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THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

A STUDY IN THE MEASUREMENT OF MUSICAL APTITUDE

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

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BY

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A STUDY IN THE MEASUREMENT OF MUSICAL APTITUDE

APPROVED BY

DISSERTATION COMMITTEE

ACKNOWLEDGMENT

This study consisted of the development of a test with possibilities of measuring musical aptitude of students in grades four through twelve. It was constructed whereby it could be broadcast over a radio station in order to reach a maximum number of persons at the same time.

I am indebted to the superintendents, principals, and teachers in twenty schools over Tillman County, without whose assistance this research could not have been conducted. I am grateful to the more than 2,000 students who took the test in their classrooms, and to the students of Frederick High School who took other tests, as well, for this problem.

My personal gratitude is extended to the members of my graduate study committee: Dr. Henry D. Rinsland, Chairman, Dr. Henry Angelino, Dr. Gail Shannon, Dr. Glenn R. Snider, and Dr. O. J. Rupiper, E. J. Schultz, Professor of Music Education, and to former member, Dr. F. F. Gaither. My thanks go to Dr. F. A. Balyeat for his encouragement during the preliminary stages in his course on research methods.

I shall always be deeply grateful to Dr. Rinsland for the many hours of counseling and guidance which he has so freely given. His wise judgment and scholarly approach have made this work possible, and it has been an inspiration to have had Dr. Rinsland direct this research.

TABLE OF CONTENTS

	Page
ACKNOWLEDGMENT	iii
LIST OF TABLES	v
LIST OF FIGURE	vi
Chapter	
I. INTRODUCTION	1
II. TEST OF PITCH	10
III. TEST OF TIME	16
IV. TESTS OF TONAL MEMORY	20
V. ADMINISTRATION AND RECORDING	26
VI. STATISTICAL ANALYSIS	33
VII. SUMMARY AND CONCLUSIONS	56
BIBLIOGRAPHY	64
APPENDIX	66

LIST OF TABLES

Table		Page
1.	Equally Tempered Scale, A_3=435 Cycles	13
2.	Test of Time Samples	19
3.	Coefficients of Reliability, Musical Aptitude Test, Using the Kuder-Richardson Formula 21 . .	34
4.	Coefficients of Reliability, Musical Aptitude Test, Measures of Musical Talents, and Diagnostic Tests of Achievement in Music	36
5.	Coefficients of Reliability for Musical Aptitude Test and Measures of Musical Talents from the Kuder-Richardson Formula 21	37
6.	Pearson Product-Moment Coefficients of Correlation between Musical Aptitude Test and Measures of Musical Talents	38
7.	Coefficients of Correlation between Diagnostic Tests of Achievement in Music and (1) Musical Aptitude Test and (2) Measures of Musical Talents	40
8.	Standard Error of Differences between Means Found on Musical Aptitude Test and Measures of Musical Talents for Students with and without Musical Training	46
9.	Tentative Norms	47

LIST OF FIGURE

Figure | Page

1. Distribution of Scores on Musical Aptitude Test Superimposed on Normal Curve for the Distribution 42

A STUDY IN THE MEASUREMENT OF MUSICAL APTITUDE

CHAPTER I

INTRODUCTION

Workers in the field of school music need economical and accurate means of measuring and evaluating the musical aptitude, musicality, musical talent or musical capacity of students for guidance purposes. If such a test has predictive capabilities it will aid in starting musical training at an earlier age on a constructive basis and not on a trial-and-error method. Too, it could help locate a hidden aptitude that might otherwise be overlooked in a child. Although manual dexterity is considered necessary for instrumental work in music, this research deals with the mental and physical characteristics of an individual which are conducive to acquiring proficiency in music, a psychological test for the prediction of musical success. The mental characteristic has reference to perception, and the physical characteristic pertains to the ear.

Statement of Problem

This has been a study in the measurement of musical aptitude. The problem was to construct a musical aptitude

test, to tape record it, and to broadcast it by means of commercial radio at a prearranged date and time, for testing students in grades four through twelve, at the same time, in twenty schools in Tillman County, Oklahoma.

The second portion of the problem consisted of analyzing the statistical data obtained when the test was rebroadcast two years later for the students of Frederick High School and from results of the Seashore Measures of Musical Talents and the Kotick and Torgerson Diagnostic Tests of Achievements in Music which were taken by the same group.

Review of the Literature

The pioneer in the field of measurement of musical aptitude or musical talent was Dr. Carl E. Seashore. It was prior to World War I that he started his work, and he continued it through the war when it was applied successfully to the selection of men for submarine detection in the Navy.[1]

Seashore's first edition of the test for use in musical guidance and selection was published in 1919. This early test, Measures of Musical Talent, consisted of six, double-disk, twelve-inch records made by the Columbia Phonograph Company, each illustrating a basic test as follows: sense of pitch, sense of intensity, sense of time, sense of rhythm, sense of consonance, and sense of memory. This test

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[1]Donald E. Super, Appraising Vocational Fitness. New York: Harper Brothers, 1949, p. 321.

required slightly over two hours to administer, and it was too long to give at one sitting and expect to obtain valid scores. Seashore suggested that the test would yield best results when given over a period of several days. The 1939 revision of the test retained six tests, but changed the term intensity to loudness, and substituted timbre for consonance. This revision shortened the time period of testing to about one hour. Farnsworth, in his review of studies on the reliability of the old form of the tests in 1931, eighty-eight in all, concluded that only the tests of pitch and tonal memory were sufficiently reliable for use with individuals.[1] Drake found these tests had reliabilities of near .86 when employing odd-even reliability coefficients, corrected by the Spearman-Brown formula.[2] The revised battery has higher reliabilities on the whole, ranging on Series A from .62 to .88 and for Series B from .70 to .89.

In 1956 a new manual was prepared for the Seashore measures. This manual replaced the Manual of Instructions and Interpretations for the Seashore Measures of Musical Talent. It was prepared by the Test Division of the Psychological Corporation. In 1957 a long-playing edition was added, this being available on one single transcription and played at 33 1/3 rpm. This supplements the 78 rpm records

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[1] P. R. Farnsworth, "An Historical, Critical, and Experimental Study of the Seashore-Kwalwasser Test Battery," Genetic Psychology Monograph, 9 (1931), p. 384.

[2] R. M. Drake, "The Validity and Reliability of Tests of Musical Talent," Journal of Applied Psychology, (1933), pp. 447-458.

for the test, and both are presently available. Two forms, Series A and B are available. This experiment used the 33 1/3 rpm transcription, Series A.

The Kwalwasser-Dykema Music Tests are similar in form and function to the Seashore Tests. The ten tests are designed for use in grades four to twelve, requiring five phonograph records. The elements measured are tonal memory (a second test on this), tonal discrimination, rhythm discrimination, pitch discrimination, melodic taste, pitch imagery, and rhythm imagery.[1]

The Whistler-Thorp Musical Aptitude Tests[2] are based on the present-day concept of pitch, utilizing no quarter or eighth tones, and given from a piano keyboard. The test is divided into five parts: rhythm recognition, pitch recognition, melody recognition, pitch discrimination, and advanced rhythm recognition. These tests require only about forty minutes to administer.

The Drake Musical Aptitude Tests[3] are designed for persons of any age above seven years whether or not they have had musical training. The battery is recorded, and

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[1]H. A. Green, A. N. Jorgensen, and J. R. Gerberich, Measurement and Evaluation in the Secondary School. New York: Longmans, Green and Company, 1954, p. 558.

[2]Harvey S. Whistler and Luis P. Thorpe, Musical Aptitude Test. Hollywood: California Test Bureau, 1950.

[3]Raleigh M. Drake, Examiner Manual for the Drake Musical Aptitude Tests. Chicago: Science Research Associates, 1954.

tests measure musical memory and rhythm. The author states that both components were determined through intensive and systematic analysis of the skills shown by successful performers in various fields of music. He also said that, "The best evidence at the present time is that 'musical aptitude' represents a cluster of three factors: musical memory, rhythm, and, to a lesser extent, pitch discrimination."

Drake attended the State University of Iowa in 1938 as a post-doctoral fellow in the psychology of music at the invitation of Dr. C. E. Seashore. There, Drake worked with Seashore for several years where he formulated his own concepts as to musical aptitude. Drake's test of rhythm is different from other standardized tests of this nature, and it appears that it can be used to good advantage as a measure of rhythm or time, depending on the definition. Drake correlated this test with Seashore's test of rhythm, Series B, and he states:

> The data clearly indicate that the two tests are not measuring the same ability. The Seashore test appears to be an auditory perceptual test which does not in any way arouse a feeling of, or a reaction to, rhythm. Drake has obtained six validity coefficients for the Seashore test, using similar groups and methods to those employed in studies of the validity of the Drake tests. In no case has the Seashore test yielded a validity coefficient higher than .37. Most of the r's cluster around .17.[1]

Drake based this portion of his test on the definition that "Rhythm is the ability to maintain an accurate beat

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[1] Ibid., p. 21.

while performing other activities at the same time." The writer is of the opinion, after a study of numerous definitions of time, tempo, and rhythm, that the above definition describes time. The test utilizes the judgment of time in a space interval as opposed to other standardized tests which employ judgment of the duration of a tone or judgment of a rhythmic pattern.

Another test that is receiving wide usage, particularly in England where it was published in 1948, is Herbert D. Wing's Standardized Tests of Musical Intelligence.[1] These tests were designed to measure persons of the age of ten years and over. There are six tests, each of which occupies one side of a twelve-inch record at 78 rpm. The whole series takes about one hour and is designed to measure pitch, loudness, rhythm, time, timbre, and memory.

From a review of the literature, the previously mentioned musical aptitude tests appear to constitute the major tests in this field. They are the ones being used mostly, and they are the ones which are receiving the greatest attention in studies of musical aptitude.

The writer constructed two original tests to measure musical aptitude. The Music Ability Examination was completed in 1939, and it was used for several months to measure the

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[1]Oscar K. Buros (ed.), The Fourth Mental Measurements Yearbook. Highland Park, N. J.: The Gryphon Press, 1953, p. 234.

musical aptitude of patients at the United States Public Health Service Hospital, Fort Worth, Texas, who were participating in the musical program. The test was given from the piano keyboard. Results of the test were noted in the writer's Master's thesis.[1] The second test was a refinement of the first, and it was recorded on three ten-inch phonograph records at 78 rpm. It was called the Test of Musical Capacity-Ability, and the development of the test was a study which required nine months to complete.[2] The test was given to all patients who enrolled in the music department of the hospital, and it was used for guidance. Both tests were designed to measure pitch, time, rhythm, harmony, intensity, and memory.

Research Design

From a review of the many items that have been used to measure various aspects of musical aptitude, the writer finally selected four elements for a new test which seemed to be basic and which could be administered in approximately one-half hour. The four elements chosen were pitch, time, and two phases of tonal memory, each of which is reported on in detail in this study.

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[1]Ronald W. Wheeler, Jr., "The Treatment with Music of Drug Addiction at the United States Public Health Service Hospital in Fort Worth, Texas" (unpublished Master's thesis, College of Education, Texas Christian University, 1940), p. 81.

[2]Ronald W. Wheeler, Jr., "Development of the Test of Musical Capacity-Ability" (unpublished report, College of Education, University of Texas, 1941).

The four elements or components selected for the Musical Aptitude Test were used, inasmuch as they are the ones which appear most frequently in the major tests and in the literature discussing the basic components of musical aptitude. Previous findings by the writer also seem to indicate this. These components were selected because they are the ones which are most in agreement. The components for the test consist of musical elements. These are tones, for pitch and tonal memory, and elapsed time or rest periods for the measurement of time. The test was produced under laboratory conditions, with components being isolated. Just as Seashore stated,[1] and quoted in part, that the Measures of Musical Talents "have been validated for what they purport to measure ...When we have measured the sense of pitch, that is, pitch discrimination, in the laboratory with high reliability and we know that pitch was isolated from all other factors, no scientist will question but that we have measured pitch." The same applies to time and tonal memory.

Definition of Terms

Musical aptitude refers broadly to a combination of physical and mental characteristics, and possibly other characteristics, which is conducive to gaining proficiency in the

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[1]Seashore, Lewis, and Saetveit, Manual. Seashore Measures of Musical Talents. New York: The Psychological Corporation, Revised 1956, p. 7.

musical field.[1] The musical field includes such primary divisions as singing, playing an instrument, composing, and directing. In the school the early emphasis or importance pertains to singing and particularly to the playing of a musical instrument.

Terms employed for the various components of the test, pitch, time, and tonal memory, will be found at the beginning of the chapter dealing with each.

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[1]Roger T. Lennon, "A Glossary of 100 Measurement Terms," Test Service Notebook, Number 13. Yonkers-On-Hudson, New York: World Book Company, (no date), p. 1.

CHAPTER II

TEST OF PITCH

Drever defines pitch as "a characteristic of tone sensation, arranging them in a series from low to high, at least to some extent differentiating them from noises..."[1] Harriman defines pitch as "The attribute of auditory sensations whereby they are judged to be relatively high, middle or low..."[2] In this study, for a working definition, pitch is defined as the attribute of auditory tone sensations capable of being differentiated as relatively high or low.

In order to measure the widest range of the potential discrimination of pitch of an individual, it was decided to utilize half-steps over five octaves (less C-6) throughout this portion of the test. A half-step is the closest tone interval with which most music students will have to deal.

Tone is defined as "periodic vibrations of sound waves evoking an auditory sensation with more or less well-

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[1]Janes Drever, A Dictionary of Psychology. London: Hazel Watson and Viney, 1955, p. 210.

[2]Phillip Lawrence Harriman, The New Dictionary of Psychology. New York: Philosophical Library, 1954, p. 262.

defined attributes..."[1] Drever defines tone as "the auditory sensation aroused by periodic sound waves, the interval between two successive notes in the musical scale, or one-sixth of an octave."[2] Another important definition in this study concerns pure tone. "A pure tone is a note constituted by waves of one wave-length only, i.e. where overtones or harmonics are entirely absent, as opposed to a compound tone or clang, which can be analysed into components or different wave-lengths."[3]

It was decided that a pure tone, a tone free of harmonics, would best satisfy a true measurement of pitch discrimination, and that pure tones from C-1 of 65 cycles or double vibrations up to and including B-5 of 1,976 cycles would cover the musical notated scale (less the tone C-6). This would be a wide enough range to give a measure of five octaves for any possible tonal gap or particular area of tone deafness. A tonal gap is defined as "a region in the continuum of sensations of tone, where, for an individual, there is marked reduction of sensitivity."[4] The Organo, an electronic organ installed on a piano, was employed to produce the pure tones used on this test. All sixty of the tones were

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[1] Ibid.

[2] James Drever, A Dictionary of Psychology. London: Hazel Watson and Viney, 1955, p. 295.

[3] Ibid.

[4] Ibid.

utilized, once each, with thirty questions covering pitch differences of one half-step, and with an octave spacing on the questions in order, C-1, C-3, C-5, C-2, and C-4, continuously through the questions.

The range for the human voice in singing is from about 60 cycles for a low bass voice to about 1,300 cycles for a very high soprano. Helmholtz gave a value of 32 cycles as the lower limit of a tone. The upper pitch for the musical scale is about 4,138 cycles, although the human ear can hear sounds between 20,000 and 30,000 cycles.

In this study the Organo was used for producing the pure tones. The cascade generators were tuned as follows: C-1 to 65 cycles, C-2 to 130 cycles, C-3 to 261 cycles, C-4 to 523 cycles, and C-5 to 1,046 cycles. Of the several different standards most experiments have been conducted using international pitch A-3 of 435 cycles and concert pitch A-3 of 440 cycles. Table 1 shows the various cycles for the 60 tones from C-1 to B-5 in international pitch. There is a slight difference between the two, but it is very slight. For instance, C-1 international pitch is 64.66 cycles while on the Organo it is 65 cycles. C-2 international is 129.33 cycles, and the Organo is tuned to 130 cycles. C-3 international is 258.65 cycles with the Organo 261 cycles. C-4 international is 517.31 cycles, and the Organo is 523 cycles. C-5 international is 1,034.61 cycles with the Organo tuned to 1,046 cycles.

TABLE 1

EQUALLY TEMPERED SCALE, A_3=435 CYCLES, C_1-B_5*

	C_1-B_1	C_2-B_2	C_3-B_3	C_4-B_4	C_5-B_5
C	64.66	129.33	258.65	517.31	1,034.61
C#	68.51	137.02	274.03	548.07	1,096.13
D	72.58	145.16	290.33	580.66	1,161.31
D#	76.90	153.80	307.59	615.18	1,230.37
E	81.47	162.94	325.88	651.76	1,303.53
F	86.31	172.63	345.26	690.52	1,381.04
F#	91.45	182.89	365.79	731.58	1,463.16
G	96.89	193.77	387.54	775.08	1,550.16
G#	102.65	205.29	410.59	821.17	1,642.34
A	108.75	217.50	435.00	870.00	1,740.00
A#	115.22	230.43	460.87	921.73	1,843.47
B	122.07	244.14	488.27	976.54	1,953.08

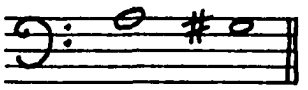
*Dayton Clarence Miller, The Science of Musical Sounds. New York: The MacMillan Co., 1926, p. 48.

Today, most pianos, organs, wind instruments, and other instruments are tuned to concert pitch.

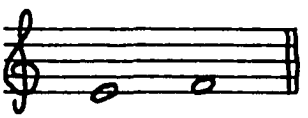
The directions for taking the test show the method employed. They appear in the following paragraph as they were actually used to record the test.

Look at the directions for Musical Aptitude Test, and you read the directions silently as I read them aloud.

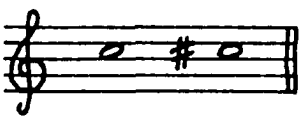
Start where it reads, Roman numeral "I. PITCH: You will hear two tones which differ in pitch. You are to judge which tone is the higher of the two. If the first tone is higher, put an "X" in the space by the number "1__". If the second tone is higher, put an "X" in the space by the number "2__". The questions on PITCH are numbered 1 to 30. Remember, listen carefully, and make no noise." Now, look where it says, "SAMPLE," and listen to the two tones.



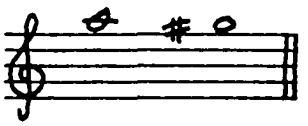
The first tone was higher, so in sample question number one an "X" has been written to the right of number one. Now, listen again.



The second tone was higher, so in sample question number two you put an "X" by the number two. Listen again.



The second tone was higher, so in sample three you put an "X" by the number two. Let's listen once more.



The first tone was higher, so in sample four you put the "X" by the number one. If you are not sure which is higher, place an "X" by the number you believe is right, and do not leave

any questions unanswered. Be sure to answer each question as we go. All right, we are ready to start the test on PITCH. Turn the directions over, and have your answer sheet ready for question one. Listen carefully, and do not make any noise. You are to start with question number one, and continue through question number thirty. Do your best. Here is the test on PITCH. (TEST) (At conclusion of test on PITCH) That is the end of the test on PITCH.

Information as to the recording of the test appears in Chapter V. Musical notations for the test of pitch appear in the appendix.

CHAPTER III

TEST OF TIME

In this study, time or time-sense is described as a "term denoting our direct experience of the lapse of time, based, however, on the very definite impression we have of a time interval within the sensory or specious present."[1]

This test of time is similar to Drake's test which he refers to as a test of rhythm. Drake says that "Rhythm is the ability to maintain an accurate beat while performing other activities at the same time."[2] This test has thirty questions while Drake's test has fifty questions. Where Drake uses a standard of four counts, in each question, to set his pattern, this test varies from three to six counts before the pattern is set. The writer is in agreement that time is basic in rhythm, and that the two are closely related.

This test was constructed on the basis of having the students judge a space in time after a pattern had been set.

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[1]James Drever, A Dictionary of Psychology. London: Hazel Watson and Viney, 1955, p. 294.

[2]Raleigh M. Drake, Examiner Manual for the Drake Musical Aptitude Tests. Chicago: Science Research Associates, 1954, p. 4.

An electric metronome was used to make the audible beats, and at the same time a voice counted the beats until they ceased.

The directions for taking the test show the method employed. They appear in the following paragraph as they were actually used to record the test. Table 2 is the guide sheet for the samples used on the test of time.

Now, look at the directions for Musical Aptitude Test, and you read the directions silently as I read them aloud. Start where it reads, Roman numeral "II. TIME: You will hear some sounds like clicks or the loud ticking of a clock, which are produced by a metronome beating at a certain rate, like this (SOUNDS: six ticks). While these clicks are being made you will also hear a voice counting, 'one, two, three, four, five, or six,' like this (SOUNDS AND VOICE TOGETHER: six ticks while counting, 'one, two, three, four, five, six'). The voice and the clicks will both stop at a certain number, but you are to continue counting, silently, to yourself, until the voice says, 'Stop.' Then you will record the number you had counted to when you heard the word, 'Stop.' The questions on TIME are numbered 31 to 60. Remember, listen carefully, and make no noise." Look where it says, "SAMPLE," and listen carefully. (Count with ticks, "ONE, TWO, THREE, FOUR," cut out ticks. On EIGHT say, "STOP.") When I said, "Stop," I had counted up to the number eight, so I would write the number "8" in the space by the sample question number 5. You can see the "8" written in the sample. Let's do it again,

you count silently as I count aloud with the clicks. (Count with ticks, "ONE, TWO, THREE, FOUR, FIVE," cut out ticks. On TEN say, "STOP.") When I said, "STOP," I had counted up to the number ten, so for question 6 you can see that "10" is written in the space by question number six. Let's do it again. (Count with ticks, "ONE, TWO, THREE," cut out ticks. On NINE say, "STOP.") When I said, "STOP," I had counted up to nine, so you can see the "9" by question number seven. You should feel the time by thinking about it. Do not respond in any way except to think and to keep the same time that I count while the clicks are beating. You must concentrate very hard on a test like this. Do not make any noise or movement which will cause others to lose their count. Here is one more sample. It will be for sample question number eight. (Count with ticks, "ONE, TWO, THREE, FOUR, FIVE, SIX," cut out ticks. On TWELVE say, "STOP.") When I said, "STOP," I had counted to twelve, so you can see the "12" in the space for question number eight. Turn the directions over, and have your answer sheet ready for the test on TIME, starting with question thirty-one. Listen carefully, and do not make any noise. Be sure that you write down the number you have counted to when you hear the voice say, "STOP." Answer each question as we go, and do not leave any question unanswered. Do your best. Here is the test on TIME. (TEST) (At conclusion of test on TIME) That is the end of the test on TIME.

Information as to the recording of the test appears in Chapter V. The guide sheet for the test of time appears in the appendix.

TABLE 2

TEST OF TIME SAMPLES[a]

Sample	Count To	"STOP" On
5	4	8
6	5	10
7	3	9
8	6	12

[a]Electric metronome was set at 92 beats per minute for all samples.

CHAPTER IV

TESTS OF TONAL MEMORY

In this study, tonal refers to musical tones. Memory or memory-image means a "revival of former experiences of an object in the absence of the object itself; the primary memory image is the very vivid memory image revived immediately after the perceptual experience of the object."[1]

Test of Tonal Memory, Part 1

This portion of the test was based on the assumption that a person who is musical should be able to note the sameness or difference of two short melodies that are played in succession, with a time interval of about three seconds duration between the two.

The writer used this idea in his two earlier tests in 1939 and 1941. The method of marking the answer sheet is different, the melodies are original, and the Organo was used to produce the pure tones of the melodies. Twenty short mel-

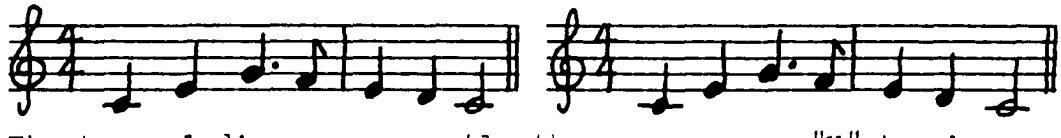
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[1] James Drever, A Dictionary of Psychology. London: Hazel Watson and Viney, 1955, p. 165.
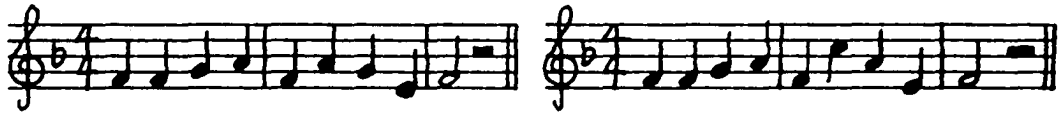
odies were composed in twelve different keys, and these were divided throughout the range of the five octaves in a pattern as follows: C-1, C-3, C-5, C-2, C-4, and continuously for the twenty questions. No two consecutive melodies were in the same key.

The directions for taking the test show the method used. They appear in the following paragraph as they were actually used to record the test.
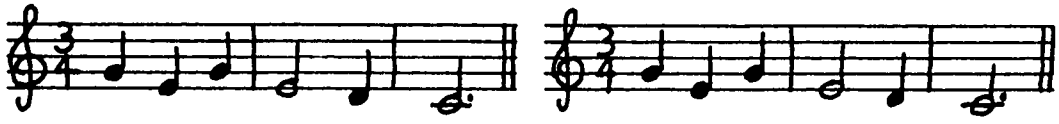
Now, look at the directions for Musical Aptitude Test, and you read the directions silently as I read them aloud. Start where it reads, Roman numeral "III. TONAL MEMORY, PART 1: You will hear two melodies, played on the Organo, which will be the same or different. You are to judge whether they are the same or different. If they are the SAME you will put an "X" in the space after "S". If they are DIFFERENT, you are to put an "X" in the space after the "D". The questions on TONAL MEMORY, PART 1 are numbered 61 to 80. Remember, listen carefully, and make no noise." Now, look where it says, "SAMPLE," and listen to the two melodies.
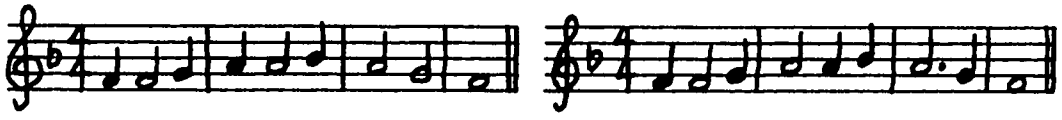


The two melodies were exactly the same, so an "X" has been written in the space after the "S" in sample number nine. Let's listen again.



The two melodies were different, so you put an "X" in the space after the "D" in sample number ten. Listen again.



The two melodies were the same, so you see the "X" after the "S" in sample eleven. Now, listen once more.



The two melodies were different, so you see the "X" written after the "D" in sample question twelve. If you are not sure whether the melodies are the same or different, make the best guess you can. Answer each question as we go, and do not leave any question unanswered. Turn the directions over, and have your answer sheet ready to start the test on TONAL MEMORY, PART 1, starting with question number sixty-one and continuing through question number eighty. Do your best. Here is the test on TONAL MEMORY, PART 1. (TEST) (At conclusion of test on TONAL MEMORY, PART 1) This is the end of the test on TONAL MEMORY, PART 1.

Information as to the recording of the test appears in Chapter V. Musical notations appear in the appendix.

Test of Tonal Memory, Part 2

This portion of the test was based on the assumption that a person who is musical should be able to hear a tone, form a memory-image of the tone, and be able to recognize
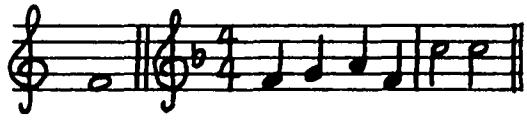
that tone in a short melody played after a time interval of about two seconds.

The idea is not original, as Seashore, Kwalwasser and others used it in tests of this nature. The method of marking the answer sheet is similar to that of an earlier test by the writer, the Organo was used to produce the pure tones in the test, and the melodies are original. It was the plan to use twenty short melodies in this test, and the melodies were composed in seven different keys, and these were divided throughout the range of the five octaves in a pattern as follows: C-1, C-3, C-5, C-2, C-4, and continuously through the questions. No two consecutive melodies were in the same key.
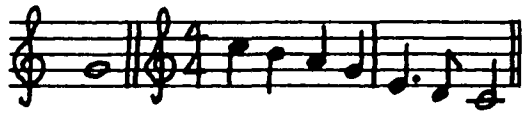
The directions for taking the test show the method employed. They appear in the following paragraph as they were actually recorded on the test.

Now, look at the directions for Musical Aptitude Test, and you read the directions silently as I read them aloud. Start where it reads, Roman numeral "IV. TONAL MEMORY, PART 2: You will hear one long tone which you must keep in mind. Following this tone you will hear a short melody. You are to determine the number of times the original, long tone is repeated in the melody. If you think the original, long tone appears once in the melody, write "1" in the space provided. If you think the original, long tone appears twice in the melody write "2" in the space, and so on. The original, long
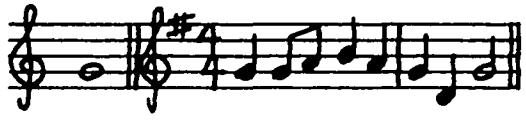
tone will not appear less than once nor more than five times. In each question you will be given a different, long tone to keep in mind. The questions on TONAL MEMORY, PART 2, are numbered 81 to 100. Remember, listen carefully, and make no noise." Now, look where it says, "SAMPLE," and listen to a long tone followed by a melody.
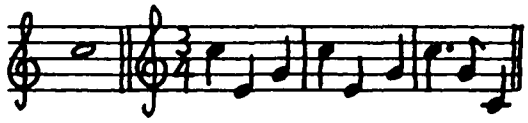


The long tone appeared twice in the melody, so you see the number "2" written in the space by sample question number thirteen. Listen again.



The long tone appeared once in the melody, so you see the number "1" written in the space by sample fourteen. Listen again.



The long tone appeared four times in the melody, so you see the number "4" in the space by sample fifteen. Listen once more.



The long tone appeared three times in the melody, so you see the number "3" in the space by the sample question number sixteen. If you are not sure how many times the original,

long tone appears in the melody, make the best guess you can. Answer each question as we go, and do not leave any question unanswered. Turn the directions over and have your answer sheet ready to start the test on TONAL MEMORY, PART 2, starting with question number eighty-one and continuing through question number one-hundred. Do your best. Here is the test on TONAL MEMORY, PART 2. (TEST) (At conclusion of test on TONAL MEMORY, PART 2) This is the end of the test on TONAL MEMORY, PART 2.

Information as to the recording of the test appears in Chapter V. Musical notations appear in the appendix.

Immediately after this fourth and final part of the test was given came the final statement, "This concludes the Musical Aptitude Test."

CHAPTER V

ADMINISTRATION AND RECORDING

The previous chapters have dealt with a survey of the field and the individual parts of the musical aptitude test constructed for this study. This chapter deals with such administrative details as compiling the test, preparation for and the printing of the necessary test forms and directions, meeting with the school administrators, interviews, instructions, and the distribution of the test materials. It also deals with the recording conditions, equipment, studios, and the broadcasting of the test.

Administration

After completing the four parts of the test they were arranged in the order of pitch, time, tonal memory, part one, and tonal memory, part two. From previous tests of this nature composed by the writer it was planned to have the entire test cover one-hundred questions; thirty on pitch, thirty on time, twenty on tonal memory, part one (same or different), and twenty on tonal memory, part two (number of times a certain long tone appeared in a melody that followed). It was

assumed that one-hundred questions would be sufficient to get a reliable measure of musical aptitude, and that they could be administered in approximately one-half hour. The questions were arranged whereby one answer sheet would suffice for the entire test, and at the same time be easy to make, easy to score by hand, and have a pleasing, symmetrical appearance. The information required of the person taking the test included his name, grade, age, school, instrument(s) played, number of years played, if he had taken singing lessons, number of years studied, and the date of the test. This was information considered necessary for a statistical treatment of the data.

The only requirement of the classroom teacher was to see that the information was completed at the top of the answer sheet, and to see that each student had the two pages for the test, and that good testing conditions prevailed. The test, itself, contained all of the directions for taking the test.

The writer had the opportunity to meet with all twenty of the school superintendents, or their representatives, at a meeting called by the County Superintendent of Tillman County for another purpose. This meeting was held at the Frederick High School in March, 1956. The problem of this study was briefly explained to the group, and the superintendents who indicated willingness to participate gave an approximate number of the students, grades four through twelve, who would be

available to take the test. It appeared, at that time, that about 2,000 students would be available to take the test in May, about two months later.

Forms for taking the test and the directions were typed on a special electric typewriter which could utilize the size of type necessary to reduce the printing to one page each. Plates were prepared, and the forms were printed by the lithographic method.

While distributing the test materials to the twenty schools in the county, an interview was held with the superintendents. This was accomplished the day before the test was scheduled to be broadcast. In each case, the superintendent seemed most anxious to take part in the study, an attitude which had not been apparent at the joint meeting with the men some two months prior.

The interview had to do with the number of test blanks needed, the nature of the test, expected testing conditions, getting a radio for each classroom, time of the test, length of time required, and the instructions they should give to their teachers.

The superintendents arranged with pupils in the various classrooms to bring a radio for each of the rooms. Several of the schools had radios in each of the rooms as permanent equipment. More than 2,000 students, grades four through twelve (plus about 30 third-graders), took the test in their own classrooms, at the same time. The Grandfield Junior and

Senior High Schools listened to the radio broadcast piped through the school's public address system from the superintendent's office to the various rooms.

The test was given on schedule, starting at 10:15 A.M, Wednesday, May 9, 1956. Scores from this test were used for the tentative norms appearing in Chapter VI.

Of the twenty schools participating in the study, sixteen were composed of white students, while there were three negro elementary schools and one negro high school.

Two years later, in May, 1958, the test was broadcast again over the same radio facilities for the students of Frederick High School. Results of this testing were used in the statistical analysis appearing in Chapter VI.

Recording

The method selected for recording the test was to make a tape recording. The facilities of Radio Station KTAT, Frederick, Oklahoma were available for both recording and broadcasting the test. Since the test had been constructed to include the directions, samples, and the test itself, a tape recording would permit a continuous test with no interruptions for changing a record or transcription or for any additional instructions or directions. The test was to be complete on the tape recording, and a time of approximately thirty minutes was set for the complete test. The time element was considered important for two reasons. First, it was felt that a test of musical aptitude could be constructed

which could be given in thirty minutes and be able to measure this trait. Second, in using commercial radio as a means of giving the test, a time segment of thirty minutes would fit into the pattern of programming of the station and not disrupt the commercial aspect of the station to any great extent.

Three different spaces or rooms were required for recording the test; a studio, the control room, and the reception room. The Organo, attached to and a part of the piano, was located in the studio. One microphone was used exclusively for recording the pure tones, with the microphone located about four inches from the Organo speaker, and another microphone was placed where the writer could be at the keyboard, give the instructions, samples, and the musical portion of the test required. The tape recorder was located in the control room, next to the console, through which the various test components were being fed before reaching the recorder. This room also served as a studio for the test of time. Experimental recordings were made of the various elements that were included on the test, with different arrangement of the microphones, different volume settings on the recorder and on the console amplifiers, and using different brands of tape to check reproduction.

The test was recorded in four different segments, with each segment checked for accuracy prior to recording a new portion of the test. The entire operation, performing and recording, was a one man operation with the exception of the

test on time which required two persons to produce. The test required about seven hours to record. This was accomplished while the radio station was off the air, when there was less chance of outside interruptions or external noises while the recording was in process.

The same microphone locations and the use of the studio and the control room were utilized for three segments of the test: pitch, tonal memory, part one, and tonal memory, part two.

The recording of the test on time required two persons, one in the studio, who controlled the speed indicator on the electric metronome, and one person in the control room where the directions and all voice work for the test originated. The reception room speaker was set at a level just high enough for the writer to hear the beats of the metronome coming from the studio, but it could not be heard on the tape recording. Intelligence from both the studio and the control room was fed into the tape recorder at the same time, which gave the effect of recording through just one microphone.

Sample questions for the test of time were recorded at the speed of 92 beats per minute, and the test questions started at the speed of sixty beats, gradually building up to 126 beats per minute for the final two questions.

The test was recorded on a high quality tape known as "Soundcraft, Plus 50." This is magnetic recording tape with a mylar base or Dupont Polyester film, one-fourth inch by

1,800 feet. It was recorded at a speed of 7 1/2 inches per second, the standard for most tape recordings. It was recorded on Eicore equipment which gives a full or double track recording.

CHAPTER VI

STATISTICAL ANALYSIS

A statistical analysis has been made by comparing the Musical Aptitude Test with the Seashore Measures of Musical Talents and with the Kotick and Torgerson Diagnostic Tests of Achievement in Music. The two musical aptitude tests were given on successive days to all students present on those days at Frederick High School, with approximately 200 students in attendance each day. Not all of the students took both of the tests, which accounts for a slight difference in the frequency on several of the computations. The achievement test was taken by a smaller number of the group who had taken both aptitude tests.

Reliability

The reliability of the Musical Aptitude Test was estimated by means of internal consistency coefficients, using the Kuder-Richardson formula 21. This formula was used because all test items were assumed to be of the same difficulty. For instance, it should be no more difficult to judge an interval from C# to D than to judge one from F# to G, to deter-

mine a space interval of four seconds or seven seconds, or to judge the number of times an original tone appears in a melody because of a change in key. This formula has the virtue of providing conservative coefficients, as its use is more likely to underestimate than to overestimate the reliability. The frequencies, means, standard deviations, standard error of the means, standard error of the measurements, and the coefficients of correlations are presented in Table 3 for each measure and for the total raw scores of the entire high school population. By combining the 10th, 11th, and 12th grade students into one group it becomes comparable to Seashore's grouping of grades 9-16.

TABLE 3

COEFFICIENTS OF RELIABILITY, MUSICAL APTITUDE TEST, USING THE KUDER-RICHARDSON FORMULA 21

Component	N	M	SD	SE_m	SE_{meas}	r
Pitch	198	25.13	4.74	.34	1.887	.84
Time	198	24.58	5.03	.35	1.937	.85
Tonal Memory #1	198	16.32	2.40	.19	1.634	.54
Tonal Memory #2	198	11.29	3.72	.27	1.901	.74
Tonal Memory (#1 & #2 combined)	198	27.92	5.37	.38	2.615	.76
Total Raw Score	198	77.54	14.15	3.69	3.899	.93

It is noted (see Table 3) that the coefficients of reliability for pitch .84 and time.85 are fairly high, while tonal memory divided into separate parts shows coefficients of .54 and .74. However, when combining the two elements of tonal memory as one complete component of musical aptitude the coefficient becomes .76, showing a higher degree of reliability than either part. The coefficient of reliability of .93 for the raw scores of the total test considers all three of the basic components of musical aptitude as agreed upon by the majority of authorities in this field.

Data obtained from the three tests administered to the Frederick High School students, first showing the raw scores and then employing the T-scale in order to compare the information, are presented in Table 4.

With data derived from scores in Table 4 and with the coefficient of correlation between the Measures of Musical Talents and the Musical Aptitude Test being .71, Table 6, Garrett's formula for the standard error of the difference between correlated means shows the SE_d to be 4.37, and a t-ratio of 28.4. This is significant at the .01 level of confidence. In like manner, with r = .31, Table 7, between the Diagnostic Tests of Achievement in Music and the Musical Aptitude Test, the SE_d is 3.89 and the t-ratio is 6.42. This, too, is significant at the .01 level of confidence. Likewise, with r = .33, Table 7, between the Diagnostic Tests of Achievement in Music and the Measures of Musical Talents, the SE_d is

6.53 and the t-ratio 15.18. This is significant at the .01 level.

TABLE 4

COEFFICIENTS OF RELIABILITY, MUSICAL APTITUDE TEST, MEASURES OF MUSICAL TALENTS, AND DIAGNOSTIC TESTS OF ACHIEVEMENT IN MUSIC

Test	N	M	SD	SE_m	SE_{meas}	r
Data Derived from Raw Scores						
Musical Aptitude	198	77.54	14.15	3.69	3.899	.93
Musical Talents	189	201.65	20.85	6.11	6.109	.91
Diagnostic Tests	43	102.50	36.80	6.88	6.884	.97
Data Derived from Calculated T-scores[a]						
Musical Aptitude	198	47.10	13.28	.84	4.794	.87
Musical Talents	189	47.83	13.06	.95	6.190	.78
Diagnostic Tests	43	48.34	13.02	2.03	5.664	.81

[a]Henry T. Garrett, Statistics in Psychology and Education. New York: Longmans, Green and Company, 1954, p. 307.

Another comparison of interest is the coefficient of reliability as shown by this experiment for the three basic components of musical aptitude and from the manual for the Seashore Measures of Musical Talents. Table 5 shows this comparison of pitch, time, and tonal memory.

TABLE 5

COEFFICIENTS OF RELIABILITY FOR MUSICAL APTITUDE TEST AND MEASURES OF MUSICAL TALENTS FROM THE KUDER-RICHARDSON FORMULA 21

Grades 9-16		Grades 10-12	
Measures of Musical Talents[a]		Musical Aptitude Test	
Pitch	.84	Pitch	.84
Time	.71	Time	.85
Tonal Memory	.83	Tonal Memory	.76

[a]Manual, Seashore Measures of Musical Talents. New York: The Psychological Corporation, Revised 1956, p. 7.

From Tables 3, 4, and 5 the data clearly indicate that the Musical Aptitude Test has a relatively high degree of reliability. It appears that the best prediction for musical aptitude will come from using the total score which is based upon the three basic components. A doubtful performance on the test should result in retesting the individual.

On original research of the Musical Aptitude Test, using data derived from tests taken in 1956, the seventh, eighth, and ninth graders were selected as an adequate sample. There were 530 test scores in this group. These were divided into two unselected groups of 265 each for the odd and even check of reliability. The mean for group one was 65.62 compared with a mean for group two of 66.45, a standard deviation of 12.87 and 13.86 respectively, with a standard error of .78 and .85. Calculations determined the critical ratio

to be .72 which shows no significant difference. This serves as another check on reliability.

Statistical Validity

The statistical validity of the Musical Aptitude Test was derived from information gathered on 200 high school students, 175 of whom took both the Musical Aptitude Test and the Seashore Measures of Musical Talents. The students taking both of the above aptitude examinations and the Kotick-Torgerson Diagnostic Tests of Achievement in Music numbered 43.

The Pearson Product-Moment Coefficient of Correlation was used to determine validity between the above three tests and between certain parts of the tests.

The coefficients of correlation between the three basic components of musical aptitude on the Musical Aptitude Test and the Measures of Musical Talents are shown in Table 6.

TABLE 6

PEARSON PRODUCT-MOMENT COEFFICIENTS OF CORRELATION BETWEEN MUSICAL APTITUDE TEST AND MEASURES OF MUSICAL TALENTS
(N = 175)

Component	r
Pitch	.69
Time	.11
Tonal Memory	.60
Total Raw Score	.71

The coefficient of correlation for time, r = .11, is not significantly different from zero at the .05 level. As mentioned in Chapter I, Drake correlated his test of rhythm with Seashore's test of rhythm, and he found that most of the r's cluster around .17. The test of time in the Musical Aptitude Test is similar in nature to the test of rhythm in the Drake test. The difference is primarily a difference in the terminology and not in content, as the two tests measure elapsed time. Drake stated that his rhythm test and Seashore's rhythm test do not measure the same thing. The same applies to the tests of time for the Musical Aptitude Test and the Measures of Musical Talents. The Seashore test on time utilizes the judgment of the duration of an actual tone in relation to a standard, while the Musical Aptitude Test uses the judgment of the time elapsed between audible beats of an electric metronome. Each of these tests of time measures some portion of a sense of time, but they could be very different kinds of time measurement. The very low r of .11 bears this out.

Another interesting observation is the total test scores of the two musical aptitude tests in relation to the achievement test, as shown in Table 7. Using the Pearson-product-moment coefficient of correlation the Musical Aptitude Test and the Diagnostic Tests of Achievement in Music show an r of .31 with the number of cases being 41. The Measures of Musical Talents and the Diagnostic Tests of Achievement in

Music show an r of .33 with the number of cases being 39. Both of these coefficients of correlation are significant at the .01 level of confidence as shown earlier in this chapter. The interesting observation is that they show r's that are positive, yet very low. This indicates, as would be expected, that musical aptitude cannot necessarily be measured by musical achievement tests or musical achievement measured by musical aptitude tests. Also, both of the r's are very close, yet the two musical aptitude tests show an r of .71 when correlated by the same method.

TABLE 7

COEFFICIENTS OF CORRELATION BETWEEN DIAGNOSTIC TESTS OF ACHIEVEMENT IN MUSIC AND (1) MUSICAL APTITUDE TEST AND (2) MEASURES OF MUSICAL TALENTS

Diagnostic Tests of Achievement in Music with	N	r
(1) Musical Aptitude Test	41	.31
(2) Measures of Musical Talents	39	.33

The r's shown in Table 7 are too low to be valid for use as predictors in musical aptitude tests versus musical achievement tests.[1] In fact, Thorndike and Hagen show that

[1] Robert L. Thorndike and Elizabeth Hagen, Measurement and Evaluation in Psychology and Education. New York: John Wiley & Sons, 1955, pp. 119-122.

the validity coefficient of the Seashore Tonal Memory Test and a performance test on stringed instrument is only .28, which is close to the findings concerned with this research.[1]

Applying the formula for the correction for attenuation, using the coefficients of reliability found in data derived from scores, Table 4, and the coefficient of correlation of .71, Table 6, the correlation between the true scores is .86, which is the upper limit to the correlation which we can obtain between the two aptitude tests as they now stand.

The score on each component as well as the score on the total test was determined for each individual who took the Musical Aptitude Test. The distribution of total scores for the entire group closely approximates the normal curve. These values indicate a relatively close fit to the theoretical normal curve, Figure 1.

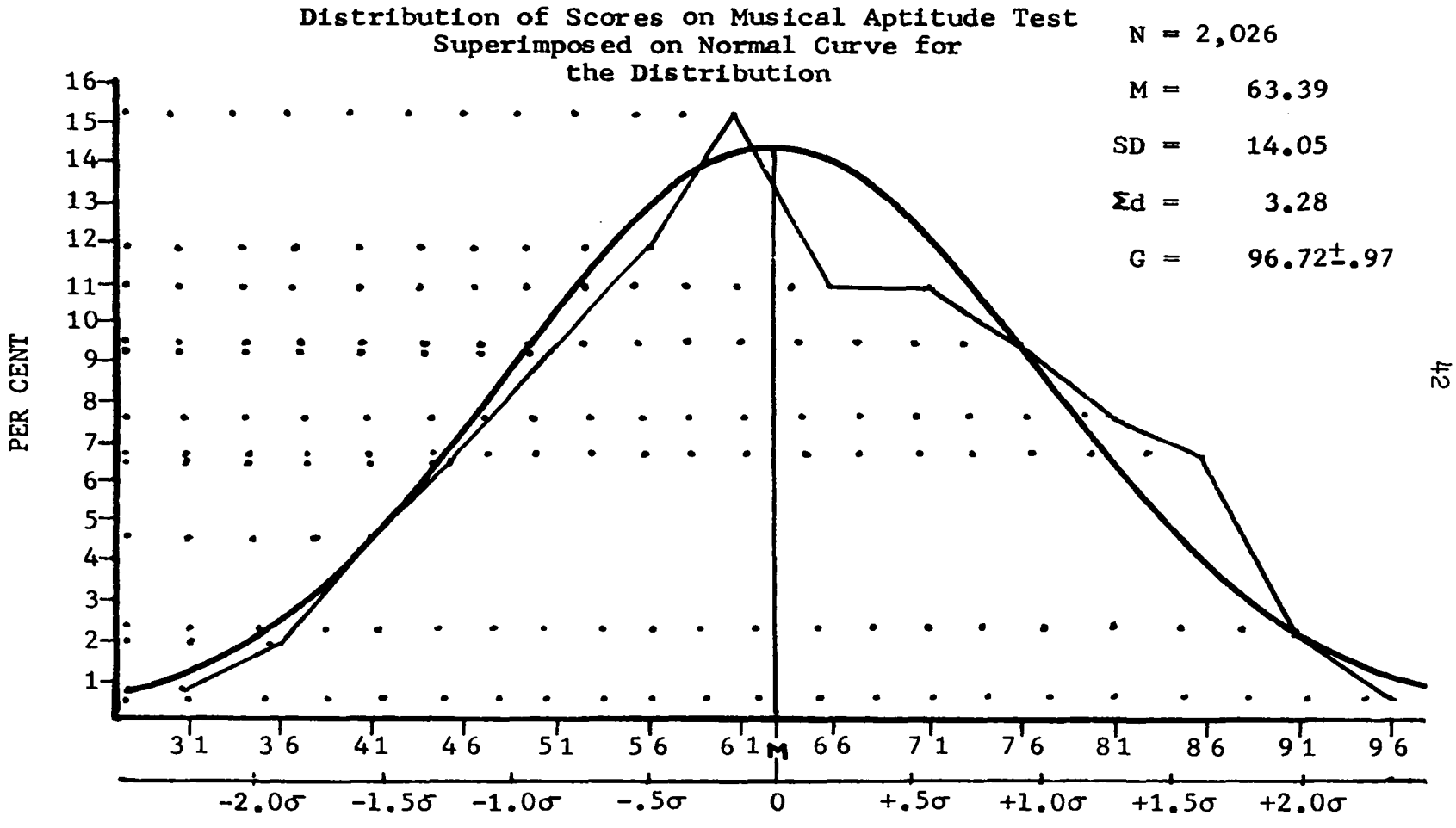
The procedure used for fitting the distribution to the normal curve is that recommended by the Dickey G formula;[2] $G = \frac{100\Sigma(f_1)}{\Sigma(f_t)} \pm \sqrt{\frac{pq}{N}}$, where f_1 is the frequency of the lesser, f_t is the theoretical frequency, p is G, and q is 1-G. The percentages obtained by this method were used in calculating the curve which has been superimposed on the theoretical normal curve in terms of the criteria.

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[1] Ibid.

[2] John W. Dickey, "Normalcy as a Statistic," Journal of Educational Psychology, September, 1934, pp. 437-446.

FIGURE 1


Distribution of Scores on Musical Aptitude Test
Superimposed on Normal Curve for
the Distribution
N = 2,026
M = 63.39
SD = 14.05
Σd = 3.28
G = 96.72±.97
PER CENT
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
31 36 41 46 51 56 61 M 66 71 76 81 86 91 96
-2.0σ -1.5σ -1.0σ -.5σ 0 +.5σ +1.0σ +1.5σ +2.0σ

The value of G equals 96.72 per cent ±.97 per cent. This means that 96.72 per cent of the observed distribution falls under the superimposed normal curve.

These results substantiate what Henry D. Rinsland has pointed out, that is, that "Reliable and valid tests, designed for the groups measured, yield close approximations to the normal curve."[1] Martha A. O'D. Rinsland stated that "The wide range of total scores, with close approximation to normal distribution, gives evidence of discrimination. This is an index of both validity and sampling."[2]

Gray and Votaw agreed with this when they said:

> The tendency of certain human traits to conform to this curve is so marked, that the failure of a group of test scores to take on this general form is usually taken by the statistician as evidence that either the test was not a satisfactory one or the sample of individuals was not representative.[3]

Concurrent validity has been verified by teachers' ratings using the Chi square method.[4] The vocal music teacher

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[1]Henry D. Rinsland, Constructing Tests and Grading in Elementary and High School Subjects. New York: Prentice-Hall, Inc., 1937, p. 230.

[2]Martha A. O'Daniel Rinsland, "A Test for Measuring Teachers' Knowledge of the Conduct and Personality of Children from Six to Eight Years of Age" (unpublished Ph.D. dissertation, College of Education, University of Oklahoma, 1936), p. 36.

[3]Clarence T. Gray and David F. Votaw, Statistics Applied to Education and Psychology. New York: The Ronald Press Co., 1939, p. 107.

[4]Allen L. Edwards, Experimental Design in Psychological Research. New York: Rinehart & Company, 1950, p. 90.

rated 81 of his students into two groups, the upper half and the lower half. Test scores on the Musical Aptitude Test for these same students were divided in the same manner. Using the Chi square method, Chi square was found to be .185 and the ∅ Coefficient to be .152. The P was found to be between .50 and .70, the probability of exceeding the tabulated value of Chi square for one degree of freedom.

The same method was used when the instrumental music teacher divided his students into two groups. Chi square was found to be .363, and the ∅ Coefficient to be .182. With one degree of freedom the P was found to be between .50 and .70, the probability of exceeding the tabulated value of Chi Square.

To make another comparison between the Musical Aptitude Test and the Measures of Musical Talents, of the students taking both tests in 1958, two groups were set up. The first group was composed of students who were members of the vocal music department, and the second group was made up of students who had received less than one year of musical instruction or none whatsoever. A total of 76 students were members of the vocal music group who had taken both tests. Included in this group were 43 students who had studied piano for one year or more, 27 who had received private singing lessons, 20 who had been in the band one or more years, and 22 who were only members of the vocal music department. The second group was made up of the 63 students who had taken both

tests, and who had received no musical instruction or had received less than one year of instruction.

For both aptitude tests, the difference between the means of scores for students who had studied music and those who had not shows a decided difference; 11.6 for the Musical Aptitude Test, and 15.23 for the Measures of Musical Talents. In each case the groups which had studied music scored higher than the groups which had not. For the Musical Aptitude Test the SE_d = 1.785, and the t = 6.49. For the Measures of Musical Talents the SE_d = 3.094, and the t = 4.93. In each case the obtained t is significant at the .01 level of confidence. There seems to be little difference in the way either of these tests distinguishes between students who have studied music and those who have not. These calculations were derived from Garrett's formulae.[1] Table 8 gives this information.

Tentative norms for the Musical Aptitude Test appear in Table 9. They were derived from 2,026 scores on the test taken by students ages 7 through 20 who were enrolled in twenty schools throughout Tillman County, Oklahoma. Since some of the schools let children age 7 take the test, these scores were included in the data. They differed little, if any, from the scores of those one year older. Norms are compiled into four groups: Ages 7-10, 11-12, 13-14, and 15-20. Percentile scores have been computed from raw scores for each

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[1]Henry T. Garrett, Statistics in Psychology and Education. New York: Longmans, Green and Company, 1954, pp. 224-225.

TABLE 8

STANDARD ERROR OF DIFFERENCE BETWEEN MEANS FOUND ON MUSICAL APTITUDE TEST AND MEASURES OF MUSICAL TALENTS FOR STUDENTS WITH AND WITHOUT MUSICAL TRAINING

TEST	TRAINING	N	M	SD	SE_m	SE_d	t
Musical Aptitude	Yes	76	82.71	9.90	1.14	1.785	6.49
	No	63	71.01	11.10	1.39		
Musical Talents	Yes	76	206.87	16.90	1.94	3.094	4.93
	No	63	191.64	19.60	2.47		

component of the test and for the total raw score. These divisions are provided in order for comparisons to be made, although the test was devised as a complete test, and therefore the total score percentile is considered to be actual performance on the test and the measure it gives on musical aptitude. Table 9-E gives a compilation of the means and standard deviations of the norms which affords a closer inspection of the results of the test.

In each age group, on each component and on the total score, it will be noted that the score increases with age. For the individual components the increase is slight, and it is noticed mostly on the total score. The difference in scores for students age 15 and above was negligible, and these were grouped together. This group is comparable to

TABLE 9-A.

TENTATIVE NORMS

Percentile Equivalents of Raw Scores Obtained by Students, Ages 7-10									
PITCH		TIME		TONAL MEMORY (#1)		TONAL MEMORY (#2)		TOTAL SCORES	
Score	%ile	Score	%ile	Score	%ile	Score	%ile	Score	%ile
30	99	28-30	99	19-20	99	16-18	99	87-98	99
29	90	27	95	17-18	95	13-15	95	80-86	95
25-28	80	25-26	90	16	90	11-12	90	74-79	90
22-24	70	23-24	80	15	80	9-10	80	66-73	80
21	60	21-22	70	14	70	8	70	60-65	70
19-20	50	19-20	60	13	60	7	60	57-59	60
17-18	40	18	50	12	50	6	50	55-56	50
16	30	15-17	40	11	40	5	40	51-54	40
15	20	11-14	30	10	20	4	30	47-50	30
14	10	9-10	20	9	10	3	20	45-46	20
0-13	1-9	6- 8	10	0- 8	1-9	2	10	39-44	10
		0- 5	1-9			0- 1	1-9	0-38	1-9
N	286		286		286		286		286
Mean	19.5		16.4		12.8		6.3		55.8
SD	5.5		6.9		2.5		3.2		12.4

TABLE 9-B.

TENTATIVE NORMS

Percentile Equivalents of Raw Scores Obtained by Students, Ages 11-12									
PITCH		TIME		TONAL MEMORY (#1)		TONAL MEMORY (#2)		TOTAL SCORES	
Score	%ile	Score	%ile	Score	%ile	Score	%ile	Score	%ile
30	99	30	99	19-20	99	17-18	99	88-98	99
29	80	29	95	18	95	14-16	95	84-87	95
27-28	70	28	90	17	90	12-13	90	80-83	90
23-26	60	26-27	80	16	80	10-11	80	74-79	80
21-22	50	25	70	15	70	9	70	70-73	70
18-20	40	23-24	60	14	60	8	60	65-69	60
17	30	22	50	13	50	7	50	61-64	50
16	20	20-21	40	12	40	6	40	58-60	40
14-15	10	18-19	30	11	30	5	30	54-57	30
0-13	1-9	16-17	20	10	10	4	20	50-53	20
		11-15	10	0-9	1-9	3	10	44-49	10
		0-10	1-9			0-2	1-9	0-43	1-9
N	503		503		503		503		503
Mean	21.1		20.2		13.2		6.9		61.2
SD	6.2		6.3		2.5		3.6		13.0

TABLE 9-C.

TENTATIVE NORMS

Percentile Equivalents of Raw Scores Obtained by Students, Ages 13-14

PITCH		TIME		TONAL MEMORY (#1)		TONAL MEMORY (#2)		TOTAL SCORES	
Score	%ile	Score	%ile	Score	%ile	Score	%ile	Score	%ile
30	99	30	99	19-20	99	15-18	99	91-98	99
28-29	70	29	95	18	95	14	95	87-90	95
25-27	60	28	90	17	90	13	90	84-86	90
23-24	50	27	80	16	80	11-12	80	78-83	80
21-22	40	25-26	70	15	70	10	70	73-77	70
19-20	30	24	60	14	50	9	60	69-72	60
17-18	20	23	50	13	40	8	50	66-68	50
15-16	10	21-22	40	12	20	7	40	62-65	40
0-14	1-9	19-20	30	11	10	6	30	59-61	30
		16-18	20	0-10	1-9	5	20	55-58	20
		11-15	10			4	10	49-54	10
		0-10	1-9			0-3	1-9	0-48	1-9
N	532		532		532		532		532
Mean	22.8		20.9		13.9		8.3		65.5
SD	5.8		6.5		2.5		3.7		12.8

TABLE 9-D.

TENTATIVE NORMS

Percentile Equivalents of Raw Scores Obtained by Students, Ages 15-20

PITCH		TIME		TONAL MEMORY (#1)		TONAL MEMORY (#2)		TOTAL SCORES	
Score	%ile	Score	%ile	Score	%ile	Score	%ile	Score	%ile
30	99	30	99	20	99	18	99	94-98	99
29	70	29	95	19	95	17	95	90-93	95
27-28	60	28	90	18	90	16	90	87-89	90
24-26	50	27	80	17	80	14-15	80	82-86	80
21-23	40	26	70	16	70	12-13	70	78-81	70
20	30	25	60	15	50	10-11	60	73-77	60
18-19	20	23-24	50	14	40	9	50	68-72	50
16-17	10	22	40	13	30	8	40	64-67	40
0-15	1-9	20-21	30	12	20	7	30	61-63	30
		17-19	20	11	10	6	20	57-60	20
		12-16	10	0-10	1-9	5	10	48-56	10
		0-11	1-9			0- 4	1-9	0-47	1-9
N	712		712		712		712		712
Mean	23.3		21.2		14.5		9.2		68.2
SD	5.4		6.7		2.5		4.1		13.6

TABLE 9-E.

TENTATIVE NORMS

Compilation of Means and Standard Deviations of the Norms

AGE	PITCH	TIME	TONAL MEMORY (#1)	TONAL MEMORY (#2)	TOTAL SCORES
7-10	M 19.58	M 16.36	M 12.76	M 6.33	M 54.87
(N 286)	SD 5.44	SD 6.91	SD 2.52	SD 3.22	SD 12.40
11-12	M 21.14	M 20.15	M 13.16	M 6.92	M 61.24
(N 503)	SD 6.16	SD 6.28	SD 2.48	SD 3.54	SD 13.00
13-14	M 22.77	M 20.88	M 13.89	M 8.31	M 65.54
(N 532)	SD 5.81	SD 6.46	SD 2.47	SD 3.67	SD 12.80
15-20	M 23.25	M 21.16	M 14.50	M 9.15	M 68.17
(N 712)	SD 5.39	SD 6.66	SD 2.53	SD 4.09	SD 13.60

norms of the Measures of Musical Talents for students in grades 9-16.[1]

An interesting point is that the highest test score of the 2,026 original tests taken in 1956 was made by a boy, age 12, who had received no musical training, other than the little singing he had done in class, not ordinarily considered to be formal training. There were more than 300 students who were members of various bands, and hundreds of high school students who were studying piano and in various vocal groups where they were receiving instructions.

Approximately 30 teachers took the test with their scores falling into the norms of the age 15-20 group.

In order to complete the picture, the writer would like to point out various things concerning the Musical Aptitude Test and the Measures of Musical Talents which are alike and those that are unlike.

Both tests are designed to measure musical aptitude or talents, and they are composed of components utilized in music. The two tests were recorded under laboratory conditions. Both of the tests measure the components of pitch, time, and tonal memory, and they are scientific instruments. No performance, as such, is necessary, and the two tests are taken with pencil and test forms. Norms for the tests are

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[1]Manual, Seashore Measures of Musical Talents. New York: The Psychological Corporation, Revised 1956, p. 10.

set up for individual components, and percentile ratings may be found from raw scores.

On the other hand, the two musical aptitude tests differ in many respects. The Musical Aptitude Test employs only three components or factors which are considered basic in musical aptitude. Two different methods were used to determine tonal memory. The Measures of Musical Talents utilizes six components which Seashore considered to be basic. The big difference in the tests is the manner in which the approach to the components of pitch, time, and tonal memory is accomplished. In each case the approach is entirely different. In the measure of pitch the Measures of Musical Talents has one standard set up and varies a tone from the standard to a slight degree. The measure of pitch is a good one, but it is good for just a small portion of the musically notated scale. In the Musical Aptitude Test it was pointed out that a range of 60 tones, in half steps, was used. In the test of time the Measures of Musical Talents used a standard of a certain duration of a tone, and this was followed by a tone of either longer or shorter duration. In the Musical Aptitude Test a pattern of time was established with a rest interval following. The rest period was to be judged rather than the length of the tone. On the tonal memory component of the Measures of Musical Talents the student was to judge which tone of a certain melody was changed, the number of the tone. On the Musical Aptitude Test the first tonal

memory portion was based on judgment as to whether two melodies were the same or different. On the second portion of tonal memory a long tone was heard, and the student had to determine the number of times that the specific tone appeared in the melody that followed. In each case, the measurements of the three basic components used an entirely different approach.

The two tests differ in the length of time required to administer them. The Musical Aptitude Test requires about one-half hour to give while the Measures of Musical Talents takes approximately one hour. The Measures of Musical Talents is available on records at 78 rpm and on transcription at 33 1/3 rpm, while the Musical Aptitude Test is tape recorded at speed 7 1/2 ips. The Measures of Musical Talents is on records or a transcription, and the person administering the test must read the directions from the manual and play samples from the test, itself. On the Musical Aptitude Test the tape recording contains all of the instructions for taking the test, the sample questions, and the test proper. This assures that the test will be exactly the same in all cases, for the complete test. The person administering the Seashore test must study the manual and practice the instructions. The tape recorded test can be given by any teacher whose job is to pass out the forms and see that good testing conditions exist. No explanations are necessary as to taking the test, and samples are not played and then repeated in case someone fails to un-

derstand the procedure. The Musical Aptitude Test is explained in simple language that even the seven-year-olds were able to grasp the first time, while following printed instructions that must contain words not in their vocabulary.

CHAPTER VII

SUMMARY AND CONCLUSIONS

This has been a study in the measurement of musical aptitude. The problem was to construct a musical aptitude test, to tape record it, and to broadcast it by means of commercial radio (Radio Station KTAT, Frederick, Oklahoma) at a prearranged date and time, for testing of students in grades four through twelve, at the same time, in the various schools in Tillman County, Oklahoma. The data were used in setting up the tentative norms.

The second portion of the problem consisted of analyzing the statistical data obtained when the test was rebroadcast two years later for the students of Frederick High School and from results of the Seashore Measures of Musical Talents and the Kotick and Torgerson Diagnostic Tests of Achievements in Music which were taken by the same group.

An original test has been constructed which appears to be a measure of musical aptitude. The four parts selected for the test were pitch, time, tonal memory (if two melodies are same or different), and tonal memory (recognition of the

number of times an original tone appears in a melody that follows).

The test of pitch is a new idea. The test of time is similar to a part of Drake's test on rhythm, but it has many differences, and new ideas have been added. All melodies for both parts of the tonal memory tests were original, as was the method of test construction and presentation.

The test was designed whereby a study could be made of a student's acuity of hearing in any of the five octaves represented on the test. This study would cover parts one, three, and four of the test.

The test was recorded on magnetic tape at a speed of 7 1/2 ips, for a full or double track. The entire test, including the directions, samples, and the test questions, is included on the one tape recording which should insure a more uniform type of test wherever it is given, regardless of who gives the test. It was primarily designed for use over the radio, but it can be given on practically any tape recorder with a two track reproduction head. The test requires 33 1/2 minutes to take, after minimum information has been noted on the test blank.

The test was first broadcast over Radio Station KTAT in May, 1956 when it was taken by all fourth through twelfth graders in twenty schools in Tillman County who were present on the day of the test. More than 2,000 students were given

the test. In addition, tests were taken by 19 third graders in two of the participating schools.

The test was broadcast again over the same radio station two years later, in May, 1958 when it was taken by 198 students of the Frederick High School who were present on the day of the test.

The reliability of the Musical Aptitude Test was estimated by means of internal consistency coefficients, using the Kuder-Richardson formula 21. The coefficients of reliability for pitch .84 and time .85 are fairly high, and for tonal memory .76, a fair degree of reliability. The coefficient of reliability for the entire test, based on the raw scores, was .93.

Using data derived from scores, Garrett's formula for the standard error of the difference between correlated means shows the SE_d to be 4.37 and a t-ratio of 28.4 between the Measures of Musical Talents and the Musical Aptitude Test; SE_d of 3.89 and a t-ratio of 6.42 between the Musical Aptitude Test and the Diagnostic Tests of Achievement in Music; and SE_d of 6.53 and t-ratio of 15.18 between Measures of Musical Talents and the Diagnostic Tests of Achievement in Music, each of which is significant at the .01 level of confidence.

With data from the 1956 test scores of the Musical Aptitude Test, dividing 530 tests of the seventh, eighth, and ninth graders into two different groups (odd and even) to check for reliability, a critical ratio of .72 was found

which shows no significant difference. The mean for group one was 65.62 compared with a mean for group two of 66.45, a standard deviation of 12.87 to 13.86, and a standard error of .78 to .85.

The statistical validity of the test was derived from information on 200 high school students, 175 of whom took this test and the Seashore Measures of Musical Talents, and 43 of whom took the two aptitude tests and the Kotick-Torgerson Diagnostic Tests of Achievement in Music. The Pearson Product-Moment Coefficient of Correlation was used to determine validity between these three tests and certain parts of the tests.

The Musical Aptitude Test and the Measures of Musical Talents showed a coefficient of correlation of .71. This correlation is high when noticing that the like components had correlations of .69 for pitch, .11 for time, and .60 for tonal memory. It is also pointed out that the Seashore test had three additional measurements or components he considered basic. Total scores were used in determining the r of .71.

The two aptitude tests revealed about the same findings when correlated with the diagnostic or achievement test. The coefficient of correlation for the Musical Aptitude Test and the Diagnostic Tests of Achievement in Music shows an r of .31, while the Measures of Musical Talents and the Diagnostic Tests of Achievement in Music have an r of .33. These are positive, but low.

Making the correction for attenuation the coefficient of correlation of .71, above, the r becomes .86, the upper limit which could be expected to be obtained between the two tests if both were perfectly reliable.

The distribution of scores of 2,026 students of an unselected group was found to be a relatively close fit to the theoretical normal curve, showing that 96.72 per cent of the observed distribution falls under the superimposed normal curve.

Concurrent validity was determined by results of test scores and teachers' ratings using the Chi square method. The P was found to be between .50 and .70. From among the students tested in 1958, 76 students were members of the vocal music department, and 63 students had received no formal training in music, all of whom had taken both of the aptitude tests. For the Musical Aptitude Test the difference between the means of scores was 11.6, the SE_d was 1.785, and the t was 6.49. For the Measures of Musical Talents the difference between the means of scores was 15.23, the SE_d was 3.094, and the t was 4.93. In each case the obtained t is significant at the .01 level of confidence. There seems to be little difference in the way either of these tests distinguishes between students who have studied music and those who have not.

Tentative norms for the Musical Aptitude Test are compiled into four groups: Ages 7-10, 11-12, 13-14, and 15-20.

Percentile scores have been computed from raw scores for each component of the test and for the total raw score. Since the test was devised as a complete test the total score percentile is considered to be the actual performance and is the measure of musical aptitude.

On the two occasions that the test has been administered, no one has made a perfect score or answered all questions correctly. In 1956 on the original 2,026 tests the highest score was made by a boy, age 12 years, who had received no formal training in music. In 1958 when 198 high school students took the test, this boy's sister made the second highest score which was one point higher than her younger brother made two years before. The highest score to date was made by a boy, age 16 years, whose only musical training was as a member of the high school chorus.

The Musical Aptitude Test and the Seashore Measures of Musical Talents are both designed to measure musical aptitude, and while there are many things about the two tests which are alike, the differences are more interesting. The big difference is the approach to the study of pitch, time, and tonal memory. An entirely different approach is utilized in each case. The other big difference is the time element to take the tests, with time for the Musical Aptitude Test at about one-half the time of the other.

The Musical Aptitude Test is unique, in that the complete test of instructions, examples, and the test proper are

all recorded which assures that the entire test will be exactly the same regardless of who administers the test.

Recommendations

It is indicated by inspection that the Musical Aptitude Test could be reduced in time of administering to just under thirty minutes by eliminating several slight delays between some of the parts of the test. By reducing the time element for giving the test it could be recorded on one side of a long-play transcription. This would give a continuous rendition, without interruption, on both methods of recording. Being recorded on both tape and transcription it would mean that schools with either a tape-recorder or a phonograph would be able to use the test in the classroom when desired. Also, this timing would meet the requirement of a half-hour program for both commercial and non-commercial radio station. Since this test was broadcast as a public service over a commercial station it seems highly probable that other stations would be receptive to the idea. Non-commercial college-owned stations could handle the test as a service to the schools in their listening area, thus covering a greater number of students in the shortest time.

On the test of time, it appears that the word "stop" should be changed to "mark." The word "mark" is a sharper and more distinct sounding word, and, too, it seems to add meaning by telling the person taking the test what to do.

It appears that further investigation should be undertaken on the sense of pitch to determine which is the better (or best) approach to its measurement, to determine if this measure should be divided with use made of each approach, to determine if two different aspects of this musical sense actually exist, or to learn if two separate basic components are being measured by two different approaches.

Another investigation might be conducted to determine if there is a relationship between the musical aptitude of parents and their children. This might be an important variable.

Finally, new research should be conducted to determine what components are basic in musical aptitude and to discover the best methods of testing for these basic components.

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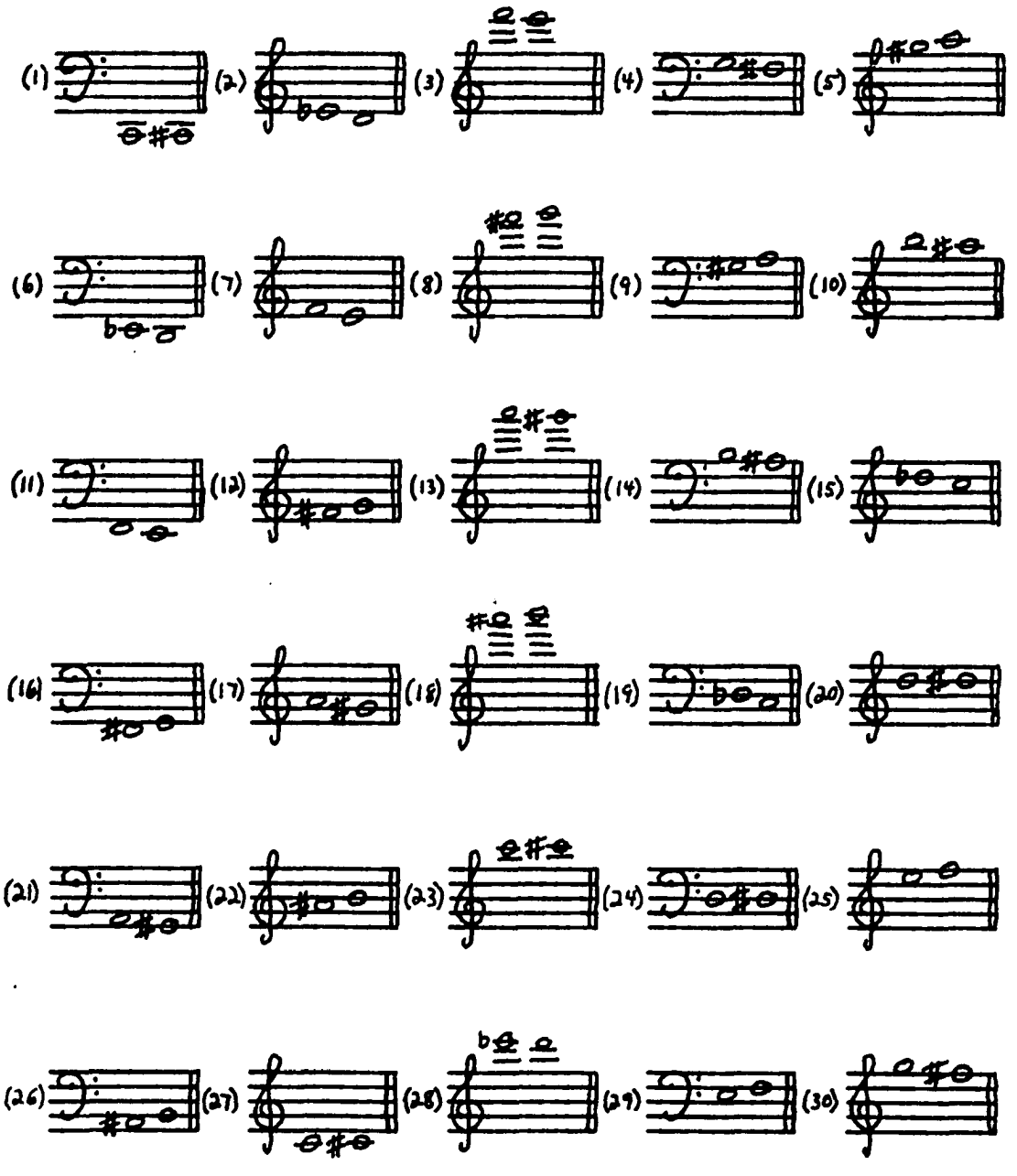
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APPENDIX

Musical Notation

Test of Pitch

C-1 C-3 C-5 C-2 C-4



APPENDIX

Guide Sheet

Test on Time

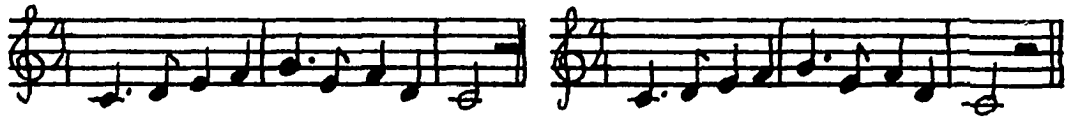
QUESTION	METRONOME	COUNT TO	"STOP" ON
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2	63	5	9
3	66	4	10
4	69	3	8
5	72	6	12
6	76	5	11
7	80	4	10
8	80	3	9
9	84	6	13
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30	126	6	17

APPENDIX
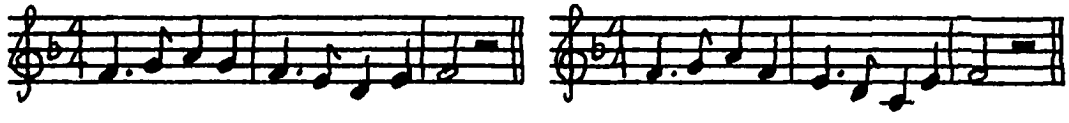
Musical Notation

Test of Tonal Memory, Part 1
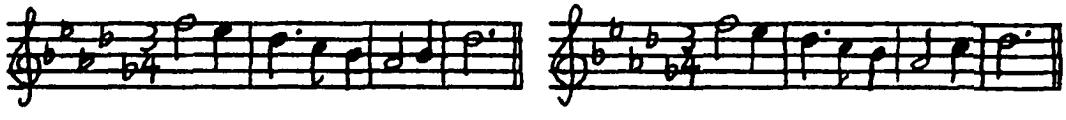
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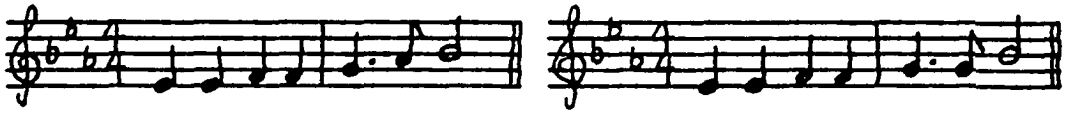


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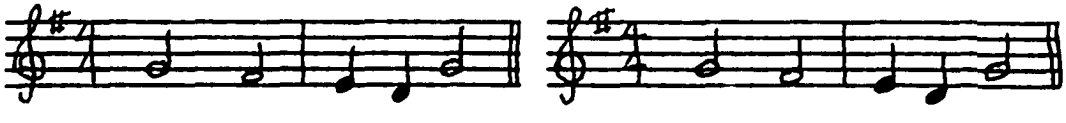


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(4) C-2 DIFFERENT



(5) C-4 SAME
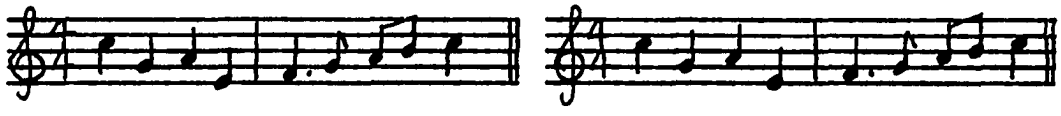


APPENDIX

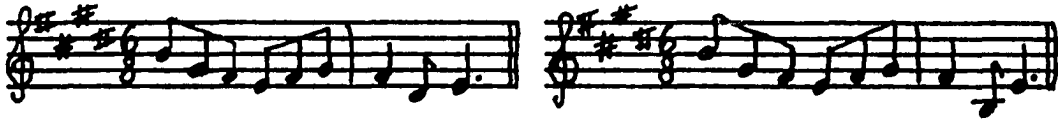
Musical Notation

Test of Tonal Memory, Part 1
(Continued)

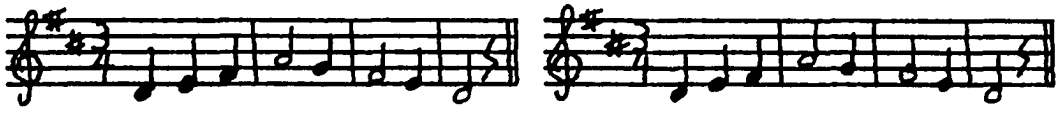
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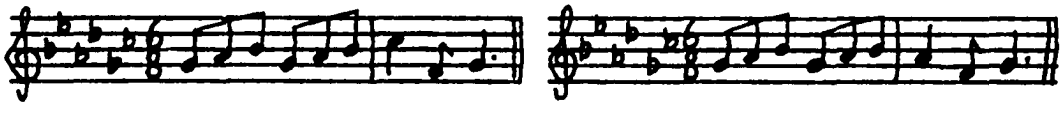
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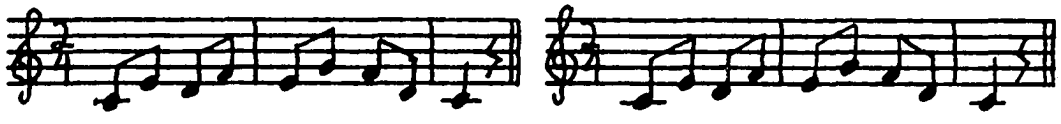
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(9) C-2 DIFFERENT



(10) C-4 SAME



APPENDIX

Musical Notation

Test of Tonal Memory, Part 1
(Continued)
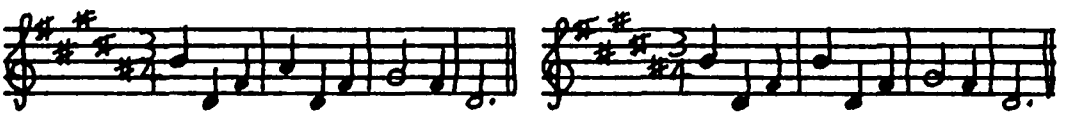
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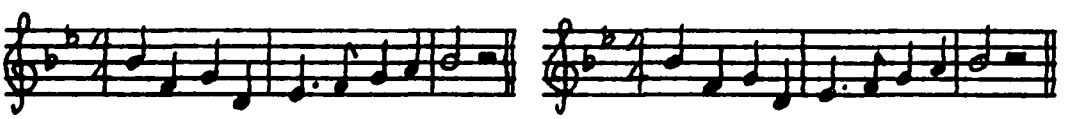


(12) C-3 DIFFERENT



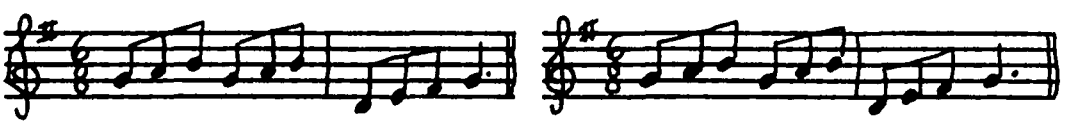
(13) C-5 DIFFERENT



(14) C-2 SAME



(15) C-4 SAME
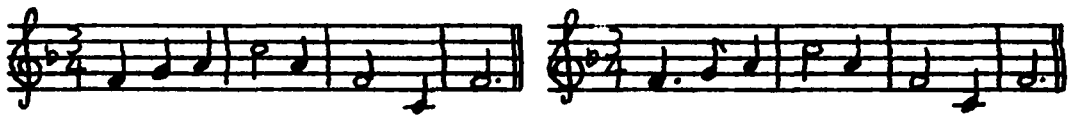


APPENDIX
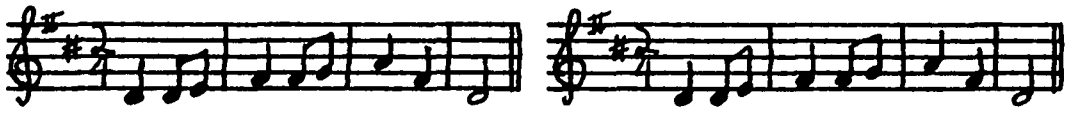
Musical Notation

Test of Tonal Memory, Part 1
(Continued)
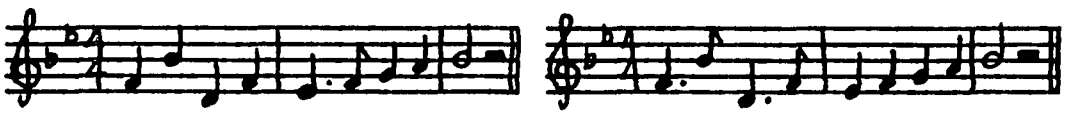
(16) C-1 DIFFERENT
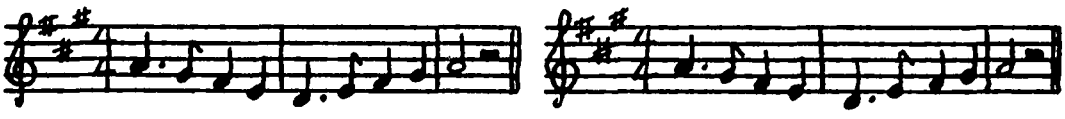


(17) C-3 SAME
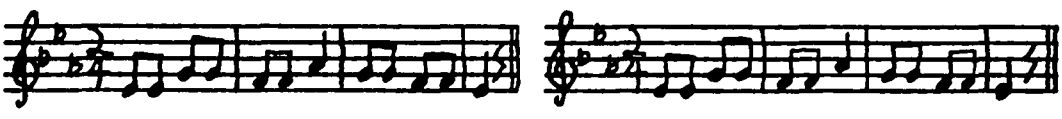


(18) C-5 DIFFERENT



(19) C-2 SAME



(20) C-4 SAME
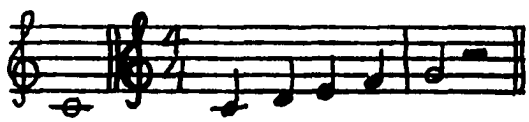


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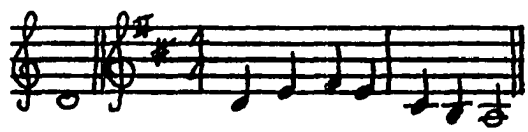
Musical Notation

Test of Tonal Memory, Part 2

(1) C-1 ONE
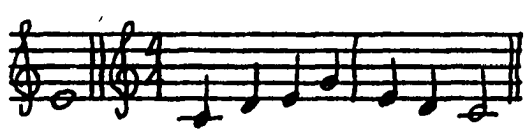


(2) C-3 ONE



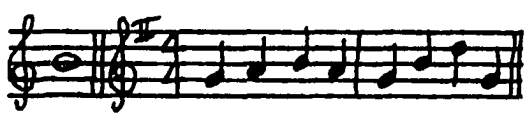
(3) C-5 THREE



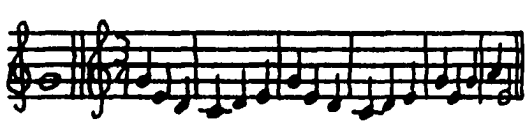
(4) C-2 TWO



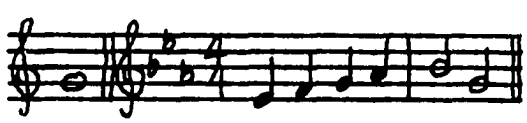
(5) C-4 TWO



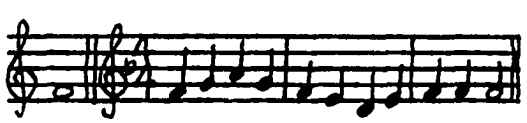
(6) C-1 FOUR



(7) C-3 TWO



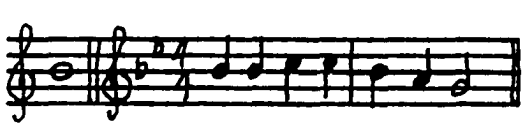
(8) C-5 FIVE



(9) C-2 THREE



(10) C-4 THREE
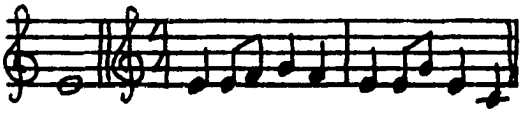


APPENDIX

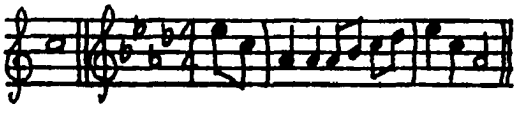
Musical Notation

Test of Tonal Memory, Part 2
(Continued)

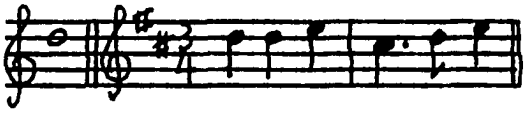
(11) C-1 FIVE
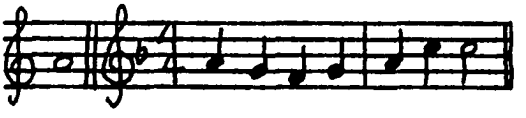


(12) C-3 THREE
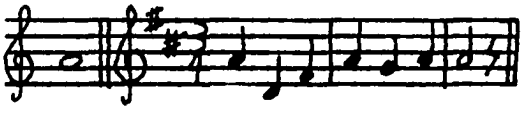


(13) C-5 THREE



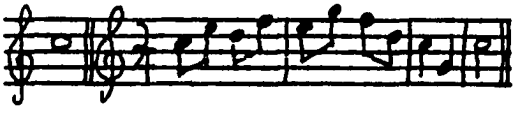
(14) C-2 TWO
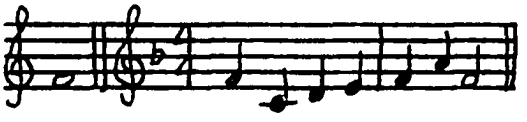


(15) C-4 FOUR



(16) C-3 THREE



(17) C-2 THREE



(18) C-4 FIVE



DIRECTIONS FOR THE MUSICAL APTITUDE TEST

I. PITCH: You will hear two tones which differ in pitch. You are to judge which tone is the higher of the two. If the first tone is higher, put an "X" in the space by the number "1__". If the second tone is higher, put an "X" in the space by the number "2__". The questions on PITCH are numbered 1 to 30. Remember, listen carefully, and make no noise.

SAMPLE: 1. 1_X_ 2 1__ 3. 1__ 4. 1_X_
2__ 2_X_ 2_X_ 2__

II. TIME: You will hear some sounds like clicks or the loud ticking of a clock, which are produced by a metronome beating at a certain rate, like this (SOUNDS). While these clicks are being made you will also hear a voice counting, "1, 2, 3, 4, 5, or 6," like this (SOUNDS AND VOICE TOGETHER). The voice and the clicks will both stop at a certain number, but you are to continue counting, silently, to yourself, until the voice says, "Stop." Then you will record the number you had counted to when you heard the word, "Stop." The questions on TIME are numbered 31 to 60. Remember, listen carefully, and make no noise.

SAMPLE: 5. _8_ 6. _10_ 7. _9_ 8. _12_

III. TONAL MEMORY PART 1: You will hear two melodies, played on the Organo, which will be the same or different. You are to judge whether they are the same or different. If they are the SAME you will put an "X" in the space after the "S". If they are DIFFERENT you are to put an "X" in the space after the "D". The questions on TONAL MEMORY, PART 1, are numbered 61 to 80. Remember, listen carefully, and make no noise.

SAMPLE: 9. S_X_ 10. S__ 11. S_X_ 12. S__
D__ D_X_ D__ D_X_

IV. TONAL MEMORY PART 2: You will hear one long tone which you must keep in mind. Following this tone you will hear a short melody. You are to determine the number of times the original, long tone is repeated in the melody. If you think the original, long tone appears once in the melody, write "1" in the space provided. If you think the original, long tone appears twice in the melody, write "2" in the space, and so on. The original, long tone will not appear less than once nor more than five times. In each question you will be given a different, long tone to keep in mind. The questions on TONAL MEMORY, PART 2, are numbered 81 to 100. Remember, listen carefully, and make no noise.

SAMPLE: 13. _2_ 14. _1_ 15. _4_ 16. _3_

MUSICAL APTITUDE TEST

NAME _____ GRADE____ AGE____ SCHOOL_____ DATE_____

INSTRUMENT PLAYED?_____ YEARS_____ SINGING LESSONS_____ YEARS_____

I. PITCH:	1.	1__ 2__	2.	1__ 2__	3.	1__ 2__	4.	1__ 2__	5.	1__ 2__	6.	1__ 2__	7.	1__ 2__	8.	1__ 2__	9.	1__ 2__	10.	1__ 2__
	11.	1__ 2__	12.	1__ 2__	13.	1__ 2__	14.	1__ 2__	15.	1__ 2__	16.	1__ 2__	17.	1__ 2__	18.	1__ 2__	19.	1__ 2__	20.	1__ 2__
	21.	1__ 2__	22.	1__ 2__	23.	1__ 2__	24.	1__ 2__	25.	1__ 2__	26.	1__ 2__	27.	1__ 2__	28.	1__ 2__	29.	1__ 2__	30.	1__ 2__
II. TIME:	31.	___	32.	___	33.	___	34.	___	35.	___	36.	___	37.	___	38.	___	39.	___	40.	___
	41.	___	42.	___	43.	___	44.	___	45.	___	46.	___	47.	___	48.	___	49.	___	50.	___
	51.	___	52.	___	53.	___	54.	___	55.	___	56.	___	57.	___	58.	___	59.	___	60.	___
III. TONAL MEMORY PART 1:	61.	S__ D__	62.	S__ D__	63.	S__ D__	64.	S__ D__	65.	S__ D__	66.	S__ D__	67.	S__ D__	68.	S__ D__	69.	S__ D__	70.	S__ D__
	71.	S__ D__	72.	S__ D__	73.	S__ D__	74.	S__ D__	75.	S__ D__	76.	S__ D__	77.	S__ D__	78.	S__ D__	79.	S__ D__	80.	S__ D__
IV. TONAL MEMORY PART 2:	81.	___	82.	___	83.	___	84.	___	85.	___	86.	___	87.	___	88.	___	89.	___	90.	___
	91.	___	92.	___	93.	___	94.	___	95.	___	96.	___	97.	___	98.	___	99.	___	100.	___