitful areas of endeavor has been the employment of music as a therapeutic tool. Weigl (1959) has coined the phrase "functional music" which is music used not for any aesthetic value, but for its effectiveness in reaching practical therapeutic goals outside of music itself. The place of music therapists in work with the mentally retarded is gradually being recognized by the several disciplines in this field.

The program at the Woodbury Colony, New Jersey, reported by

Murphy (1958) utilizes "live" music because it is felt that it provides far more versatility. Children who were unruly, destructive, aggressive, and termed a general behavior problem at the beginning of the live music group sessions were seen to undergo a dramatic change in behavior which carried over outside the session. The songs played were mostly old familiar folk songs. Of the 112 patients taken in a group, these changes were noticed:

1. Group participation in marching, singing, etc.
2. The development of more desirable interpersonal attitudes,
3. Improved pronunciation of words,
4. Higher vocabulary development,
5. More precise motor coordination,
6. Regard for other organized recreation,
7. Interest in playing an instrument of their own, for example, a comb or harmonica.

These subjects had an average mental age of 19 months, with an average chronological age of 16 years! The same general behavioral changes occurred with younger (CA) children and also with a group of brain damaged children. This is a striking example of the practical use of an auditory stimulus of primitive nature, which is attended to by various types and classifications of mental retardation.

Rittmanic (1959) has done considerable work in hearing rehabilitation and has kept accurate records of patients fitted with hearing aids over the past years at Dixon State State School in Illinois. He reports marked improvement of teachability, personality, temperament, and general improvement of behavior simply through the use of hearing aids. The program is now expanded under the assertion that most retardation is accompanied by some degree of hearing loss and that audition is one of the primary sources for the intake of meaningful information.

Many other researches could be introduced but these are representative of the current trends. It will be noticed, in retrospect, that the mentally retarded can discriminate sensory stimuli but to a lesser degree owing to factors such as mental age, chronological age, and IQ. It was also seen that when mental age is held constant differential responses still occur which must be accounted for on the basis of unspecified factors. It has also been reported that proximity of stimuli correlates highly with heightened response latency as does lowered intelligence. Finally, the literature reflects the utilization of auditory stimulation for programs of training and control of behavior which are restricted entirely to music. The study that follows will investigate auditory discrimination as it relates to preference, latency, and correlates of some of the constructs set forth in this chapter.

CHAPTER II

EXPERIMENTAL PROCEDURE

Statement of the Problem

From the previous studies it is evident that auditory stimulation effects behavior. However, the question remains as to what type of auditory stimulation the mentally retarded attend to most and how this differs from normal individuals. The present study employs a musical stimulus and attempts to specify, in terms of the two largest categorizations of tonal qualities, namely dissonance and consonance, which type of auditory stimulation is most attended to and preferred by both normal and retarded children.

In such a study of the differential effects of tonal quality two important variables must be controlled. The first is rhythm or "beat" and the second is intensity. For instance, drums or other percussion rhythm instruments give no tonal quality but can have behavioral effects. The same is true of intensity if for no other reason than irritability of the organism to loud sounds. Therefore, the stimuli presented and employed in the study, by necessity, utilize no rhythm or phrasing and are held at constant intensity.

The problem specifically is this: Do the mentally retarded attend to and prefer consonant or dissonant tonal qualities and do they discriminate as well as normals between the two? It is the purpose of this study to investigate the question: Do retarded children, as a group, differ significantly from normal children of the same chronological age in their preference and discrimination of auditory stimulation? If so, what is the nature of this difference? The objectives of the study are twofold; first, to determine if conventional harmony or if discords are more appealing to normal and retarded children, and second, to ascertain the differential discrimination abilities of the children within the types of chords indicated as most appealing, whether harmonic or discord.

Subjects

The subjects used in this study were all drawn from two residential elementary schools in the city of Tulsa, Oklahoma. Both schools drew students from districts in the older residential areas which could be classed socio-economically from lower middle class to upper lower class. The primary occupations of the families centered around unskilled to semi-skilled labor related to the industries of oil refining and aircraft manufacturing. Both schools offered special education classes for the educable retarded as well as regular classes, and they both had similar placement policies for the regular classes, i.e., one section per grade for the "fast learners" and one section per grade for the "average learners". The normal subjects were drawn from the "average learners" sections.

There were 42 subjects in the study, 21 of whom were drawn from the special education classes and 21 from the normal sections. There were 13 male and 8 female retardates and 10 male and 11 female normal subjects.

The first step in choosing subjects was the consideration of their chronological ages. Only those retarded students who were between six and nine years 11 months (CA) were used. A further restriction was that the children have no backgrounds of obvious parental achievement in music, as it was felt there may be some hereditary or environmental influence, or both, to be reflected in the children. There was, of course, no way to control for "latent" musical abilities or "talent". The teachers were heavily relied upon for this information--especially the music teachers. One other important restriction was that those children who were known to have had some brain injury as attested by their school records be disqualified. Due to the high degree of conflicting professional opinions and uncertainty surrounding the brain damaged it was decided to use as subjects for the study only those people not suspected as being brain damaged. In other words, "familial" type mental retardation was the goal in selection of subjects.

Fifteen students of one school and 6 students of the other met these qualifications and were used as subjects for the study. All students assigned to the special education classes undergo thorough psychological examination prior to placement by the Tulsa Public School System. From these tests it was found that the average mental age of the 21 retarded subjects was 70.3 months and their range of mental ages ran from 51 to 100 months. The chronological ages ran from 80 to 119 months with a mean age of 102.5 months.

The normals were drawn at random from the "average learners" sections in each school. Since 15 retarded subjects were drawn from one school 15 normal subjects were drawn from the same school using the same restrictions as for the retardates. In like manner, 6 normal subjects were drawn from the other school to match the 6 retarded subjects from that school. This necessitated using the second grade classes due to the corresponding chronological ages. Comparable testing of the normal group was neither available nor possible, however it was assumed the mean mental age would center around 100 months since all subjects were progressing satisfactorily in their academic programs and were termed "average" as a group, by their teachers. The average chronological age for the normal group was 100.0 months with a range from 96 to 104 months. The study was conducted in the late spring facilitating maximal acquaintance on the part of the teachers with each participant in the study.

Materials and Apparatus

Twelve pairs of chords were chosen with the help of the Department of Music at Oklahoma State University. One of each pair was designated as harmonic or consonant and its counterpart designated as discordant or dissonant. Both terms will be used interchangeably throughout the study and will be regarded as having the same meaning. The harmonic chords were defined as those chords surrounding "middle C" and in the key of C. The triad of the key of C was the basic harmonic chord and others deviated from it by a progression through the minor expression to the augmented expression and by other means of supplemented notes until the twelfth harmonic chord was hardly distinguishable as a "harmonic" (see Appendix E). Strictly speaking, the only way objectively to state whether the last few chords were "harmonic" or "discord" was by following the ever-increasing proximity of the harmonic to the discord through the entire progression. The dissonant chords were the expression of all the notes, half notes included, between and including the extreme notes of the range for the accompanying harmonic. In other words, for the harmonic triad CEG, the accompanying discord contained CC#DD#EFF#G, all sounding simultaneously. In like manner, for the harmonic in pair number 6 (see Appendix E) these notes were played: A#CD#G, which is a derivative of the original CEG triad supplemented with a minor seventh, A#, below it. The chord is paired with its particular discord which in this case was A#CC#DD#EFF#G. The particular progression of the harmonic chords was obviously a difficult and subjective process and owes much of its validity as to internal consistency as it moves from the more conventional harmony to the "modern" harmony to present cultural aesthetic sanction. However, the overall progression from the first harmonic to the twelfth harmonic was considered valid for comparative purposes to the blatant discords which parallel them.

These twelve pairs of chords were randomized according to a table of random numbers as to which would be presented first, the discord of the pair or the harmonic, and then reversed for a second series of twelve pairs thus creating twenty four trials per subject (see Appendix E). The purpose of the reversed repetition was twofold; first, to increase the number of trials per subject and thus the validity and second, to facilitate the manifestation of fixation or stereotypy, if any. In effect, the second progression of twelve pairs was a mirror image of the first progression of twelve pairs. The progressions will be referred to as "series".

The twenty four pairs of chords were recorded by a professional organist on an Ampro tape recorder at a speed of 7.5 inches per second for maximal fidelity. A Hammond electronic organ was chosen over other instruments for reasons of experimental control. Stringed and wind instruments were disqualified because of the difficulty to maintain exact pitch and intensity repetition. The electronic organ accomodates these controls easily. The volume pedal was locked in position and the same stops were used throughout with no electronic vibrato or reverberation. Decibel level of recording was not ascertained as it was deemed unnecessary partly due to the nature of the recorder and its reproduction capacity and also the fact that the recorded material would be played back to all forty two subjects at exactly the same level of intensity. Control of reproduced intensity to each subject was the main objective rather than the decibel level of recording. In this study the material was played back at the same level at which it was recorded.

A Standard Electric Timer constructed to make one complete sweep of the dial every second was used to time the recording of each chord. The organist memorized the chords to be recorded and then watched the clock for as near perfect timing as possible. Due to human errors there was present a slight fluctuation in the stimulus presentation of an estimated 1/10 second. The chords were presented for three seconds followed by a pause of one second followed by the counterpart chord, also of three seconds duration. Actual presentation of the stimuli per trial, therefore, was seven seconds, not including the 1/10 seconds of possible error. After a brief pause of 4 to 5 seconds on the tape another pair of like timing was presented. During actual experimentation the recorder could be stopped between pairs for the subjects' responses and recording of the data.

A stopwatch was employed to time the subjects' responses as they progressed through the twenty four trials. As the stimuli became harder to discriminate it was anticipated that response latency should increase. Responses were timed from the cessation of the second stimuli per pair to the overt response movements. In case there was a response before the cessation of the second stimulus it was recorded as "I", immediate. Otherwise latency in seconds was recorded.

Two small flat boxes of identical measurements, 9 3/4" X 7 1/2" X 1/2", wrapped in green and silver wrapping paper and appearing identical were the actual response objects. Subjects were to make their responses by pointing to the appropriate boxes according to the instructions given (see below). Each subjects' responses were recorded by hand on a separate data sheet (see Appendix D).

Procedure

Subjects were seated facing the examiner across a small table upon which the boxes and tape recorder were placed. All subjects in the study received the same treatment and instructions. The children were all prepared in their homeroom classes to play a "different kind of game" which created an attitude of recreation rather than of testing and anxiety. Upon entering the testing room each subject was warmly greeted and a brief period of conversation was stimulated by the examiner which provided additional opportunity for the subject to become more at ease and to establish a maximum degree of rapport. The examiner told all subjects what each of the pieces of apparatus was and they were allowed to watch the recorder rewind to the starting position following the previous child. They were allowed to handle and inspect the boxes and ask any questions they desired. The stopwatch, however, was not revealed as it was decided the knowledge of "timing" or of "speed" might have tended to precipitate anxiety and undue haste.

For the experimentation, the boxes were placed one on the right of the subject and the other on the left. The tape recorder was to the left of the subject. Both boxes were within easy reach of either hand of the subjects.

When the experimenter was satisfied the subject was ready to cooperate these instructions were given:

> "We are going to play a listening game and hear some funny kind of music. When I turn on this recorder we will hear two very short songs. While we listen I am going to point to these boxes one at a time so you can tell which song it stands for. You are supposed to point to the box which stands for the song you like best. Listen closely because we can't go back again. Help me pick the best song."

As an aid in making certain the subject understood his task there was recorded three introductory pairs of highly obvious diversity. These pairs were identical and were, musically, the F major tonic triad, or FAC, as the harmonic, and a range of seven notes struck with the palm of the hand an octave above this as the dissonant. During the three practice trials the experimenter demonstrated his pointing and the subject was reinstructed to point to the best one. These instructions preceded the practice session, "Let's practice two or three times to make sure we know what to do," whereupon the recorder was turned on and as the first chord sounded the experimenter pointed to the box on the subject's left and spoke aloud, "This is the first one," followed by another point to the subject's right and the sentence, "This is the second one." The recorder was stopped and the subject asked to point to the one he liked best. This procedure was repeated three times through the practice trials. No further instructions were needed or used during actual experimentation except an occasional "which do you like best". The sequence was always from left to right (for the subject) and no mention or statement was made to the effect that one of the two stimuli was really the best or the worst.

Throughout the experimentation the experimenter made visible pretense of listening closely and concentrating on the sounds and urged the subject to do the same. No clues were given, however, in the form of nodding or facial expressions. Since, to the subject, the sequence was always from left to right a fixation or stereotype to either the left or the right would automatically result in a 50-50 response pattern to harmonic and discord due to the original randomization of the presented stimuli.

The rationale behind this procedure was this: If a child can indicate and do this consistently to either harmonic or discord both his preference and his discrimination ability is manifested. As the experiment progresses the pairs become more difficult to categorize into harmonic and discord, therefore it can be stated that if one remains consistent throughout the twenty four trials in his indication of either harmonic or discord that person has discriminated accurately.

During the course of the experiment brief notes on the behaviors and verbalizations of each subject were recorded on the data sheets. Further information was gained by asking each subject at the end of the session why they chose as they did. This was done as discreetly as possible in regular conversation so that highly untrue answers due to a feeling of obligation to the experimenter would not be generated. It was felt that voluntary answers would be more valid than forced answers.

Each subject was thanked "for helping me decide which was best" and told he had done a very good job and was returned to the classroom.

All responses of the subjects were recorded either "L" or "R" (Left or Right) and the response latency recorded in seconds, whether "I" for immediate or a number for seconds. The responses were then transcribed according to the randomization table of Appendix F to determine if a specific response was "harmonic" or "discord". Thus the original left and right movement responses became "harmonic" and "discord" responses, designated "H" or "D" (see Appendix D).

CHAPTER III

RESULTS

The results were analyzed according to four major topics in keeping with the objectives of the study.* These four topics were: (1) harmonic vs. discord, (2) errors, or discrimination difficulty, (3) response latencies, and (5) relation to mental age, chronological age, and intelligence quotient. These will be revealed in systematic order.

Harmonic vs. Discord

Total harmonic and discord responses were summed for the group performances. With twenty four responses per subject and twenty one subjects this made a total of 504 responses per group. Working from a null hypothesis to the effect that there were no differences in responses to either harmonic or discord the results are shown in Table I.

TABLE I

DISTRIBUTION OF FREQUENCIES OF DISCORDS OR HARMONICS

		Discords	Harmonics	X^2
Normals	Observed	74	430	251.46**
	Expected	252	252	
Retardates	Observed	201	303	19.84**
	Expected	252	252	

** Significant beyond the .01 level

For the normal group 74 discords were observed and 430 harmonics. The theoretical responses according to a 50-50 null hypothesis would be 252 responses per chord type. In this situation a chi-square computation of 251.46 is highly significant beyond the .01 level. The mentally retarded group gave 201 discord responses and 303 harmonic responses. Upon the same theoretical expectancy a calculated chi-square of 19.84 is still significant beyond the .01 level, but its magnitude is not as great as the normal group.

A chi-square test of independence was computed on the data as shown in Table II.

TABLE II

INDEPENDENCE OF GROUPS TO CHORDS CHOSEN

		Discords	Harmonics	Totals
Normals	Observed	74	430	504
	(Expected)	(138)	(366)	(504)
Retardates	Observed	201	303	504
	(Expected)	(138)	(366)	(504)
Totals		275 (276)	733 (732)	1008

$X^2 = 81.74 \quad (P<.01)$

A highly significant chi-square value of 81.74 carried over indicating independence of the two groups.

Considering the data more specifically by taking the harmonic frequencies per subject as in Table III and comparing the means between the two groups a t-value of 4.04 was calculated, which is highly significant beyond the .01 level of confidence. It can be seen that the normal group group gave 20.47 harmonic responses per subject and the retarded group gave 14.42 harmonic responses per subject.

TABLE III

HARMONIC RESPONSES PER SUBJECT FOR BOTH GROUPS

Subject	Normals	Retardates
1.	15	10
2.	24	11
3.	24	11
4.	24	16
5.	24	12
6.	23	13
7.	23	13
8.	19	18
9.	24	9
10.	23	15
11.	24	10
12.	23	21
13.	10	14
14.	24	15
15.	15	22
16.	24	11
17.	22	18
18.	18	23
19.	7	12
20.	18	11
21.	22	18
	430	303
	$X = 20.47$	$X = 14.42$

$t = 4.04$ ($P < .01$)

<u>Error Scores</u>

In order to more closely pinpoint the locus of difference between the two groups the first six trials per series were grouped together for each group of subjects and compared as in Table IV. To do this each subject of each group was denoted as a "harmonic choosing" or "discord choosing" subject according to his majority of responses to either harmonic or discord. A "harmonic choosing" subject, therefore, was considered as having made an error when he gave a response to a discord stimulus. A "discord choosing" subject was considered as having made an error when he gave a response to a harmonic stimulus. These errors were tabulated for both groups and compared by means of a t-test as in Table IV by reading across the top row. The unequal group numbers are due to the fact that two of the retarded group showed no majority of responses either way and therefore could not be denoted "harmonic choosing" or "discord choosing" subjects and had to be eliminated from this phase of the analysis. These unequal numbers necessitated a special t-test (Steele and Torrie, 1960) yielding a value of -3.766 which is significant beyond the .01 level of confidence. Two of the normal subjects and seven of the retarded subjects were "discord choosing", none of whom were significantly so.

TABLE IV

COMPARISON OF GROUPS ON ERRORS DURING FIRST AND SECOND SIX TRIALS PER SERIES

	Normals (N=21)	Retardates (N=19)	t-value
First	31	75	-3.766 ($P<.01$)
Second	30	80	-5.171 ($P<.01$)
t-value	.155 ($P>.05$)	-.568 ($P>.05$)	

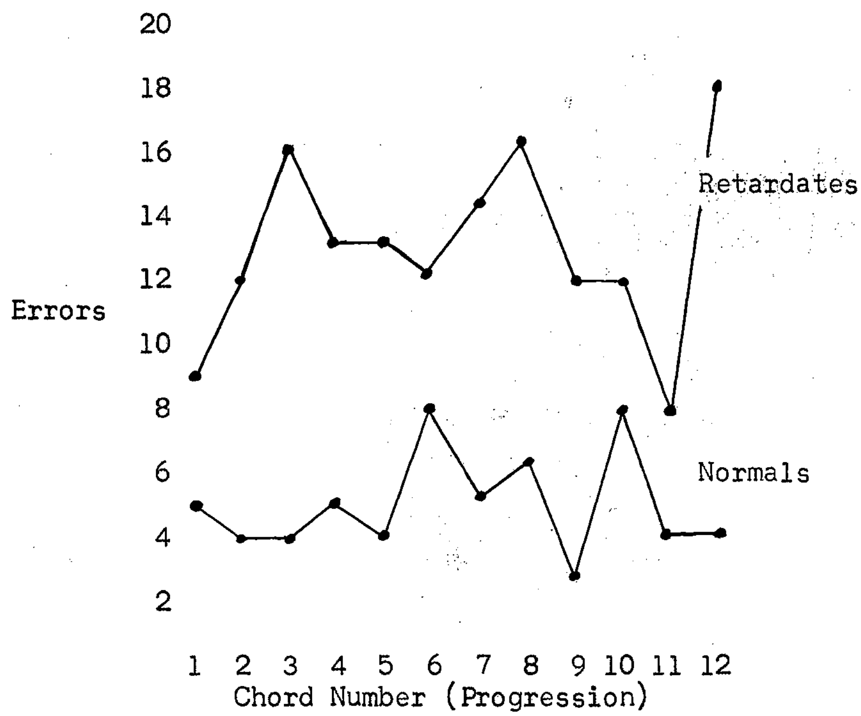
In similar manner the two groups were compared according to the errors shown on the second six trials per series as in Table IV by reading across the bottom row where a t-value of -5.171 was computed which is also significant beyond the .01 level. Both of the previous statistics, of course, indicate more errors made by the retarded group. Further discussion of these findings will be presented further in the paper. Individual scores for these data will be found in Appendices A_1 and A_2.

In accordance with the hypothesis that more errors should be committed in the latter part of the 12 trials per series due to the increasing proximity of the stimuli and therefore an increase in discrimination difficulty, the errors committed during the first 6 trials per series for both groups were compared with the errors committed during the last 6 trials per series for both groups. Again, Table IV shows the results according to the normal group performance and also the data for the retarded group. A t-value of .155 for the normal group computed by comparing performance on the "easier" half to the "difficult" half is not significant at the .05 level of confidence. For the retarded group the same t test was computed to be -.568 which more nearly approached significance than the normal group but is not significant at the .05 level. The negative t-value does show, however, that the second half of each series afforded more errors. Individual scores for these data will be found in Appendices A_3 and A_4.

By reference to Figure 1 it can be seen that the retarded group made many more inconsistent responses than the normal group for each of the twelve pairs of stimuli as attested by the overall heights of the graphs. This figure also reveals those pairs that were harder to discriminate for both groups. It is interesting to note, by further reference to Appendix E, that numbers 3, 8, and 12 for the retarded group are all major chords and that numbers 6 and 10 for the normals are all minor chords.

FIGURE 1

FREQUENCY OF ERRORS COMMITTED PER CHORD
FOR BOTH GROUPS



Response Latency

Upon further inspection of the data it was found that the response latencies between the two groups were of considerable importance to the previous findings. By comparing total seconds of response latency for both groups it was found that the normal group showed far less hesitation in responding than the retarded group. The normal group gave a total latency of 12 seconds for the first 6 trials of both series over all subjects while the retarded group had a total of 81 seconds. This is significant beyond the .05 level, as shown in Table V. For the second 6 trials of both series or the "difficult discriminations" the normal group showed a total latency of 20 seconds while the retarded group again showed a total latency of 81 seconds. A t test reveals this to be barely non-significant at the .05 level, as in Table V, probably due to extreme variance (see Appendix B_2). Comparing latencies within each group showed no significance for differences between the "easy" and the "difficult" discriminations, however there was a difference of 8 seconds for the normal group as again in Table V, reading down. Individual scores for these data will be found in Appendices B_1, B_2, B_3, and B_4.

TABLE V

COMPARISON OF GROUPS ON LATENCIES DURING FIRST AND SECOND SIX TRIALS PER SERIES (IN SECONDS)

	Normals	Retardates	t-value
First	12	81	-2.251 ($P<.05$)
Second	20	81	-2.069 ($P>.05$)
t-value	.497 ($P>.05$)	not necessary	

Relation to Age

The final stage of analysis concerned the possibility of a relationship between performance and the concepts of mental age, chronological age, and intelligence quotient. Using the psychological test data previously mentioned with the retarded group each of the three concepts were correlated with the percentages of harmonics chosen per subject. These results are shown in Table VI. Although a positive correlation does exist for the retarded group none of the three reach significance. Mental age correlated with performance barely misses significance in this case. Comparable correlations were not possible or considered necessary with the normal group. However, chronological age was computed and correlated with percentages of harmonics chosen and a Pearson r of -.21 was found as in Table VI, also not significant. Detailed data for this analysis will be found in Appendices C_1 and C_2.

TABLE VI

CORRELATIONS OF PREFERENCE FOR HARMONICS TO CA, MA, AND IQ FOR BOTH GROUPS

	I.Q.	M.A.	C.A.
Normals	X	X	-.21 ns
Retardates	.31 ns	.38 ns	.31 ns

CHAPTER IV

DISCUSSION OF THE RESULTS

The initial stages of analysis according to Tables I, II, and III seem to give evidence of the "preference" of both groups in that both heavily preferred the harmonics, although the retarded group indicated harmonics to a much lesser degree. The test of independence gives evidence that a higher probability of choosing a discord occurs among the retarded subjects than among the normals. The groups, with respect to each other, are therefore heterogeneous, or independent. Table III gives further evidence that the two group means could not have arisen from the same population with any confidence.

Using these findings as evidence that the two stimulus conditions had significant differential effects the next point of discussion centers around the question of difficulty of discrimination as shown by errors committed and the response latency times. Perhaps one of the most surprising of the results shown in this study was the failure to support statistically the effect of increasing proximity of stimuli on response latency within the groups. As was seen in Table V, the retarded subjects showed exactly the same latency on what was regarded as the "easy" as they did on the more difficult discriminations. This, of course, brings to the fore several considerations. First, it may be that the "easy" discriminations were, in fact, not so easy as far as the retarded subjects were concerned. Second, this may be attributable to one or both of two things; (a) the stimuli presented were not appropriate for showing a difference or (b) the first half of each series was not perceived as any different from the latter half of each series due to peripheral or central distortion or perceptual anomalies. Third, the retarded subjects may have considered each of the two paired stimuli as having a qualitative identity caused by a relative unawareness of current cultural aesthetic preferences. The latter interpretation is favored due to the fact that it can account for the elevated response latency of 81 seconds by due consideration and careful judgement of the subjects on each trial. In other words, each stimulus of each pair was carefully judged against its counterpart as if they both held merit of their own. This, by necessity, disregards cultural aesthetics. The objective is not to hypothesize the reasons for the elevated response latency but rather the reason why they were identical or even nearly so. The contention here is that they were identical, in this case, due to a lack of acute awareness of cultural modes of responding to dissonants. To the retarded individual it may be true that each stimulus being presented has effects that must be reconciled without recourse to past experience or social and cultural dictations.

Although the normal group did not reach statistical significance in its difference of response latencies it was shown that from a total of 32 seconds of response latency 20 of these seconds occurred during the more difficult phase of discrimination. By the above hypothesis, the normal subjects may have assimilated cultural and experiential behaviors and thus made their judgements on the basis of previous recalled exposure in society.

The number of errors committed by both groups as seen in Table IV can also, in part, be interpreted in this light. Since the normal subjects of obviously higher abilities had a repertoire or backlog of experience at judging paired stimuli or groups of stimuli in society and had, to a greater degree, incorporated cultural sanction through previous experience they did not have trouble in discriminating what they considered the "good" from the "bad". The retarded subjects, on the other hand, had not the benefit of these "higher abilities" and considered the easiest of the discriminations as equal to the most difficult, insofar as their perception of the task was concerned. It is a further possibility that the retarded subjects did not perceive the tasks as becoming increasingly more difficult whereas the normal subjects did and had the ability to call upon these higher abilities for accurate discrimination, which can be seen by the increasing response latencies.

It must be pointed out that some of the "errors" were actually responses to a harmonic chord. The question may be raised as to why a harmonic response was scored an error. The error scores were used only for consistency assessment and do not enter this discussion of the overall preference rates of the groups according to cultural standards. Furthermore, it was stated before that none of the "discord choosing" subjects in either group were statistically significant.

The verbal responses given by the normal group as reasons for the particular pattern of responses were almost without exception concrete or abstract associations with "scary shows", "trains", "bad tunes", or other situations reflecting associations outside the stimulus itself. The retarded group reported such phrases as, "The second one was usually best," or "I just picked the ones I liked," or "Both are pretty good, I don't know," --statements confined within the comparison of the two stimuli. Only three retarded subjects gave associative verbal responses by their mention of outside bases of comparison. Upon investigating this occurrance it was found that one of these three had the highest measured IQ of 86 as well as being one of the oldest chronologically of the retarded group (116 months). One of the other two was the oldest chronologically (119 months) and also one of the highest IQ retarded subjects at 82. The third was third oldest chronologically (118 months). This information strongly suggests chronological age, interpreted as experience, coupled with a higher IQ can have a definite influence upon associative comparisons of stimuli related to societal and cultural standards.

It is realized, of course, that this is a highly speculative conclusion for the general population, however in this situation it more nearly approximates the questions at hand and is a usable hypothesis for further experimentation.

It was stated before in regard to Figure 1 that those chords seen as most difficult to discriminate for the retarded group were all major chords, namely numbers 3, 8, and 12, in Appendix E. It should be pointed out that on this evidence alone no sweeping statements can be drawn due to the fact that other major chords were much more easily discriminated as in numbers 1, 9, and 11. There were eight major triads presented and no conclusive statements can be made on the difficulty shown to three of them. It is interesting to note, however, that two of these three chords were supplemented with minor tonal elements. The retarded group showed difficulty on two of the four minor chords presented and both of these chords were supplemented by sevenths.

CHAPTER V

SUMMARY AND CONCLUSIONS

A study was done to ascertain the degree of discrimination and preference of harmonic vs. dissonant musical chords with normal and retarded children. Twenty one educable retarded children between the ages of six and nine years (CA) were used and matched with twenty one normal second grade children of the same locality.

The results of this study indicate that both the mentally retarded of educable level and normals of the same chronological age prefer harmonic as opposed to dissonant auditory stimulation. Consideration must be given to the fact that although both groups responded more to the harmonic the retarded performed much less consistently than the normals. The two groups differed in this respect only as a matter of degree of relative abilities to discriminate, not according to the specific stimulus qualities preferred.

It was shown that as discriminations become more difficult latencies are seen to be more meaningful for the analysis of normal children, however, the retarded children showed much more overall latency which was distributed not as a function of increasing difficulty. In other words, performance of the normal subjects reflects the increasing difficulty and increasing proximity of stimuli by increasing latencies, whereas the retarded subjects' responses do not reflect this but rather show a random distribution of latency scores over the entire continuum.

This phenomenon is the basis for an hypothesis put forward to the effect that the normal subjects are more able to base their discriminations on associative factors outside the experimental stimuli, e.g., trains, shows, songs, etc., which conform to societal and cultural behavoiral and aesthetic experience. The retarded, on the other hand, confine their judgements of the stimuli presented to the stimuli themselves without recourse to outside associations and the benefit of these experiential factors. Each stimulus is regarded as having merit of its own and the general increasing difficulty of the task is not perceived as such.

It would appear from the data that the concepts of mental age, chronological age, and intelligence quotient have a minimal relationship to performance at discriminating with the retarded group. However, it was seen that increased chronological age does suggest the incorporation of associative factors which may or may not have a bearing on discriminatory behavior. This last statement is based solely on verbal reports of the subjects themselves in response to the inquiry of why they chose as they did.

Finally, with reference to the original line of reasoning at the beginning, it was shown that distortions seem to occur subsequent to the sensory intake of stimuli. This study gives no reason to believe that peripheral distortion is present but that central distortion on the part of the retardate may be a heavily influencing intervening factor in the discrimination and the utilization of sensory stimuli, aside from the foregoing cultural interpretation. The possibility of an overlay or an interaction of the two factors cannot be overstressed.

This was a basic information study designed to present experimental evidence for the differential responses gained from both retarded and normal children. From this study alone no broad practical conclusions can be drawn for utilization in the training and treatment of the educable retarded or in the musical education of normal children. The study did not attempt to investigate experimentally the reasons why the two groups differed, although several hypotheses were postulated for future investigation. The question of the origin of differences must be answered before the theoretical experiment can be applied to a practical situation.

BIBLIOGRAPHY

Alvin, Juliette. "The Response of Severely Retarded Children to Music." Amer. Jour. Ment. Def. 1959, 63: 988-996.

Cantor, G. and Girardeau, F.L. "Rhythmic Discrimination Ability in Mongoloid and Normal Children." Amer. Jour. Ment. Def. 1959, 63: 621-625.

Dember, W.N. "The Relation of Decision Time to Stimulus Similarity." Jour. Exper. Psych. 1957, 53: 68-72.

Grice, G. Robert. "Discrimination Reaction Time as a Function of Anxiety and Intelligence." Jour. Abn. Soc. Psych. 1955, 50: 71-74.

House, B.J., and Zeaman, David. "A Comparison of Discrimination Learning in Normal and Mentally Defective Children." Child Devel. 1958, 29: 411-416.

______. "Visual Discrimination Learning in Imbeciles." Amer. Jour. Ment. Def. 1958, 63: 447-452.

Mednick, S.A., and Lehtinen, L.E. "Stimulus Generalization as a Function of Age in Children." Jour. Exper. Psych. 1957, 53: 180-183.

Murphy, Mary M. "Rhythmical Responses of Low Grade and Middle Grade Mental Defectives to Music Therapy." Jour. Clin. Psych. 1957, 361-364.

______. "Large Scale Music Therapy Program for Institutionalized Low and Middle Grade Defectives." Amer. Jour. Ment. Def. 1958, 63: 268-273.

Petzold, R.G. "Development of Auditory Perception of Musical Sounds by Children in the First Six Grades." U.S. Department of Health, Education, and Welfare, Cooperative Research Program No. 766, June, 1960.

Rittmanic, Paul A. "Hearing Rehabilitation for the Institutionalized Mentally Defective." Amer. Jour. Ment. Def. 1959, 63: 778-783.

Sakurabayashi, H., Uehara, E., and Sato, Y. "An Experiment Concerning Learning of Auditory Discrimination of the Blind." Jour. Psych. Blind. 1957, 2: 45-48.

Schlanger, B.B., and Gottsleben, R.H. "Testing the Hearing of the Mentally Retarded." Train. Sch. Bull. 1957, 54: 21-25.

Spradlin, J., Foshee, J.G., and Cromwell, R.L. "The Effect of Auditory Stimulation Conditions on Activity Level, I." Amer. Jour. Ment. Def. 1960, 65: 754-757.

Steele, Robert G.D., and Torrie, James H. Principles and Procedures of Statistics. New York: McGraw-Hill, 1960.

Tredgold, R.F., and Soddy, K. A Textbook of Mental Deficiency, 9th ed. Baltimore: Williams and Wilkins, 1956.

Weigl, Vally. "Functional Music, A Therapeutic Tool in Working with the Mentally Retarded." Amer. Jour. Ment. Def. 1959, 63: 672-678.

APPENDICES

APPENDIX A_1

COMPARISON OF GROUPS ON ERRORS DURING FIRST SIX TRIALS PER SERIES

Subject	Normals (N=21)	Retardates (N=19)
1.	4	4
2.	0	6
3.	0	6
4.	0	6
5.	0	
6.	1	7
7.	0	5
8.	3	3
9.	0	5
10.	1	5
11.	0	6
12.	0	0
13.	4	4
14.	0	3
15.	6	0
16.	0	5
17.	0	2
18.	3	1
19.	5	
20.	4	5
21.	0	2
	31	75
	$\bar{X} = 1.47$	$\bar{X} = 3.95$

$t = -3.766$ ($P < .01$)

APPENDIX A_2

COMPARISON OF GROUPS ON ERRORS DURING SECOND SIX TRIALS PER SERIES

Subject	Normals (N=21)	Retardates (N=19)
1.	5	6
2.	0	5
3.	0	5
4.	0	2
5.	0	
6.	1	4
7.	1	6
8.	2	3
9.	0	4
10.	0	4
11.	0	4
12.	1	3
13.	6	6
14.	0	6
15.	3	2
16.	0	6
17.	2	4
18.	3	0
19.	2	
20.	2	6
21.	2	4
	30	80
	$\bar{X} = 1.43$	$\bar{X} = 4.21$

$t = -5.171$ $(P < .01)$

APPENDIX A_3

FIRST SIX TRIALS PER SERIES VS SECOND SIX TRIALS PER SERIES ON ERRORS MADE BY NORMALS (DISCRIMINATION DIFFICULTY)

Subject	First	Second
1.	4	5
2.	0	0
3.	0	0
4.	0	0
5.	0	0
6.	1	1
7.	0	1
8.	3	2
9.	0	0
10.	1	0
11.	0	0
12.	0	1
13.	4	6
14.	0	0
15.	6	3
16.	0	0
17.	0	2
18.	3	3
19.	5	2
20.	4	2
21.	0	2
	31	30

$\Sigma D = 1$
$\bar{D} = .047$

$t = .155$ ns ($P > .05$)

APPENDIX A_4

FIRST SIX TRIALS PER SERIES VS SECOND SIX TRIALS PER SERIES ON ERRORS MADE BY RETARDATES (DISCRIMINATION DIFFICULTY)

Subject	First	Second
1.	4	6
2.	6	5
3.	6	5
4.	6	2
5.		
6.	7	4
7.	5	6
8.	3	3
9.	5	4
10.	5	4
11.	6	4
12.	0	3
13.	4	6
14.	3	6
15.	0	2
16.	5	6
17.	2	4
18.	1	0
19.		
20.	5	6
21.	2	4
	75	80

$\Sigma D = -5$
$\bar{D} = -.238$

$t = -.568$ ns $(P > .05)$

APPENDIX B_1

COMPARISON OF GROUPS ON LATENCY DURING FIRST SIX TRIALS PER SERIES

Subject	Normals	Retardates
1.	1	0
2.	0	0
3.	0	3
4.	0	3
5.	0	10
6.	0	2
7.	0	23
8.	0	12
9.	3	3
10.	0	0
11.	0	1
12.	8	0
13.	0	2
14.	0	2
15.	0	0
16.	0	5
17.	0	0
18.	0	0
19.	0	0
20.	0	15
21.	0	0
	12 sec.	81 sec.

$$\Sigma D = -69$$
$$\bar{D} = -3.28$$

$$t = -2.251 \quad (P < .05)$$

APPENDIX B_2

COMPARISON OF GROUPS ON LATENCY DURING SECOND SIX TRIALS PER SERIES

Subject	Normals	Retardates
1.	0	4
2.	0	0
3.	0	1
4.	0	1
5.	0	16
6.	13	3
7.	0	13
8.	0	10
9.	3	5
10.	0	0
11.	0	0
12.	0	0
13.	0	13
14.	0	0
15.	0	0
16.	0	0
17.	0	0
18.	0	2
19.	0	0
20.	0	13
21.	4	0
	20 sec.	81 sec.

$\Sigma D = -61$

$\bar{D} = -2.904$

$t = -2.069$ ns $(P > .05)$

APPENDIX B_3

FIRST SIX TRIALS PER SERIES VS SECOND SIX TRIALS PER SERIES ON RESPONSE LATENCY FOR NORMALS (DISCRIMINATION DIFFICULTY)

Subject	First	Second
1.	1	0
2.	0	0
3.	0	0
4.	0	0
5.	0	0
6.	0	13
7.	0	0
8.	0	0
9.	3	3
10.	0	0
11.	0	0
12.	8	0
13.	0	0
14.	0	0
15.	0	0
16.	0	0
17.	0	0
18.	0	0
19.	0	0
20.	0	0
21.	0	4
	12 sec.	20 sec.

$\Sigma D = -8$
$\bar{D} = -.381$

$t = -.497$ ns ($P > .05$)

APPENDIX B_4

FIRST SIX TRIALS PER SERIES VS SECOND SIX TRIALS PER SERIES ON RESPONSE LATENCY FOR RETARDATES (DISCRIMINATION DIFFICULTY)

Subject	First	Second
1.	0	4
2.	0	0
3.	3	1
4.	3	1
5.	10	16
6.	2	3
7.	23	13
8.	12	10
9.	3	5
10.	0	0
11.	1	0
12.	0	0
13.	2	13
14.	2	0
15.	0	0
16.	5	0
17.	0	0
18.	0	2
19.	0	0
20.	15	13
21.	0	0
	81 sec.	81 sec.

(Analysis not necessary)

APPENDIX C_1

CORRELATIONS OF PREFERENCE FOR HARMONICS TO CHRONOLOGICAL AGES, MENTAL AGES, AND INTELLIGENCE QUOTIENTS OF THE RETARDED SUBJECTS

Subject	C A	M A	I Q	% Harmonics
1.	109	68	62	42
2.	111	75	68	46
3.	108	61	56	46
4.	119	72	60	67
5.	96	54	55	50
6.	101	65	64	54
7.	100	64	64	54
8.	102	84	82	75
9.	92	70	76	37
10.	116	100	86	63
11.	87	65	75	42
12.	81	58	72	88
13.	82	62	76	58
14.	90	51	57	63
15.	116	84	73	92
16.	115	76	66	42
17.	119	98	82	75
18.	117	84	72	96
19.	80	61	76	50
20.	93	56	60	46
21.	118	78	66	75
	M = 102.4	M = 70.3	M = 68.9	M = 60.0

r (CA to % Harmonics) = .31 ns

r (MA to % Harmonics) = .31 ns

r (IQ to % Harmonics) = .38 ns

APPENDIX C_2

CORRELATION OF PREFERENCES FOR HARMONICS TO CHRONOLOGICAL AGES OF THE NORMAL SUBJECTS

Subject	C A	% Harmonics
1.	98	62
2.	99	100
3.	97	100
4.	101	100
5.	100	100
6.	99	96
7.	104	96
8.	102	79
9.	100	100
10.	99	96
11.	101	100
12.	101	96
13.	103	42
14.	98	100
15.	99	62
16.	96	100
17.	104	91
18.	101	75
19.	102	29
20.	96	75
21.	101	91
	M = 100.0	M = 85.2

r (CA to % Harmonics) = -.21

APPENDIX D

TYPICAL DATA SHEET SHOWING TRANSCRIPTION FROM POSITION TO QUALITY

Series 1				Series 2			
Trial	Position	Time	Quality	Trial	Position	Time	Quality
1.	L	I	D	13.	L	I	H
2.	L	I	H	14.	R	I	H
3.	R	I	D	15.	L	I	D
4.	R	I	H	16.	R	I	D
5.	R	I	H	17.	L	I	H
6.	L	I	D	18.	R	I	D
7.	R	I	D	19.	R	I	H
8.	L	I	H	20.	L	I	D
9.	R	I	H	21.	R	2	D
10.	L	I	H	22.	L	I	D
11.	L	I	D	23.	R	3	D
12.	L	I	H	24.	L	2	D

Total Harmonics 11
Total Discords 13
Total Latency 7 sec.

Remarks: "They sound best because the music in them is best."

Name John Doe C.A. 111 M.A. 75 Group Retarded

APPENDIX E

THE HARMONIC CHORD PROGRESSION AS RECORDED

1. C Major triad
2. C minor triad
3. C Major triad with minor seventh (below)
4. C Major triad with sixth (below)
5. C minor triad with sixth (below)
6. C minor triad with minor seventh (below)
7. C Major triad with major second (within)
8. C Major triad with perfect fourth (within)
9. C Major triad with major seventh (below)
10. C minor triad with major seventh (below)
11. C Major triad with augmented fourth (within)
12. C Major triad with minor second (within)

APPENDIX F

THE RANDOMIZED ORDER OF PRESENTATION

	Left		Right	
1.	Dissonant	-	Harmonic	First Series
2.	Harmonic	-	Dissonant	
3.	Harmonic	-	Dissonant	
4.	Dissonant	-	Harmonic	
5.	Dissonant	-	Harmonic	
6.	Dissonant	-	Harmonic	
7.	Harmonic	-	Dissonant	
8.	Harmonic	-	Dissonant	
9.	Dissonant	-	Harmonic	
10.	Harmonic	-	Dissonant	
11.	Dissonant	-	Harmonic	
12.	Harmonic	-	Dissonant	
1.	Harmonic	-	Dissonant	Second Series
2.	Dissonant	-	Harmonic	
3.	Dissonant	-	Harmonic	
4.	Harmonic	-	Dissonant	
5.	Harmonic	-	Dissonant	
6.	Harmonic	_	Dissonant	
7.	Dissonant	-	Harmonic	
8.	Dissonant	-	Harmonic	
9.	Harmonic	-	Dissonant	
10.	Dissonant	-	Harmonic	
11.	Harmonic	-	Dissonant	
12.	Dissonant	-	Harmonic	

VITA

Richard Nelson Day

Candidate for the Degree of

Master of Science

Thesis: TONAL QUALITY DISCRIMINATION AND PREFERENCE OF NORMAL AND MENTALLY RETARDED CHILDREN.

Major Field: Psychology

Biographical:

Personal Data: Born in Arkansas City, Kansas, January 25, 1938, the older son of Emory Nelson and Mildred Elizabeth Day. Married the former Ruth Smith of Hollis, Oklahoma.

Education: Attended grade school in Okmulgee, Oklahoma, and was graduated from Okmulgee High School, May, 1956. Received the Bachelor of Arts degree from Oklahoma Baptist University in May of 1960 with a major in Psychology and a minor in Biology. Completed requirements for the Master of Science degree at Oklahoma State University, August, 1962, in Psychology.

Professional Experience: Part time Psychometrist at Oklahoma State University School of Technical Training, Rehabilitation Center, Okmulgee, Oklahoma, during fall semester, 1960; Staff Psychologist for the Children's Section, Winfield State Hospital and Training Center, Winfield, Kansas, from February, 1961 to September, 1961. Carried on various studies while at Winfield, one of which prompted this thesis.

Professional Organizations: Psi Chi, National Honorary Society in Psychology.