The Manifestation of Developmental Music Aptitude in the Audiation of "Same" and "Different" as Sound in Music

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Introduction

Music aptitude is the potential for music achievement. Music achievement is the actual attainment of music knowledge and skills. Early in the twentieth century, Carl E. Seashore stated, "When the proximate physiological threshold has been reached, practice is of no avail."[1] That declaration agreed with the views of his European predecessors who engaged to some extent in the study of the psychology of music.[2] Thus, although considered to be a relative capacity by Seashore, music aptitude was thought to be a God-given gift that one was born with or without: practice and training in music would not affect one's physiological limit, but only his cognitive limit. Nature was the controlling influence on level of music aptitude and nurture was the controlling influence on level of music achievement. Moreover, Seashore came to believe that music aptitude was not only innate, but that it was inherited. That is, he seemed certain that the level of music aptitude one was born with was determined genetically and that it could be predicted with a high degree of accuracy.[3]

The belief that music aptitude was inherited and that it stabilizes at birth, if not prenatally, held firm for approximately two decades. James Mursell became suspicious of it and he popularized his point of view in an exchange of letters with Seashore which were published in the *Music Educators Journal* during the 1930's. The nature/nurture issue ultimately evolved into a major controversy among music educators and was discussed by Mursell in *The Psychology of Music* in 1937.[4] Mursell posed the question that if indeed music aptitude is innate and if it cannot be altered with practice and training, why are the majority of students in the schools of America required to receive instruction in general music? He reasoned that if Seashore is correct, training in music is all but useless for those born without a high level of music aptitude. Seashore appeared to be primarily interested in the identification and education of the musically talented and to a much lesser extent in pedagogical practices in terms of students' individual musical differences. Nonetheless, Mursell's argument became the focus of a great deal of research, which has been summarized by

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1. Carl E. Seashore, *The Psychology of Musical Talent.* (Boston: Silver Burdett, 1919), p. 60. For a more current detailed discussion, see Part One of *The Psychology of Music Teaching* by Edwin Gordon. (Englewood Cliffs: Prentice Hall, 1971).
2. For example, see Carl Stumpf, "Akustische Versuche mit Pepito Areola," *Zeitschrift für Experimentelle und Angewandte Psychologie,* 2 (1909), 1-11.
3. Hazel M. Stanton, "The Inheritance of Specific Musical Capabilities," *Psychological Monographs,* 31 (1922), 157-204.
4. James L. Mursell, *The Psychology of Music.* (New York: W.W. Norton, 1937).

Lundin[5] and Farnsworth[6], that began with the Heinlein study in 1928[7] and virtually came to an end with the Wyatt study in 1945.[8] The majority of the findings reported by independent researchers, from studies which were in the main poorly controlled and were based on a period of instruction of only a semester or less, indicated that level of music aptitude can be changed with practice and training, and thus that music aptitude is neither innate nor stabilized. Seashore's aptitude battery was considered to be simply another music achievement test. Seashore remained undaunted by such evidence and opinions and reaffirmed his position in *Psychology of Music* in 1938.[9] Moreover, he came forth with a revision and a re-justification of his tests one year later.[10] Particularly in opposition to what was referred to as a Gestalt point of view, as later exemplified by Herbert Wing in his tests of music intelligence[11], Seashore maintained that music aptitude has more than only one dimension. He explained that he was an "atomist", though the British psychologist Lowery, not he, coined the term, and he emphasized his position by re-titling the 1939 revision of his battery the *Seashore Measures of Musical Talents;* the final word in the title was pluralized. The Gestalt/atomistic issue notwithstanding, the one longitudinal predictive validity study of the Seashore measures directed by Hazel Stanton under the guidance of Seashore himself included far too many limitations in design and analysis to substantiate its validity or the validity of either the nature or the nurture position.[12] From the results, however, it seemed clear that the music aptitudes of the subjects who participated in the study remained stable over a period of years.

The debate about the source and nature, not to mention the description, of music aptitude seemed to be of only minimal concern even to scholars during the 1950's. Most took sides on the basis of what they had been taught or in terms of their academic-political persuasion; they rarely discussed the matter. The disruption of their apathy took place with the publication of the *Musical Aptitude Profile* in 1965[13], soon to be followed by a three-year study in which

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5. Robert W. Lundin, *An Objective Psychology of Music.* (New York: Ronald Press, 1967).
6. Paul R. Farnsworth, *The Social Psychology of Music.* (Ames: The Iowa State University Press, 1969).
7. Christian Paul Heinlein, "A Brief Discussion of the Nature and Function of Melodic Configuration in Tonal Memory with Critical Reference to the Seashore Tonal Memory Test," *Pedagogical Seminary and Journal of Genetic Psychology,* 35 (1928), 45-61.
8. Ruth F. Wyatt, "Improvability of Pitch Discrimination," *Psychological Monographs,* 58 (1945), 1-58.
9. Carl E. Seashore, *Psychology of Music.* (New York: McGraw Hill, 1938).
10. Carl E. Seashore, Don Lewis, and Joseph Saetveit, *Seashore Measures of Musical Talents.* (New York: Psychological Corporation, 1956).
11. Herbert Wing, *Tests of Musical Ability and Appreciation.* (London: Cambridge University Press, 1971).
12. Hazel M. Stanton, *Measurement of Musical Talent: The Eastman Experiment.* Studies in the Psychology of Music. (Iowa City: University of Iowa, 1935).
13. Edwin Gordon, *Musical Aptitude Profile.* (Boston: Houghton Mifflin, 1965).

the longitudinal predictive validity of the battery was found to be .77.[14] The *Musical Aptitude Profile* reflects both Gestalt and atomistic principles. In terms of the present discussion, the most important contribution of the *Musical Aptitude Profile* is in the results of the longitudinal predictive study. It was found that regardless of practice and training in music, students maintained their relative standings on all seven subtests in the battery for the three-year period of the course of the study. Other researchers, even those who exposed students to practice and training on items quite similar to those found in the test, reported the same findings; raw scores increased with chronological age but percentile ranks remained ostensibly the same for each subject.[15] That the battery is relatively impervious to practice and training effects is demonstrated by the uncorrected-for-attenuation correlation of .75 between *Musical Aptitude Profile* composite scores before and after three years of music training. Thus the findings of Seashore and Wing with their own tests were corroborated in the research with the *Musical Aptitude Profile,* the only other study in which the stability of music aptitude scores was investigated over a period of time. In the standardization of the *Musical Aptitude Profile* it was determined that scores are not sensitive to socio-economic influences, and that music aptitude is normally distributed. Pre-standardization research identified more than thirty different music aptitudes, which demonstrated from moderately low to rather high intercorrelations; post standardization research indicated that the same norms can be used with students of different races and nationalities.[16] Of all of these findings, those which were given most attention by the profession through the 1960's were that music aptitude is stable and that music aptitude is innate.

It is important to remember that the *Seashore Measures of Musical Talents* and the *Musical Aptitude Profile* are designed for use with students beginning in grade four who are approximately nine years old. Wing offered composite score, but not subtest score, norms for students eight years old but the reliability of such scores has been questioned.[17] Because no valid standardized test had been developed which was suitable for use with children eight years old and younger, it was impossible to gather facts about the effects of practice and training on the music aptitudes of very young children. It was assumed that the music aptitudes of very young children had the same characteristics as those of older

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14. Edwin Gordon, *A Three-Year Longitudinal Predictive Validity Study of the Musical Aptitude Profile.* (Iowa City: University of Iowa Press, 1967).
15. For a partial summary, see Oscar K. Buros, ed. *The Seventh Mental Measurements Yearbook.* (Highland Park, New Jersey: The Gryphon Press, 1972), pp. 528-529.
15. For information on race, see Edwin Gordon, "Fourth-Year and Fifth-Year Results of a Longitudinal Study of the Musical Achievement of Culturally Disadvantaged Students," *Experimental Research in the Psychology of Music: Studies in the Psychology of Music,* 10 (1975), 24-52. In regard to nationality, the battery has been translated for use in various countries in which normative data have been found to be comparable to those published in those manuals for use with American students.
17. Jack Heller, *The Effects of Formal Training on Wing Musical Intelligence Test Scores.* Ph. D. Thesis. (Iowa City: University of Iowa, 1962).

children. Nonetheless, attempts were made to adapt the *Musical Aptitude Profile* for use with younger children.[18] None of the attempts was successful. It was not until 1979 that a standardized group test of music aptitude for very young children, ages five through eight, was published.[19] The content of the test, the *Primary Measures of Music Audiation,* was derived from an eight-year program of research in which a taxonomy of tonal patterns and rhythm patterns and their relative difficulty levels was established.[20] Information derived from the *Primary Measures of Music Audiation* suggests how very young children conceptualize sound as music. That information is to be given emphasis in the remainder of this report.

The results of the research over the past three years with the *Primary Measures of Music Audiation* leave little doubt about the source of music aptitude.[21] Neither side of the nature/nurture controversy is the correct nor the incorrect one. Music aptitude is a product of both nature and nurture. A child may be born with a high degree of music aptitude, but unless he receives appropriate early informal environmental influences, the potential he was born with will atrophy. On the other hand, a young child will profit from early exposure to music no more than his level of innate music aptitude will allow. The interaction between capacity and environment continues probably from birth through age eight, although the effect of environment on a child's music aptitude decreases substantially with age. The greatest gain from environmental music influences is observed at age five. It rapidly decreases until the child reaches age nine, give or take a few months. At age nine, music aptitude becomes stabilized; it is no longer increased or decreased by environment. Thus the music aptitude of students nine years old and older is stabilized and the music aptitude of children from five through eight years old (and most probably

18. For example, see Charles J. Harrington, "An Investigation of the Primary Level Musical Aptitude Profile for Use with Second and Third Grade Students," *Journal of Research in Music Education,* 17 (1969), 359-368.
19. Edwin E. Gordon, *Primary Measures of Music Audiation.* (Chicago: G.I.A., 1979).
20. Edwin Gordon, "Toward the Development of a Taxonomy of Tonal and Rhythm Patterns: Evidence of Difficulty Level and Growth Rate," *Experimental Research in the Psychology of Music: Studies in the Psychology of Music,* 9 (1974), 39-232; Edwin Gordon, *Tonal and Rhythm Patterns: An Objective Analysis.* (Albany: State University of New York Press, 1976); and Edwin E. Gordon, *A Factor Analytic Description of Tonal and Rhythm Patterns and Objective Evidence of Pattern Difficulty Level and Growth Rate.* (Chicago: G.I.A., 1978).
21. Relevant research is reported in Part Seven of the Manual for the *Primary Measures of Music Audiation* by Edwin E. Gordon. (Chicago: G.I.A., 1979). For more current research, see Edwin E. Gordon, "Developmental Music Aptitude as Measured by the Primary Measures of Music Audiation," *Psychology of Music,* 7 (1979), 42-49; Edwin E. Gordon, "Developmental Music Aptitudes Among Inner-City Primary Children," *Council for Research in Music Education,* 63 (1980), 25-30; and Edwin E. Gordon, "The Assessment of Music Aptitudes of Very Young Children," *The Gifted Child Quarterly,* 24 (1980), 107-111. The research to be reported in the final sections of this paper will also contribute to a clearer understanding of the nature as well as to the description of music aptitude. The distinction between the source of music aptitude and the nature of music aptitude is covered in detail in *The Psychology of Music Teaching* by Edwin Gordon. (Englewood Cliffs: Prentice Hall, 1971). In particular, see Chapter One of that book.

younger, though no valid test is yet available to prove this assumption) is developmental. It seems that the research findings of earlier years were incomplete. Had a valid test of developmental music aptitude been available along with the valid tests of stabilized music aptitude at the time, all of the presently known intricacies of the characteristics of music aptitude would have been observed.

There are additional differences between developmental and stabilized music aptitudes. Although both types of music aptitude are normally distributed, differences between the two do exist in the number and content of the dimensions each comprises. The *Musical Aptitude Profile* includes seven dimensions.[22] In contrast, the *Primary Measures of Music Audiation* include only two dimensions: tonal and rhythm. It was found that no other dimensions could be developed for appropriate use in the battery. This may be a result of lack of knowledge of how to design such tests for very young children or it may be that other dimensions of developmental music aptitude do not exist. The dimensions of timbre (more properly, sonance) and dynamics were investigated and it was intended that tests of these dimensions would be constructed to become part of the *Primary Measures of Music Audiation.* It was found that the reliability of such tests approached zero, because test items were either too easy or too difficult. The children could recognize only gross differences in timbre and in dynamics. Those children who could recognize typically smaller differences were very few. No items could be developed which displayed difficulty values between .10 and .90. Thus the discrimination value of the items approaches zero. It is true that the *Musical Aptitude Profile* also does not include atomistic tests of timbre and dynamics. This is by design, not necessity, because it was decided that aspects of timbre and dynamics would be best included in two of the three preference tests of *Musical Sensitivity* so that they could contribute realistically to a Gestalt of music phrasing and style. As Moorhead and Pond discovered many years earlier in their observations of preschool children in spontaneous music activities, very young children are interested in how music is constructed rather than in its expressive ramifications.[23] Further, very young children are more adept at describing music they have heard than they are in performing music they have been taught.

In further regard to the differences between developmental and stabilized music aptitudes, particularly as they relate to the measurement of both, it is evident that very young children cannot attend to two music dimensions simultaneously and make reliable decisions about what they hear. When a rhythm pattern is heard in a melodic context and when a tonal pattern is heard

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22. More dimensions of stabilized music aptitude were identified in the preliminary development of the battery. Concern for minimizing administration time, however, precluded the possibility of including more than seven dimensions in the battery.
23. Gladys Evelyn Moorhead and Donald Pond, *Music for Young Children.* (Santa Barbara, California: Pillsbury Foundation for Advancement of Music Education, 1978).

in a rhythm context, as they are in the *Musical Aptitude Profile,* the child in the developmental music aptitude stage does not know which of the two dimensions should be attended to in the listening process. Only when the differences are gross, as in a high flute compared to a low bass, will group means, not individual scores, be found to be moderately reliable for making such discriminations. It was also discovered that children who are progressing through the developmental music aptitude stage find it distracting to listen to precise differences in the performance of a test item when a familiar instrument is used as the stimulus. They are, however, quite comfortable and attentive when listening to a synthesizer rather than to a violin or a trumpet, for example. In contrast, typical instruments serve well in the performance of all test items in the *Musical Aptitude Profile.*

All of these differences between developmental and stabilized music aptitudes are important. Even more compelling differences remain to be discussed in terms of what is audiated. The meaning of the verb *to audiate* must be explained. Audiation takes place when one hears music through memory or creativity, the sound not being physically present except when one is engaging in performance. What is remembered may or may not be exact. That is, one may audiate through memorization or recall, the latter being the more prevalent type. Aural perception, on the other hand, takes place when one listens to music actually being performed by others. In order to perceive and conceive music aurally in a meaningful manner, one must audiate music, for referential and predictive purposes, heard at a previous time. When one is listening to music, he is audiating that which has been heard at a previous time as well as that which is being currently heard in order to give meaning to what is being heard and to predict what will be heard. Without audiation, even repetition and sequence could not exist and thus there could be no form in music.

Audiation functions in long term memory and short term memory, and both types of memory represent formal music achivement. However, the tests included in the *Primary Measures of Music Audiation* require neither short term memory nor long term memory. In the *Primary Measures of Music Audiation* the listener reacts with intuitive responses to immediate impressions of what is aurally perceived. Such responses represent, at most, only informal music achievement, possibly in terms of simple aural conception. A phrase which comprises one tonal pattern or one rhythm pattern is heard, and it is immediately reinforced or not reinforced in audiation. There is not enough time to memorize the first phrase before the second phrase is heard. Therefore, the phrases must be compared in terms of sameness and difference through audiation and only through recall. This type of audiation response is indicative of informal music understanding. It is impossible to teach another or oneself to derive an immediate impression and to make an intuitive response. The quality of one's formal achievement in long term memory and short term memory depends upon how well one can derive immediate impressions and make intuitive responses in the audiation process.

Whether one is in the developmental or stabilized music aptitude stage, one audiates tonal and rhythm patterns, not the pitch nor the duration of individual tones or notes. As in language, one is primarily concerned with words, not letters. The transition from developmental music aptitude to stabilized music aptitude appears to be a well-defined process. In tonal audiation, one is concerned first one with the pitch center of a part or the whole of a piece of music. Then one gradually becomes concerned with the key which the patterns collectively suggest, and finally with the mode which the patterns collectively suggest. In rhythm audiation, one first attends to paired beats which are most pronounced and are of equal length in a part of an entire piece of music. Then one gradually becomes concerned with the melodic rhythm which the patterns collectively suggest, and finally with the meter which the patterns collectively suggest.[24]

Immediate impressions and intuitive responses are developed according to the level of a child's innate music capacities and the quality of his early informal environmental experiences in music. These impressions and responses are not based on rational processes; they cannot be explained. As the quality of the music environment changes, the way each child audiates music fluctuates until he is approximately nine years old. The fluctuations represent the continuous interaction between a child's innate capacities and his environment. The degree to which a child can audiate immediate impressions and give intuitive responses at any given time is the best indicator of the level at which his music aptitudes will stabilize at approximately age nine. Probably the development of music-pattern "babble", which at present defies description but must exist as a parallel to word babble in language, from birth through age two or three is most significant in establishing a child's ability in audiating music as an adult.[25] It would seem that one's achievement in notational audiation (the reading and writing of music), among other music skills, would be best predicted by one's level of stabilized music aptitude.[26]

Design and Results of the Study

The *Primary Measures of Music Audiation* is a tape recorded group test in two parts: *Tonal* and *Rhythm*. Each part has forty items and requires approximately twelve minutes of listening time, including directions and practice examples. A child does not need to know how to read a language or music, or to know numbers, in order to use the answer sheets. The child answers the ques-

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24. For further information, see Part Seven of the Manual for the *Primary Measure of Music Audiation* by Edwin E. Gordon. (Chicago: G.I.A., 1979). A thorough discussion can be found in *Learning Sequences in Music: Skill, Content, and Patterns* by Edwin E. Gordon. (Chicago: G.I.A., 1980). These concepts will be discussed further in this paper in terms of their implications.
25. Although the analogy between music and language is made, music should not be considered to be a language. Language has grammar but music does not. Music does have syntax, which is the orderly arrangement of sounds.
26. For data on the relationship of music aptitude to music achievement, see pages 28 through 31 of *A Three-Year Longitudinal Predictive Validity Study of the Musical Profile* by Edwin Gordon. (Iowa City: The University of Iowa Press, 1967).

tions presented on the tapes by making circles around pictures on the answer sheet. He draws a circle around the pair of faces which are the same on the answer sheet if the two tonal patterns or rhythm patterns heard on the tape sound the same; if the two tonal patterns or rhythm patterns heard on the tape sound different, he draws a circle around the pair of faces which are different on the answer sheet. All that is asked of the child is to determine if the two tonal patterns or the two rhythm patterns sound the same or different.

As part of the standardization program of the *Primary Measures of Music Audiation,* in 1978 the battery was administered to 127 kindergarten children in nine elementary schools in West Irondequoit, New York. After the tests were scored and typical forms of data were derived, the product-moment intercorrelations among the test items were computed for each test separately. With the degrees of freedom granted, an intercorrelation is significant at the one percent level of confidence if the coefficient is .23. To account for practical as well as statistical significance, only pairs of items within each subtest that had intercorrelation coefficients of at least .30, positive and negative, were identified. For each subtest, 1600 (40 items x 40 items) intercorrelations are possible. It was found that 26 percent (422) of the tonal pattern intercorrelations that equaled or exceeded .30 were positive and that 8 percent (122) were negative, making 34 percent (544) in all. Similarly, 17 percent (277) of the rhythm pattern intercorrelations that equaled or exceeded .30 were positive and 9 percent (147) were negative, making 26 percent (424) in all.[27] The smaller percentage of overall significant rhythm pattern intercorrelations probably is the result of the lower reliability of the rhythm test items as indicated by the lower reliability of the rhythm subtest as compared to that of the tonal subtest. The split-halves reliability was .72 for the rhythm subtest, .88 for the tonal subtest, and .90 for the composite score. What is more startling than the number of highly significant item intercorrelations is that all of the pairs which demonstrate positive intercorrelations have the identical correct option response of same or different, and all of the pairs which demonstrate negative intercorrelations do not have the identical correct option response; one of the items of the pair has *same* as the correct option response and the other has *different* as the correct option response.

All of the *Tonal* test items and all of the *Rhythm* test items were factor analyzed to aid in the interpretation of the zero-order intercorrelations. The principle components technique was used in conjunction with the highest multiple r to determine communality estimates. The factors were rotated to the varimax criterion of orthogonal simple structure, and factors which accounted for at least 1.5 percent of the variance were identified. The results of the factor analysis for the tonal subtest are presented in Table 1. The results of the factor analysis for the rhythm subtest are presented in Table 2. Included in these tables

27. These data for the first year of the study can be found in Part Seven of the Manual for the *Primary Measures of Music Audiation* by Edwin E. Gordon. (Chicago: G.I.A., 1979).

in the second and third columns are the difficulty and discrimination values of the test items, with decimals omitted. An *s* after an item number in the first column indicates that the correct option response to that item is *same,* the remaining items having *different* as the correct option response. As can be seen in Table 1, five tonal factors were extracted to account for 16.5 percent of the variance. As can be seen in Table 2, seven rhythm factors were extracted to account for 16.3 percent of the variance.

Only those items with a factor loading of .30 and higher are presented in notational form in Table 1a for the tonal analysis and in Table 2a for the rhythm analysis. The line which separates items within a factor indicates that the factor is bipolar. All items of one sign, positive or negative, are above the line and all items of the other sign are below the line. The numerals to the left of the notation are test item numbers. The key signature is not notated for the second pattern of a pair in a tonal item, because the key and mode remain the same for both patterns in each item. The measure signature, however, is notated for the second pattern of a pair in a rhythm item because the meter is not always the same for both patterns in every item.

As can be deduced from Tables 1, 2, 1a, and 2a, the factors follow the structure suggested by the item intercorrelations. All of the items in the two non-bipolar factors, one tonal and one rhythm, have the identical correct option response. Every bipolar factor in the tonal and rhythm analyses comprises items that correlate positively with the factor and items that correlate negatively with the factor. All of the items that correlate positively with the factor have one identical correct option response, and all of the items that correlate negatively with the factor have the other identical correct option response. Of the five tonal factors, two are *same* factors and three are *different* factors in terms of the correct option responses for the items which constitute the factors. All are group factors. Of the seven rhythm factors, one is a *same* factor and six are *different* factors in terms of correct option responses for the items which constitute the factors. The *same* factor is, of course, unique, and the remaining six are group factors. Although all but one of the factors are group factors, there is very little overlap of items among them. Approximately 71 percent of the true (non-error) variance in the tonal analysis and approximately 56 percent of the true variance of the rhythm analysis are unaccounted for.

Table 1

TONAL FACTORS ROTATED TO THE VARIMAX CRITERION OF ORTHOGONAL SIMPLE STRUCTURE: 1978

			Factors				
Test Items	Difficulty	Discrimination	I	II	III	IV	V
1	72	47	.18	.49	-.12	-.09	-.28
2s	66	41	.56	.12	-.20	.01	-.08
3	70	53	.16	.56	.10	.14	-.41
4s	76	38	.41	-.07	-.04	-.11	-.17
5s	73	33	.52	-.01	-.02	-.29	-.06
6	71	46	.16	.54	.10	.00	-.07
7	62	53	.01	.59	.13	-.05	-.03
8s	72	38	.19	.15	.01	-.11	.48
9	59	43	-.16	.63	.00	.03	.23
10s	68	43	.56	.00	.05	-.23	.22
11s	80	35	.63	-.12	-.06	-.26	.05
12	57	34	-.03	.34	.28	.15	.10
13	51	41	-.19	.42	.24	-.12	.22
14s	74	44	.50	.13	-.07	-.17	.14
15	71	54	-.01	.52	.07	.10	.11
16s	71	45	.69	.09	-.12	.00	-.04
17s	75	32	.24	.29	-.22	-.47	.10
18	63	39	-.31	.44	.23	-.12	-.04
19	30	20	-.23	-.10	.14	.60	-.02
20s	75	41	.59	.01	-.29	.00	.04
21	36	24	-.37	.12	.25	.37	-.07
22s	65	40	.46	.15	-.36	-.18	.31
23s	79	39	.62	-.02	.03	-.39	.03
24	36	20	-.15	-.02	.48	.43	-.15
25s	78	44	.61	-.01	-.22	-.16	.41
26	45	23	-.27	.20	.47	.09	.10
27s	71	21	.21	-.14	-.05	-.50	.21
28s	71	20	.24	.00	-.47	-.29	.13
29	34	21	-.35	.14	.10	.40	-.01
30	57	43	.07	.37	.59	.11	.04
31s	79	29	.53	-.10	-.29	-.17	.23
32	43	24	-.11	.01	.44	.52	.01
33s	78	31	.40	-.03	-.16	-.38	.23
34s	69	31	.40	.02	-.29	-.35	.34
35	50	44	-.07	.37	.31	.44	.10
36	53	38	.03	.30	.66	.16	.01
37s	72	36	.47	-.06	.00	-.42	.26
38	57	40	-.24	.14	.56	.10	-.01
39	71	49	-.01	.55	.01	.48	.15
40s	68	23	.32	.06	-.40	.04	.22
Sum of Squared Loadings			5.4	3.3	3.2	3.1	1.5

Table 2

RHYTHM FACTORS ROTATED TO THE VARIMAX CRITERION OF ORTHOGONAL SIMPLE STRUCTURE: 1978

Test Items	Difficulty	Discrimination	Factors I	II	III	IV	V	VI	VII
1s	82	23	.24	.29	.07	.04	-.43	.16	.19
2	64	29	.28	.10	-.20	.20	-.01	.50	.01
3	46	31	.12	-.09	-.03	.12	.59	-.05	-.31
4s	65	44	-.25	.17	.42	-.05	.20	-.22	.00
5	44	27	.25	-.03	-.24	.11	.54	.14	.19
6s	62	26	-.02	.42	.29	-.20	.02	.04	.08
7s	69	20	-.04	.23	.25	.14	-.42	-.27	.14
8	50	28	.30	-.02	-.14	.61	.03	.08	.05
9	22	21	.00	-.15	-.39	-.13	.21	.33	-.04
10s	65	23	-.05	.20	.22	-.33	.03	-.13	.07
11	51	38	.15	-.17	.07	.24	.59	.11	.08
12s	63	29	-.01	.18	.55	-.15	-.08	-.06	.09
13	43	24	.26	.02	-.07	.19	.41	.35	.00
14	59	40	.26	.09	-.55	.18	.09	.11	.13
15s	74	25	.01	.38	.10	-.06	-.19	-.33	-.03
16s	60	28	-.21	.43	.24	.02	-.17	.11	-.10
17	42	24	-.02	-.05	-.36	.31	.04	.30	-.20
18s	67	28	-.09	.41	-.04	-.10	-.15	-.07	.00
19	40	20	-.13	-.19	-.41	.17	.09	.40	-.10
20s	73	28	-.03	.49	.08	-.18	-.05	-.08	.05
21	43	20	.14	-.21	-.16	.46	.16	.07	-.13
22	60	29	.53	-.02	-.06	-.08	.14	.26	-.37
23s	67	21	.09	.23	.05	-.64	-.12	-.20	.14
24s	64	30	-.09	.42	.27	.18	-.08	-.34	.11
25	52	39	.40	.03	-.30	.32	.05	-.15	-.17
26s	64	35	-.44	.41	.01	-.15	-.16	-.17	.09
27	59	39	.45	.06	-.37	.17	.04	-.01	-.15
28s	74	36	-.19	.72	.02	-.11	.01	-.13	.01
29	38	21	.11	-.14	-.55	.18	.08	.00	-.26
30	55	29	.71	-.21	.00	.04	.16	-.01	-.07
31s	62	22	-.17	.18	.22	-.33	-.18	-.01	.33
32	52	30	.62	-.24	-.09	.06	.07	.16	-.12
33s	65	22	-.19	.26	.22	-.33	-.24	-.08	.03
34s	71	28	-.16	.29	.14	.00	-.03	-.53	.21
35	50	39	.43	-.05	-.18	.38	.07	-.05	-.22
36s	65	23	-.36	.34	.16	-.08	-.06	-.16	-.02
37s	59	22	-.09	.03	.02	-.18	-.01	-.15	.60
38	48	21	.40	-.28	.05	.26	.01	.17	-.03
39	54	44	.30	.05	-.20	.04	.04	.11	-.61
40s	60	24	-.07	.16	-.05	-.25	-.06	-.53	.10
Sum of Squared Loadings			3.1	2.8	2.5	2.4	2.1	2.0	1.6

Table 1a

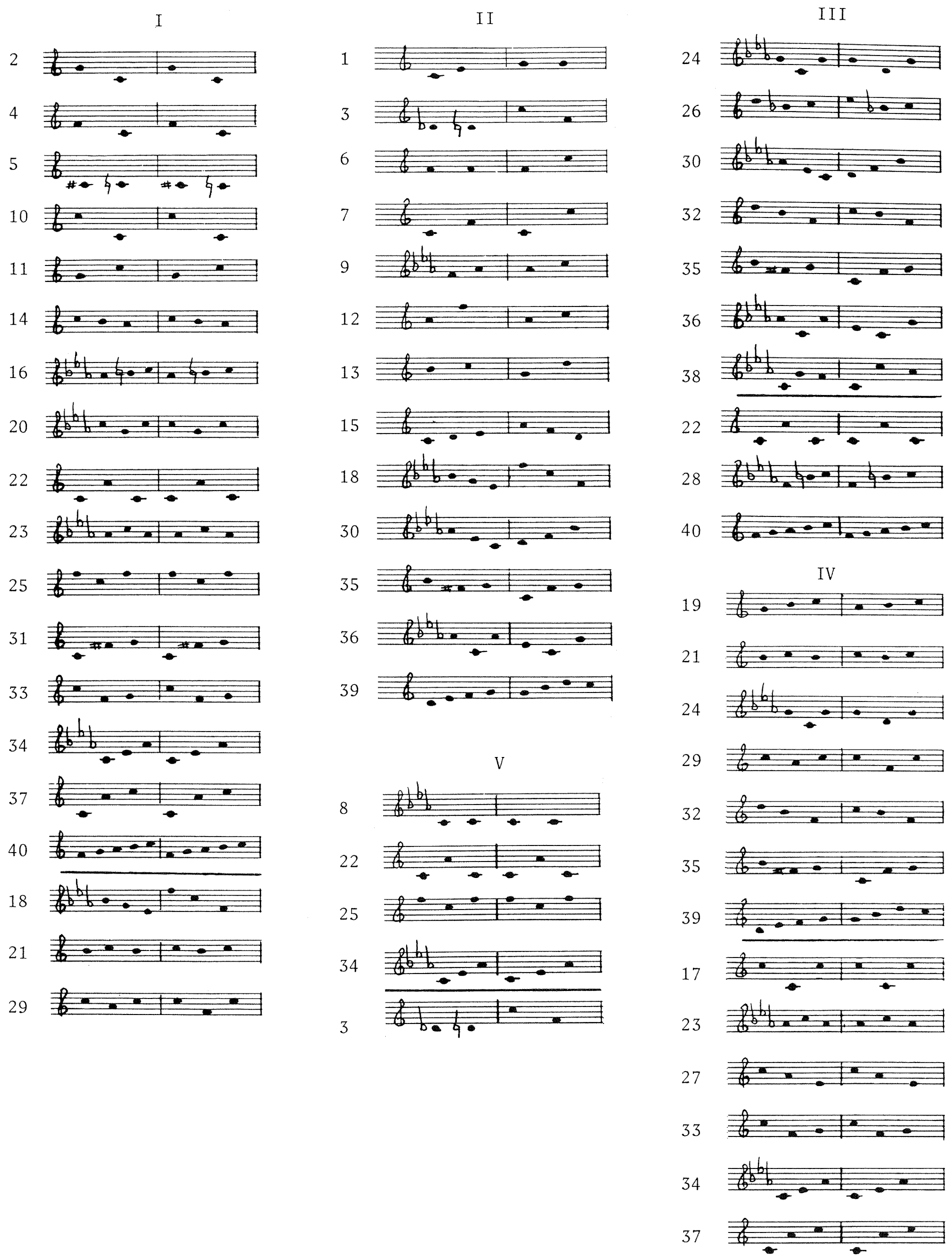
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Table 2a


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In 1979, approximately one year after the first administration, the *Primary Measures of Music Audiation* were administered a second time to the children when they were in first grade. Of the 127 children who had taken the tests the first time in kindergarten in 1978, sixteen had moved away from the school district and were unable to take the tests in 1979. In the summer after the children had taken the tests the first time, the music teachers were given the results so that they might become familiar with the scores before they began instruction again in the following September. Once instruction began, the teachers followed the suggestions provided in the test manual for teaching to children's individual musical differences in accordance with their test scores. Also, as the teachers interpreted the test results for some parents, the latter were given suggestions found in the test manual for providing informal home experiences and formal music instruction. It was strongly recommended that for children who received a composite percentile rank of 80 and above on the battery, some type of out-of-school special instruction be provided to supplement the general music program in the school.

The 1979 test results for the 111 children were analyzed in the same manner as they had been analyzed the previous year; the items were intercorrelated and factor analyzed separately for the *Tonal* and *Rhythm* tests. It was found that 11 percent (176) of the tonal test items intercorrelated .30 and higher, and all were positive. Unlike the results for the previous year, not only were there no negative intercorrelations, but, in contrast to none for the previous year, 7 of the 40 tonal items exhibited no intercorrelation with any other item in the test at a magnitude of at least .30. There were even fewer rhythm item intercorrelations; of the 2 percent (38) that were .30 and higher, one-half of one percent (8) were negative. Almost three times more (19) of the rhythm items exhibited no intercorrelation with any other test item than did the tonal items. In the year before, the smallest number of intercorrelations for any one rhythm item was three. Further, unlike the results of the previous year, half of the negatively intercorrelating pairs of rhythm items shared the identical correct option response.

As in the analysis for the previous year, five tonal factors were extracted. In the rhythm analysis, only six factors were extracted. The factors accounted for somewhat less of the variance the second year. As can be seen in Tables 3 and 4, there is 13.5 percent for the tonal analysis and 11.5 percent for the rhythm analysis. Thus, given the reliabilities of the tests, approximately 76 percent of the true variance in the tonal analysis and approximately 72 percent of the true variance in the rhythm analysis are unaccounted for. Though the variance percentages are not very different for the first year and second year factor analyses, there are differences as well as similarities in the structure of the factors for the two years. The bipolar factors notwithstanding in the 1979 analyses, only the third factor in the tonal analysis and the first and fourth factors in the rhythm analysis include only items which have the identical correct option response. The tonal factor is a *different* factor, and one of the rhythm factors is a *same* factor and the other is a *different* factor. The remaining four tonal factors and four rhythm factors are mixed. That is, they include items which do not always share the identical correct option response. Nonetheless, all of the factors in the tonal and rhythm analyses are group factors. In comparison to the 1978 results, there were fewer items included in the factors, and as a result, fewer items overlapped among the factors in the 1979 results than in the 1978 results. The tonal factors and the rhythm factors are represented in notational form for the second year in Tables 3a and 4a.

In 1980, the *Primary Measures of Music Audiation* were administered to the children a third time when they were in second grade. Of the 111 children who took the tests in first grade, 87 remained in the school district. The same procedures results that were used in the two previous years were used to analyze the results. It was found that 15 percent (240) of the tonal test items intercorrelated .30 and higher, and all were positive; of these, two did not include items which share the identical correct option response. As in the second-year results, six tonal items exhibited no intercorrelation with any other item, and in contrast to the first-year and second-year results, 11 tonal items intercorrelated with only one other test item. With the exception of two tonal items, numbers 6 and 7, all of those which intercorrelated with from two to eighteen other tonal items share *same* as the correct option response. Again, there were fewer rhythm item intercorrelations; only one percent (21) were found. Twenty of the intercorrelations of .30 and higher were positive and only one was negative. Over half (22) of the rhythm items showed no intercorrelation with any other item, and none had more than two item intercorrelations. Unlike the results for the tonal analysis, half of the rhythm items with positive intercorrelations share *same* as the correct option response and the other half share *different* as the correct option response.

In both the tonal and rhythm analyses, six factors were extracted the third year. As can be seen in Tables 5 and 6, 20.3 percent of the variance was accounted for in the tonal analysis and 18.7 percent of the variance was accounted for in the rhythm analysis. These percentages are higher than those found in either of the two previous years. Approximately 69 percent of the true variance in both the tonal and rhythm analyses is unaccounted for. Although the test items which have *same* as the correct option response dominate in the tonal intercorrelation analysis, this is not reflected in the structure of the tonal factors.

Two tonal factors are *same* factors and two tonal factors are *different* factors. The remaining two factors are mixed factors. The rhythm factor analysis, as in the previous years, does not reflect the results of the rhythm intercorrelation analysis. Two rhythm factors are *different* factors and three rhythm factors are *same* factors, one of them being *same* by virtue of having only one item (number 36). Only one rhythm factor is a mixed factor. In contrast to the results of the previous years, there were no bipolar tonal factors and there was only one bipolar rhythm factor. Further, four tonal factors are group factors and two tonal factors are unique factors. Three rhythm factors are group factors and three rhythm factors are unique factors. Item number 38 is found in three factors, thus being responsible for the three rhythm group factors. As can be seen in the notated tonal factors in Table 5a and the notated rhythm factors in Table 6a, there are few items, as compared to the two previous years, found in the tonal factors and the rhythm factors. Nonetheless, it is quite clear that the structure of the tonal factors and the rhythm factors resembles more the structure of the factors in the second-year analysis than in the first-year analysis.

In 1981, the *Primary Measures of Music Audiation* were administered to the children a fourth and final time when they were in third grade. Of the 87 children who took the tests in the second grade, 82 remained in the school district. The same procedures were used to analyze the results then as in all previous years. Only 5 percent (88) of the tonal test items intercorrelated .30 and higher, and all were positive. That is, approximately two-thirds fewer tonal items had significant intercorrelations than were found the year before. Moreover, eleven tonal items exhibited no intercorrelation with any other item; two of these items, numbers 1 and 2, had difficulty levels of 100 percent. Of more importance, however, is the nature of the item intercorrelations, which departs drastically from that of the item intercorrelations for all previous years, particularly the first year. Thirteen tonal test items intercorrelated with three or more tonal items and sixteen tonal items intercorrelated with one or two tonal items which do not share the identical correct option response as well as with tonal items which do share the identical correct option response. The rhythm item intercorrelations generally follow the same structure as the tonal item intercorrelations. Specifically, of the seven rhythm items which demonstrated intercorrelations with other rhythm items, four intercorrelated with other rhythm items which do not share the identical correct option response. As in all previous years, there were fewer rhythm item than tonal item intercorrelations. As in the previous year, twenty three (approximately 1 percent) of the rhythm items intercorrelated with one another at .30 and higher. Of these, twenty one were positive and two were negative. Twenty four rhythm items exhibited no intercorrelation with any other rhythm item, and nine rhythm items intercorrelated with only one other rhythm item. The greatest number of intercorrelations for any one rhythm item was three.

Table 3

TONAL FACTORS ROTATED TO THE VARIMAX CRITERION OF ORTHOGONAL SIMPLE STRUCTURE: 1979

Test Items	I	II	III	IV	V
1	.15	.07	.15	-.62	-.04
2s	.15	.36	-.05	-.24	-.02
3	.09	-.07	.12	-.43	.24
4s	.51	.09	-.06	-.48	-.03
5s	.57	.25	.04	-.16	-.09
6	.38	.43	.10	-.52	-.04
7	.09	-.04	.26	.06	.39
8s	.04	-.02	-.03	-.44	.05
9	.00	.07	.27	-.30	.35
10s	.40	.02	-.41	-.31	.42
11s	.63	.17	-.11	-.04	.01
12	.01	.06	.34	.01	.30
13	-.13	.01	.28	-.03	.51
14s	.55	.15	.02	-.33	-.16
15	-.03	-.09	.24	-.22	.42
16s	.50	-.29	-.07	-.11	.07
17s	.36	.39	-.23	-.44	.13
18	.19	.12	.36	.04	.04
19	.01	-.31	.19	-.04	.07
20s	.19	.28	-.20	.00	.13
21	.00	-.17	.44	-.08	.09
22s	.41	.30	.04	-.08	.14
23s	.23	.71	.11	.03	-.06
24	-.01	-.11	.46	.08	.03
25s	.44	.38	.13	.04	-.09
26	.00	-.11	.41	.01	.14
27s	.22	.36	-.22	-.21	.22
28s	.06	.49	.02	.05	-.01
29	-.09	.03	.47	-.08	.14
30	.24	.09	.27	-.14	.30
31s	.34	.65	-.02	-.42	.02
32	-.09	.01	.43	-.18	.18
33s	.48	.37	-.08	-.03	.10
34s	.15	.23	-.19	-.13	.08
35	.03	-.03	.13	-.05	.52
36	.30	-.01	.24	.11	.37
37s	.60	.26	.15	-.11	.08
38	.16	.10	.44	-.21	.31
39	-.10	.05	.18	-.31	.53
40s	.03	.02	-.08	.05	.55
Sum of Squared Loadings	3.5	2.8	2.5	2.4	2.4

Table 4

RHYTHM FACTORS ROTATED TO THE VARIMAX CRITERION OF ORTHOGONAL SIMPLE STRUCTURE: 1979

	Factors					
Test Items	I	II	III	IV	V	VI
1s	-.11	-.30	.28	.06	.07	-.22
2	-.19	-.10	.04	.35	-.12	-.14
3	.04	-.05	.17	.02	.08	.46
4s	.08	-.13	-.04	-.07	.11	.30
5	.03	-.13	.04	.21	-.25	.51
6s	.08	-.31	-.15	-.19	.26	.35
7s	.45	-.12	.35	.17	-.05	-.10
8	.15	-.03	.56	.20	-.05	.10
9	.00	.01	-.38	.12	-.06	-.05
10s	.50	-.08	.06	.00	.15	.08
11	.12	.02	.11	.10	.36	.22
12s	.07	-.16	-.08	.02	.37	.01
13	-.09	.07	-.07	.35	.16	.33
14	-.05	-.09	.46	.23	.01	.02
15s	.26	-.27	.25	-.10	.05	-.02
16s	-.07	-.14	.11	-.06	.55	.11
17	.05	-.03	.03	.44	.09	-.14
18s	.20	-.08	.05	.05	.48	-.04
19	-.38	.32	-.13	.18	.12	.26
20s	.46	-.08	.04	.05	.28	.29
21	-.02	.58	.00	.03	.07	-.13
22	.16	-.39	.28	.19	.18	.00
23s	-.02	-.18	.31	-.16	.04	.07
24s	.52	.07	-.03	.02	.40	-.07
25	.16	.09	.10	.47	-.14	.31
26s	.24	-.02	-.34	-.02	.22	.17
27	.17	.17	.11	.44	.12	.13
28s	.29	.04	.22	-.14	.05	.22
29	-.29	.60	.13	-.03	-.24	.13
30	.10	-.02	.42	.11	.25	.05
31s	-.06	-.31	.10	-.09	.22	.22
32	-.14	-.39	.19	.34	.04	.24
33s	.03	-.51	.20	-.10	.04	.09
34s	.67	-.05	-.04	.15	.07	.10
35	.28	.05	.05	.40	.01	-.01
36s	.31	-.18	-.20	.03	.22	.03
37s	.21	-.34	.18	-.11	.11	.11
38	.09	-.12	.40	.19	-.03	.00
39	-.05	.05	.03	.49	.06	.05
40s	.14	.06	.06	.08	.38	.00
Sum of Squared Loadings	2.4	2.1	1.9	1.8	1.8	1.5

Table 3a

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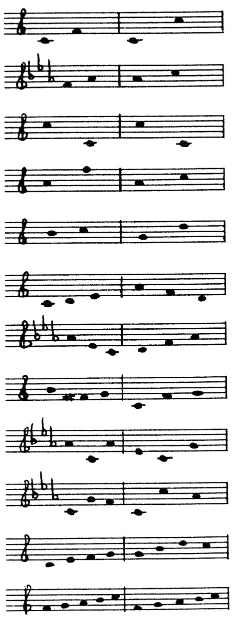


7, 9, 10, 12, 13, 15, 30, 35, 36, 38, 39, 40

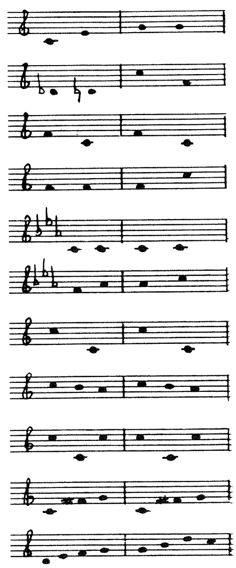
II

2, 6, 17, 22, 23, 25, 27, 28, 31, 33, 19

III

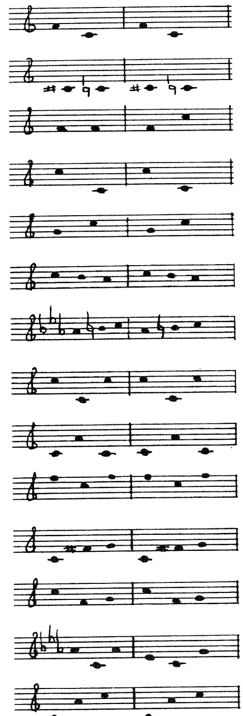
12, 18, 21, 24, 26, 29, 32, 38, 10

IV



1, 3, 4, 6, 8, 9, 10, 14, 17, 31, 39

V



4, 5, 6, 10, 11, 14, 16, 17, 22, 25, 31, 33, 36, 37

Table 4a


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Table 5

TONAL FACTORS ROTATED TO THE VARIMAX CRITERION OF ORTHOGONAL SIMPLE STRUCTURE: 1980

	Factors					
Test Items	I	II	III	IV	V	VI
1	.02	.25	-.02	-.01	.00	-.02
2s	.37	-.06	.05	.02	.00	.13
3	-.03	-.01	-.01	.00	.01	-.02
4s	.56	.14	.01	.18	-.03	-.02
5s	.04	.48	.05	.50	.00	.04
6	.27	.67	-.05	.32	-.02	-.06
7	.08	.56	-.15	.11	.13	.21
8s	.35	.34	-.04	.07	-.13	-.06
9	-.11	.33	.11	-.10	-.07	.28
10s	.00	.51	.13	.13	.24	-.06
11s	.38	.67	-.08	.16	-.03	-.02
12	.26	.25	.12	.01	-.07	.11
13	.07	.15	.36	.02	.10	-.02
14s	.20	.93	.06	.06	-.03	.01
15	.04	.08	.16	-.09	-.06	.71
16s	.25	.04	-.01	.48	-.01	.03
17s	.30	.21	.02	.71	-.01	.06
18	-.13	.10	.29	.10	-.02	.33
19	-.14	-.01	.18	-.05	.07	.12
20s	.64	.17	-.03	.22	.42	-.11
21	.01	-.08	.22	.09	.22	.14
22s	.73	.11	-.11	.15	-.02	.05
23s	-.01	.03	-.12	-.06	.79	-.02
24	-.07	.00	.61	-.02	.04	.05
25s	.83	.08	-.09	.13	-.02	.11
26	-.12	-.17	.48	-.05	-.10	.03
27s	.39	.11	-.19	.10	-.22	-.10
28s	.49	.12	.10	.18	-.04	.22
29	.08	-.02	.54	.11	-.06	.09
30	-.02	.00	.17	-.01	-.07	.16
31s	.52	.22	.12	.08	-.01	-.14
32	-.02	.06	.42	-.16	-.10	.11
33s	.41	.10	.11	.19	.24	-.11
34s	.28	.11	.00	.10	.19	.05
35	-.09	.10	.29	.01	.14	.23
36	-.06	.09	.13	-.09	.17	.03
37s	.31	.06	.09	.09	.14	-.01
38	.09	-.06	.29	.09	-.08	.18
39	.03	-.06	.03	.19	.05	.47
40s	.16	.31	.03	.60	.00	-.03
Sum of Squared Loadings	5.9	3.9	3.3	2.7	2.3	2.2

Table 6

RHYTHM FACTORS ROTATED TO THE VARIMAX CRITERION OF ORTHOGONAL SIMPLE STRUCTURE: 1980

Test Items	I	II	III	IV	V	VI
1s	-.03	.10	.02	.04	.04	.12
2	.05	.01	.23	.01	-.03	-.29
3	.20	.03	.30	.07	.15	-.05
4s	.17	.52	.14	.14	.02	-.05
5	-.05	.07	.05	.01	-.03	.00
6s	-.10	.72	-.03	-.02	-.05	.09
7s	.06	.08	.05	-.06	.02	.10
8	.21	.16	.19	-.04	-.01	.01
9	-.02	-.15	-.02	-.04	-.06	-.05
10s	.09	.01	.03	.02	.19	.21
11	.14	.06	.46	-.04	.01	.04
12s	-.05	.01	.12	.52	.02	.08
13	.03	-.05	.15	.03	-.02	-.17
14	-.08	.06	.58	.04	-.06	.10
15s	.07	.00	.09	-.04	.08	.60
16s	.05	.16	.09	.27	.01	.49
17	.08	-.28	.21	.07	-.01	-.02
18s	-.14	.18	-.02	.06	.00	-.04
19	-.08	.17	.12	-.22	.00	-.17
20s	.02	.07	.01	.03	.09	.04
21	-.37	-.02	-.16	-.08	-.14	-.19
22	.49	.02	.29	-.08	-.04	.22
23s	.12	.05	-.07	.22	.10	-.06
24s	.20	.00	.01	.13	.02	.04
25	.14	.13	.16	.19	.10	.27
26s	.05	.21	-.18	.46	.13	-.09
27	.62	-.01	-.02	-.07	.00	.03
28s	-.01	.07	.03	.08	.22	-.01
29	-.14	.03	-.10	-.05	-.12	.07
30	.12	-.09	.65	.06	-.03	.04
31s	.25	.45	.02	.22	.23	.02
32	.03	-.05	.18	.22	.00	-.05
33s	-.04	-.10	.04	.23	-.03	.03
34s	.08	.00	-.07	.08	-.01	.15
35	.48	.03	.17	.17	-.07	-.05
36s	-.04	.00	-.05	.04	.84	.11
37s	-.10	.18	.03	.28	-.02	-.10
38	.41	-.13	.30	.45	-.16	-.06
39	.11	-.07	.01	-.02	.02	.06
40s	-.07	.14	.03	.28	.44	.09
Sum of Squared Loadings	4.7	3.7	2.9	2.7	2.4	2.3

Eight tonal factors and seven rhythm factors were extracted in the analysis for the final year. As can be seen in Tables 7 and 8, 16.2 percent of the variance was accounted for in the tonal analysis, and 13.0 percent of the variance was accounted for in the rhythm analysis. These percentages are more like those found in the second year than those found in the first and third years. However, the percentages of the unaccounted for true variance, approximately 68 for the tonal analysis and 72 for the rhythm analysis, are as much like those found in the third year as they are like those found in the second year. Unlike the results for all previous years, the structure of the tonal factors and the rhythm factors follow quite closely the nature of the tonal item and rhythm item intercorrelations: five of the eight tonal factors are mixed, two are *different* factors, and one is a *same* factor. The structure is even more pronounced for the rhythm factors. Six of the seven rhythm factors are mixed factors and one is a *different* factor. As in all previous years, bipolar factors are dominant in the rhythm analysis as compared with the tonal analysis. Each of the analyses has one unique factor; the remaining factors in the tonal and rhythm analyses are group factors. As can be observed in Tables 7a and 8a, of the thirty tonal items found among the eight factors, five are found in two factors, two in three factors, and one (item number 15) in four factors. Of the twenty seven rhythm items found among the seven factors, two are found in two factors and one (item number 27) in four factors. As indicated, rhythm item number 38 is found in three factors in the third-year analysis. Overall, the results of both the tonal and rhythm factor analyses have more in common with the corresponding analyses for the second and third years than the first year of the study.

Interpretation of the Data

Factor analysis proved useful as an exploratory technique in interpreting the data. In regard to this study, children who answer one item correctly in a factor tend to answer all other items correctly in that factor, and children who answer one item incorrectly in a factor tend to answer all other items incorrectly in that factor. In the case of a bipolar factor, children who answer one item above the line correctly in a factor tend to answer all other items above the line correctly in that factor and all items below the line incorrectly in that factor, and vice versa. What children attend to in music becomes relatively clear as defined by the factors when the items which constitute a factor possess obviously common characteristics. Such characteristics may or may not be associated with music. To the extent that the investigator (or the reader) is able to identify correctly the content of a factor, the interpretation and conclusions drawn from the factor analysis are valid.

Table 5a

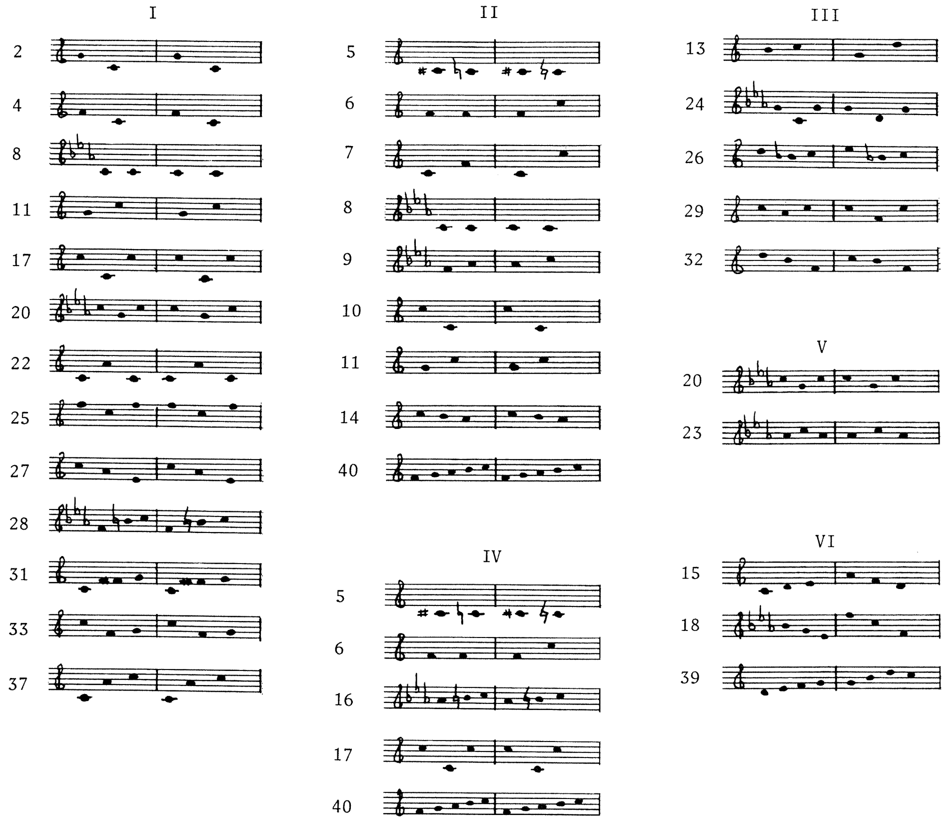
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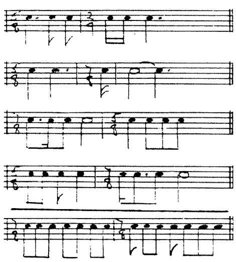
Table 6a

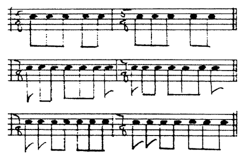
I

22, 27, 35, 38, 21



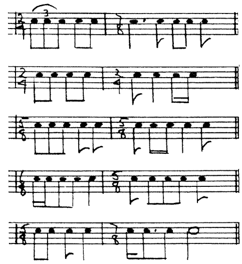
II

4, 6, 31



III

3, 11, 14, 30, 38



IV

12, 26, 38

V

36

VI

15, 16

Table 7

TONAL FACTORS ROTATED TO THE VARIMAX CRITERION OF ORTHOGONAL SIMPLE STRUCTURE: 1981

	Factors							
Test Items	I	II	III	IV	V	VI	VII	VIII
1	.00	.00	.00	.00	.00	.00	.00	.00
2s	.00	.00	.00	.00	.00	.00	.00	.00
3	.84	.05	.29	-.01	.05	.08	.01	-.04
4s	.87	.01	-.19	.03	-.04	-.02	-.01	-.02
5s	.21	.02	.87	-.02	.00	-.05	.00	-.03
6	.86	.00	.35	-.02	.03	-.06	.02	.01
7	.51	.14	.27	-.01	.34	.46	-.02	-.04
8s	-.06	-.10	.02	.03	.00	.00	.01	.00
9	.30	.06	-.16	.51	.41	.22	.04	-.09
10s	.00	-.12	.02	-.08	.00	-.05	-.01	.06
11s	-.01	-.23	-.01	.59	.00	.04	.16	.00
12	.09	.07	.79	.00	.32	.08	-.03	.12
13	.28	.28	.20	.33	.12	.08	-.12	-.10
14s	-.02	.10	-.01	-.06	-.04	-.06	.00	-.02
15	.38	.08	-.14	.42	.40	.03	.32	-.05
16s	-.02	.00	.04	.15	-.06	.00	.22	.28
17s	.02	.08	-.01	-.06	-.03	-.01	-.12	-.13
18	-.08	.38	-.01	.37	-.04	-.03	-.04	-.28
19	.08	.64	.00	-.03	.02	.14	.05	.14
20s	-.02	.10	-.02	.08	-.05	-.03	.04	.78
21	.07	.36	-.18	.29	.19	-.07	.05	.20
22s	-.03	.18	.02	-.05	-.06	-.21	.60	-.09
23s	-.02	-.03	-.05	-.10	-.06	.80	-.05	.03
24	-.07	.65	.09	.21	-.16	.14	.09	.00
25s	.03	.04	.14	-.05	.00	.00	-.05	.70
26	-.04	.60	.05	.02	.22	.07	-.15	.01
27s	-.01	.03	-.03	.02	.06	.03	.73	-.06
28s	.04	.14	.04	.12	.19	.69	.19	-.08
29	-.02	.47	.28	.17	.08	.00	.04	-.27
30	-.07	.01	.05	.17	.77	.24	.04	.01
31s	-.02	.05	-.02	.07	.03	-.03	.00	-.03
32	.15	.61	-.02	-.19	.19	-.09	.03	.12
33s	-.02	-.12	-.02	.06	.01	.28	.64	.21
34s	.02	.05	-.04	-.02	-.08	.10	-.11	.03
35	-.07	.14	.06	.79	.05	-.09	-.06	.13
36	.32	.22	.36	.22	.11	.31	-.08	.29
37s	-.03	.00	.08	.07	.15	.13	.24	-.04
38	-.05	.32	-.01	.34	.08	.29	-.08	-.20
39	.09	.13	.26	-.03	.76	-.10	-.04	-.04
40s	.50	-.10	-.14	-.01	-.06	-.02	-.01	.01
Sum of Squared Loadings	3.2	2.1	2.0	2.0	1.9	1.8	1.6	1.6

Table 8

RHYTHM FACTORS ROTATED TO THE VARIMAX CRITERION OF ORTHOGONAL SIMPLE STRUCTURE: 1981

Test Items	I	II	III	IV	V	VI	VII
1s	-.01	-.05	-.01	-.01	.08	-.01	-.06
2	-.05	.05	-.12	.04	.59	.26	-.04
3	.11	.13	.38	-.16	.31	.11	-.24
4s	-.05	.02	-.06	-.03	.00	-.07	.09
5	.00	.28	.11	-.02	.15	.05	-.11
6s	.24	.03	.42	.11	-.10	.05	.27
7s	-.03	.60	-.12	.20	-.02	-.01	.11
8	-.02	.78	.00	-.07	.02	.00	-.02
9	.07	-.11	-.37	.07	.00	.06	-.06
10s	.27	.31	.13	.04	-.11	.13	-.25
11	-.04	.00	.02	-.06	-.03	-.03	-.06
12s	.09	-.07	.23	.70	-.02	-.11	.00
13	-.11	.14	.16	-.12	.09	.14	.12
14	-.06	.12	-.08	.06	.20	-.12	.13
15s	.36	.29	-.08	-.19	.00	-.02	.33
16s	.00	.00	.09	.02	.00	-.02	.75
17	-.05	-.24	.39	.02	.27	.24	.01
18s	.07	.31	-.02	.12	.01	.10	.20
19	.01	.00	.00	-.06	-.06	-.09	.23
20s	.06	-.07	.12	.14	.21	.01	-.19
21	-.82	.02	-.25	-.10	.08	-.01	.04
22	.77	-.06	-.03	-.03	.18	.07	.02
23s	.51	.27	-.08	.10	.18	.05	.29
24s	.17	.26	-.07	.07	.00	.41	.13
25	.00	.35	-.09	.33	.19	.29	-.13
26s	.57	-.03	.06	.34	-.06	.12	-.01
27	.42	-.10	.09	.11	.51	-.09	-.33
28s	.07	-.02	.03	.13	-.05	.18	-.06
29	.23	.05	-.61	-.17	-.07	.00	-.27
30	.07	-.05	.04	.07	.21	.71	.20
31s	.15	.07	.12	.77	-.08	.09	.02
32	.06	.04	.08	-.07	.00	.72	-.25
33s	.02	-.10	.02	-.04	.00	.11	.05
34s	.25	-.17	-.08	-.27	-.12	.27	.35
35	.12	-.05	.01	-.02	.13	-.03	-.15
36s	.20	-.16	-.05	.21	.05	-.11	.26
37s	.25	.12	-.35	.26	.22	.07	.14
38	.22	-.27	.04	.08	.13	.23	.06
39	.07	.02	.01	-.12	.75	.03	.09
40s	.04	-.03	.66	.20	-.06	.04	-.04
Sum of Squared Loadings	2.6	1.8	1.8	1.8	1.7	1.7	1.6

Table 7a

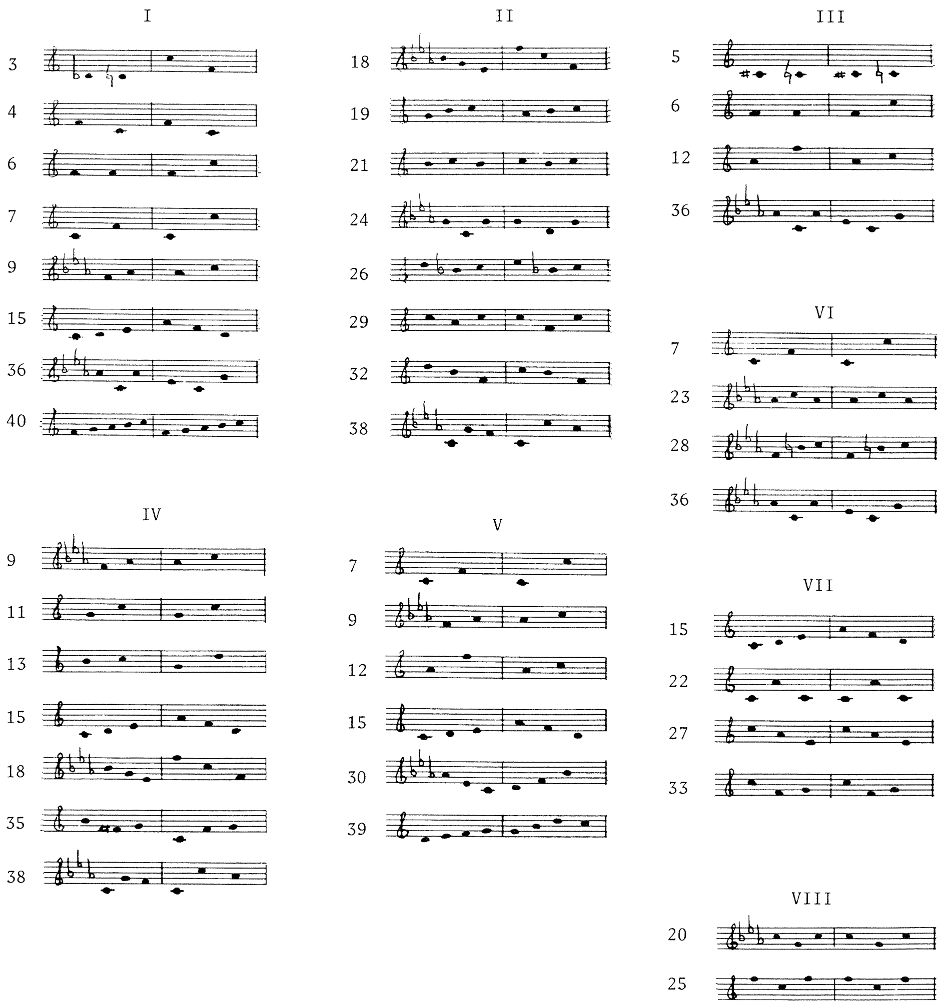
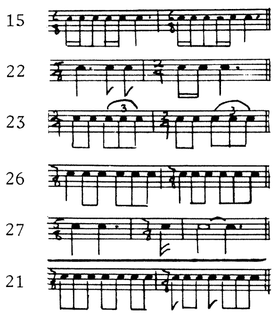

I
3
4
6
7
9
15
36
40
II
18
19
21
24
26
29
32
38
III
5
6
12
36
VI
7
23
28
36
IV
9
11
13
15
18
35
38
V
7
9
12
15
30
39
VII
15
22
27
33
VIII
20
25

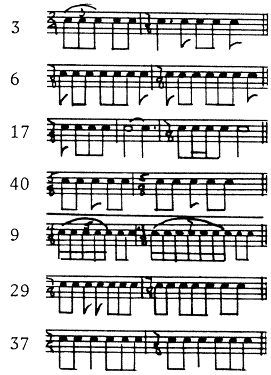
Table 8a

I

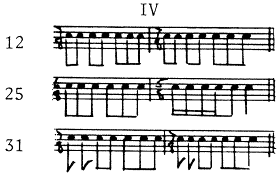


II

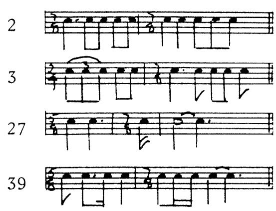
III



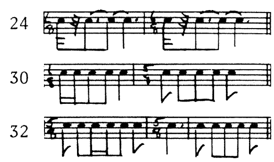
IV



V



VI



VII

Considerable time was spent by musicians and psychologists in trying to determine the common characteristics of the items which are found in each factor in the tonal and rhythm analyses. The attempt was unsuccessful. In regard to the tonal analysis, music characteristics such as mode, melodic contour, number of tones in a pattern, interval size and direction, pentatonic versus diatonic, and accidentals were diversified in every factor. Characteristics such as meter, relative note length, type of beats, number of notes in a pattern, melodic rhythm, and syncopation were also diversified in every factor. Only by examining and comparing the factor content from year-to-year as well as within each year was meaning derived. Specifically, no obvious music characteristics were found for any factor (nor among items that did not correlate .30 or higher with any factor), but non-music characteristics were found. How the non-music characteristics might embrace music characteristics still cannot be explained. The non-music characteristics demonstrate a trend across the four years of the study. Simply stated, all of the factors found in the four years of the study are either *same* factors, *different* factors, or mixed factors. *Same* factors include only those items which share *same* as the correct option response. *Different* factors include only those items which share *different* as the correct option response. Mixed factors include some items which have *same* and others which have *different* as the correct option response. A bipolar factor is not considered a mixed factor. For the first year, all factors are either *same* or *different;* none is a mixed factor. For the second year, there are more than twice as many mixed factors than there are *same* and *different* factors combined. For the third year, one third of the factors are mixed. For the fourth year, four times as many factors, almost all of them, are mixed. The dissimilarity between the content of the factors when the children were five years old and when they were eight years old is striking. At five years old, the children attended to sameness and difference apart from each other, whereas at eight years old, the children attended almost totally to sameness and difference in relationship to each other. Whatever attention was given by the children when they were eight years old to sameness and difference apart from each other, the emphasis was on difference almost to the total exclusion of sameness. The trend is systematic except for the second-year results; there is a greater proportion of mixed factors the second year than there is the third year. Nonetheless, there is a substantial number of mixed factors for both years. Why this reversal took place is not easily explained. It may be due to nothing more than chance. In spite of the change in factor content from the first year to the fourth year of the study and the proportional reversal of mixed factors in the second and third years of the study, the variance associated with the factors remains rather consistent throughout the four years of the study. The proportion of the variance associated with the factors was from approximately 15 to 20 percent, and the proportion of the unaccounted true (non-error) variance was from approximately 50 to 75 percent throughout the four years of the study. The unaccounted for true variance is most likely a manifestation of individual differences associated with developmental music aptitudes.

As five-year-old children's preoccupation with sameness and difference apart from each other changes to concern for sameness and difference in relationship to each other, beginning at age five and solidifying at age eight, it is curious that the item content of the factors does not share commonality from one year to the next. It is not realistic to expect that identical items should cluster in a *same* factor and a mixed factor or in a *different* factor and a mixed factor (or, of course, in a *same* factor and a *different* factor, except for a bipolar factor) from year-to-year, but it is reasonable to expect that identical items would tend repeatedly to cluster to form similar, if not identical, factors from year-to-year. This is the case to only a limited extent. Further, it will be recalled that although more than one *same* factor, more than one *different* factor, and more than one mixed factor may be found in an analysis for a given year, there is little commonality of items in factors of the identical type. In many cases, only one item was responsible for the establishment of a group factor. An explanation of what young children audiate as sound in music will become more precise when it is determined what makes one *same* factor unlike another *same* factor, one *different* factor unlike another *different* factor, and one mixed factor unlike another mixed factor.

A factor analysis of the subtests which constitute the *Musical Aptitude Profile* was undertaken several years ago.[28] As part of that study, the items in selected subtests were also factor analyzed. Items were factored for the *Tonal Imagery* subtests which have *like* or *different* as option responses and for the *Rhythm Imagery* subtests which have *same* or *different* as option responses. The results of the item factor analyses are not included in the report of that study, because the music characteristics associated with the items could not be identified. Nonetheless it is important to know that none of the factors which were extracted was a *like* or *different* factor, or a *same* or *different* factor. All of the item factors were mixed. That is, the structure of the item factors for the *Musical Aptitude Profile* parallels the structure of the item factors found in the fourth-year results for the *Primary Measures of Music Audiation* in the present study. Although the content of the items and the performance stimuli are quite different for the two test batteries, item factors extracted for the *Musical Aptitude Profile* for students nine years old and older are more like item factors extracted for the *Primary Measures of Music Audiation* for eight-year old children than for five-year-old children. The trend in item factor structure found in the present study appears to continue as children become older and audiate different aspects of music. Of course it would be ideal to establish this fact objectively rather than to extrapolate it. Unfortunately, this cannot be accomplished, because the *Musical Aptitude Profile* which measures stabilized music aptitude is too difficult for young children and the *Primary Measures of Music Audiation* which measure developmental music aptitude are too easy for older

28. Edwin Gordon, "The Contribution of Each Musical Aptitude Profile Subtest to the Overall Validity of the Battery," *Council for Research in Music Education,* 12 (1967), 32-36.

students. Evidence of these limitations is found in the results for the first two items of the *Tonal* test in Table 7, which indicate that every child answered each item correctly, and in the Manual for the *Musical Aptitude Profile,* Table 6, where it is reported that only with extreme adaptation of the directions for administering certain subtests can musically select young children comprehend what is expected of them.[29]

The factor analytic results of the study reported herein, although compelling, might raise some doubts. Is it possible that sameness and difference factors found to be particularly prominent in the audiation of younger children are artifacts? It may seem that the order in which items are presented in the *Tonal* and *Rhythm* tests affects the results. This is not the case: when the tests were rerecorded with the items in random order, the resultant factors were still identified as sameness, difference, and mixed, depending upon the age of the children to whom the adapted tests were administered. It may be asked whether the option responses *same* and *different* dictate the sameness and difference factors, and possibly the mixed factors. The validity of the tests described in the test manual and in studies cited and reported in this paper precludes such a possibility. Moreover, it is obvious from the discrimination values of the items reported in Tables 1 and 2 that the items are answered correctly or incorrectly according to each child's developmental music aptitudes. It will also be observed that there is no relationship between the discrimination value of an item and the correct option response of an item. If the children were attending to only sameness and difference in some isolated unspecified manner, it would seem odd to find more than one *same* factor or more than one *different* factor in a given analysis. It may be asked whether a response-set produces the resultant factors. If this were true, the chances of finding predictably changing non-music factors from year-to-year on both the *Tonal* and *Rhythm* tests as children become older and their audiation becomes more complex, would be remote. Further, if this were the case, the fact that the proportion of the variance associated with the factors remains rather consistent from year-to-year would require explanation. Finally, it may be asked whether spurious factors, particularly difficulty factors, are disguised and appear to be sameness and difference factors. The design of the study, including degrees of freedom and factor ratio, and the statistical analyses employed seem not to be of the type described by Catell and others which produce such artificial "unitariness".[30] In this connection, it should be explained that there is approximately 10 percent or less of variance in common between *Primary Measures of Music Audiation* scores and *Lorge Thorndike Verbal and Nonverbal Intelligence scores* for children of ages five through eight.[31]

29. Edwin Gordon, Manual for the *Musical Aptitude Profile.* (Boston: Houghton Mifflin, 1965), p. 23.

30. For a thorough discussion of spurious factors, see Chapter Eighteen of *Factor Analysis* by Raymond B. Cattell. (New York: Harper and Brothers, 1952).

31. These data are reported in Table 12 of the Manual for the *Primary Measures of Music Audiation* by Edwin E. Gordon. (Chicago: G.I.A., 1979), p. 88. In a more recent unpublished study with sixty-five first grade children in a county school system in Maryland, correlations between *Otis-Lennon Mental Ability Test* IQ scores and *Primary Measures of Music Audiation Tonal, Rhythm,* and Composite scores were .31, .34, and .38, respectively.

The factor analytic results reported for the West Irondequoit children who participated in this study have been cross-validated in a number of studies. The Harrisburg study represents the most extensive undertaking of that type because it was designed as a longitudinal validity study; the items were factor analyzed as an ancillary interest. Three-hundred sixty-five first grade children enrolled in seven elementary schools in Harrisburg, Pennsylvania, were divided into experimental and control groups in each school. In each school the same music teacher taught all groups. Before instruction was initiated, the children were tested on the *Primary Measures of Music Audiation*. In the experimental groups, the teacher used the test scores to teach to the individual music differences among the children in accordance with the suggestions provided in the test manual. Five to ten minutes of each music period were used to teach tonal patterns and rhythm patterns with tonal syllables and rhythm syllables. The remainder of each period was used for traditional music instruction. Only traditional music instruction was offered in the control groups, and no consideration was given to the children's test scores. At the conclusion of one year of instruction, the children were tested again on the *Primary Measures of Music Audiation*. It can be seen in Table 9 that children in the combined experimental groups improved significantly more in developmental music aptitude than did children in the combined control groups. In only one of the seven schools were the observed gains of the experimental group not statistically significant for both the *Tonal* and *Rhythm* tests. The mean differences between the first and second test results for the children in the experimental and control groups is 3.8 for the *Tonal* test and 3.1 for the *Rhythm* test. The effect of instruction adapted to serve the individual musical differences among children is further observed in the comparison of the correlations between the pre-instruction and post-instruction scores for children in the experimental group and the control group. As shown in Table 9, developmental music aptitudes fluctuate considerably more, as should be expected, when instruction is designed in accordance with the diagnostic results of the *Primary Measures of Music Audiation*. Of concern, however, are the results of the item factor analyses. For both the experimental group and the control group, the factor structures were highly similar to those found for children in the present study when they were in the first and second grades; consistent with previous findings, the item content of the factors was not similar from analysis to analysis.

Table 9

MEANS, STANDARD DEVIATIONS, MEAN DIFFERENCES, AND SIGNIFICANCE OF THE DIFFERENCES FOR HARRISBURG EXPERIMENTAL AND CONTROL GROUP FIRST GRADE CHILDREN'S PRE-TRAINING AND POST-TRAINING SCORES ON THE PRIMARY MEASURES OF MUSIC AUDIATION

	Experimental Group (N=182)						Control Group (N=183)					
	Pre-Training		Post-Training		Difference		Pre-Training		Post-Training		Difference	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Tonal	24.5	6.05	29.8	5.18	5.3	5.86	27.1	5.82	28.6	5.53	1.5	4.07
Rhythm	26.7	5.78	29.4	4.61	2.7	4.82	28.2	4.83	27.8	5.36	-0.4	4.23
Composite	51.2	10.21	59.2	8.75	8.0	8.91	55.3	9.42	56.4	9.72	1.1	6.27

Difference Between the Mean Differences

	Mean	t-value	
Tonal	3.8	7.45	Significant at the .01 level
Rhythm	3.1	2.74	Significant at the .01 level
Composite	6.9	8.62	Significant at the .01 level

Correlations

	Experimental Group Pre-Training with Post-Training	Control Group Pre-Training with Post Training
Tonal	.46	.74
Rhythm	.58	.66
Composite	.56	.79

Not only do children who attend school in different parts of the country and who reflect different cultural backgrounds audiate in a similar manner, but, more importantly, the type of music instruction they receive appears to have no pronounced effect on how they audiate. These data support the findings for the West Irondequoit children who received special music instruction during the first grade but not in the second grade. Presented in Table 10 are the *Primary Measures of Music Audiation Tonal, Rhythm,* and Composite test score means, mean differences from year-to-year, standard deviations, and split-halves reliabilities for the eighty-two West Irondequoit students who remained in the study for the four-year period. It will be observed that the greatest mean gains on the *Primary Measures of Music Audiation* took place the second year of the study.[32] Nonetheless, the structure of the factors found in the tonal and rhythm analyses for the second year and that found for the third year are not materially different. Further evidence of the existence of developmental music aptitudes as well as of the fact that what is audiated is rather insensitive to instructional procedure may be found in Table 11. Scores on the same test from year-to-year *(Tonal* with *Tonal* and *Rhythm* with *Rhythm)* correlate to about the same degree as scores on the *Tonal* and *Rhythm* tests intercorrelate for any given year. Moreover, the intercorrelations and correlations associated with 1979 are not substantially different from those associated with any other year. The coefficients in Table 11 are moderate and, as should be expected, they are considerably lower than the split-halves reliabilities reported in Table 10 for each test for each of the four years of the study.

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32. The effect of special music instruction becomes quite clear when the means in Tables 9 and 10 are compared with the means for students of whom the majority do not receive special music instruction, found in Part Seven of the Manual for the *Primary Measures of Music Audiation.* (Chicago: G.I.A., 1979).

Table 10

TEST MEANS, STANDARD DEVIATIONS, SPLIT-HALVES RELIABILITIES, AND MEAN GAINS FOR THE EIGHTY-TWO FOLLOW-THROUGH STUDENTS

	1978			1979			1980			1981		
	T	R	C	T	R	C	T	R	C	T	R	C
Mean	24.8	22.5	47.3	32.7	30.5	63.2	35.5	32.1	67.6	36.3	33.4	69.7
Standard Deviation	5.65	3.61	8.04	4.04	3.91	6.81	3.46	3.74	6.24	3.32	3.15	5.76
Reliability	.88	.73	.91	.90	.84	.91	.89	.88	.93	.84	.85	.90

	1978-1979	1978-1980	1978-1981	1979-1980	1979-1981	1980-1981
Mean Gain						
Tonal	7.9	10.7	11.5	2.8	3.6	.8
Rhythm	8.0	9.6	10.9	1.6	2.9	1.3
Composite	15.9	20.3	22.4	4.4	6.5	2.1

Table 11

TEST INTERCORRELATIONS AND LONGITUDINAL CORRELATIONS FOR THE EIGHTY-TWO FOLLOW-THROUGH STUDENTS

	1978	1979	1980	1981
Intercorrelations				
Tonal with Rhythm	.48	.47	.50	.58
Tonal with Composite	.92	.86	.85	.89
Rhythm with Composite	.79	.85	.88	.88

	1978-1979	1978-1980	1978-1981	1979-1980	1979-1981	1980-1981
Correlations						
Tonal with Tonal	.49	.43	.33	.57	.56	.45
Rhythm with Rhythm	.38	.37	.34	.53	.43	.37
Composite with Composite	.51	.42	.40	.65	.59	.52

When the *Primary Measures of Music Audiation* are administered, most children answer correctly items that have *same* as well as items which have *different* as the keyed response. Obviously, children with higher developmental music aptitude answer correctly more items of both types of keyed responses, and children with the greatest developmental music aptitude answer all items correctly. However, it became of interest in interpreting the results of the factor analyses to determine if children in the developmental music aptitude stage who receive less than perfect scores answer more items correctly that are keyed *same* or more items correctly that are keyed *different*. Thus the *Tonal* and *Rhythm* test answer sheets for each of the four years were re-scored. Every one of the children was given two scores on each test. One score indicated how many items were answered correctly that are keyed *same* and the other score indicated how many items were answered correctly that are keyed *different*. The means and standard deviations for the regular test scores for all of the children in a given year and the means and standard deviations for their derived *same* and *different* scores are reported in Table 12. Also included in Table 12 are the mean differences between the *same* and *different* scores for each year. It can be seen in the table that the items which have *same* as the keyed response are consistently easier on both tests every year. On the average, children answer approximately four more items correctly each year that are keyed *same* than they do items that are keyed *different*. The obviously lower mean difference for the *Tonal* test in 1981 is probably a result of the easiness of the test for older children and thus a lack of variability in the total score. Nonetheless, regardless of the magnitude of the total score or of the quality of music instruction, children in the developmental music aptitude stage find it easier to audiate sameness than difference. In other words, it takes less developmental music aptitude, both tonal and rhythm, to audiate correctly patterns as being the same than it does to audiate correctly patterns as being different. The primacy of sameness has been recognized also by psychologists who have conducted research in disciplines other than music.[33]

A further analysis was undertaken with the *same* and *different* scores. They were correlated with *Tonal, Rhythm,* and *Composite* test scores for each of the four years. The results are presented in Table 13. For each year of the study, the correlations are higher for the *different* score and all corresponding test scores (for example, the *different* score for the *Tonal* test and the total score for the *Tonal* test) than for the *same* score and all corresponding test scores. The correlation between the *Tonal different* and total scores is almost perfect in the fourth year. Moreover, the strength of such correlations is substantially higher for the fourth year than for the first year; the results for the second and the third years, though reversed in a manner similar to the factor analyses results, show a

33. For example, see David W. Bessemer, *Knowledge of the Meaning of the Terms "Same" and "Different" by Children*. Technical Note. Southwest Regional Laboratory. (Los Alamitos, California: SWRL, 1975).

Table 12

MEANS AND STANDARD DEVIATIONS FOR TEST TOTAL, SAME AND DIFFERENT SCORES

	Total		Same		Different	
	Mean	SD	Mean	SD	Mean	SD
1978						
Tonal	24.7	5.28	14.6	3.12	10.1	2.91
Rhythm	22.3	3.74	13.4	2.99	8.9	2.84
1979						
Tonal	32.6	4.65	18.5	2.53	14.1	2.89
Rhythm	30.3	4.10	17.1	3.14	13.2	3.04
1980						
Tonal	34.9	4.52	19.1	2.87	15.8	3.92
Rhythm	31.7	4.19	18.0	2.78	13.7	2.69
1981						
Tonal	36.3	3.32	19.5	2.27	16.8	3.10
Rhythm	33.4	3.15	18.6	1.90	14.8	2.23

Mean Difference Between Same and Different Scores

	Tonal	Rhythm
1978	4.5	4.5
1979	4.4	3.9
1980	3.3	4.3
1981	2.7	3.8

Table 13

CORRELATIONS OF TONAL, RHYTHM, AND COMPOSITE SCORES WITH SAME AND DIFFERENT SCORES

	Tonal	Rhythm	Composite
1978			
Tonal			
Same	.11	.02	.09
Different	.32	.23	.33
Rhythm			
Same	.33	.17	.31
Different	.30	.33	.36

	Tonal	Rhythm	Composite
1979			
Tonal			
Same	.22	.32	.31
Different	.55	.38	.55
Rhythm			
Same	.19	.28	.27
Different	.40	.37	.45

	Tonal	Rhythm	Composite
1980			
Tonal			
Same	.14	.35	.29
Different	.41	.34	.43
Rhythm			
Same	.21	.28	.28
Different	.34	.29	.36

	Tonal	Rhythm	Composite
1981			
Tonal			
Same	.35	.14	.28
Different	.98	.55	.87
Rhythm			
Same	.34	.72	.59
Different	.53	.81	.75

trend in increased association between *different* scores and corresponding test scores as children become older. These data confirm that children who can audiate correctly more patterns as being different possess higher levels of developmental music aptitude than children who can audiate correctly more patterns as being same.

Conclusions and Implications

Children five years old are very conscious of sameness and difference. They become increasingly less concerned with those concepts during the first few years of school. By the time they reach the intermediate grades, they are no longer directly concerned with the concepts as they apply to the audiation of music. Like adults, children nine years old and older are probably concerned with sameness and difference only indirectly. Older children and adults are directly concerned, for example, with sequence and repetition in music; as a consequence they are only indirectly concerned with sameness and difference in music. Younger children are directly concerned with sameness and difference in music, but it is not known what elements of music they are indirectly concerned with. Developmental music aptitude appears to coincide with direct concern for sameness and difference in music, whereas stabilized music aptitude appears to coincide with indirect concern for sameness and difference in music. In extrapolation of the results of this study, it would seem that infants are concerned only with sameness and difference in music. Some time before they reach the age of five they begin to acquire some indirect concern for the elements of music which older children and adults find of direct concern. It is possible that direct concern for sameness and difference in music is a matter of perception and that indirect concern for sameness and difference in music is a matter of conception.

The unknown music content indirectly audiated and performed by children five years old and younger as they are directly concerned with audiating and performing sameness and difference in music may be thought of as initial "music babble" in the same way that preschool speech habits are thought of as language babble. In the spoken language it seems that one derives meaning as a result of more than syntax, grammar, and semantics. For example, melodic contour, pitch, phrasing, and rhythm of the words and sentences also contribute to meaning. Unfortunately, elements, musical or extra-musical, beyond sameness and difference which also contribute to music are not so obvious. Yet they may play a central role in the audiation of music during the developmental music aptitude stage, particularly in the music babble stage. These unknown elements do exist. The factor analyses results of this study clearly indicate that there are various types of sameness and difference concepts that concurrently operate in the audiation process of the young child. This is true for both tonal and rhythm dimensions of music. It is possible that timbre and dynamics interact with tonal and rhythm patterns in the audiation process of the young child, thus creating contrasting types of sameness and difference factors. Though the *Primary Measures of Music Audiation* were designed to hold timbre and dynamics constant on the tape recordings of the tonal and rhythm patterns, possibly in terms of physics and at least in terms of phenomenology, that is an impossible goal to achieve.[34] The adult can deal with normal illusions and adapt for unintended inconsistencies in the audiation of music, whereas it is likely that the background of the young child is not rich enough for him to audiate in such a musically sophisticated manner.[35] A young child cannot analyze what he is audiating in music. He is only indirectly concerned with what he is audiating in music beyond his direct concern for sameness and difference in music.[36]

If these assumptions are plausible to a music teacher, then he must be sure that he does not teach what he knows rather than what the young child is capable and desirous of learning. It is clear that the young child does not audiate music as an adult does. Thus the young child does not learn music as an adult does. Types of formal music instruction designed for older children and adults are not appropriate for younger children. Learning theories must be developed especially for use with young children which informally encourage their use of music babble. When young children enter school, they have been through the language babble stage. It is conceivable that a young child who has been traditionally diagnosed as a monotone might be trying to establish a sense of pitch center as he belatedly goes through his music babble stage. Or a young child who has been traditionally diagnosed as having poor rhythm may not be attending to rhythm at all as he attempts to establish a sense of pitch center; the repeated pitches themselves may be defining tempo, meter, and melodic rhythm. And who can be sure that music babble does not have its origins in crying and crawling which are interrupted by language babble? If this is the case, music instruction for the young child might best provide for continuity between crying and the establishment of a sense of pitch center and between crawling and the establishment of a sense of consistent tempo.

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34. Perhaps such a misconception led to the lack of success in developing timbre and dynamics subtests for the *Primary Measures of Music Audiation.* For insight into the implications of philosophical phenomenology as an aid in interpreting the results of this study, see *The Foundation of Phenomenology* by Marvin Farber. (Albany: State University of New York Press, 1968).
35. Subjective rhythm versus objective rhythm is discussed in terms of normal illusion in *Psychology of Music* by Carl E. Seashore. (New York: McGraw Hill, 1938). The topic of normal illusion as it applies to music audiation in general can be found in *Learning Sequences in Music: Skill, Content, and Patterns* by Edwin E. Gordon. (Chicago: G.I.A., 1980).
36. For an intriguing discussion of how one can be unconscious of his consciousness and of how that might relate to indirect and direct concern for what is audiated in music, see *The Origins of Consciousness in the Breakdown of the Bicameral Mind* by Julian Jaynes. (Boston: Houghton Mifflin, 1978).

It has been established that for the young child sameness of patterns is easier to audiate than difference in patterns. Thus a teacher may assume that sameness of patterns in terms of echo responses should be taught before difference in patterns in terms of creative responses. It is true, however, that very young children are acutely aware of difference in sound as music long before they receive instruction in music. It is logical to conjecture that shortly after birth, children begin to interpret various stimuli as being different. Indeed, there are no two things that are in fact the same;[37] even if two objects, ideas, or sounds could be found that were identical, they would be perceived differently by two human minds or by one human mind on different occasions. In their own way, very young children are probably aware of this. As a result they become confused when adults speak of sameness. The very young child must soon learn on his own what constitutes "just unnoticeable differences" between two sounds which the adult accepts as being the same. He must learn that differences in sound may be so slight that adults hear or accept those sounds as being the same. It would seem reasonable that the role of the teacher is to help the young child as soon as possible to determine how much difference must be audiated before one can no longer call two sounds the same. Only by learning what the adult considers the same can the young child understand what should be interpreted as being different. With proper instruction, young children with high and lower levels of developmental music aptitudes will learn sooner, and with greater clarity, that it is normal to audiate large and comparatively insignificant differences, and that the adult applies the label *same* to the insignificant differences.

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37. For a philosophical treatment of this issue, see Chapter Five, Part 2-*On the Likeness of Meaning* and Part 3-*On Some Differences About Meaning* in *Problems and Projects* by Nelson Goodman. (Indianapolis: Bobbs-Merrill, 1972).

38. I find it easy to believe that humans are born with "perfect pitch" and "perfect time", but that both attributes are lost when very young children begin to interact with adults. In his early evolution, man depended upon his hearing for survival because he had limited sight. As his sense of sight developed, he had less need for perfect pitch and perfect time. They became as unnecessary as his appendix has become. And adults in the child's environment who give little attention to precision in pitch and time contribute to the demise of perfect pitch and perfect time through interference and contradiction intended as instruction. Nevertheless, the identification of the various types of unknown music elements which young children attend to in terms of sameness and difference is of the utmost importance. This is so because such elements, as they impinge on sameness and difference, form the foundation upon which older children and adults give meaning to music. If those unknown music elements could be identified so that they might be reinforced in interaction with sameness and difference in teaching very young children, the younger the better, then children's developmental music aptitudes, and ultimately their stabilized music aptitudes, would be enhanced.

The idea that very young children audiate sound in music differently from the way adults do should be no more startling than that very young children's concept of a year in time is enormously different from that of adults. Retroactive inhibition on the part of the young child in attempting to erase supposedly erroneous concepts rather than learning how to assimilate them into new understanding, as a result of no, or inappropriate formal instruction, may be the most potent cause of low developmental music aptitude among young children. Unfortunately, there are yet no valid methods for determining the extent to which babies and children younger than five are aware of sameness and difference in music. However, it is not unreasonable to speculate that direct concern for sameness and difference in music is substantial during the first three years of life.[39] By age nine, the concern for sameness and difference in music becomes indirect. It is imperative that music educators should know more about concern for sameness and difference in music and how it changes with chronological age; about what is audiated in music at various age levels in terms of the abstractions *same* and *different;* about what might constitute sequential learning theories in music for very young children and school-age students; and about the extent to which characteristics of developmental music aptitudes and stabilized music aptitudes are interrelated.

39. For a philosophical discussion, see *The Absorbent Mind* by Maria Montessori, translated by Claude A. Claremont. (New York: Dell, 1967). For more objective evidence, see William Kesson, Janice Levine, and Kenneth A. Wendrich, "The Imitation of Pitch of Infants," *Infant Behavior and Development,* 2 (1979), 93-99.

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