HOW YOUNG CHILDREN CONCEPTUALIZE SOUND AS MUSIC: A LONGITUDINAL STUDY IN MUSIC APTITUDE

Edwin E. Gordon
Temple University

Introduction

Music aptitude is the potential for music achievement whereas music achievement is the actual attainment of music knowledge and skills. Early in the twentieth century, in writing about the nature and measurement of music aptitude based on evidence gathered in 1910, Carl E. Seashore stated "When the proximate physiological threshold has been reached, practice is of no avail." 1 Beginning with that declaration which was not in opposition to the views of his European predecessors who engaged to some extent in research in the psychology of music, the belief in stabilized music aptitude was solidified. 2 Thus although considered to be a relative capacity by Seashore, music aptitude was thought to be a God-given gift that one is born with or without: practice and training in music would not affect one's physiological limit, only his cognitive limit. Simply, nature was the controlling influence on level of music aptitude and nurture was totally without effect on level of music aptitude but it was a controlling influence on level of music achievement. Moreover, Seashore came to believe that music aptitude was not only innate but more exactingly, 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 doctrine that music aptitude is inherited and that it stabilizes at birth, if not prenatally, held firm for approximately two decades. However, James Mursell soon became suspicious of it and he initially popularized his point of view with 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, as expressed 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 all students in the schools of America required to participate in instruction in general music? He reasoned that if Seashore was 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 musicall talented and to a much lesser extent in pedagogical practices in terms of students' individual musical differences. Nonetheless, Mursell's argument became the focal point of a spate of research, which has been summarized by 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 included a period of instruction of only a semester or less, indicated that level of music aptitude could be changed with practice and training, and thus that music aptitude is not innate or stabilized. Seashore's aptitude battery was considered simply just another music achievement test. Seashore remained undaunted by such evidence and opinions and he 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 latter. 10 Particularly in opposition to what was considered 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. In other words, he explained that he was an "atomist", and he emphasized his position by re-titling the 1939 revision of his test 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 either the nature or nurture position. 12 However, it seemed clear from the results that the music aptitude 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 even to scholars during the 1950's. Most took sides on the basis of what they were taught or in terms of their political persuassion; they rarely discussed the matter. The disruption of the 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 the longitudinal predictive validity of the battery was found to be .77 14. The Musical Aptitude Profile is eclectic; that is, its construction combines 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 15, reported the same findings. 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 in association 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 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, and post-standardization research indicated that the same norms can be used with students of different races and nationalities. 16 Of all of these findings, the ones which were given most attention by the profession through the 1960's were that music aptitude is stable and its consequence, 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 called into question. 17 Because no valid standardized test had been developed which was suitable for use with children eight years and younger, it was impossible to gather facts about the effects of practice and training on the music aptitude of very young children. It was simply assumed that the music aptitude of very young children had the same characteristics as those associated with older children. Nonetheless, due to nagging doubts, attempts were made to adapt the Musical Aptitude Profile for use with younger children. 18 However, 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 this test, the Primary Measures of Music Audiation, was derived from an eight-year program of research in which a taxonomy of tonal and rhythm patterns and their relative difficulty levels was established. 20 It is essentially the information derived from the Primary Measures of Music Audiation as it relates to how very young children conceptualize sound as music that is to be considered in 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 Succinctly, neither side of the proverbial nature/nurture controversy is the correct or incorrect one. The fact of the matter is that music aptitude is a product of both nature and nurture. That is, a child might be born with a high degree of music aptitude but unless he receives appropriate early informal environmental influences, what potential he was born with will atrophy. On the other hand, regardless of its quality and quantity, a young child will not profit from exposure to music any 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 and it rapidly decreases in the form of a positively accelerated curve until the child reaches age nine, give or take a few months. At age nine, music aptitude becomes stabilized; it is no longer effected by environment to the extent of being increased or decreased. Thus the music aptitude of students nine years and older is stabilized but the music aptitude of children from five through eight years, and most probably 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 that 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 type comprises. The Musical Aptitude Profile includes seven dimensions: more dimensions of stabilized music aptitude would have been included in the battery except the concern for necessary additional administration time precluded the possibility. In contrast, the Primary Measures of Music Audiation include only two dimensions: tonal and rhythm. It was found that no other dimension could be developed for appropriate use in the battery. The reason for this might be a result of the lack of knowledge of how to design such tests for very young children or because other dimensions of developmental music aptitude do not exist. It is interesting that the dimensions of timbre (more properly, sonance) and dynamics were experimented with and it was intended that tests of these dimensions would be constructed and become part of the Primary Measures of Music Audiation. However, it was found that the reliability of such tests approached zero. The items for both tests 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 in number. No items could be developed which displayed difficulty values between .10 and .90. Thus the discrimination values of the items approached zero. It is true that the Musical Aptitude Profile also does not include 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 music sensitivity so that they could realistically contribute 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 more interested in how music is constructed rather than in its expressive ramifications. 22 Further, very young children are more adept at describing music they have heard than they are in performing familiar music.

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. Only when the differences are gross, such as the comparison of a high flute with a low bass, will group means, not individual scores, be found to be at least moderately reliable. That is, when a rhythm pattern is heard in a melodic context and when a tonal pattern is heard in a rhythm context, as they are in the Musical Aptitude Profile, the child in the developmental music aptitude stage becomes confused in terms of which of the two dimensions should be attended to with precision in the listening process. 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. However, they are quite comfortable and attentive when listening to a synthesizer rather than to a violin or 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 but even more compelling ones remain to be discussed in terms of what is audiated. First 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 what 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 would be no form in music.

Audiation functions in long term memory and short term memory, and both types of memory represent formal music achievement. 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 to immediate impressions with intuitive responses to 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 only in terms of recall. This type of audiation response is indicative of informal music training. 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 is dependent upon how well one can derive immediate impressions and make intuitive responses in the audiation process.

Regardless of whether one is in the developmental or stabilized music aptitude stage, he audiates tonal and rhythm patterns, not the pitch or duration of individual notes. As in language, one is primarily concerned with words, not letters. However, the transition from developmental aptitude to stabilized aptitude appears to be a well-defined process. In tonal audiation, one is concerned first only with the pitch center of a part or of the whole of a piece of music. Then he gradually becomes concerned with the key 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 or an entire piece of music. Then he gradually becomes concerned with the meter the patterns collectively suggest, and finally with the melodic rhythm which the patterns collectively suggest. 23

Immediate impressions and intuitive responses are developed in correspondence with 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 these music reactions fluctuates until he is approximately nine years old. The fluctuations represent the continuous interaction between a child's innate capacities and his environment. Before age nine, 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 age nine. And, one's achievement in notational audiation, among other music skills, is best predicted by his level of stabilized music aptitude. 24

Design and Results of the Study

The Primary Measures of Music Audiation are a tape recorded group test in two parts: Tonal and Rhythm. Each part has forty items and requires approximately 12 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 questions presented on the tapes by making circles around pictures on the answer sheet. The child simply 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, the child 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, 127 kindergarten children in nine elementary schools in West Irondequoit, New York were administered the battery in 1978. After the tests were scored and the typical forms of data were derived, the 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 significance 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 (40x40) 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. 25 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. The smaller percentage of overall significant rhythm pattern than tonal pattern intercorrelations probably is due to the lower reliability of the rhythm test items as indicated by the lower reliability of the rhythm test as compared to that of the tonal test. The split-halves reliability was .72 for the rhythm test, .88 for the tonal test, and .90 for the composite score. What is more startling than the number of highly significant item intercorrelations is that all of the pairs that are positively intercorrelated share the identical correct option response of same or different, and all of the pairs that are negatively intercorrelated do not share the identical correct option response; one is same and the other is different.

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. The results for the tonal test are presented in Table 1 and the results for the rhythm test are presented in Table 2. Included in these tables in the second and third columns are the difficulty and discrimination values of the test items, with decimals omitted. An s after a 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 group factors were extracted to account for 16.5 percent of the variance in common. Approximately 22 percent of the total variance was accounted for by nineteen unrotated factors. And, as can be seen in Table 2, seven rhythm group factors were extracted to account for 16.3 percent of the variance in common. Approximately 21 percent of the total variance was accounted for by nineteen unrotated factors.

Those test items which correlate with a group factor .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 the items in the bipolar factors in the tables indicates that 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 the test item numbers. As can be deduced from Tables 1, 2, 1a, and 2a, the group factors follow the structure suggested by the item intercorrelations. All of the items in the two non-bipolar factors, one tonal and one rhythm, share the identical correct option response. Every bipolar factor in the tonal and rhythm analyses comprises items that correlate, of course, positively with the factor, and items that correlate negatively with the factor. All of the items that correlate positively with the factor share one identical correct option response and all of the items that correlate negatively with the factor share the other identical correct option response. It is obvious that unique factors, primarily in terms of individual test items, constitute a substantial portion of the variance in the Tonal and Rhythm tests; approximately 71 percent for the Tonal test and 56 percent for the Rhythm test. Though every one of the test items is included in at least one group factor, most, if not all, of the test items are responsible for unique variance. Only a few test items appear in more than one factor.

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 took the tests the first time in kindergarten in 1978, 16 had moved away from the school district and were unable to take the tests in 1979. The summer after the children took the tests the first time, the music teacher were given the results in order that they might become familiar with the scores before they began instruction again 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 the 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 on the battery of 80 and above, some type of out-of-school special instruction be provided to supplement the general music program in the school.

The 1979 test results of 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 items intercorrelated .30 and higher, and all were positive. Unlike the results for the previous year, not only were there no negative intercorrelations, but moreover, 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 as many (19) of the rhythm items exhibited no intercorrelation with any other test item than did the tonal items. 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 rhythm items shared the identical correct option response.

As in the analysis for the previous year, five group tonal factors were extracted but only six rhythm factors were extracted. The variance in common, as reported in Tables 3 and 4, was approximately three percent and five percent less for the tonal analysis and the rhythm analysis, respectively, the second year than the first year. Approximately 18 percent of the tonal variance was accounted for by nineteen unrotated factors in the tonal analysis and approximately 16 percent by nineteen unrotated factors in the rhythm analysis. Unique variance was 76 percent for the tonal analysis and 72 percent for the rhythm analysis. Although the factor analyses results reflect the intercorrelation results for both years, there are differences as well as similarities between the factor analysis results for the two years. The bipolar factors notwithstanding, with the exception of one test item in the first tonal factor for the 1979 analysis, the first two factors in the tonal and the rhythm analyses include only those test items which share the identical correct option response. Further, with the exception of two items in the fourth and fifth factors in the tonal analysis and two items in the third and sixth factors in the rhythm analysis, only those items which share the identical correct option response are included in the factors. However, the third factor in the tonal analysis and the fourth factor in the rhythm analysis, as well as the bipolar portion of the sixth factor in the rhythm analysis, are quite diversified in terms of including items which represent both correct option responses. As explained, all factors in the tonal and rhythm first-year analyses include without exception only those items which share the identical correct option response. It will be noticed that, as for the first-year analysis, some items in the second-year analyses can be found in more than one factor. The tonal factors and the rhythm factors are presented 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 the first grade, only 87 remained in the school district. The 1980 test results were analyzed like the 1978 and 1979 test results. Approximately 15 percent (240) of the tonal test items intercorrelated .30 and higher, and all were positive; of these, only two did not share the identical correct option response with another test item. Similar to 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 tonal item. With the exception of two tonal items, 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, only one was negative. Over half (22) of the rhythm items displayed no intercorrelation with any other rhythm 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, the percentage of the variance in common for the rotated factors was highest for both the tonal and rhythm analyses the third year; 20.3 percent for tonal and 18.7 percent for rhythm. The total variance in common for nineteen unrotated factors was 21 percent for tonal and 15 percent for rhythm. The unique variance was found to be 69 percent for both the tonal and rhythm analyses. Although the test items which have same as the correct option response dominate in the tonal intercorrelation analysis, this is not reflected in the factors themselves. Two of the tonal factors include only items which have same as the correct option response, and two other factors include only items which have different as the correct option response. As can be seen in Table 5a, the remaining two tonal factors display characteristics found in some factors for the second-year analysis. That is, two-thirds of the items found in the second factor have same as the correct option response and one-third of the items have different as the correct option response, and all except one of the five items in the fourth factor have same as the correct option response. The rhythm factor analysis, as in the previous two years, does reflect the rhythm intercorrelation analysis. As can be seen in Table 6a, three rhythm factors include without exception items which have same as the correct option response, including the bipolar factor, and two of the rhythm factors include without exception items which have different as the correct option response. Only one rhythm factor, the fourth, includes items with both correct option responses. There are fewer items found in more than one factor in the tonal and rhythm analyses the third year than there were the two previous years; item 38 was the only one to overlap in the rhythm analysis. Thus the rhythm factor analysis, though it has traces in common with the second-year analysis, primarily follows the trend of the first-year analysis.

Interpretation of the Data

An examination of the factor analyses indicates consistency in the results across the three years. Though the specific item content of the factors is not identical from year to year, the structure of the factors is highly similar enough to be suggestive of the way in which very young children conceptualize sound as music. Very young children are preoccupied, possibly obsessed, with the concept of sameness versus difference in terms of music to which they attend. The evidence from this study indicates that the strength of concern of children with sameness and difference in music remains relatively consistent from ages five through eight. It is known from data associated with related research that when items which constitute subtests with the option responses of either same and different or either like or different in the Musical Aptitude Profile are factor analyzed, the factors in no way lend themselves to the same interpretation they obviously do when items in the Primary Measures of Music Audiation are factor analyzed. 26 Specifically, in contrast to the earlier research which has demonstrated that students in the stabilized music aptitude stage have no noticeable concern for sameness and difference when they attend to music, the most significant finding of this study is that young children in the developmental music aptitude stage are primarily concerned with sameness and difference when they attend to music.

As can be seen in Tables 1 through 6, young children's concern for sameness and difference in music accounts for approximately fifteen to twenty percent of their attention. Unfortunately, there are yet no valid methods for determining the extent to which babies and children younger than age five are aware of sameness and difference in music. However, it is not unreasonable to speculate that concern for sameness and difference in music is substantial during the first three years of life. 27 As reported, by age nine such direct concern no longer exists. It is imperative that music educators should know more about how and why the concern for sameness and difference in music is phasic and that it atrophies with chronological age; what is audiated as sameness and difference in terms of developmental aptitude; and why audiation becomes focused on other music characteristics in stabilized music aptitude and the extent to which characteristics in developmental and stabilized music aptitudes are interdependent and/or interrelated. Because the factor analyses results indicate that concern for sameness and difference functions identically in tonal and rhythm understanding, the answers to these questions apply to both tonal and rhythm audiation.

The reliance on sameness and difference for gathering clues to give meaning to music stimuli remains rather consistent in the early school years regardless of quality and quantity of training and exposure. This is substantiated in the item intercorrelations and factor analyses results. There is even further evidence which bears on this matter. In Table 7, 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 are presented for only the 87 children who remained in the study for the three-year period. It will be noticed that although the children received special attention in terms of in-school and out-of-school music instruction between the first two administrations of the battery, as attested to by the mean gains from 1978 to 1979, the structure of the factor analyses for both the Tonal and the Rhythm subtests remains highly similar for the two years. Moreover, the structure of the factors remains highly similar for the final two administrations of the battery in 1979 and 1980 even though the mean gains are typical as a result of the children not receiving any special attention in music during the interim. 28 In extrapolation of the data it would seem that children are quite concerned with sameness and difference after birth, they become less concerned with the concepts during the first few years of school, and by the time they reach the intermediate grades, they are not directly concerned with the concepts any longer. Like adults, children nine years and older are probably concerned with sameness and difference only indirectly. In other words, older children and adults are directly concerned, for example, with sequence and repetition in music and only as a consequence are they indirectly concerned with sameness and difference in music. Developmental music aptitude and stabilized music aptitude are phases one passes through as are direct and indirect concern for sameness and difference phases one passes through. The developmental music aptitude phase appears to coincide with direct concern for sameness and difference in music whereas the stabilized music aptitude phase appears to coincide with the indirect concern for sameness and difference in music. Thus it should not be thought to be contradictory that, as seen in Table 8, facture structures in how young children conceptualize sound as music is consistent although their music aptitude is developmental. In this connection it is important to notice in Table 8 that scores on the same subtest, Tonal or Rhythm, correlate similarly, but only moderately, from year-to-year, and that these correlations are similar in magnitude to the intercorrelations between the two subtests for any given year. 29 As should be expected, the split-halves reliabilit for each subtest is considerably higher than any of the correlations and intercorrelations between the subtests reported in Table 8.

The fact that all significant tonal item intercorrelations share same as the correct option response but that all significant rhythm item intercorrelations do not may be suggestive of the possibility that the transition from developmental rhythm aptitude to stabilized rhythm aptitude comes sooner than the transition for the two types of tonal aptitude. That is, these data may indicate that children learn to audiate more like adults sooner in terms of rhythm concepts than they do in terms of tonal concepts. The lower reliability of the Rhythm subtest than the Tonal subtest may be reflecting the confusion children experience as they progress from developmental rhythm aptitude to stabilized rhythm aptitude.

The results of the study, although compelling, might raise some doubts that are associated with the possibility that sameness and difference are artifacts rather than valid findings. It might seem conceivable that the order in which the items are presented in the subtests effects the results. This can be ruled out because when the subtests were re-recorded with the items in random order, the resultant factors are still identified as sameness and difference. Another doubt may be that the option responses same and different dictate the sameness and difference factors. The item difficulty and discrimination indexes reported in Tables 1 and 2 preclude such a possibility. It is obvious from the discrimination levels that the items are answered correctly and incorrectly consistent with each child's developmental music aptitude. If they were answered in terms of sameness and difference in isolation from their music characteristics, the discrimination values would approach zero, and the items would prove to be not valid. Moreover, if the children were attending only to sameness and difference in some isolated unspecified manner, the difficulty distributions of the items in the two subtests would be bimodal, not normally distributed. In this connection it would be difficult to understand how sameness and difference factors could be present in a developmental music aptitude test but not present in a stabilized music aptitude test simply as a result of the content of the tests even though identical or similar option responses are used in both types of tests. A final doubt may be that a response-set is responsible for the resultant factors. If this were true, the chances of finding highly similar factors for both the tonal and rhythm subtests, and repetitious factors over a period of years for the same children as they become older and therefore continually respond to new sets of extra-musical factors, would be remote.

When the Primary Measures of Music Audiation are administer to a group of children, most of them answer items correctly that have same as the keyed response as well as items that have different as the keyed response. Obviously, children with the greatest developmental music aptitude answer all of the items correctly. However, it became of interest 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. The intercorrelation and factor analysis results simply indicate that if a portion of the group answers one item correctly or incorrectly, that portion will answer other specific items, which usually have the identica keyed option response, correctly or incorrectly. Thus the tonal and rhythm answer sheets for each of the three years were re-scored. Every one of the 87 children who remained in the study throughout the three years was given two scores for each test for each of the three years. One score was for how many items were answered correctly that are keyed same and the other score was for how many items were answered correctly that are keyed different. The means and standard deviations for the tota score, the same score, and the different score are reported in Table 9. Also included in Table 9 are the mean differences between the same and different scores for each year. It can be seen in the table that 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. This is true regardless of the magnitude of the total score or of the quality and quantity of music instruction they receive during the developmental music aptitude stage. In other words, accepting the validity of the Primary Measures of Music Audiation, it takes less developmental music aptitude, both tonal and rhythm, to correctly audiate two patterns as being the same than it does to correctly audiate two patterns as being different. The primacy of sameness has been recognized also by psychologists who have conducted research in disciplines other than music. 30

Conclusions and Implications

It is obvious that young children and adults do not conceptualize sound as music in the same way. Young children emphasize sameness and difference in the audiation process, and this seems to give rise to an unconscious awareness of various types of unknown (to the adult) music content. The reverse would seem to be true for adults; they ostensibly emphasize known music content, as commonly described by the traditional music theorist, in the audiation process, and this seems to give rise to an unconscious awareness of sameness and difference. The unknown music content audiated by the young child might possibly 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 simply syntax and semantics. For example, the melodic contour, pitch, phrasing, and rhythm of words and sentences also contribute to meaning. Unfortunately, elements beyond melody and rhythm which also contribute meaning to tonal and rhythm patterns, particularly in the developmental music aptitude stage, are not so obvious, but nonetheless exist. That is, the factor analyses results of this study patently indicate that there are various types of sameness and difference concepts that concurrently operate in the audiation process of the young child. It is possible that timbre and dynamics interact with tonal and rhythm patterns to create 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, at least in terms of phenomenology this is an impossible goal to achieve. 31 It is possible that such a misconception led to the lack of success in developing timbre and dynamics subtests for the Primary Measures of Music Audiation. The adult can deal with normal illusions and adapt for unintended inconsistencies in sound, whereas the young child probably sees no need to resort to normal illusion and moreover, he probably could not engage in normal illusion behavior even if he saw the need; his background is not rich enough for him to audiate in such a musically sophisticated manner. 32 If these assumptions are plausible to a music teacher. then he must be cautious to be sure that he does not teach what he knows rather than what the young child is capable and desirous of learning in the audiation process.

It has been established that sameness of patterns is easier to audiate than difference in patterns for the young child. Thus a teacher might assume that sameness of patterns should be taught before difference of patterns. However, it is not fiction that very young children are accutely aware of difference in sound as music long before they receive instruction in music. That is, it is logical that very young children, shortly after birth, would begin to interpret all pairs of stimuli as being different. Indeed, if we, as adults, care to think about it, there are no two things that are in fact the same; 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 very own way, very young children are probably aware of this. As a result they become confused when adults speak of <u>sameness</u>. The very young child must soon learn, on his own, what constitutes "just unnoticable differences" before two sounds may be considered as being the same by the adult. It would seem reasonable that the role of the teacher is to help as soon as possible the young child 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. The idea that very young children audiate sound as music differently than the adult does should be no more startling than the fact that very young children's concept of a year in time is enormously different from that of adult's. 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 insensitive, instruction, might be the most potent reason for the low developmental music aptitude of some children.

In closing, allow me to speculate a bit more. I find it easy to believe that all 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, or no, sight. As his sense of sight developed, he had no more need for perfect pitch or perfect time for survival. They became as unnecessary as his appendix and tonsils have 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. Regardless, the identification of the various types of unknown music content which young children attend to in terms of <u>sameness</u> and <u>difference</u> is of the utmost importance. This is so because such content, as it impinges on <u>sameness</u> and <u>difference</u>, forms the foundation upon which older children and adults give meaning to music. If that unknown music content could be identified so that it might be reinforced in interaction with <u>sameness</u> and <u>difference</u> at an early age, the earlier the better, in the conscious and unconscious audiation of young children, the more probable it is that children's developmental music aptitude, and ultimately their stabilized music aptitude, would be enhanced. To accept this challenge, we, as adults, must learn to think and audiate as children do, and then blend the knowledge and wisdom that accrues with personal and professional integrity.

Edwin E. Gordon
Philadelphia, Pennsylvania
Summer, 1980

FOOTNOTES

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).
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).
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.
16. 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 that published in the manual 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).
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 and Edwin E. Gordon, "Developmental Music Aptitudes Among Inner-City Primary Children," *Council for Research in Music Education*, 63 (1980), 25-30. Also, Edwin E. Gordon, "The Assessment of Music Aptitudes of Very Young Children," *The Gifted Child Quarterly*, in press. The research to be reported in the final sections of this paper will also contribute to a clearer understanding of the source as well as to the description of music aptitude.
22. Gladys Evelyn Moorhead and Donald Pond, *Music for Young Children*. (Santa Barbara, California: Pillsbury Foundation for Advancement of Music Education, 1978).
23. For further information, see Part Seven of the Manual for the *Primary Measures 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 discussed further in terms of their implications later in this paper.
24. For data on this and related matters, see pages 28 through 31 of *A Three-Year Longitudinal Predictive Validity Study of the Musical Aptitude Profile* by Edwin Gordon. (Iowa City: University of Iowa Press, 1967).
25. 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).
26. 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.
27. 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 in Infants," *Infant Behavior and Development*, 2 (1979), 93-99.
28. The effect of music instruction might be best understood by comparing the longitudinal means and mean gains reported in Table 7 to the cross-sectional means reported in Part Seven of the Manual for the *Primary Measures of Music Audiation*. (Chicago: G. I. A., 1979).
29. Additional cross-sectional coefficients are reported in Part Seven of the Manual for the *Primary Measures of Music Audiation*. (Chicago: G. I. A., 1979).
30. 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).

31. For insight into the implications of philosophical phenomenology as an aid in interpreting the results of this study, see <u>The Foundation of Phenomenology</u> by Marvin Farber. (Albany: State University of New York Press, 1968).
32. Subjective rhythm versus objective rhythm is discussed in terms of normal illusion in <u>Psychology of Music</u> 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 <u>Learning Sequences in Music: Skill, Content, and Patterns</u>. (Chicago: G. I. A., 1980).

Table 1

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

TEST ITEMS	DIFF	DISC	FACTORS I	II	III	IV	V	h^2
1	72	47	.18	.49	-.12	-.09	-.28	.37
2s	66	41	.56	.12	-.20	.01	-.08	.38
3	70	53	.16	.56	.10	.14	-.41	.53
4s	76	38	.41	-.07	-.04	-.11	-.17	.22
5s	73	33	.52	-.01	-.02	-.29	-.06	.36
6	71	46	.16	.54	.10	.00	-.07	.33
7	62	53	.01	.59	.13	-.05	-.03	.36
8s	72	38	.19	.15	.01	-.11	.48	.30
9	59	43	-.16	.63	.00	.03	.23	.48
10s	68	43	.56	.00	.05	-.23	.22	.42
11s	80	35	.63	-.12	-.06	-.26	.05	.49
12	57	34	-.03	.34	.28	.15	.10	.23
13	51	41	-.19	.42	.24	-.12	.22	.33
14s	74	44	.50	.13	-.07	-.17	.14	.32
15	71	54	-.01	.52	.07	.10	.11	.29
16s	71	45	.69	.09	-.12	.00	-.04	.50
17s	75	32	.24	.29	-.22	-.47	.10	.42
18	63	39	-.31	.44	.23	-.12	-.04	.36
19	30	20	-.23	-.10	.14	.60	-.02	.44
20s	75	41	.59	.01	-.29	.00	.04	.43
21	36	24	-.37	.12	.25	.37	-.07	.35
22s	65	40	.46	.15	-.36	-.18	.31	.49
23s	79	39	.62	-.02	.03	-.39	.03	.54
24	36	20	-.15	-.02	.48	.43	-.15	.46
25s	78	44	.61	-.01	-.22	-.16	.41	.61
26	45	23	-.27	.20	.47	.09	.10	.35
27s	71	21	.21	-.14	-.05	-.50	.21	.36
28s	71	20	.24	.00	-.47	-.29	.13	.38
29	34	21	-.35	.14	.10	.40	-.01	.32
30	57	43	.07	.37	.59	.11	.04	.50
31s	79	29	.53	-.10	-.29	-.17	.23	.45
32	43	24	-.11	.01	.44	.52	.01	.47
33s	78	31	.40	-.03	-.16	-.38	.23	.39
34s	69	31	.40	.02	-.29	-.35	.34	.48
35	50	44	-.07	.37	.31	.44	.10	.44
36	53	38	.03	.30	.66	.16	.01	.55
37s	72	36	.47	-.06	.00	-.42	.26	.47
38	57	40	-.24	.14	.56	.10	-.01	.40
39	71	49	-.01	.55	.01	.48	.15	.56
40s	68	23	.32	.06	-.40	.04	.22	.32
Sum of Squared Loadings			5.4	3.3	3.2	3.1	1.5	16.5

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

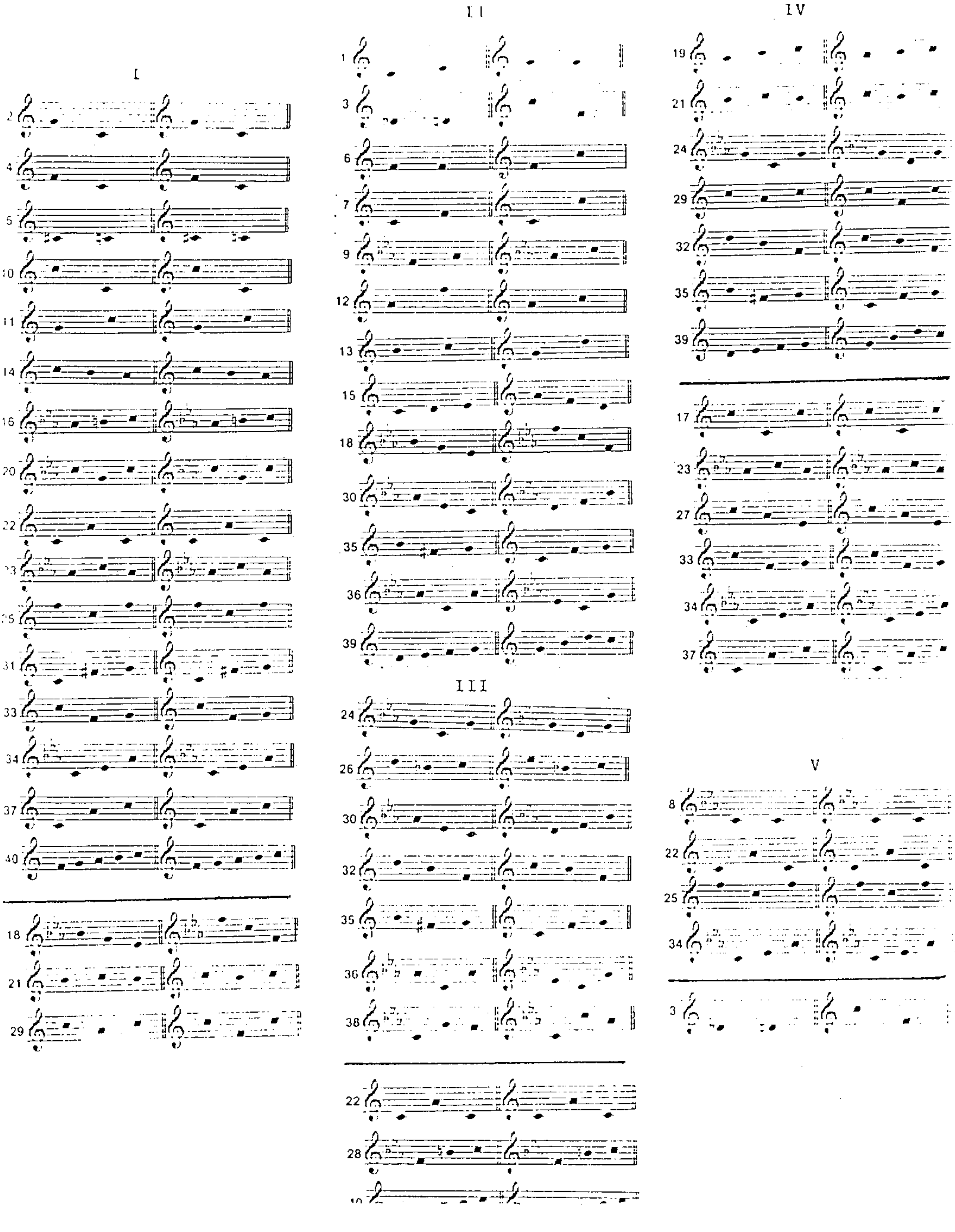


Table 2

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

TEST ITEMS	DIFF	DISC	FACTORS I	II	III	IV	V	VI	VII	h^2
1s	82	23	.24	.29	.07	.04	-.43	.16	.19	.39
2	64	29	.28	.10	-.20	.20	-.01	.50	.01	.42
3	46	31	.12	-.09	-.03	.12	.59	-.05	-.31	.49
4s	65	44	-.25	.17	.42	-.05	.20	-.22	.00	.30
5	44	27	.25	-.03	-.24	.11	.54	.14	.19	.4[illegible]
6s	62	26	-.02	.42	.29	-.20	.02	.04	.08	.31
7s	69	20	-.04	.23	.25	.14	-.42	-.27	.14	.40
8	50	28	.30	-.02	-.14	.61	.03	.08	.05	.50
9	22	21	.00	-.15	-.39	-.13	.21	.33	-.04	.34
10s	65	23	-.05	.20	.22	-.33	.03	-.13	.07	.2[illegible]
11	51	38	.15	-.17	.07	.24	.59	.11	.08	.49
12s	63	29	-.01	.18	.55	-.15	-.08	-.06	.09	.37
13	43	24	.26	.02	-.07	.19	.41	.35	.00	.39
14	59	40	.26	.09	-.55	.18	.09	.11	.13	.4[illegible]
15s	74	25	.01	.38	.10	-.06	-.19	-.33	-.03	.36
16s	60	28	-.21	.43	.24	.02	-.17	.11	-.10	.3[illegible]
17	42	24	-.02	-.05	-.36	.31	.04	.30	-.20	.36
18s	67	28	-.09	.41	-.04	-.10	-.15	-.07	.00	.22
19	40	20	-.13	-.19	-.41	.17	.09	.40	-.10	.42
20s	73	28	-.03	.49	.08	-.18	-.05	-.08	.05	.29
21	43	20	.14	-.21	-.16	.46	.16	.07	-.13	.3[illegible]
22	60	29	.53	-.02	-.06	-.08	.14	.26	-.37	.5[illegible]
23s	67	21	.09	.23	.05	-.64	-.12	-.20	.14	.5[illegible]
24s	64	30	-.09	.42	.27	.18	-.08	-.34	.11	.3[illegible]
25	52	39	.40	.03	-.30	.32	.05	-.15	-.17	.4[illegible]
26s	64	35	-.44	.41	.01	-.15	-.16	-.17	.09	.4[illegible]
27	59	39	.45	.06	-.37	.17	.04	-.01	-.15	.39
28s	74	36	-.19	.72	.02	-.11	.01	-.13	.01	.5[illegible]
29	38	21	.11	-.14	-.55	.18	.08	.00	-.26	.4[illegible]
30	55	29	.71	-.21	.00	.04	.16	-.01	-.07	.5[illegible]
31s	62	22	-.17	.18	.22	-.33	-.18	-.01	.33	.3[illegible]
32	52	30	.62	-.24	-.09	.06	.07	.16	-.12	.50
33s	65	22	-.19	.26	.22	-.33	-.24	-.08	.03	.3[illegible]
34s	71	28	-.16	.29	.14	.00	-.03	-.53	.21	.4[illegible]
35	50	39	.43	-.05	-.18	.38	.07	-.05	-.22	.4[illegible]
36s	65	23	-.36	.34	.16	-.08	-.06	-.16	-.02	.31
37s	59	22	-.09	.03	.02	-.18	-.01	-.15	.60	.4[illegible]
38	48	21	.40	-.28	.05	.26	.01	.17	-.03	.3[illegible]
39	54	44	.30	.05	-.20	.04	.04	.11	-.61	.5[illegible]
40s	60	24	-.07	.16	-.05	-.25	-.06	-.53	.10	.3[illegible]
Sum of Squared Loadings			3.1	2.8	2.5	2.4	2.1	2.0	1.6	16.3

Table 2.a

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

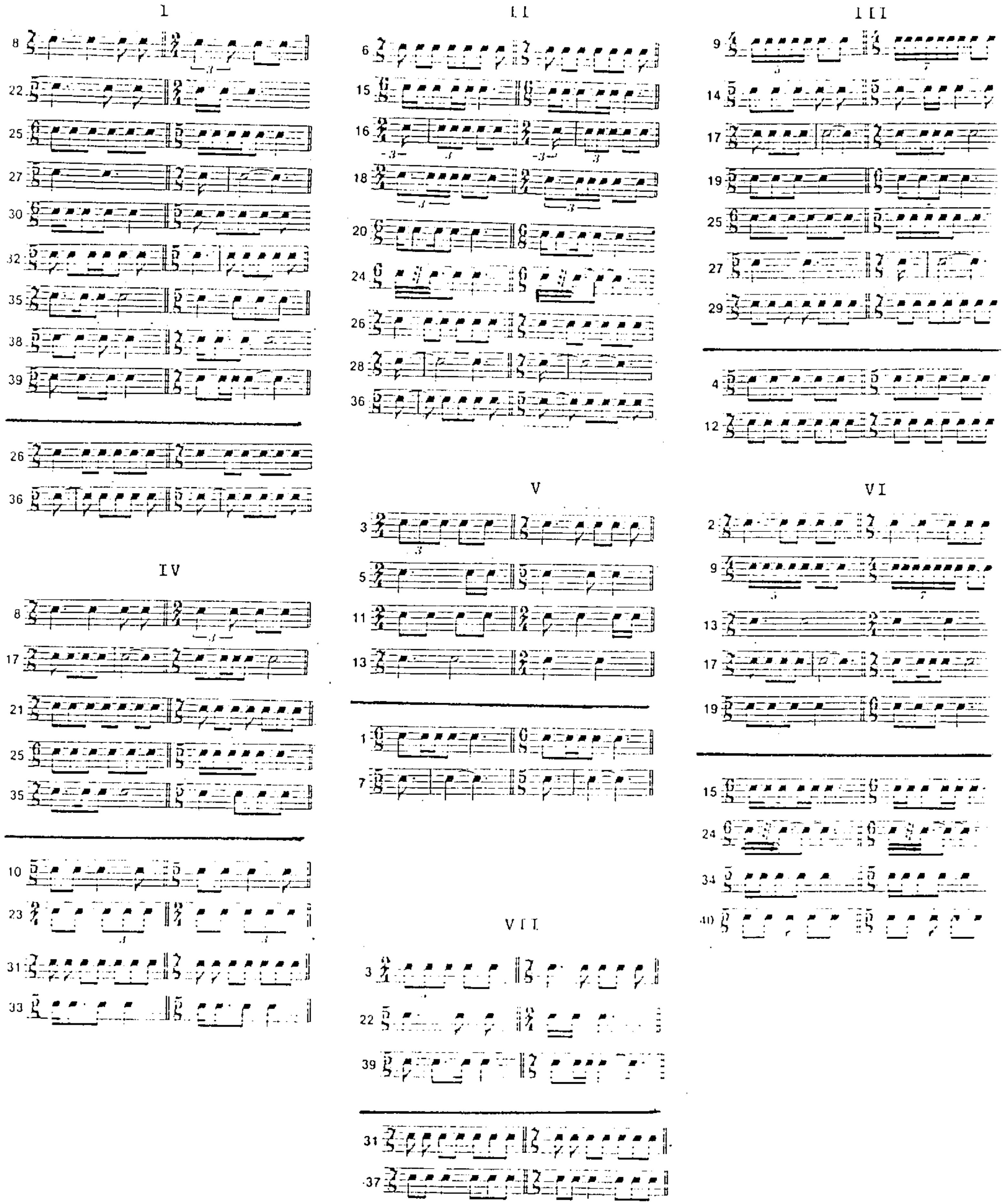


Table 3

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

TEST ITEMS	I	II	III	IV	V	h^2
			FACTORS			
1	.07	.15	-.62	-.04	.15	.44
2s	.36	-.05	-.24	-.02	.15	.22
3	-.07	.12	-.43	.24	.09	.27
4s	.09	-.06	-.48	-.03	.51	.50
5s	.25	.04	-.16	-.09	.57	.42
6	.43	.10	-.52	-.04	.38	.61
7	-.04	.26	.06	.39	.09	.23
8s	-.02	-.03	-.44	.05	.04	.20
9	.07	.27	-.30	.35	.00	.29
10s	.02	-.41	-.31	.42	.40	.59
11s	.17	-.11	-.04	.01	.63	.44
12	.06	.34	.01	.30	.01	.21
13	.01	.28	-.03	.51	-.13	.36
14s	.15	.02	-.33	-.16	.55	.45
15	-.09	.24	-.22	.42	-.03	.29
16s	-.29	-.07	-.11	.07	.50	.36
17s	.39	-.23	-.44	.13	.36	.55
18	.12	.36	.04	.04	.19	.18
19	-.31	.19	-.04	.07	.01	.14
20s	.28	-.20	.00	.13	.19	.17
21	-.17	.44	-.08	.09	.00	.23
22s	.30	.04	-.08	.14	.41	.29
23s	.71	.11	.03	-.06	.23	.57
24	-.11	.46	.08	.03	-.01	.23
25s	.38	.13	.04	-.09	.44	.36
26	-.11	.41	.01	.14	.00	.20
27s	.36	-.22	-.21	.22	.22	.32
28s	.49	.02	.05	-.01	.06	.25
29	.03	.47	-.08	.14	-.09	.26
30	.09	.27	-.14	.30	.24	.25
31s	.65	-.02	-.42	.02	.34	.72
32	.01	.43	-.18	.18	-.09	.26
33s	.37	-.08	-.03	.10	.48	.38
34s	.23	-.19	-.13	.08	.15	.14
35	-.03	.13	-.05	.52	.03	.29
36	-.01	.24	.11	.37	.30	.29
37s	.26	.15	-.11	.08	.60	.47
38	.10	.44	-.21	.31	.16	.37
39	.05	.18	-.31	.53	-.10	.42
40s	.02	-.08	.05	.55	.03	.31
Sum of Squared Loadings	2.8	2.5	2.4	2.4	3.5	13.5

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

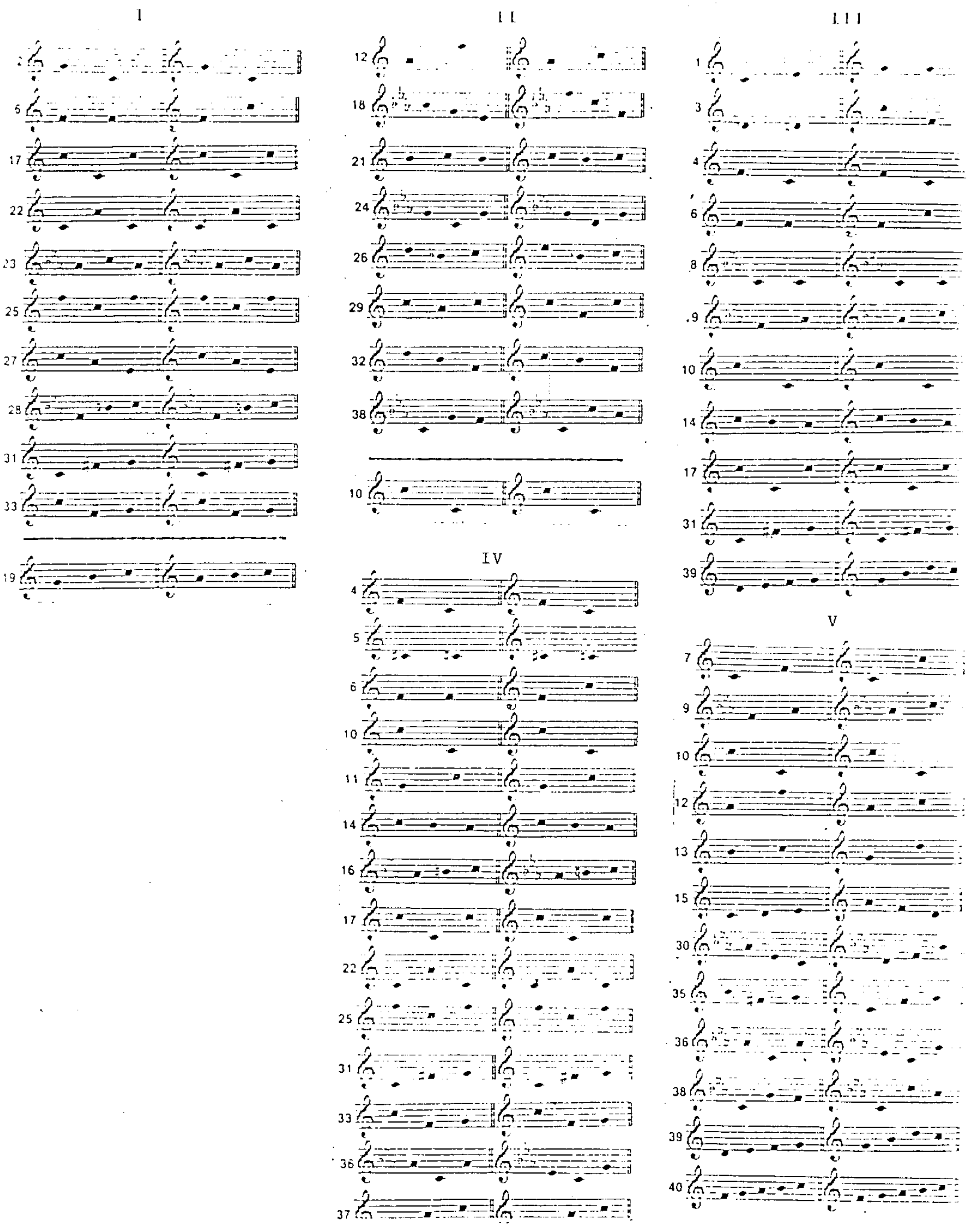


Table 4

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

TEST ITEMS	FACTORS I	II	III	IV	V	VI	h^2
1s	-.11	.06	-.30	-.22	.07	.28	.24
2	-.19	.35	-.10	-.14	-.12	.04	.21
3	.04	.02	-.05	.46	.08	.17	.25
4s	.08	-.07	-.13	.30	.11	-.04	.13
5	.03	.21	-.13	.51	-.25	.04	.38
6s	.08	-.19	-.31	.35	.26	-.15	.36
7s	.45	.17	-.12	-.10	-.05	.35	.38
8	.15	.20	-.03	.10	-.05	.56	.38
9	.00	.12	.01	-.05	-.06	-.38	.16
10s	.50	.00	-.08	.08	.15	.06	.29
11	.12	.10	.02	.22	.36	.11	.22
12s	.07	.02	-.16	.01	.37	-.08	.17
13	-.09	.35	.07	.33	.16	-.07	.28
14	-.05	.23	-.09	.02	.01	.46	.28
15s	.26	-.10	-.27	-.02	.05	.25	.22
16s	-.07	-.06	-.14	.11	.55	.11	.36
17	.05	.44	-.03	-.14	.09	.03	.23
18s	.20	.05	-.08	-.04	.48	.05	.29
19	-.38	.18	.32	.26	.12	-.13	.38
20s	.46	.05	-.08	.29	.28	.04	.39
21	-.02	.03	.58	-.13	.07	.00	.36
22	.16	.19	-.39	.00	.18	.28	.32
23s	-.02	-.16	-.18	.07	.04	.31	.16
24s	.52	.02	.07	-.07	.40	-.03	.44
25	.16	.47	.09	.31	-.14	.10	.38
26s	.24	-.02	-.02	.17	.22	-.34	.25
27	.17	.44	.17	.13	.12	.11	.30
28s	.29	-.14	.04	.22	.05	.22	.21
29	-.29	-.03	.60	.13	-.24	.13	.54
30	.10	.11	-.02	.05	.25	.42	.26
31s	-.06	-.09	-.31	.22	.22	.10	.21
32	-.14	.34	-.39	.24	.04	.19	.38
33s	.03	-.10	-.51	.09	.04	.20	.32
34s	.67	.15	-.05	.10	.07	-.04	.49
35	.28	.40	.05	-.01	.01	.05	.24
36s	.31	.03	-.18	.03	.22	-.20	.21
37s	.21	-.11	-.34	.11	.11	.18	.22
38	.09	.19	-.12	.00	-.03	.40	.22
39	-.05	.49	.05	.05	.06	.03	.25
40s	.14	.08	.06	.00	.38	.06	.18
Sum of Squared Loadings	2.4	1.8	2.1	1.5	1.8	1.9	11.5

Table 4a
RHYTHM FACTORS ROTATED TO THE VARIMAX CRITERION OF ORTHOGONAL SIMPLE STRUCTURE: 1979

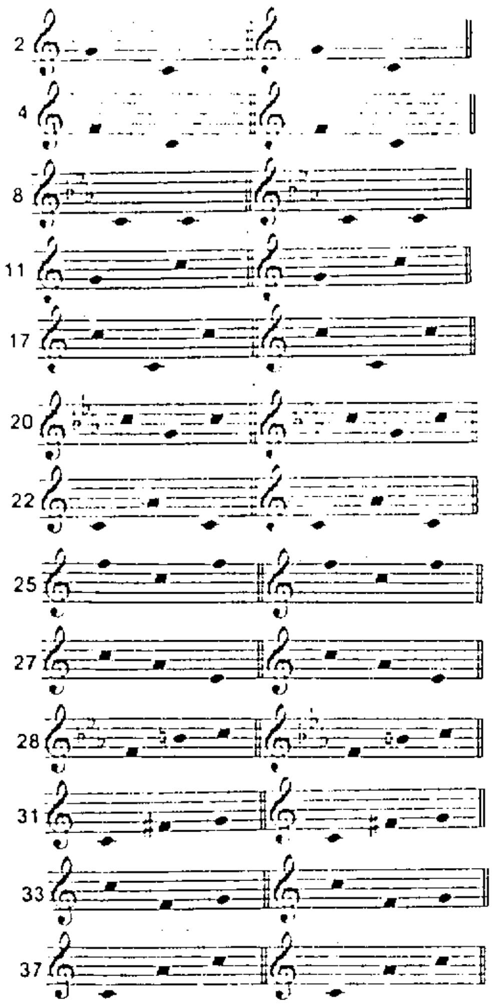
Table 5

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

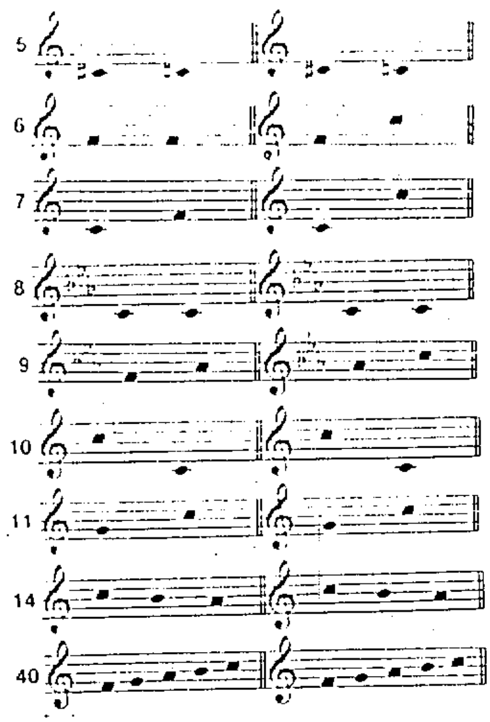
TEST ITEMS	FACTORS I	II	III	IV	V	VI	h^2
1	.02	.25	-.02	-.01	.00	-.02	.06
2s	.37	-.06	.05	.02	.00	.13	.16
3	-.03	-.01	-.01	.00	.01	-.02	.00
4s	.56	.14	.01	.18	-.03	-.02	.37
5s	.04	.48	.05	.50	.00	.04	.49
6	.27	.67	-.05	.32	-.02	-.06	.63
7	.08	.56	-.15	.11	.13	.21	.42
8s	.35	.34	-.04	.07	-.13	-.06	.27
9	-.11	.33	.11	-.10	-.07	.28	.23
10s	.00	.51	.13	.13	.24	-.06	.36
11s	.38	.67	-.08	.16	-.03	-.02	.63
12	.26	.25	.12	.01	-.07	.11	.16
13	.07	.15	.36	.02	.10	-.02	.17
14s	.20	.93	.06	.06	-.03	.01	.91
15	.04	.08	.16	-.09	-.06	.71	.55
16s	.25	.04	-.01	.48	-.01	.03	.30
17s	.30	.21	.02	.71	-.01	.06	.64
18	-.13	.10	.29	.10	-.02	.33	.23
19	-.14	-.01	.18	-.05	.07	.12	.07
20s	.64	.17	-.03	.22	.42	-.11	.68
21	.01	-.08	.22	.09	.22	.14	.13
22s	.73	.11	-.11	.15	-.02	.05	.58
23s	-.01	.03	-.12	-.06	.79	-.02	.64
24	-.07	.00	.61	-.02	.04	.05	.38
25s	.83	.08	-.09	.13	-.02	.11	.73
26	-.12	-.17	.48	-.05	-.10	.03	.29
27s	.39	.11	-.19	.10	-.22	-.10	.27
28s	.49	.12	.10	.18	-.04	.22	.34
29	.08	-.02	.54	.11	-.06	.09	.32
30	-.02	.00	.17	-.01	-.07	.16	.06
31s	.52	.22	.12	.08	-.01	-.14	.35
32	-.02	.06	.42	-.16	-.10	.11	.23
33s	.41	.10	.11	.19	.24	-.11	.30
34s	.28	.11	.00	.10	.19	.05	.14
35	-.09	.10	.29	.01	.14	.23	.17
36	-.06	.09	.13	-.09	.17	.03	.07
37s	.31	.06	.09	.09	.14	-.01	.14
38	.09	-.06	.29	.09	-.08	.18	.14
39	.03	-.06	.03	.19	.05	.47	.26
40s	.16	.31	.03	.60	.00	-.03	.48
Sum of Squared Loadings	5.9	3.9	3.3	2.7	2.3	2.2	20.3

OF ORTHOGONAL SIMPLE STRUCTURE: 1980

I



II



III

VI

V

IV

Table 6

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

TEST ITEMS	I	II	III	IV	V	VI	h^2
1s	-.03	.10	.02	.04	.04	.12	.03
2	.05	.01	.23	.01	-.03	-.29	.14
3	.20	.03	.30	.07	.15	-.05	.16
4s	.17	.52	.14	.14	.02	-.05	.34
5	-.05	.07	.05	.01	-.03	.00	.01
6s	-.10	.72	-.03	-.02	-.05	.09	.54
7s	.06	.08	.05	-.06	.02	.10	.03
8	.21	.16	.19	-.04	-.01	.01	.11
9	-.02	-.15	-.02	-.04	-.06	-.05	.03
10s	.09	.01	.03	.02	.19	.21	.09
11	.14	.06	.46	-.04	.01	.04	.24
12s	-.05	.01	.12	.52	.02	.08	.29
13	.03	-.05	.15	.03	-.02	-.17	.06
14	-.08	.06	.58	.04	-.06	.10	.36
15s	.07	.00	.09	-.04	.08	.60	.38
16s	.05	.16	.09	.27	.01	.49	.35
17	.08	-.28	.21	.07	-.01	-.02	.13
18s	-.14	.18	-.02	.06	.00	-.04	.06
19	-.08	.17	.12	-.22	.00	-.17	.13
20s	.02	.07	.01	.03	.09	.04	.02
21	-.37	-.02	-.16	-.08	-.14	-.19	.22
22	.49	.02	.29	-.08	-.04	.22	.26
23s	.12	.05	-.07	.22	.10	-.06	.08
24s	.20	.00	.01	.13	.02	.04	.06
25	.14	.13	.16	.19	.10	.27	.18
26s	.05	.21	-.18	.46	.13	-.09	.32
27	.62	-.01	-.02	-.07	.00	.03	.39
28s	-.01	.07	.03	.08	.22	-.01	.06
29	-.14	.03	-.10	-.05	-.12	.07	.05
30	.12	-.09	.65	.06	-.03	.04	.45
31s	.25	.45	.02	.22	.23	.02	.37
32	.03	-.05	.18	.22	.00	-.05	.09
33s	-.04	-.10	.04	.23	-.03	.03	.07
34s	.08	.00	-.07	.08	-.01	.15	.04
35	.48	.03	.17	.17	-.07	-.05	.30
36s	-.04	.00	-.05	.04	.84	.11	.72
37s	-.10	.18	.03	.28	-.02	-.10	.13
38	.41	-.13	.30	.45	-.16	-.06	.51
39	.11	-.07	.01	-.02	.02	.06	.02
40s	-.07	.14	.03	.28	.44	.09	.11
Sum of Squared Loadings	4.7	3.7	2.9	2.7	2.4	2.3	18.7

Table 6a

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

I

22, 27, 35, 38, 21

II

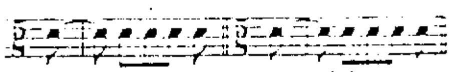
4, 6, 31

III

3, 11, 14, 30, 38

V

36



IV

12, 26, 38

VI

15, 16

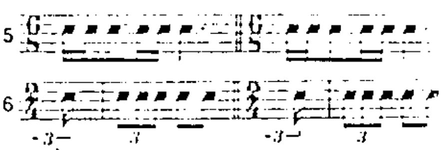


Table 7

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

	1978			1979			1980		
	T	R	C	T	R	C	T	R	C
Mean	24.7	22.4	47.1	32.7	30.5	63.2	34.9	31.7	66.6
SD	5.63	3.59	8.03	4.21	3.90	6.99	4.52	4.19	6.11
Reliability	.88	.73	.91	.90	.84	.91	.89	.88	.93

	1978-1979	1979-1980	1978-1980
Mean Gain			
Tonal	8.0	2.2	10.2
Rhythm	8.1	1.2	9.3
Composite	16.1	3.4	19.5

Table 8

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

	1978	1979	1980
Intercorrelations			
Tonal with Rhythm	.49	.49	.50
Tonal with Composite	.92	.87	.86
Rhythm with Composite	.79	.85	.88

	1978-1979	1979-1980	1978-1980
Correlations			
Tonal with Tonal	.50	.57	.44
Rhythm with Rhythm	.38	.53	.37
Composite with Composite	.51	.65	.42

Table 9

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

	TOTAL		SAME		DIFFERENT	
	Mean	SD	Mean	SD	Mean	SD
1978 (N=127)						
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 (N=111)						
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 (N=87)						
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

Mean Difference Between Same and Different

	Tonal	Rhythm
1978	4.5	4.5
1979	4.4	3.9
1980	3.3	4.3