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SCORE READING AND RETENTION OF TWENTIETH-CENTURY COMPOSITIONS: EFFECTS OF CONVENTIONAL NOTATION, GRAPHIC NOTATION, AND IMPROVISATION ON AURAL PERCEPTION

by

Judith L. Harrison

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Approved by

Walter L. Wehner

Dissertation Adviser

APPROVAL PAGE

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This study was an investigation of the use of a non-traditional visual aid, graphic notation, in the aural perception of 20th-century music. Tests on score reading and retention were administered to fourth graders, eighth graders, and college non-music majors. Subjects, grouped according to different methods of presentation, (1) listened while viewing conventional scores, (2) listened while viewing graphic scores, and (3) participated in improvisatory activities using graphic techniques and then listened while viewing graphic scores. Experimenter-constructed graphic scores of excerpts from three 20th-century woodwind quintets by Hindemith, Chávez, and Schuller, were contrasted with conventional scores of the same works. Pitch was represented on the vertical axis, time on the horizontal axis; a different color was used for each instrument.

Score reading was defined as the ability to follow the progress of musical events during listening; students located placement in the score as the music stopped on four occasions. Retention was defined as the ability to recognize the work previously heard from among three analogous works; one week after score-reading activities, students identified the work heard by <u>yes</u> or <u>no</u> answers on six trials. The sample was composed of public school students in Hardin County,

Ohio, and music appreciation students at Ohio Northern University.

The null hypotheses, tested at the .05 level of significance, were that there would be no significant differences among methods of presentation, among grade levels, or among compositions; that there would be no significant first-order interaction between method and grade level, method and composition, or grade level and composition; and that there would be no significant second-order interaction among method, grade level, and composition. Analyses of variance were performed on the test score data for each dependent variable, score reading and retention.

Score-reading results showed a significant first-order interaction between grade level and composition; the corresponding null hypothesis was rejected. Null hypotheses referring to significant differences among grade levels and among compositions were both rejected. Utilizing Tukey's multiple comparison procedures, each pair of means between grade levels was found to be significantly different; means between the Hindemith and Chávez compositions and between the Chávez and Schuller compositions were significantly different, but means between the Hindemith and Schuller compositions were not. All other null hypotheses were supported by the data for the score-reading variable.

The analysis of variance of the retention data yielded a significant second-order interaction among method, grade level, and composition; a significant first-order interaction between grade level and composition; and a significant difference among compositions. The corresponding null hypotheses were rejected; other findings confirmed remaining null hypotheses. Using Tukey's multiple comparison procedure, means between the Chávez and each of the other compositions were significantly different; those between the Hindemith and Schuller showed no significant difference.

Students at all three grade levels were successfully able to follow graphic scores of 20th-century works at least as well as conventional scores. This finding indicates that graphic scores are appropriate but not superior visual aids for use in aural perception in the general music classroom. Prior improvisation did not enhance learning on score reading or retention. Results showed that score-reading achievement, but not retention, increased with grade level.

A more refined instrument for testing musical recall is needed. Research with the use of nontraditional visual aids, including the effect of motivation on achievement, is recommended.

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CHAPTER I

INTRODUCTION

Guiding students' growth in listening to 20th-century music is a formidable task for music educators. The immense variety of compositional techniques employed makes generalizations difficult. In focusing attention on more conventional music of the past, familiar clues such as meter, themes, key relationships, cadences, and definitive parts of the formal structure are called upon; many of these elements are less apparent or nonexistent in 20th-century music. Without such points of focus, the listener may be overwhelmed with unfamiliarity. In seeking to develop listening guides to describe 20th-century music, educators may need to consider nonverbal clues.

Graphic notation is one way of providing visual clues for listeners whereby a graph of the sound is made. Pitch is shown on the vertical axis and time is represented on the horizontal axis, thus adopting ideas from contemporary experimental notation. If students are able to follow such a graphic score as they listen to a musical work, it may serve to heighten awareness of musical events and contribute to the process of remembering the music that has been heard.

This study is an investigation of the feasibility of using graphic notation as a visual aid in the aural perception of 20th-century music. Experimenter-constructed graphic scores are compared with published conventional scores of the same 20th-century works to test students' score reading and retention. For the purposes of this study, score reading is defined as the ability to follow the progress of the musical events during listening. Retention is defined as the ability to recognize the specific work previously heard from among a group of analogous works.

The following questions were to be the focus of the research. Upon first presentation, is it possible for students to accurately follow a graphic score? Upon a subsequent hearing can they recognize the music? At which level is graphic notation most effective: fourth grade, eighth grade, or college (non-music major)? If students engage in a short period of group improvisation using graphic techniques, will this experience contribute to success in graphic score reading and later recognition of the work previously heard?

It is not the purpose of this study to propose the adoption of graphic notation as a superior alternative to conventional notation in music education. If the efficacy of graphic notation in the aural perception of 20th century music can be shown, then additional inclusion of graphic techniques in music education reference materials and textbooks should be considered.

Graphic representation is not a new tool for the music educator; examples can be found in textbooks for elementary music, beginning theory, and music appreciation. As a preliminary introduction to the problem, an overview of the use of graphic techniques (any pictorial representation without staves) in current music education literature will follow, accompanied by viewpoints on its merit by theorists and music educators.

Current Use of Graphic Notation in Music Education

Musical notation evolved as a set of necessary directions for performance. While the primary function of any system of musical notation is directive, notation can also describe (provide visual clues that lead to a clearer understanding of musical events) and inspire (give rise to improvisation or composition). The latter two functions, that of describing and inspiring, are of greater significance in the use of graphic notation.

Two tasks in the present study involve the use of graphic notation in an experimental situation: (1) graphic scores are utilized as listening guides (descriptive function of notation), and (2) graphic symbols are used in improvisation (inspirational function). Thus, it is necessary to examine the rationale behind the current use of graphic notation in these two activities of music education: analyzing (descriptive notation used as an aid in understanding musical works) and creating (inspirational or implicit notation used for improvisation and composition).

Descriptive

In comparing conventional notation with graphic notation, Cole (1974) presents an analogy of two signs: Sign A is a picture of children, books in hand, walking to school, and Sign B is the word School. Sign A is suggested as a better device of communication than Sign B unless the whole population is composed of English-speaking functional readers. Citing one type of graphic notation (where size of noteheads indicates relative dynamic level and where time is measured in equal spatial units, called proportional notation), Cole theorizes that graphic notation will be less effective than conventional "since all Western musicians can read conventional notation if they can read at all" (Cole, 1974, p. 27). However, for non-music readers, especially children, graphic notation may be a means of focusing attention in a more vivid way; it may be a method of presenting a concept that is as immediately accessible as the picture of school children is to the illiterate person.

In textbooks, graphic symbols are often used instead of conventional notation because of their accessibility to the novice. A graphic representation is used in Boroff and Irvin's music appreciation text Music in Perspective (1976) to show the pitch contour of a Shostakovitch melody. In describing the effectiveness of this visual aid, the authors state: "This type of graph indicates visually the character of a melodic line--whether it is curved or angular in shape, wide or narrow in range, convoluted or simple in design" (Boroff & Irvin, 1976, p. 25). Similar visual aids for listening have been developed for the college non-music major by Phillips (1967).

Several authors have espoused the usefulness of graphs in guiding understanding of the entire shape of a composition. This factor is pertinent to the present study in that recalling the shape of the composition may influence later recognition of the work. Self (1967) stresses the importance of pupils having "some picture of the music as a whole" (p. 3), while Kontarsky claims that "in graphic notation, the whole shape will be perceptible" (Kontarsky, 1972, p. 81).

Cogan and Escot's theory textbook <u>Sonic Design</u> (1976) exhibits their pioneering work in making graphs from pre-existing scores; it was from the use of these graphs in the classroom that the idea of this study emerged. Cogan and Escot's efforts coincide with notational experiments which are a result of composers' frustrations with traditional notation. Their graphs were developed to heighten awareness of musical factors that are not clarified by traditional score perusal, especially spatial motion.

Contemporary composers have altered the limits of musical space, both the outer boundaries and the interior packing of musical space.

> Whereas previous space was divided into modes or scales (diatonic or chromatic), present musical space is often conceived as a continuum, a flexible entity that may be more or less tightly partitioned or packed. This has required new notation, new instrumental techniques, and above all, a new imaginative vision of motion in space. (Cogan & Escot, 1976, pp. 77-78)

Realizing the necessity of conveying information to students about spatial motion, other theorists agree that graphing helps to show large flow, registral motion, density, and distribution of activity (Bernard, 1977; Cogan, 1974; Gallaher, 1975; McDermott, 1966).

Each of the three compositions chosen for the present study has a distinct shape (see Appendix A). At first observation the element of exact pitch is the least accessible to the viewer; other conclusions about motion in space can be quickly deduced.

Simplified graphs to promote understanding of texture and intersection and interaction of lines are employed by Schafer (1969) to focus students' attention during listening. Schafer uses the term "ear cleaning" to refer to the necessary dissolution of narrow musical preferences, the opening up to wider possibilities for appreciation. Visual aids, especially graphs, play an important part in his work.

Schafer uses simple pictorial representation not as a substitute for traditional notation, but to simplify the beginning of the conceptual process that is basic in any reading program. He presents graphic symbols in paired sets, where obvious contrasts can be shown: size = dynamics, height = pitch, length = duration. Figure 1 depicts a low-pitched moderately loud, short tone paired with a higher, soft, long tone.

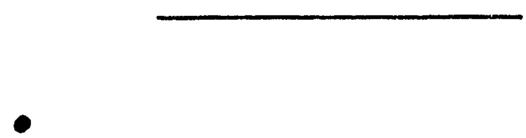


Figure 1: Graphic symbols in contrasting pairs. (Schafer, 1969, p. 28)

In conclusion, general clues may be derived from graphic notation that will enable students to better perceive and understand the changes in the musical language of today. In its descriptive function, graphic notation is being used to free students from conventional melody-harmony-rhythm conceptual molds, to begin the visual-aural association leading to music reading through simple graphs, to show the angular characteristics of 20th century melody through line drawings, to demonstrate the entire shape of a composition, and to show spatial and registral motion, density, and texture through more intricate graphs of compositions.

<u>Creative</u>

Before constructing the graphic notation used in this study, it was necessary to survey the types of compositions using graphic notation and to determine which graphic techniques would be most effective for group improvisation. The use of graphic notation in its creative function will next be discussed, including viewpoints on its value by theorists and music educators.

In music of the past, some of the expressive parameters of performance (such as timbre, loudness, articulation, attack and decay, and vibrato) were left to the performer's discretion. Among contemporary composers' options are two polar extremes: (1) to closely regulate all performance considerations or (2) to allow enormous freedom, even with pitch and time relationships. These options are termed by Stone to be trends toward "uncompromising exactitude" in the first case and "chance" in the latter (Boretz & Cone, 1976, p. 10). Kontarsky views the former trend as an attempt "to preserve traditional notation" and the latter as a departure from traditional toward spatial notation (Kontarsky, 1971, p. 81).

It is the trend toward indeterminacy that has produced much experimentation in notational graphics. Karkoschka describes the emergence of graphic notation:

> Composers developed symbols for notating approximate values, soon followed by "musical graphics"--drawings which are meant to lead a player with an aesthetic imagination to make corresponding actions or sounds. (Karkoschka, 1972, p. 2)

With the liberation and dissolution of meter, an aim of contemporary composers has been to develop notations based on visual space relationships rather than compartmentalized arithmetical units. John Cage was the first to develop open time-field notation, in which durations are represented on a horizontal time axis. Cope credits proportional notation as being "probably the most important concept in new music notation" (Cope, 1976, p. 28). Proportional notation is used with or without traditional noteheads and beaming; also it occurs in conjunction with indeterminate pitches along an approximate vertical axis or on a conventional staff.

In the present study, proportional or open time-field notation is used without traditional noteheads. The score reader's eyes should follow the progress of musical events steadily from left to right. Attacks are indicated by colored dots; if notes are held, a horizontal line extends from the initial attack. In each graph the left-right flow is unbroken by transfer from the end of one staff to the beginning of another, since each score is a fold-out with a continuous set of events.

A criticism of proportional notation that is often voiced is the lack of accuracy in performance: "Human beings simply do not seem to possess a space perception equal in acuity to their pulse perception; if they are not given something they can count, they will not be able to play 'in time'" (Boretz & Cone, 1976, p. 22). In the score-reading portion of this experiment, the concept of following a score with visual space relationships was compared with following a score with metrical note-value relationships to determine if students were too reliant upon pulse perception to follow a spaced proportional score.

Indeterminate composers sometimes devise their own intricate indications for dynamics and articulation, as chronicled by Karkoschka (1972) and Risatti (1975), while leaving pitch and temporal relationships freer. Often termed "implicit notation," the symbols are intended to provide a stimulus for a personal reaction from the performer.

Cole considers such a family of signs "enigmatic or paradoxical; its members may or may not be related to the conventional signs of notation" (Cole, 1974, p. 143). When the signs are highly ambiguous, Cole feels that "inspirational" would be a more apt adjective than "implicit" (p. 146). While the score-reading graphs for this study show exact pitches on a vertical axis, the graphic techniques for student improvisation prior to the score-reading activities feature approximate pitches or "inspirational" notation. The problem of finding appropriate signs for student improvisation was approached through a survey of "inspirational" graphic techniques in music education.

Application of indeterminate graphic notation is viewed by many writers as an important pursuit in music education. Karkoschka states that notation with approximate indications frees the interpreter from inhibitions, permitting new discovery of sounds; that "unusual lines, shapes, spots, and dots stimulate the musician to produce analogous, and therefore unusual sounds" (Karkoschka, 1972, pp. 2-4). Early experimentation with unconventional sounds is deemed crucial by Cogan:

> Especially at the beginning of learning, extraordinary care must be taken to avoid foreclosing possibilities, so that the process always remains one of unveiling and opening up. To be avoided in particular is the

> conveying of erroneous "norms:" for example, that music need deal with fundamental pitches and their relationships or with harmonies; that it need be tonal or metrical. (Cogan, 1974, p. 70)

The legacy in indeterminacy beginning with Cage's music is regarded as a starting point in the classroom by English composers Brian Dennis, author of Experimental Music in Schools (1972) and George Self, whose New Sounds in Class (1967) makes use of a simplified graphic notation. Both books have short indeterminate compositions which can be used to inspire improvisation and further composition. Self lists the advantages of simplified notation as "enabling the children to venture among a range of sounds and rhythms with considerable freedom to improvise, to perform that which would not be possible with conventional notation" (Self, 1967, p. 2).

Dennis and Self advocate the duplication of blank grids for students to fill in by composing (Figure 2). The influence of Dennis' and Self's ideas can be seen in this study not only through the development of graphs, but through the incorporation of improvisation in the experimental design.

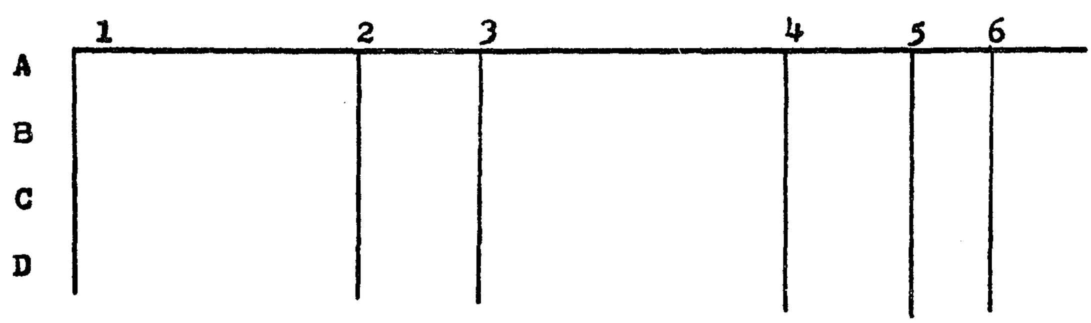


Figure 2: Blank grid for classroom composition. (Dennis, 1972, p. 42).

In Sound and Silence: Classroom Projects in Creative Music, Paynter and Aston employ simple graphs where each performer's three horizontal lines correspond to high, medium, and low on the particular instrument (Paynter & Aston, 1970, p. 100). Students are also encouraged to create their own designs, as is suggested in the chapter "Shapes into Music:"

> Doodle interesting shapes and patterns on a stave without a clef. . . . Players can now improvise freely on any instrument, taking their stimulus from the shapes. (Paynter & Aston, 1970, p. 128)

Horazak (1973) advocates listening and score-reading activities before asking elementary students to compose with a devised notation. Schafer (1969) uses the analogy of the flight of a bird, drawing its path, including circling, singing to its mate, and descending. From the resulting chalkboard drawing, flutists are encouraged to interpret the flight through improvisation. Johnson (1972) finds that it is easy for students to imagine and perform sounds that parallel the pictures in Figure 3.

(1) (2)

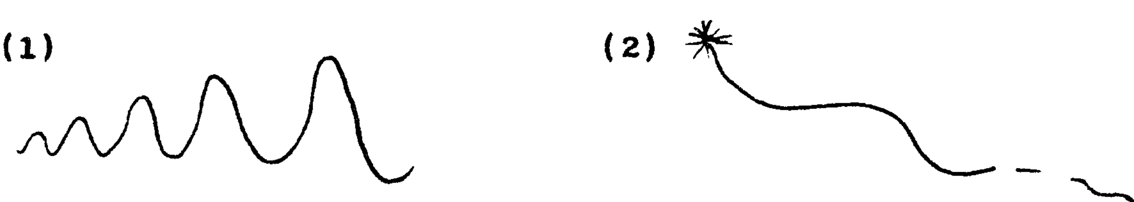


Figure 3: Examples of drawings used to inspire improvisation. (Johnson, 1972, p. 31)

Reese (1973) cites the confusion that students feel due to the discrepancy between sign and sound in traditional music; he finds new notation nearer to the depiction of the sound. Cole (1974) acknowledges the interaction of graphic notation with contemporary art, mentioning Earle Brown's scores that have been exhibited at art galleries. Myers (1975) writes of Brown's search for the flexibility and spontaneity he admired in Calder's works. Wehner (1977) states: "The symbols used by the musician and music educator are similar to those used in the visual arts" (p. 109).

Commenting upon the importance of the visual aspect of notation, Cole recognizes a connection between sight and sound as it influences avant-garde composers to "search for a close equivalence between the look and the sound of music" (Cole, 1974, p. 124). Paynter and Aston agree: "The look of music on paper can stimulate a composer's imagination, providing him with leads and openings for development" (Paynter & Aston, 1970, p. 126).

In the performance of contemporary music Self finds graphic notation less exacting for performers, "but equally effective and most useful for school music" (Self, 1967, p. 5). He theorizes that using graphic techniques in notating pupils' own works can be a much easier task for them than finding exact rhythms and locations on staves. Benson (1973) feels that the process of students notating their creations is a central aim of comprehensive musicianship.

Paynter and Aston (1970) and Palmer (1974) warn against the danger of stifling the creative attempts of children. If students are confined to traditional notation, they may become frustrated by their ineptness. Invention of simpler systems or adaptations of conventional notation are considered to be superior alternatives. Palmer views graphic notation as a bridge or intermediate stage between improvising and competent use of conventional notation in composing.

Tait (1971) warns against premature notation of children's compositions. He believes that the student should have developed confidence through much experience with aural media before beginning to notate his work. "Problems have arisen in the past because music educators have attempted to impose a detailed visual system on a generalized aural experience" (Tait, 1971, p. 34). He recommends an initial simple notation representing the fundamental characteristics of sound; gradually more refinements may be introduced.

The element of communication is stressed by Brindle (1975); in ensemble works involving chance elements, the players must listen to each other. Poné explores the necessary notational techniques required to enable performers to communicate and to "explore and determine formative potential" (Poné, 1966, p. 219).

Of those who use more abstract graphs in music education, Paynter and Aston (1970) present the example of a physical object such as a music stand being held up to a chalkboard; the tracing of its pattern can be interpreted by student improvisation. The value of students' aesthetic decision-making is paramount.

Serendipitous benefits from the use of indeterminate notation are listed by several music educators. First, its use enables more children to make visual records of their creative activities, not just those who can read conventional notation (Johnson, 1972; Palmer, 1974; Self, 1967). As a second benefit, Palmer upholds the involvement with the sound itself:

> When a performer is faced with unfamiliar notation that only outlines the material he is to perform, his attention is shifted from interpreting symbols to the stuff of music itself--*sound*. . . . He is left to experiment with sound and with the relationship of his sounds to those of other performers in his group. (Palmer, 1974, p. 43)

Although the topic of experimentation with unconventional notation in creative activities is often broached in basal series in music and in texts for music educators, it is often given brief treatment without sequential ideas of presentation. In *New Dimensions in Music*, Book 4, one suggestion included without elaboration is to "have children listen for sounds on their way home and use schematic symbols to write down their sounds" (Choate, 1970, p. xi). Another example is from *Music in Today's Classroom: Creating, Listening, Performing*; the student is asked to "use body sounds to create (his) own solo composition and devise a notation for it" (Land and Vaughan, 1973, p. 54).

Inherent in the activity of improvisation may be the use of acquired understandings of a particular idiom. Kolar defines improvisation as

> the experimentation with a musical concept to further establish the understanding of that concept. . . . The creator simultaneously uses his understandings, emotions, and skills in improvising. (Kolar, 1975, p. 6360)

Horton (1972) posits that improvisation engenders appreciation, that children who improvise and compose "are naturally more likely to take an interest in the aims and work processes of professional composers" (p. 22).

The use of graphic notation in its creative function, for improvisational and compositional activities, has been shown to be more extensive than in its descriptive function. The following advantages have been attributed to the use of graphic notation in a creative learning situation. Students (1) are freer to explore unconventional sounds, (2) are better able to notate and perform their own musical ideas, (3) can grow in deciding how to interpret the score, (4) can build skills in ensemble interaction, and (5) can experience a deeper appreciation of 20th century techniques through improvising.

CHAPTER II

REVIEW OF LITERATURE

Published Research

Several problems pertinent to the design of the study may be solved through reference to previous research. Questions will be posed concerning student attitudes toward 20th-century music, the value of score reading in aural perception, success of graphs in an educational setting, the role of improvisation and composition, and selection of appropriate age levels for testing.

Theorists and music educators have called for new methods for presenting 20th-century music (Cogan, 1974; Demand, 1971; Self, 1967); they realize that acquaintance engenders acceptance. Is student dislike of contemporary music a reality or a myth?

Eisenstein (1979) allowed elementary school children to choose between silence and various presentations of a Webern tone row. She found that second and third graders exercised more listening options than did fifth and sixth graders, concluding that older students show less preference for unfamiliar music. When a combined humanities approach was used by Lawrence (1974), in which third-, seventh-, and twelfth-grade classes were tested to select lesson materials which revealed the highest degree of student preference, students selected music, visual art, and literature from the 20th century. These conflicting findings may point to the approach used; exposure to 20th-century music without elucidation may not lead to acceptance, while an approach that draws upon art and literature to clarify concepts may be more effective.

Does score reading improve aural perception? Junior college students were better able to recall thematic excerpts with the aid of notated themes. Of two groups, one using notated themes, one without visual aids, Smith (1952) found significant differences between means of the groups for immediate recall, recall after one week, and after one month.

Goewey (1969), in testing the effectiveness of the use of melodic line scores during music listening tasks with college music appreciation students, found that students scored significantly higher on measures of musical literacy after using melodic line scores as a perceptual aid. Younger students were tested by Peterson (1965) on melodic recognition, with and without notation. Listening achievement was higher with the use of notation for seventh graders; the significant difference indicated the value of notation in listening instruction.

Two other studies show educators' concern with score reading. Schell (1964) developed a guide for teachers with plans for correlating instrumental scores (reductions and full scores) with selections for listening. She stressed the need for more materials utilizing scores with aural perception. An instructional guide of pre-reading activities showing focal points in contemporary choral compositions was compiled by Robison (1969), who acknowledged the inadequacy of traditional reading techniques.

What success has occurred when graphs are used as perceptual aids in an educational setting? The use of visual aids, especially filmstrips, in college music appreciation teaching was studied by Hill (1972). He found no significant difference in mean music achievement scores between experimental and control groups; however, melodic recognition scores were higher for the experimental group using the filmstrip method. Hill recommended additional research to ascertain the type of visual image most influential in student achievement.

Line drawings were used to describe musical events in a study by Thompson (1971), who compared methods using drawings, words, and a combination of drawings and words as guides in developing fourth graders' perceptions of melody and rhythm. No significant differences were found between pretest and posttest scores on musical perception measures. In an experiment by Olson (1978), first-grade children performed matching tasks of melodic contour perception in which contour-line graphs were employed. It was significantly easier for the children to match initial melodies with subsequent melodies within the same sense (aural with aural) than intersensory (aural with visual or visual with aural). The above studies did not include musical examples from 20th-century literature, which limits their application to the present study.

Graphic representation has been tested for its influence on musical literacy. Heller (1973) tested the use of student-made paper and pencil graphs that were immediately transformed into the corresponding auditory frequency and duration by a tone generator and a computer to read graphical input. While no scientific conclusions were made, the initial results showed a positive influence on pitch and rhythmic learning.

A similar study was conducted by Asselin (1972), who used a computer-assisted synthesizer system designed to read a graphical input and convert it to an aural equivalent. Using fifth- and eighth-grade classes, the tone-generated graph method was found to be as successful as conventional instrumental training for both age levels in developing musical aptitude as shown by scores on the Seashore Measures of Musical Talents.

In the Heller and Asselin projects, pitch was the parameter under investigation. Two additional studies are concerned with spatial representation. In an experimental study using music rewritten so that linear spacing was in direct ratio to the durational values of the symbols, Peitersen (1954) found no unique advantage from training using spaced music in learning to read conventional music. However, high school band students who had the benefit of training using metric and representational notation showed significantly greater improvement than did students trained with conventionally spaced notation, as tested by Mortenson (1970). Neither of these studies incorporated 20th-century compositions in their designs.

Because no educational research using aural discrimination and graphs of 20th century music was ascertained, the process of devising graphs for the present study was based on the analytical models of Bernard (1977), Cogan and Escot (1976), Gallaher (1975), and McDermott (1966), and on the suggestions of Paynter and Aston (1970) and Self (1967) in music education. Colored graphs to show the interaction of different instruments were selected. The parameters were restricted to timbre, pitch, and movement in time, elaborating on Fuller's work (1966), which stressed the importance of shape, proportion, and limited critical detail in the development of notational aids.

What are the effects of unconventional improvisation and composition on musical perception? In a study testing the effects of aleatory techniques in composition on the musicality of non-music majors, Wollman (1972) found a significant increase in scores on the tonal memory test of the Seashore Measure of Musical Talents after experience in composing.

Bradley (1974) exposed fourth-grade students to a one-year treatment of creative activities, relying on Paynter and Aston's ideas. Much improvising and composing were encouraged. On measures of aural and visual discrimination, the experimental (creative) group showed highly significant gains when compared with the control (regular classroom music) group.

Both Wollman and Bradley made use of contemporary compositional techniques; results from both studies support the theory that creative activities contribute to success in aural perception and memory. These findings led to the decision to incorporate improvisation in the design of the present experimental study, in which two groups would view graphic scores while listening to a 20th-century excerpt. One group would first engage in improvisation using graphic scores; the other group would have no exposure to graphic scores. A third control group would view conventionally notated scores while listening to the same excerpt.

What grade levels are most appropriate for comparing student response to conventional and graphic notation and improvisation using graphic scores? An aim of the present study was to identify and test three grade levels of general music students: (1) the youngest level at which the aural discrimination tasks of score reading and retention can be performed, (2) a middle level at which students will have had experience in performing reading and listening tasks, and (3) the undergraduate college level for non-music majors studying music appreciation.

The decision to include fourth-grade students as the youngest level in the present study was due to the following findings about perceptual growth, improvisatory ability, and musical preference. Petzold (1963) reported that there is a turning point in the acquisition of musical behaviors after the third grade, an opinion confirmed by Torrey (1977). Basing his work on Piagetian theory, Torrey found that children could not perform multiple seriation until age nine or ten. Peterson (1965) called for auditory-visual discrimination training with emphasis on notation beginning at the fourth-grade level.

That fourth graders could successfully improvise using graphic techniques was shown by Bradley (1974). Greer, Dorow, and Randall (1974) identified a pivotal point in student taste to be between the third and fourth elementary grades, after which taste patterns narrow; this conclusion is verified by Eisenstein (1979).

The eighth grade was a practical choice for the middle level for comparison. One of the last levels for general music classes is the eighth grade; at higher grade levels students freely elect other music courses. Research by Schultz (1969) was also a factor in the decision. In testing children's abilities to conceptually organize elements of music in a changing context, Schultz found a slight plateau with a lower rate of increase in students' abilities in grades five, six, and seven; eighth graders showed a higher rate of increase.

Unpublished Research

In an effort to refine the graph-construction process and to test the reliability of a measure for score reading, a pilot study was conducted by the researcher to compare graphic score reading with conventional score reading. The null hypothesis was that there would be no significant difference between the means of two groups following different scores. Two classes of college non-music majors at the University of North Carolina at Greensboro served as subjects. Students were randomly assigned to experimental (graphic notation) and control (conventional notation) groups.

The musical example chosen was an excerpt from Woodwind Quintet by Gunther Schuller (1958). A graph was developed of the last 23 measures of the second movement (see Appendix A). On the vertical pitch axis, each square was set equal to two half-steps; on the horizontal axis, six squares were allotted per measure of conventional notation, with adjustments at each tempo alteration. Each instrument was assigned a different color. Attacks were shown by dots; held notes were indicated by lines extending from the dots. Lines were connected between pitches to illustrate contour. Placed at the top of the graph were numbers corresponding to measure numbers on the conventional score.

While subjects in both groups followed the scores, a tape of the Schuller excerpt was played. On first hearing the experimenter announced reference numbers to enable students to better follow the score; the students then listened to the excerpt without help. After one example illustrating the testing technique, students were asked to follow the scores and on four trials to identify the place in the score where the music stopped.

An error score was calculated for each student, where zero represented no wrong answers, and points assigned corresponded to the number of measures a student's answer differed from the right answer. If a student answered 46 (indicating that the music stopped at measure 46), and the right answer was 48, the error score for that question was 2.

The classes were combined for computational purposes. The mean error score for the experimental group ($N = 13$) was .31; the mean for the control group ($N = 14$) was 2. A t test was employed to compare the means. An obtained value of 3.28 was contrasted with ±2.787 in the student's t-distribution with 25 degrees of freedom (Glass & Stanley, 1970). The test statistic revealed a significant difference between the means at the .01 level of significance; the null hypothesis was rejected.

It was concluded that, in comparing score reading using graphic and traditional notation, the group following graphic scores had a significantly lower mean score. Using data from the conventional and graphic groups ($N_1 = 14$ and $N_2 = 13$), the power of the pilot study to detect a difference in population means equal to the sample mean difference was found to be .91.

Overview of the Main Study and Hypotheses

Due to the results of the pilot study and from the implications of related literature, it was concluded that further research was warranted. Tests on two dependent variables, score reading and retention, were administered to students at three grade levels (fourth grade, eighth grade, and college) using three 20th-century compositions and three methods of presentation: (1) one-third of each group viewing conventionally notated scores, (2) one-third viewing graphic scores, and (3) one-third who participated in prior improvisational activities using graphic techniques and viewed graphic scores.

The null hypotheses that were formulated and tested in this study are as follows. In their effects on score reading and retention:

(1) there will be no significant differences among methods of presentation;

(2) there will be no significant differences among grade levels;

(3) there will be no significant differences among compositions;

(4) there will be no significant first-order interaction between method and grade level;

(5) there will be no significant first-order interaction between method and composition;

(6) there will be no significant first-order interaction between grade level and composition;

(7) there will be no significant second-order interaction among method, grade level, and composition.

All null hypotheses were tested at the .05 level of significance for each of the dependent variables, score reading and retention.

CHAPTER III

PROCEDURE

Population and Sample

The population to which generalization is recommended is composed of all fourth-grade and eighth-grade students in Hardin County, Ohio, who are enrolled in public schools. Hardin County is a semi-rural farming area in northwestern Ohio. In addition, generalization is recommended to students at Ohio Northern University who are studying music appreciation. Ohio Northern University is a small, private university in Ada, Ohio. Music appreciation is an undergraduate elective course for non-music majors in the College of Arts and Sciences.

The sample for this study was drawn from two elementary schools, one middle school, and two junior high schools in Hardin County. Intact classes, three of fourth graders and three of eighth graders, were chosen, based upon scheduling demands and willingness to participate by classroom teachers, music teachers, and administrators. The public school students of the sample were tested between December, 1979, and March, 1980.

College students enrolled in sections of Music 100 at Ohio Northern University during the fall quarter, 1979, and the winter quarter, 1979-80, served as subjects for the college level of the sample. This testing was conducted between October, 1979, and January, 1980.

Subjects were randomly divided into three treatment groups from each of three fourth-grade classes, three eighth-grade classes and three college classes. Test score data were randomly discarded to equalize sizes of treatment groups. The resulting sample size was nine observations per cell. There were 27 cells in the research design; the total number of students in the sample was 243.

Independent Variables

Grade Levels

The three grade levels chosen for the experiment were fourth grade, eighth grade, and college (non-music major).

Methods

Within each class there were three methods of presentation involving score reading during listening activities: (1) listening while viewing conventional notation, (2) listening while viewing graphic notation, and (3) prior improvisation in groups using graphic techniques, followed by the same procedure as method (2). Details of the methods are provided in the discussion of the dependent variables, below.

Improvisation.

For the purposes of this study, improvisation is defined as a free translation or realization of graphic symbols into musical sound without the usual parameters of traditional notation of exact pitches and rhythm. One-third of each class was exposed to improvisation using graphic notation in a group activity. The other two groups did not participate in improvisation and were not present during this activity.

Three charts using graphic techniques had been prepared in advance; these are reproduced in reduced form in Appendix B. Colored dots were used for entrances; extended lines for held notes; pitches were approximate.

While showing the charts to the students, the experimenter asked: "If each player were assigned a different color, how many people would play?" After the correct answer of <u>three</u> was stated, the experimenter distributed one non-pitched percussion instrument (hand drum or clavés) and two pitched percussion instruments (tone-bar instruments with which the students were familiar, such as xylophone, glockenspiel, or metallophone) to three students. These students were allowed to choose one of the three charts. The experimenter asked which color should be assigned to the non-pitched instrument; the correct response was the part which remained on the same pitch level. The experimenter then explained to those playing pitched instruments that the higher the placement on the chart, the higher the pitch.

During the performance the experimenter used a pointer to show steady movement across the chart, calling out the numbers placed at the top as they were approached. The activity lasted approximately 15 to 20 minutes, continuing until each student in the group had played. At no time during the improvisation were suggestions made relating to the subsequent listening activity; the improvisation treatment was designed for experimentation, not instruction.

Compositions

Various criteria for selection of appropriate 20th-century compositions were set by the researcher. First, the work was to be (1) notated conventionally for the control group to view and (2) scored for a relatively small group of instruments, preferably varying in tone color. It was also necessary to find numerous examples of the specific instrumentation in 20th-century literature.

Following a literature search, a pool of eight compositions for woodwind quartets and woodwind quintets were found that satisfied the established criteria. Composers were Barber, Berger, Carter, Chávez, Hindemith, Ligeti, Schuller, and Seeger. Excerpts varying in length from 54 to 102 seconds were chosen. The researcher used subjective judgment to determine beginnings and endings, so that each excerpt that was not an entire movement would not sound incomplete or abrupt.

The eight examples were recorded on magnetic tape and reviewed by three qualified judges (a music educator, a theorist, and a composer) who were asked to rank them as to appropriateness for inclusion in the study. Instructions indicated that the works were to (1) display contemporary techniques, (2) be alike enough to be remembered, and (3) be of sufficient musical value for inclusion in an educational setting.

Ranks were assigned point values, with higher ranks receiving more points (see Appendix C). The three compositions with the highest average scores were then selected for use in the study: Woodwind Quintet (1958) by Gunther Schuller, Soli No. 2 for Wind Quintet (1963) by Carlos Chávez, and Kleine Kammermusik, Op. 24, No. 2, (1927) by Paul Hindemith. The excerpt from the Schuller work was used in the pilot study.

Inter-judge reliabilities of judges' rankings, estimated by using Spearman rank-correlation coefficients, are shown in Table 1. To determine the overall agreement among the three judges, a coefficient of concordance (W) of .58 was calculated using Kendall's method (Kirk, 1969). Lack of perfect agreement among the judges may be attributed to the difficulty of the ranking process; the earlier elimination process undertaken by the experimenter had insured that each excerpt would be a representative example from the 20th century woodwind literature.

Table 1

Inter-judge Reliabilities of Judges' Rankings

Judges	Spearman Rank-correlation Coefficient
1 with 2	$r = -.05$
1 with 3	$r = .68$
2 with 3	$r = .46$

Dependent Variables

Immediately following the isolated treatment of the improvisation group, each complete class was tested on score-reading ability. The construct to be measured was students' abilities to accurately identify the location in the score as the music progressed. After an interval of one week, each complete class was tested on retention ability; the construct of retention was defined as students' abilities to recognize the specific work heard previously during the score-reading activities by choosing that work from excerpts of the Schuller, Chávez, and Hindemith works. On both occasions, the paper-and-pencil tests administered did not require the use of musical vocabulary in directions or responses. Sample test sheets are contained in Appendix C.

Score Reading

Conventional and graphic scores were distributed during the testing period. The experimenter briefly explained the purpose of the study, focusing attention on the two types of scores to be viewed by different groups while listening. The taped excerpts were then played.

On the first playing of an excerpt, the experimenter announced reference numbers from the score as the music progressed; these numbers were to be used later by students as they responded to the test. On the next playing, the students listened and attempted to follow the scores without help from the experimenter. When the music stopped, the correct answer was supplied as an illustrative example. At this point, students were asked to identify the place in the score where the music stopped on four successive occasions.

Prior to the testing procedure, six segments were taped for each of the three compositions: a complete presentation of the excerpt, one illustrative example, and four segments in which subjects were to identify where the music stopped. To ensure that the tests for each composition were comparable, the experimenter chose three analogous stopping places for each of five categories (near the beginning, middle, and end; after rests, and after held notes). The actual stopping places for each composition were then chosen at random from the categories; the order of the segments was also randomized. Each segment started from the beginning of the score, so that no answer was contingent upon a previous answer.

An improvement based on problems identified in the pilot study was included in the score-reading test. Questions concerning stopping places were phrased: "Find the two numbers between which the music stops" instead of "Find the nearest number to the stopping place."

The content validity of the score-reading measure is reflected first by the agreement between student abilities required and testing procedures: the construct of following the score is matched by questions which exclusively tested behavioral responses of students to recognize location within the score. Next, the lack of musical vocabulary in the test's explanations and responses prevented any advantage by more experienced learners. Finally, the scoring procedure, the same as described in the pilot study, allowed the researcher to determine the extent of each student's deviation through error scores that depicted how far the response deviated from the correct answer.

The reliability of the score-reading test was estimated using Cronbach's alpha. The coefficient of reliability found was .727.

Retention

The retention test was composed of six fragments; two from each of the Schuller, Chávez, and Hindemith works, from which subjects were to identify which work they had heard previously. To begin the fragment selection process, four fragments at least 20 seconds in length were subjectively chosen by the experimenter. Then two of the four fragments were randomly selected to represent each composition. The order of the six resulting fragments was the same for the entire sample, regardless of method and composition heard, and was determined by random selection. The fragments were recorded on magnetic tape.

All subjects received the same retention test; however, their scores were processed according to prior grouping. The test was administered after one week had elapsed following the score-reading test. Responses to the six items of the retention test were in the form of yes or no answers; students were asked if the segment they were hearing was the one they had heard the previous week. Error scores were calculated. A score of zero indicated perfect recall; one point was added for each incorrect answer.

The retention test was intended to measure the construct of student ability to recognize the specific work previously heard from among a group of analogous works. The content validity of the test was ensured by the agreement between the student skills required and the questions.

Item statistics were calculated using the Kuder-Richardson Formula 20 to estimate the reliability of the retention test. The coefficient of reliability was found to be .556.

Experimental Design

The experiment was structured in a 3 X 3 X 3 factorial design. The effects of the three independent variables on the dependent variables of score reading and retention were examined. The independent variables were as follows:

A. Methods of presentation (A_1 = graphic score with prior improvisation, A_2 = graphic score, A_3 = conventional score)

B. Grade levels (B_1 = fourth grade, B_2 = eighth grade, B_3 = college)

C. Composition (C_1 = Hindemith, C_2 = Chávez, C_3 = Schuller).

A schematic of the design can be seen in Table 2. At each grade level (B_1, B_2, B_3), three classes were randomly assigned different compositions (C_1, C_2, C_3); within each class there were three methods of presentation (A_1, A_2, A_3).

Analysis of Data

In order to test the research hypotheses, separate analyses of variance were performed on the test score data for each dependent variable, score reading and retention. The basic linear model used in this study is as follows:

$$X_{ijkm} = \mu + \alpha_i + \beta_j + \gamma_k + \alpha\beta_{ij} + \alpha\gamma_{ik} + \beta\gamma_{jk} + \alpha\beta\gamma_{ijk} + \varepsilon_{m(ijk)}$$

where X_{ijkm} denotes an observation on a dependent variable;
i is the subscript for Factor A, method, and takes on values from 1 to 3;
j is the subscript for Factor B, grade level, and takes on values from 1 to 3;
k is the subscript for Factor C, composition, and takes on values from 1 to 3;
m is the subscript that identifies observations within a cell, from 1 to 9;
μ describes the general size of scores;
α_i represents the effect of level i of Factor A;
β_j represents the effect of level j of Factor B;
γ_k represents the effect of level k of Factor C;
$\alpha\beta_{ij}$, $\alpha\gamma_{ik}$, and $\beta\gamma_{jk}$ are first-order interaction terms;
$\alpha\beta\gamma_{ijk}$ is a second-order interaction term;
$\varepsilon_{m(ijk)}$, for each score, is a residual or error term for subject in cell ijk.

Table 2

$3 \times 3 \times 3$ Experimental Design

Method	Improvisation and graphic score A_1			Graphic A_2			Conventional score A_3		
Composition	C_1	C_2	C_3	C_1	C_2	C_3	C_1	C_2	C_3
Grade levels B_1 (4th)	$A_1B_1C_1$	$A_1B_1C_2$	$A_1B_1C_3$	$A_2B_1C_1$	$A_2B_1C_2$	$A_2B_1C_3$	$A_3B_1C_1$	$A_3B_1C_2$	$A_3B_1C_3$
B_2 (8th)	$A_1B_2C_1$	$A_1B_2C_2$	$A_1B_2C_3$	$A_2B_2C_1$	$A_2B_2C_2$	$A_2B_2C_3$	$A_3B_2C_1$	$A_3B_2C_2$	$A_3B_2C_3$
B_3 (col.)	$A_1B_3C_1$	$A_1B_3C_2$	$A_1B_3C_3$	$A_2B_3C_1$	$A_2B_3C_2$	$A_2B_3C_3$	$A_3B_3C_1$	$A_3B_3C_2$	$A_3B_3C_3$

The PDP-11 computer at Ohio Northern University was used for data analysis. The Statistical Package for the Social Sciences Subprogram ANOVA was used to compute statistics needed to test all hypotheses.

To determine how the dependent measures varied as a function of the three independent factors, the $\underline{F}$ ratios were tested for significance at the .05 level in both analyses of variance. Tukey's multiple comparison procedures were utilized to determine which pairs of means showed differences large enough to permit the conclusion that the corresponding population means differed. Plots of significant interactions were made to aid in the interpretation of the results.

CHAPTER IV

EVALUATION OF THE DATA

Results of data analyses conducted to test the research hypotheses listed in Chapter II will be presented below for each of the dependent variables: score reading and retention.

Score Reading

Means of the error scores on the score-reading test are presented in Table 3 for each independent variable: method, grade level, and composition. The grand mean was 6.09, N = 243.

Table 3

Score-Reading Means for Independent Variables

	Method		
	1 Graphic + Improvisation	2 Graphic	3 Conventional
Means:	5.80	5.68	6.79
N:	81	81	81
	Grade Level		
	1 Grade 4	2 Grade 8	3 College
Means:	10.27	6.91	1.09
N:	81	81	81
	Composition		
	1 Hindemith	2 Chávez	3 Schuller
Means:	3.52	10.84	3.91
N:	81	81	81

Table 4 contains the results of an analysis of variance of the score-reading data.

Table 4

Score-Reading Results of Three-Way Fixed Effects ANOVA

Source of variation	df	SS	MS	F	significance
Method	2	60.082	30.041	0.686	0.509
Grade level	2	3499.193	1749.597	39.957	<0.001
Composition	2	2746.477	1373.239	31.362	<0.001
Method X Grade	4	108.214	27.053	0.618	0.653
Method X Comp.	4	186.634	46.658	1.066	0.375
Grade X Comp.	4	1302.856	325.714	7.439	<0.001
Method X Grade X Comp.	8	190.551	23.819	0.544	0.824
Within groups	216	9457.998	43.787		

When interpreting the results of an analysis of variance, it is important to examine interactions among variables before interpreting main effects. If a significant interaction exists, an associated main effect must be interpreted within levels of other associated main effects.

The data shown in Table 4 indicate that there was no significant three-way interaction among method, grade level, and composition ($F_{8,216} = 0.544$, $p > .05$). The seventh null hypothesis of the study stated that there would be no significant interaction among these three independent variables; the results are consistent with this null hypothesis.

The data in Table 4 also show that there was no significant first-order interaction between method and grade level ($F_{4,216} = 0.618$, $p > .05$). This finding is consistent with null hypothesis four, as stated in Chapter II. There was no significant first-order interaction between method and composition ($F_{4,216} = 1.066$, $p > .05$). Thus null hypothesis five, which stated that there would be no significant interaction between method and composition, was retained.

A significant first-order interaction was found between grade level and composition ($F_{4,216} = 7.439$, $p < .001$). Hence null hypothesis six of Chapter II, that there would be no significant interaction between grade level and composition, was rejected. Further analysis of this interaction follows.

The means for each composition are listed by grade level in Table 5. In Figure 4, these means are plotted to further illuminate the nature of the composition by grade level interaction. For all three compositions, error scores diminish with grade level, but the most striking decrease is found for the error scores of those listening to the Chávez composition. A negligible disordinal relationship is found among the grade-level means of those tested using the Hindemith and Schuller compositions; however, the grade-level patterns of means are similar for students exposed to these compositions.

Table 5

Score-Reading Means for Each Composition and Grade Level

Grade level	1 (Grade 4)	2 (Grade 8)	3 (College)
Composition			
1 (Hindemith)	6.00	4.30	.26
2 (Chávez)	18.70	12.22	1.59
3 (Schuller)	6.11	4.22	1.41

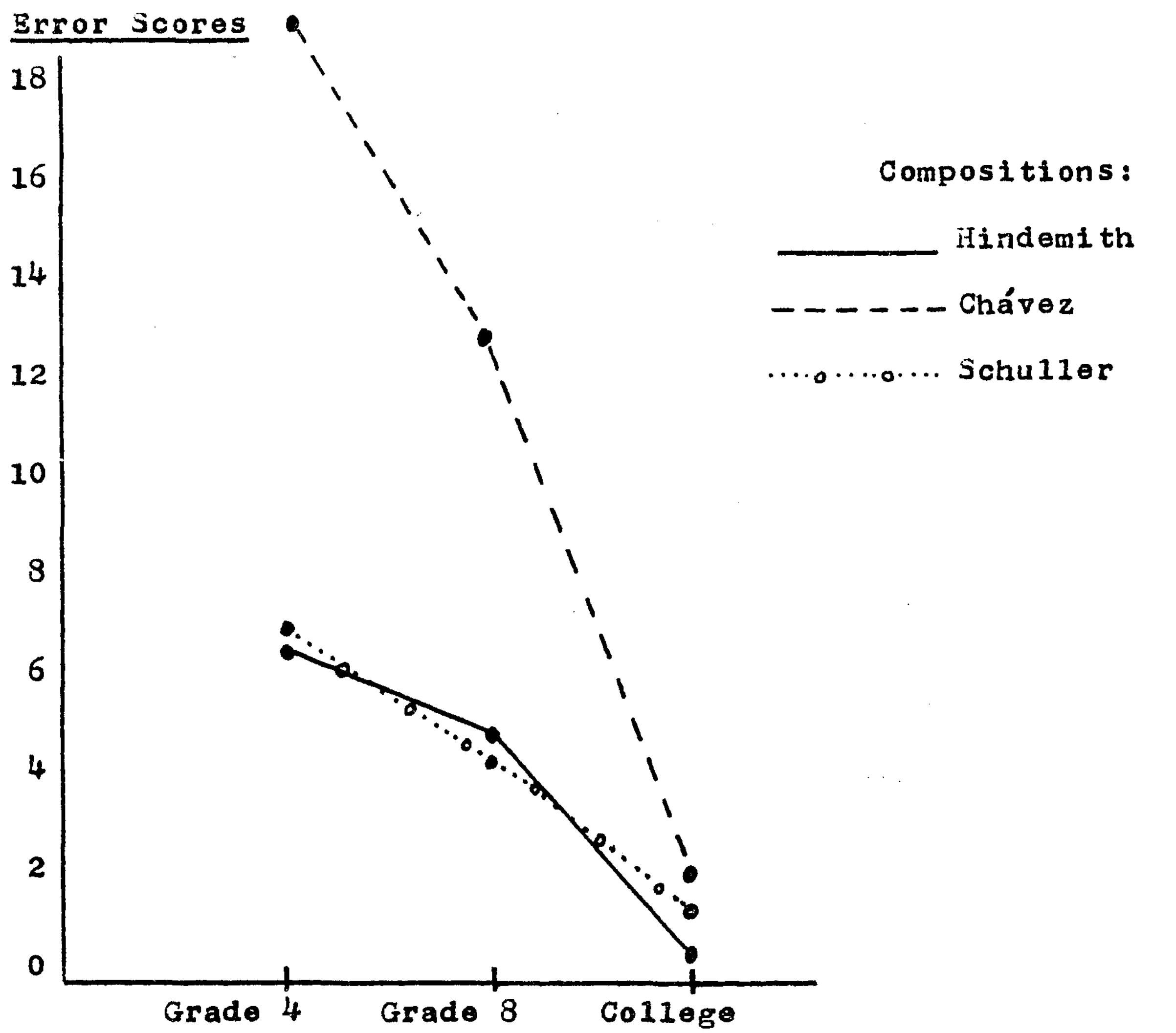


Figure 4: Interaction between composition and grade level for the score-reading dependent variable.

When main effects were examined, only the first null hypothesis, that there would be no significant differences due to methods of presentation, was supported by the data ($F_{2,216} = 0.686$, $p > .05$). Significant differences among mean error scores on the score-reading variable were found for the three grade-level groups and for the three groups exposed to different compositions. The null hypothesis that there would be no significant differences among grade-level groups was rejected well beyond the .05 level of significance ($F_{2,216} = 39.957$, $p < .001$). The null hypothesis that there would be no significant differences among groups exposed to different compositions was similarly rejected ($F_{2,216} = 31.362$, $p < .001$).

Tukey's multiple comparison procedures were utilized to determine which pairs of sample means differed significantly. In the Studentized range distribution for three and 216 degrees of freedom, any value exceeding 3.356 would be significant at the .05 level. The value calculated for the difference between the fourth-grade mean and the eighth-grade mean (4.5699) was significant, as was the value calculated for the eighth-grade and college means (7.9158). Finally, the fourth-grade mean and the college mean differed significantly at a Type I error level of .05. These results are shown in Table 6.

The score-reading means of those exposed to the Hindemith and the Chávez compositions showed a significant difference (α = .05), as did the score-reading means of those responding to the Chávez and the Schuller compositions. However, the difference between means of those responding to the Hindemith and the Schuller compositions was not sufficiently large to warrant conclusions about corresponding differences between population means.

Table 6

Tukey's Multiple Comparisons of Score-Reading Means (Values of the Studentized Range Statistic)

	I. Grade Level	
Fourth with Eighth	Fourth with College	Eighth with College
4.5699 *	12.4857 *	7.9158 *
	II. Composition	
Hindemith with Chávez	Hindemith with Schuller	Chávez with Schuller
-9.9287 *	-.5304	9.4255 *

* exceeds value of $_{.95}q_{3,216}$ = 3.356

Retention

The results of the retention test showed much less variability than did the results on the score-reading test, since the highest possible retention error score was six. The grand mean was 0.43, N = 243. Table 7 depicts the means of error scores on the retention test for each level of each independent variable.

Table 7

Retention Means for Independent Variables

	Method		
	1	2	3
	Graphic + Improvisation	Graphic	Conventional
Means:	.42	.32	.56
N:	81	81	81
	Grade Level		
	1	2	3
	Grade 4	Grade 8	College
Means:	.59	.35	.36
N:	81	81	81
	Composition		
	1	2	3
	Hindemith	Chávez	Schuller
Means:	.20	.72	.38
N:	81	81	81

The results of an analysis of variance of the data from the retention test are contained in Table 8. The interaction among variables will be examined prior to an examination of the main effects.

There was a significant three-way interaction among method, grade level, and composition ($F_{8,216} = 2.132$, $p < .05$). The seventh null hypothesis of the study stated that there would be no significant interaction among these independent variables; hence this null hypothesis was rejected.

Table 8

Retention Results of Three-Way Fixed Effects ANOVA

Source of variation	df	SS	MS	F	significance
Method	2	2.247	1.123	1.717	0.180
Grade level	2	3.136	1.568	2.396	0.091
Composition	2	11.185	5.593	8.547	<0.001
Method X Grade	4	1.654	0.414	0.632	0.643
Method X Comp.	4	2.213	0.531	0.811	0.521
Grade X Comp.	4	6.790	1.698	2.594	0.037
Method X Grade X Comp.	8	11.160	1.395	2.132	0.034
Within groups	216	141.333	0.654		

The retention error-score means for each cell are listed in Table 9. To illuminate the nature of the three-way interaction among independent variables, the cell means are plotted in Figure 5.

Table 9

Retention Cell Means

	Method 1 Graph. + Improv.			Method 2 Graphic			Method 3 Conventional		
Comp.	4th	8th	Col.	4th	8th	Col.	4th	8th	Col.
1	.00	.22	.33	.00	.11	.11	.22	.11	.67
2	1.89	.44	.22	.67	.44	.33	.67	1.11	.67
3	.33	.00	.33	.56	.33	.33	1.00	.33	.22

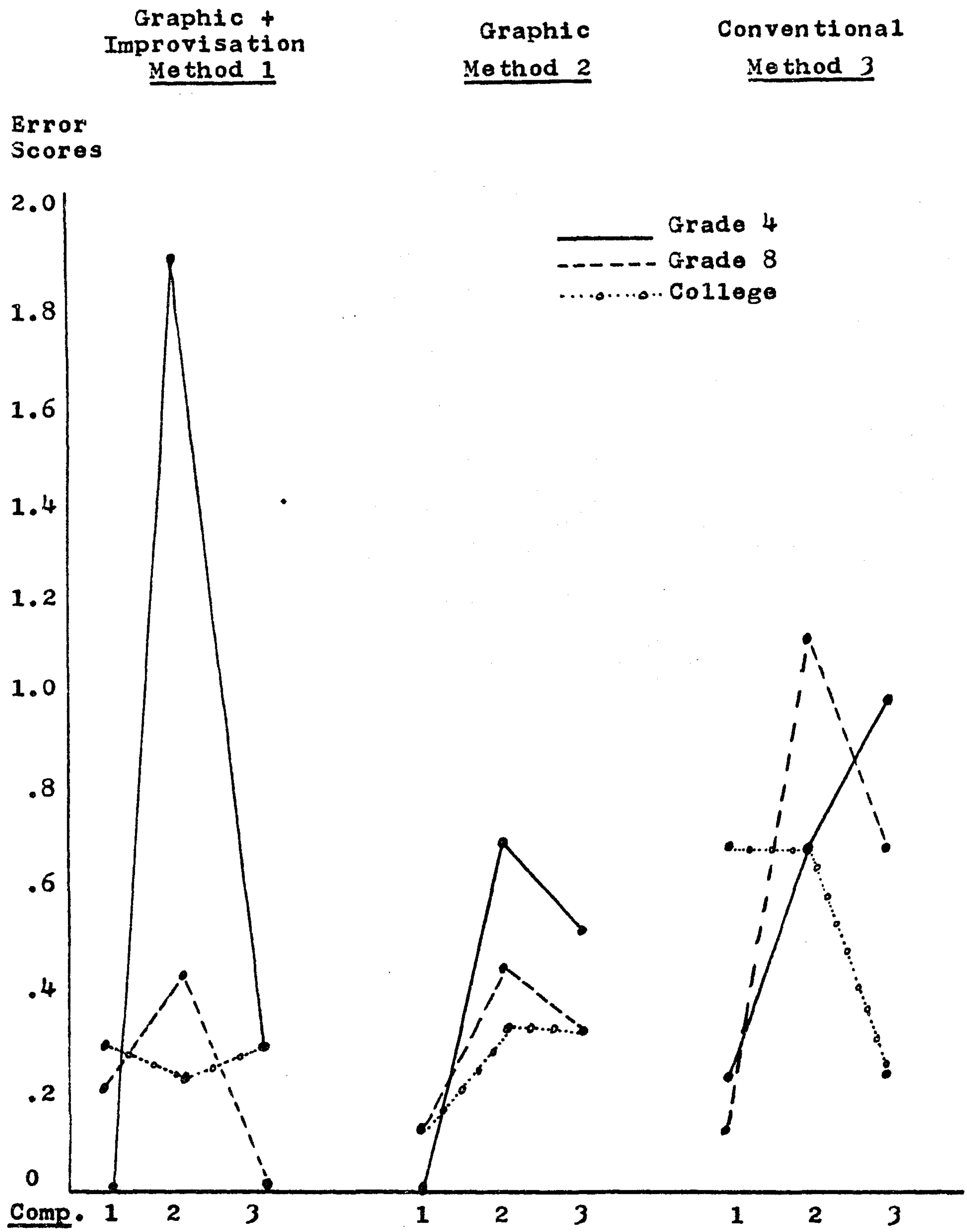


Figure 5: Retention means by grade level and composition, within methods.

It can be seen in Figure 5 how levels of the independent variable, method of presentation, affect the interactions of grade level and composition. Error-score means of groups exposed to Method 1 show a similar pattern for fourth-grade and eighth-grade levels, except for a more extreme fourth-grade contrast due to the high error-score mean of the group exposed to the Chávez composition. In groups exposed to Method 2, the pattern for all three grade levels is similar; again the fourth-grade contrast is greater. However, error-score means that are plotted for groups exposed to Method 3 differ greatly in pattern from those for groups exposed to Methods 1 and 2. Fourth-grade means show an increase across compositions (not found in the other methods), and the college students' error-score mean decreases on the Schuller composition.

The data in Table 8 show that there was no significant first-order interaction between method and grade level ($F_{4,216} = 0.632$, $p > .05$), and no significant interaction between method and composition ($F_{4,216} = 0.811$, $p > .05$). These findings are consistent with null hypotheses four and five, as stated in Chapter II, for the dependent variable, retention.

A significant first-order interaction was found between grade level and composition ($F_{4,216} = 2.594$, $p < .05$). Hence the sixth null hypothesis of the study, that there would be no significant interaction between grade level and composition, was rejected. The means for each composition by grade level are listed in Table 10. These means are plotted to show their interaction in Figure 6.

Table 10
Retention Means for each Composition and Grade Level

Grade Level	1 (Grade 4)	2 (Grade 8)	3 (College)
Composition			
Hindemith	.07	.15	.37
Chávez	1.07	.67	.41
Schuller	.63	.22	.30

As with the score-reading means, the retention error-score means of the groups exposed to the Chávez composition diminish drastically with increasing grade level; however, with neither of the other compositions does this pattern hold true. With the group who listened to the Hindemith work, error scores increase with grade level. With the Schuller group, there is a sharp decrease in errors from fourth to eighth grade, then an increase between eighth grade and college. Mean scores are stabilized somewhat at the college level; there is great divergence between mean error scores at the fourth-grade level and a lesser but still prominent contrast at the eighth-grade level.

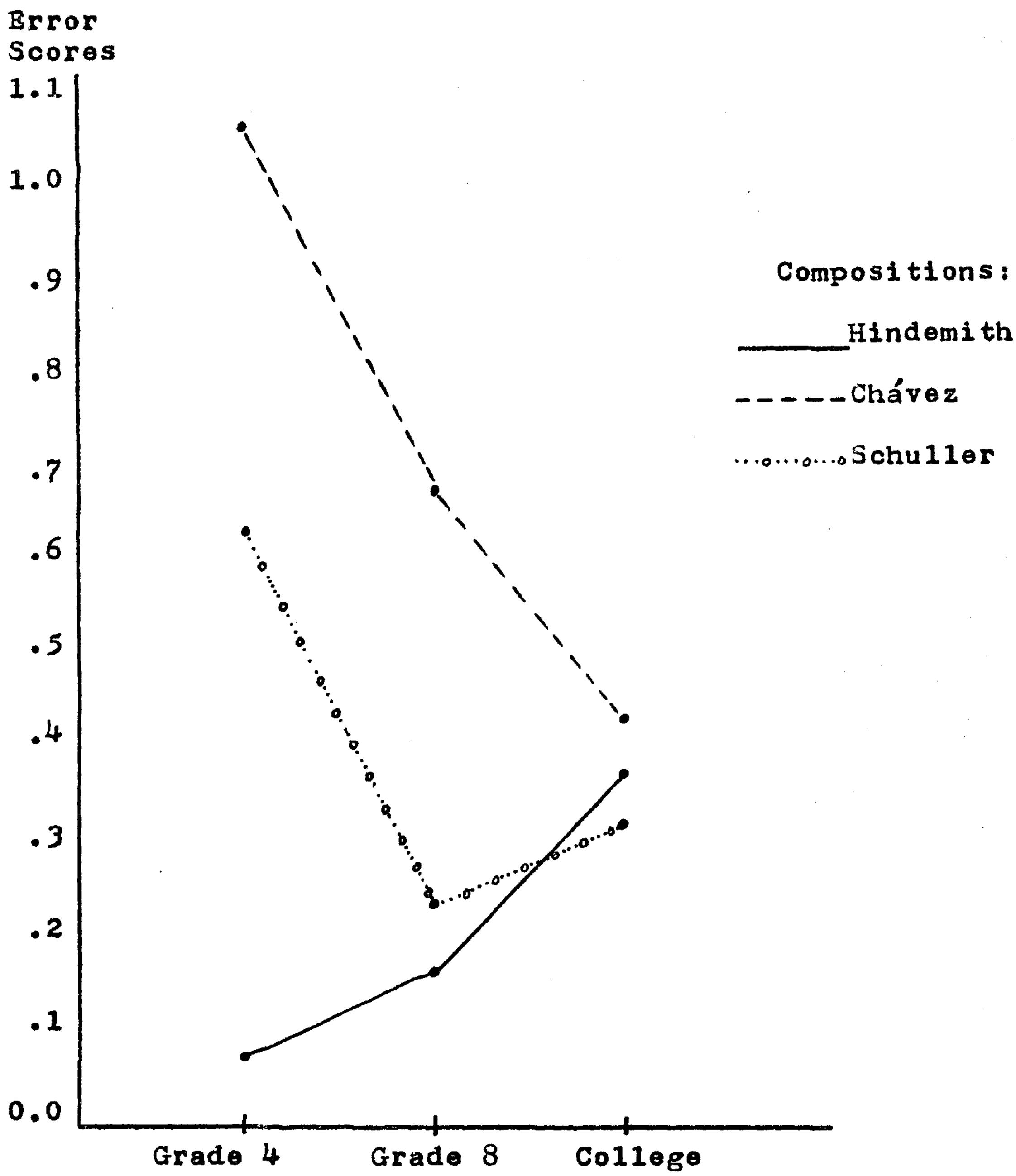


Figure 6: Retention interaction between composition and grade level.

Regarding the main effects, there was a significant difference among compositions ($F_{2,216} = 8.547$, $p < .001$). In interpreting this difference, the analysis of the two-way interaction must be considered, specifically that the effect of each composition varied at each grade level.

Null hypothesis three, as stated in Chapter II, was rejected.

To determine which pairs of means for the composition variable showed differences large enough to permit conclusions about population means, Tukey's multiple comparison procedure was employed. Using the statistic from the Studentized range distribution for three and 216 degrees of freedom, a value must exceed 3.356 to be significant at the .05 level. Between the Hindemith and Chavez compositions, the value was found to be significant (-5.7853), but between the Hindemith and the Schuller compositions, it was not (-2.0026). Between the Chávez and the Schuller compositions the value was significant (3.7827). These comparisons are shown in Table 11.

Table 11

Tukey's Multiple Comparisons of Retention Means
(Values of the Studentized Range Statistic)

Composition		
Hindemith and Chávez	Hindemith and Schuller	Chávez and Schuller
-5.7853 *	-2.0026	3.7827 *

Further Analyses and Results

Data from each of the tests were examined for individual outlying scores which might have acted to skew the results. From the 27 cells of the score-reading data, eight outliers were deleted; from each remaining cell, one score was randomly discarded. A three-way ANOVA was performed on the remaining data with the new sample size of 216 and cell size of eight. No appreciable change was found. Due to the strikingly similar results, the original sample size of 243 with a corresponding cell size of nine was retained.

Discussion

The aim of this study, to test the initial effects of the use of graphic scores during aural perception of 20th century compositions in a classroom setting, should be reviewed in light of the results of the data analyses. It was found that students were able to follow graphic scores at least as well as conventional scores. While the analysis of variance on the score-reading data did not reveal any significant differences among error-score means of students exposed to the three methods (use of graphic scores with prior improvisation, use of graphic scores alone, and use of conventional scores), it is important to note that students at all grade levels were able to perform the score-reading tasks while viewing unfamiliar notation. The means for each method are listed by grade level in Table 12.

Table 12

Score-Reading Error-Score Means for Methods by Grade level, Averaged Across Compositions

N = 81

	Graphic + Improvisation	Graphic	Conventional
Grade 4	9.44	10.52	10.85
Grade 8	7.04	5.26	8.44
College	0.93	1.26	1.07

In Table 13, scores from both graphic groups are averaged. Similar success at score reading can be seen; at all grade levels, the means for the combined graphic groups were close in value to the means for conventional groups. Error-score means for fourth-grade students and eighth-grade students were slightly lower for the combined groups using graphic notation than for the groups using conventional notation. Differences between means narrowed at the college level. Even though the superiority of graphic notation was not shown with or without prior improvisation, it can be concluded that graphic notation was as effective as conventional notation when employed as a visual aid (at least to the degree that effectiveness is measured by the score-reading test).

Table 13
Score-Reading Means: Graphic Methods vs. Conventional by Grade Level, Averaged Across Compositions

	Combined graphic groups N = 162	Conventional N = 81
Grade 4	9.98	10.85
Grade 8	6.15	8.44
College	1.09	1.07
Overall	5.74	6.79

When considering the educational significance of the use of graphic notation, one may pose the question: What differences in means would warrant the conclusion that one method of notation is more effective than another? Formulating an alternative hypothesis of three points difference in means between each group (e.g., graphic notation with improvisation: μ_1 = 3; graphic notation: μ_2 = 6; conventional notation: μ_3 = 9) and using the variance and sample size from the present study, the power of the experiment to accurately detect real population differences of this magnitude was calculated to be .99.

That the score-reading task could be accomplished by fourth-grade students affirms findings about development of music concepts by Torrey (1977).

The present study showed that score-reading achievement increased with grade level, regardless of method of presentation (see Tables 3 and 11). This is consistent with Schultz's conclusions (1969) about an increase in conceptual organization that takes place at the eighth-grade level. While differences in score-reading means from the present study were greatest between eighth grade and college level, the differences between all three grade levels were statistically significant.

On the score-reading test, an educationally significant difference between true grade-level means was defined as two raw-score points (e.g., grade 4: μ_1 = 8; grade 8: μ_2 = 6; college: μ_3 = 4). From the present study the variance and sample size were used to calculate the power of the experiment to detect such differences. The power to accurately detect real population differences of this magnitude was found to be .68.

A result of the study that was consistent for both tests, score reading and retention, was the relative difficulty of the Chávez composition (see Tables 3 and 7). In comparing means using Tukey's multiple comparison procedures, the same results were again found--a significant difference between the means of groups exposed to each of the other compositions and those exposed to the Chávez work, but no significant difference between the groups exposed to the Hindemith and Schuller compositions. It must be concluded that the Chávez work was more difficult to read and to remember.

The retention test presented a less challenging task for students at all grade levels than did the score-reading task. The high achievement of all groups, coupled with the low reliability coefficient (.556), suggests that the test was not a highly discriminating measure.

No significant difference was found between methods of presentation. Even though this finding is not consistent with research reported by Wollman (1972) and Bradley (1974) concerning contribution of improvisation to tonal memory, the weakness of the retention test must be considered in interpreting these conflicting results.

CHAPTER V

SUMMARY AND CONCLUSIONS

Statement of Outcomes

This study was an investigation of the use of experimenter-constructed graphic scores of 20th-century compositions, with and without prior improvisation, as compared with conventional notation, by fourth-grade, eighth-grade, and college non-music major students. Results showed no significant differences among methods of presentation on both dependent variables: score reading and retention. There were significant differences among error-score means of groups exposed to different compositions, with the composition by Chávez being more difficult, as revealed by performances on score-reading and retention tasks.

Results from the score-reading data showed a significant difference between grade levels. Score reading became an increasingly easier task for the latter two grade levels. On both dependent variables there was a significant two-way interaction between grade level and composition. Retention results showed a three-way interaction among method, grade level, and composition.

Additional Findings

In addition to their relevance to the research questions initially posed, the findings of this study illuminate several practical issues in music education. These issues are discussed below.

1. Upon first presentation, is it possible to follow a graphic score? Students at all three grade levels were successfully able to follow graphic scores of 20th-century compositions at least as well as conventional scores of the same works. This finding indicates that graphic scores are appropriate but not superior visual techniques for use in aural perception in the general music classroom.

2. Upon a subsequent hearing, can students recognize the music? Regardless of the type of score followed upon first presentation, a week later the students were able to discriminate between unknown works and the work played during score-reading activities. Answers to questions (1) and (2) above apply only to the aural perception of the specific compositions used in this study; however, it is the researcher's opinion that inferences may be made to include 20th-century works with small instrumentation of varied timbre that can be notated both conventionally and graphically.

3. At which level is graphic notation most effective: fourth grade, eighth grade, or college (non-music major)? Graphic notation was as accessible a tool as conventional

notation for students at each grade level. Two research results pertaining to grade level are particularly relevant to music education. On the score-reading test, there was a decrease in error rate as a function of grade level, whether graphic notation or conventional notation was used; however, retention results showed that fourth-grade students could remember the work heard as well as could eighth-grade students or college students.

4. Does group improvisation contribute to success in following the score or remembering the composition heard? Prior improvisation did not enhance learning as exhibited by score-reading and retention results. Students were eager to participate in group improvisation. While it did not contribute to greater success on either test, neither did it produce negative results.

Extrapolations

Student attitude and receptivity were not subjected to formal measurement in the present study; however, the appeal of a new visual aid may have been a factor in student success at score reading and retention. Competition was evident between graphic and conventional groups, particularly by fourth-grade students, but also by the older students. Curiosity about the graphic scores was encountered, including questions and positive comments by students. The few negative comments that were voiced about 20th century music did not appear to affect attentiveness to the tasks. The researcher was present for all testing, and did not perceive any students to be unwilling to attempt the task. Research with the use of nontraditional visual aids, including the effect of motivation on achievement, is recommended.

The present format and use of the retention test should aid in the subsequent development of a more refined instrument for testing retention. A retention measure with greater discriminating power is needed. A longer time period between the initial hearing and the retention test may be advantageous.

Incorporation of a control group into the experimental design should be considered in testing the effect of visual aids on memory of the work previously heard. If some students heard the composition without following a score, this control group's achievement on retention could be compared with the success of students who followed a visual aid such as graphic notation during listening.

BIBLIOGRAPHY

Asselin, M. M. Graphic representation of musical concepts: A computer-assisted instructional system (Doctoral dissertation, University of Connecticut, 1972). _Dissertation Abstracts International_, _34_, 2966-A. (University Microfilms No. 72-32, 200)

Barber, S. _Summer music for woodwind quintet_. New York: G. Schirmer, 1957.

Benson, W. Compositional processes and writing skills. _Monographs on Music in Higher Education No. 1_. Washington: The National Association of Schools of Music, 1973.

Berger, A. _Quartet in C major for woodwinds_. New York: C. F. Peters, 1961.

Bernard, J. W. A theory of pitch and register for the music of Edgard Varése (Doctoral dissertation, Yale University, 1977). _Dissertation Abstracts International_, _38_, 3125-A. (University Microfilms No. 77-27, 059)

Boretz, B., & Cone, E. T. _Perspectives on notation and performance_. New York: W. W. Norton and Co., Inc., 1976.

Boroff, E., & Irvin, M. _Music in perspective_. New York: Harcourt Brace Jovanovich, Inc., 1976.

Bradley, I. L. Development of aural and visual perception through creative processes. _Journal of Research in Music Education_, 1974, _22_(3), 234-240.

Brindle, R. S. _The new music: The avant-garde since 1945_. London: Oxford University Press, 1975.

Carter, E. _Eight etudes and a fantasy for woodwind quartet_. New York: Associated Music Publishers, Inc., 1959.

Chávez, C. _Soli II for woodwind quintet_. New York: Mills Music, 1963.

Choate, R. A. New dimensions in music, book 4. New York: American Book Co., 1970.

Cogan, R. Teaching music theory: The conservatory. Journal of Music Theory, 1974, 18, 59-74.

Cogan, R., & Escot, P. Sonic design: The nature and sound of music. Englewood Cliffs, N. J.: Prentice-Hall, 1976.

Cole, H. Sounds and signs: Aspects of musical notation. London: Oxford University Press, 1974.

Cope, D. Contemporary notation in music. The Instrumentalist, 1976, 30(10), 28-32.

Demand, M. F. Aesthetics and twentieth-century music in music education (Doctoral dissertation, University of Southern California, 1971). Dissertation Abstracts International, 33, 4452-A. (University Microfilms No. 72-17, 465)

Dennis, B. Experimental music in schools. London: Oxford University Press, 1972.

Eisenstein, S. R. Grade/age levels and the reinforcement value of the collative properties of music. Journal of Research in Music Education, 1979, 27(2), 76-85.

Fuller, C. M. Music notation based on E and G. Journal of Research in Music Education, 1966, 14, 193-196.

Gallaher, C. S. Density in twentieth-century music (Doctoral dissertation, Indiana University, 1975). Dissertation Abstracts International, 36, 1389-A. (University Microfilms No. 75-23, 425)

Glass, G. V., & Stanley, J. C. Statistical methods in education and psychology. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1970.

Goewey, G. I. An experimental study of the effectiveness of the melodic line score approach to music listening in developing musical literacy in general college students (Doctoral dissertation, Boston University, 1969). Dissertation Abstracts International, 31, 2421-A. (University Microfilms No. 70-22, 444)

Greer, R. D., Dorow, L. G., & Randall, A. Music listening preferences of elementary school children. Journal of Research in Music Education, 1974, 22(3), 284-291.

Heller, J. T. Graphic representation of musical concepts: A computer-assisted instructional system. Report of the Third International Seminar on Research in Music Education. Kassel, Germany: Barenreiter, 1973.

Hill, J. R. An investigation and evaluation of the use of visual aids for teaching music appreciation at the college level (Doctoral dissertation, University of Oklahoma, 1972). Dissertation Abstracts International, 33, 2411-A. (University Microfilms No. 73-29, 889)

Hindemith, P. Kleine Kammermusik, Op. 24, No. 2. New York: Associated Music Publishers, Inc., 1927.

Horazak, T. V. Focus on the unconventional: Sound, symbol, composition and performance in a fourth grade general music class. Music Educators Journal, 1973, 60(2), 49-51.

Horton, J. Music. New York: Citation Press, 1972.

Johnson, T. Teachers, step up to the avant-garde! Music Educators Journal, 1972, 58(9), 30-33.

Karkoschka, E. Notation in new music. New York: Praeger Publishers, 1972.

Kim, J., & Kohout, F. J. Analysis of variance and covariance. In Nie, N., Hull, C., Jenkins, J., Steinbrenner, K., & Bent, D. (Eds.), Statistical package for the social sciences (2nd ed.). New York: McGraw-Hill Book Co., 1975.

Kirk, R. E. Experimental design: Procedures for the behavioral sciences. Belmont, California: Brooks/Cole Publishing Co., 1968.

Kolar, J. M. A guide to elementary keyboard improvisation using selected 20th century compositional techniques (Doctoral dissertation, Columbia University, 1975). Dissertation Abstracts International, 36, 6360-A. (University Microfilms No. 76-7779)

Kontarsky, A. Notation for piano. Perspectives of New Music, 1972, 10(2), 72-91.

Land, L. R., & Vaughan, M. A. Music in today's classroom: Creating, listening, performing. New York: Harcourt Brace Jovanovich, Inc., 1973.

Lawrence, J. E. Development of methods and materials for increasing perception of music, visual art and literature through concepts about elements held in common (Doctoral dissertation, Case Western Reserve University, 1974). Dissertation Abstracts International, 35, 6184-A. (University Microfilms No. 75-5065)

Ligeti, G. Ten pieces for wind quintet. New York: Schott Music Corp., 1969.

McDermott, J. V. The articulation of musical space in the twentieth century (Doctoral dissertation, University of Pennsylvania, 1966). Dissertation Abstracts International, 28, 252-A. (University Microfilms No. 67-3090)

Mortenson, G. R. Development and use of computerized procedures for scoring sight reading of rhythms to compare the effectiveness of metric and representational notation with conventional notation (Doctoral dissertation, Northwestern University, 1970). Dissertation Abstracts International, 31, 4205-A. (University Microfilms No. 71-1924)

Myers, M. C. A study of Earle Brown's "December '52." The Instrumentalist, 1975, 30(1), 44-46.

Olson, G. Intersensory and intrasensory transfer of melodic contour perception by children. Journal of Research in Music Education, 1978, 26(1), 41-47.

Palmer, M. Sound exploration and discovery. New York: The Center for Applied Research in Education, Inc., 1974.

Paynter, J., & Aston, P. Sound and silence: Classroom projects in creative music. Cambridge: University Press, 1970.

Peitersen, D. N. An experimental evaluation of the transfer effects of rhythmic training in spaced notation on subsequent reading of commercially printed music (Doctoral dissertation, University of Minnesota, 1954). Dissertation Abstracts, 14, 983.

Peterson, A. V. A study of developmental listening factors in children's ability to understand melody (Doctoral dissertation, University of Rochester, 1965). Dissertation Abstracts International, 27, 1855-A. (University Microfilms No. 66-2361)

Petzold, R. The development of auditory perception of musical sounds by children in the first six grades. Journal of Research in Music Education, 1963, 2, 21-43.

Phillips, D. G. Sound and sight in music: Visual reinforcement for aural perception of musical content for the non-music major in college (Doctoral dissertation, Columbia University, 1967). Dissertation Abstracts International, 28, 1460-A. (University Microfilms No. 67-12, 702)

Poné, G. Action-reaction: Paralipomena to a genesis of graphics form in music. The Music Review, 1966, 27(3), 218-227.

Reese, S. New music breeds creators, not repeaters. Music Educators Journal, 1973, 59(5), 65-67; 107-109.

Risatti, H. New music vocabulary: A guide to notational signs for contemporary music. Urbana: University of Illinois Press, 1975.

Robison, R. W. Reading contemporary choral literature: An analytical study of selected contemporary choral compositions with recommendations for the improvement of choral reading skills (Doctoral dissertation, Brigham Young University, 1969). Dissertation Abstracts International, 30, 4484-A. (University Microfilms No. 70-4721)

Schafer, R. The composer in the classroom. Toronto: Clark and Cruickshank, 1969.

Schell, W.M. A guide for correlating the instrumental score with representative recorded selections in classroom music (Doctoral dissertation, Columbia University, 1964). Dissertation Abstracts International, 30, 3047-A. (University Microfilms No. 70-154)

Seeger, R. C. Suite for wind quintet. New York: Alexander Broude, Inc., 1969.

Self, G. New sounds in class. London: Universal Edition, 1967.

Smith, B. H. An experiment to determine the value of notated thematic excerpts relative to the recognition of aural musical themes (Doctoral dissertation, New York University, 1952). Dissertation Abstracts, 13, 103.

Schuller, G. Woodwind quintet. New York: Associated Music Publishers, Inc., 1968.

Schultz, S. W. A study of children's ability to respond to elements of music (Doctoral dissertation, Northwestern University, 1969). Dissertation Abstracts International, 30, 3047-A. (University Microfilms No. 70-154)

Stanley, G. C. Reliability. In Thorndike, R. L. (Ed.), Educational measurement (2nd ed.). Washington, D.C.: American Council on Education, 1971.

Tait, M. J. Whispers, growls, screams, and puffs lead to composition. Music Educators Journal, 1971, 57(6), 33-34.

Thompson, K. P. Relative effectiveness on aural perception of televised verbal descriptions and visual representations of selected musical events (Doctoral dissertation, Case Western University, 1971). Dissertation Abstracts International, 32, 4653-A. (University Microfilms No. 72-6344)

Thorndike, R. L., & Hagen, E. P. Measurement and evaluation in psychology and education (4th ed.). New York: John Wiley and Sons, 1977.

Torrey, R. W. The growth in children of capacities for making selected music seriations (Doctoral dissertation, University of California, Berkeley, 1975). Dissertation Abstracts International, 37, 4106-A. (University Microfilms No. 76-30, 332)

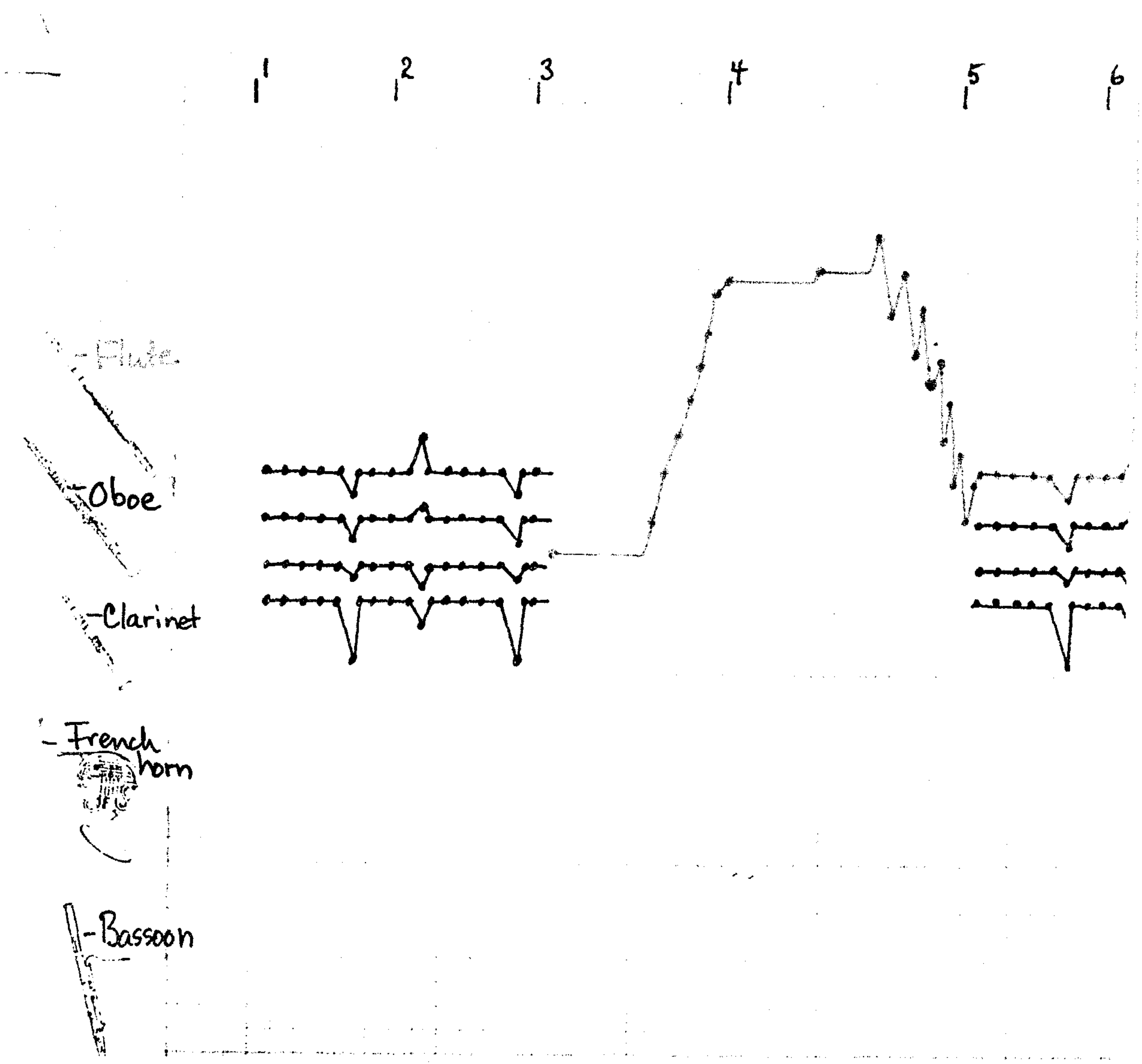
Wehner, W. L. Humanism and the aesthetic experience in music: Education of the sensibilities. Washington, D.C.: University Press of America, 1977.

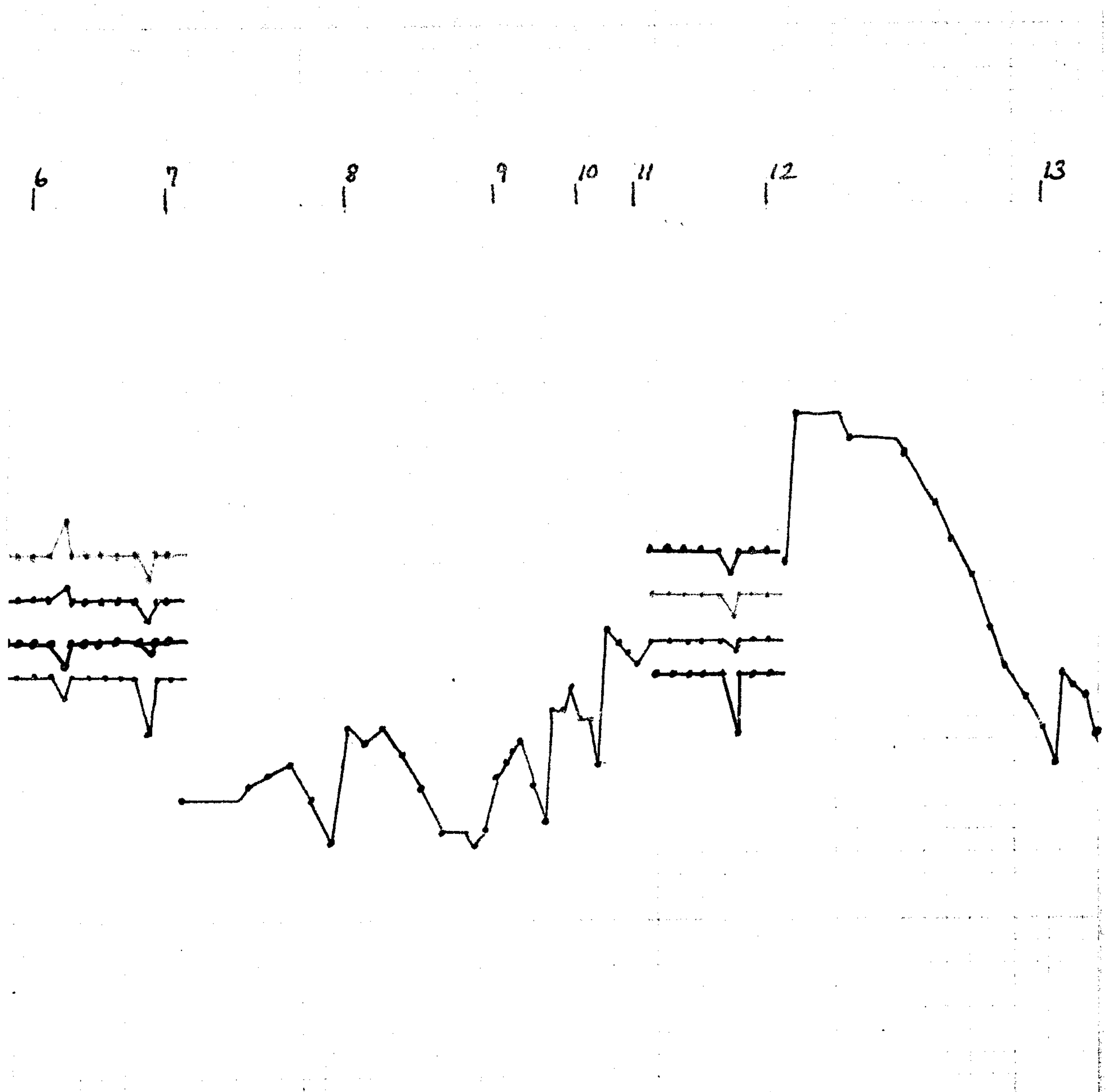
Wollman, W. A. The effect of a contemporary compositional process derived from aleatory techniques on the musicality of college level non-music majors (Doctoral dissertation, New York University, 1972). Dissertation Abstracts International, 33, 1775-A. (University Microfilms No. 72-26, 644)

APPENDIX A

Graphic Scores

I. Hindemith, P. **Fourth movement from Kleine Kammermusik, Op. 24, No. 2.**

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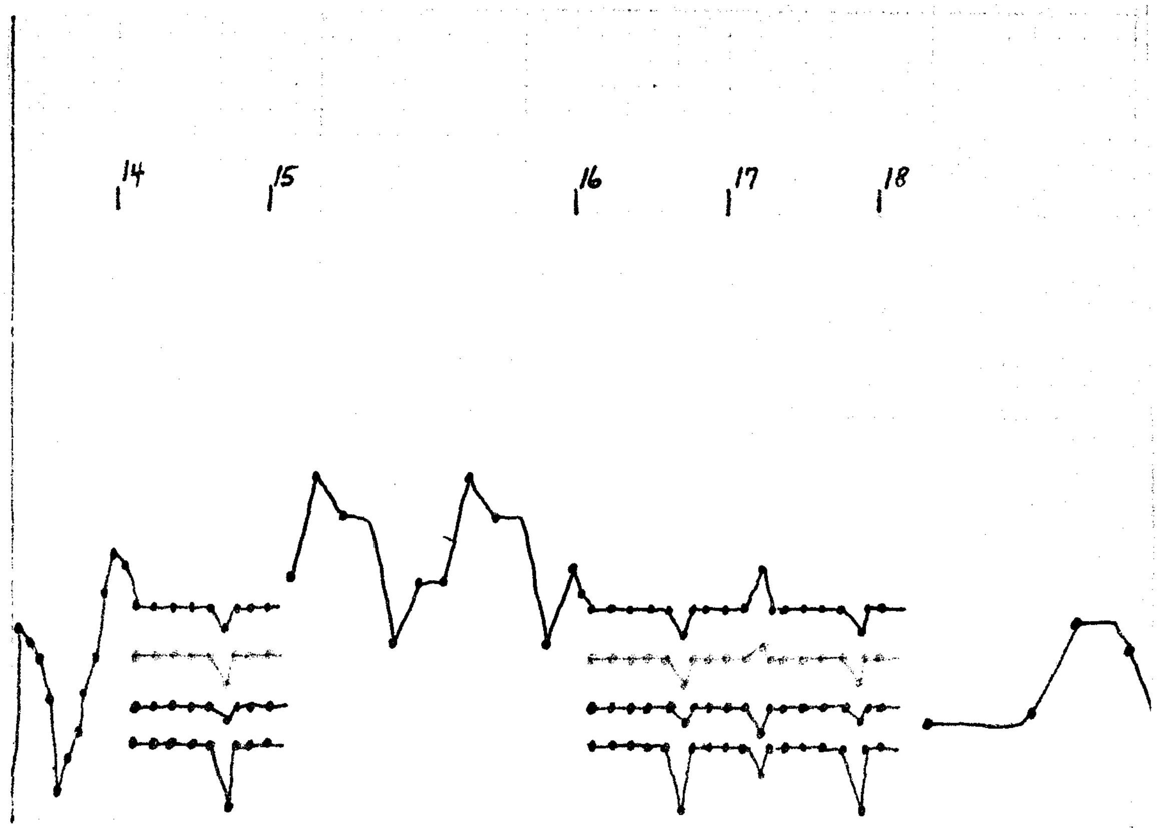
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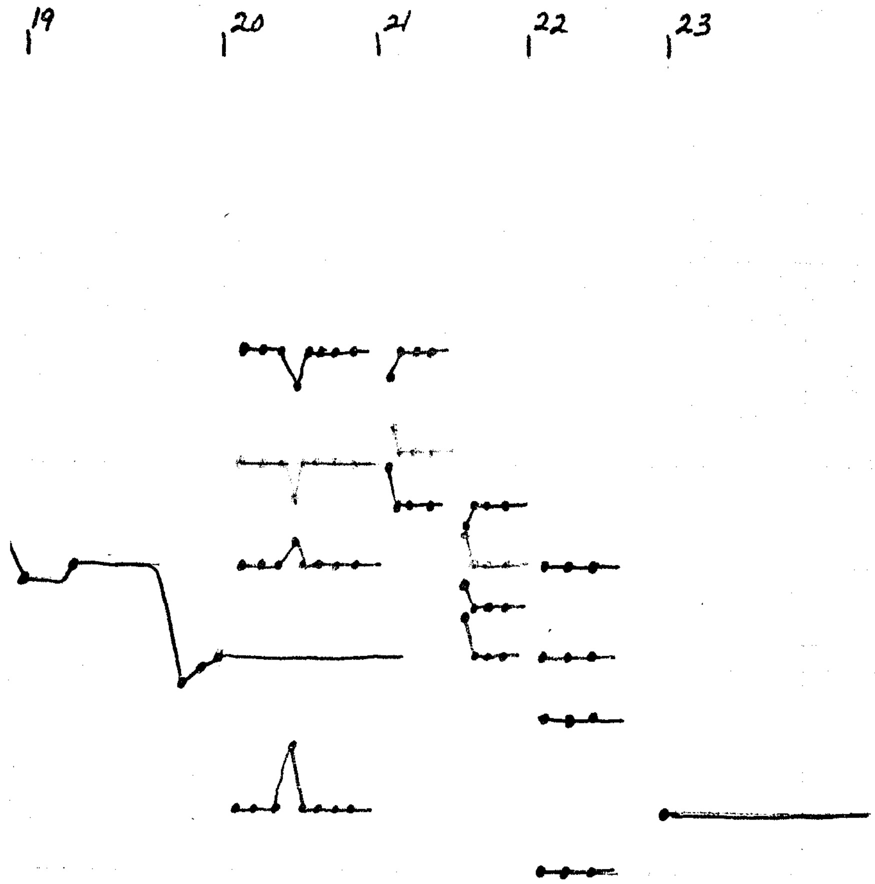
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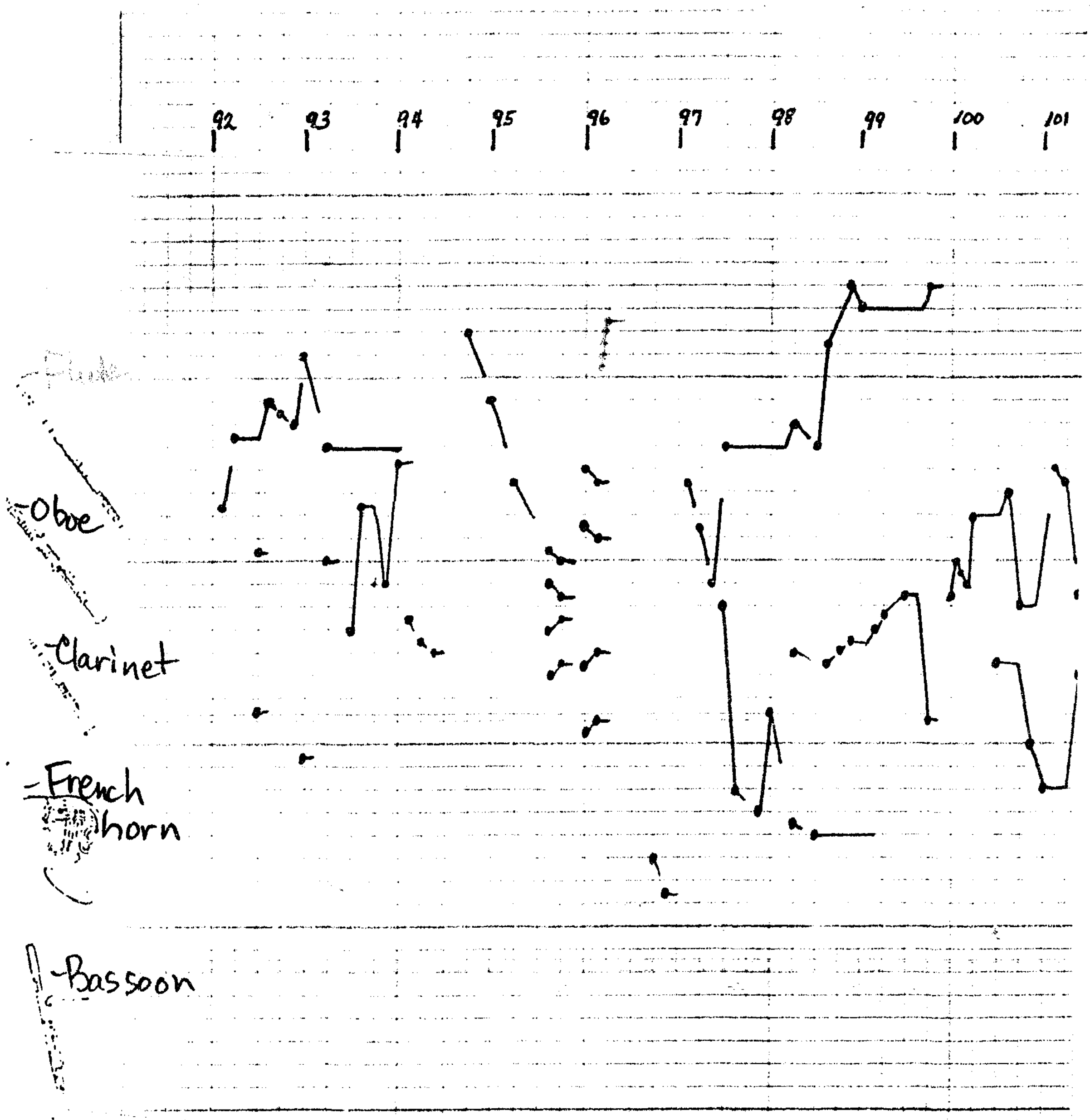
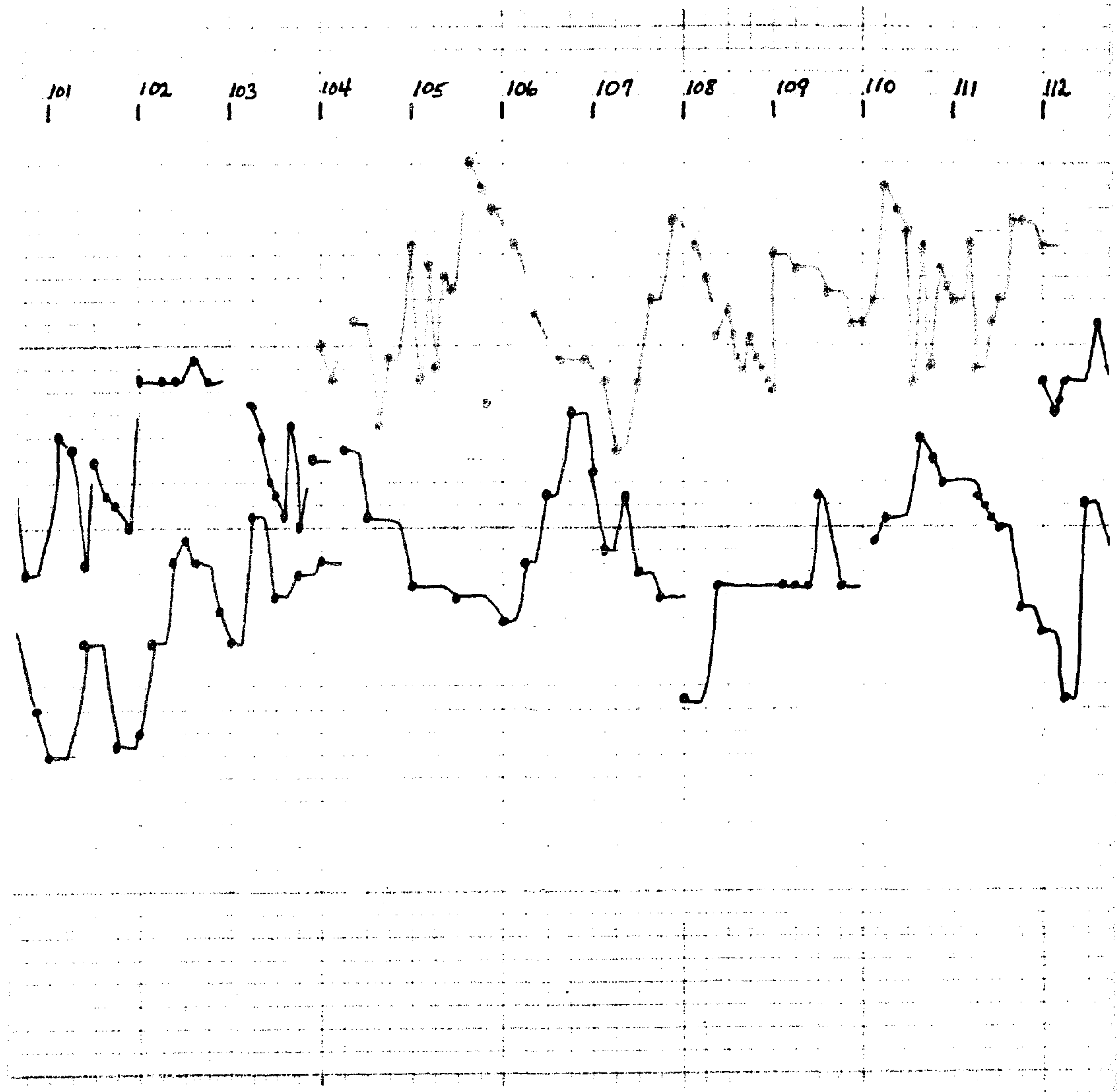
II. Chávez, C. "Rondo" from Soli II for Woodwind Quintet, measures 92-133.

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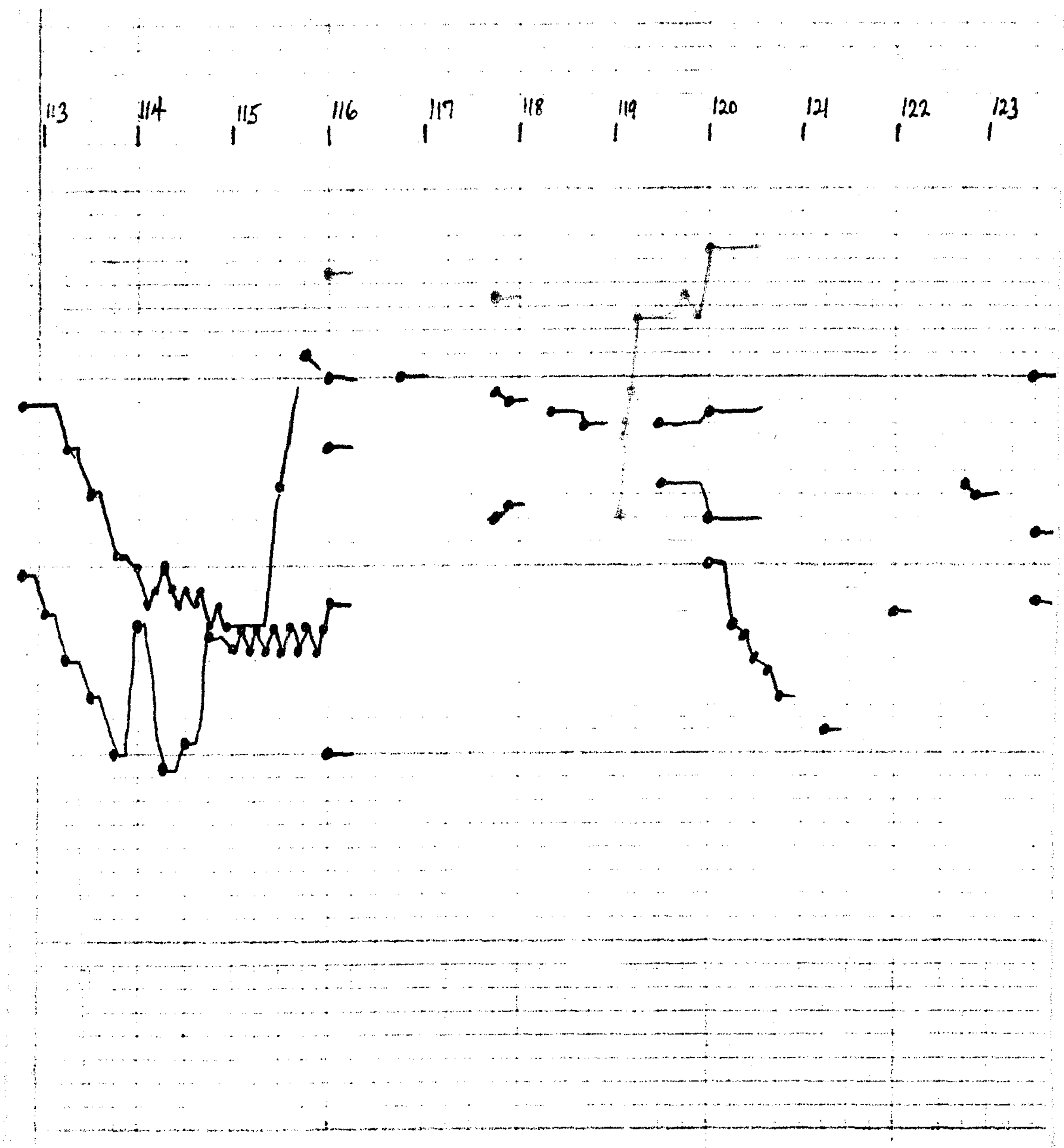
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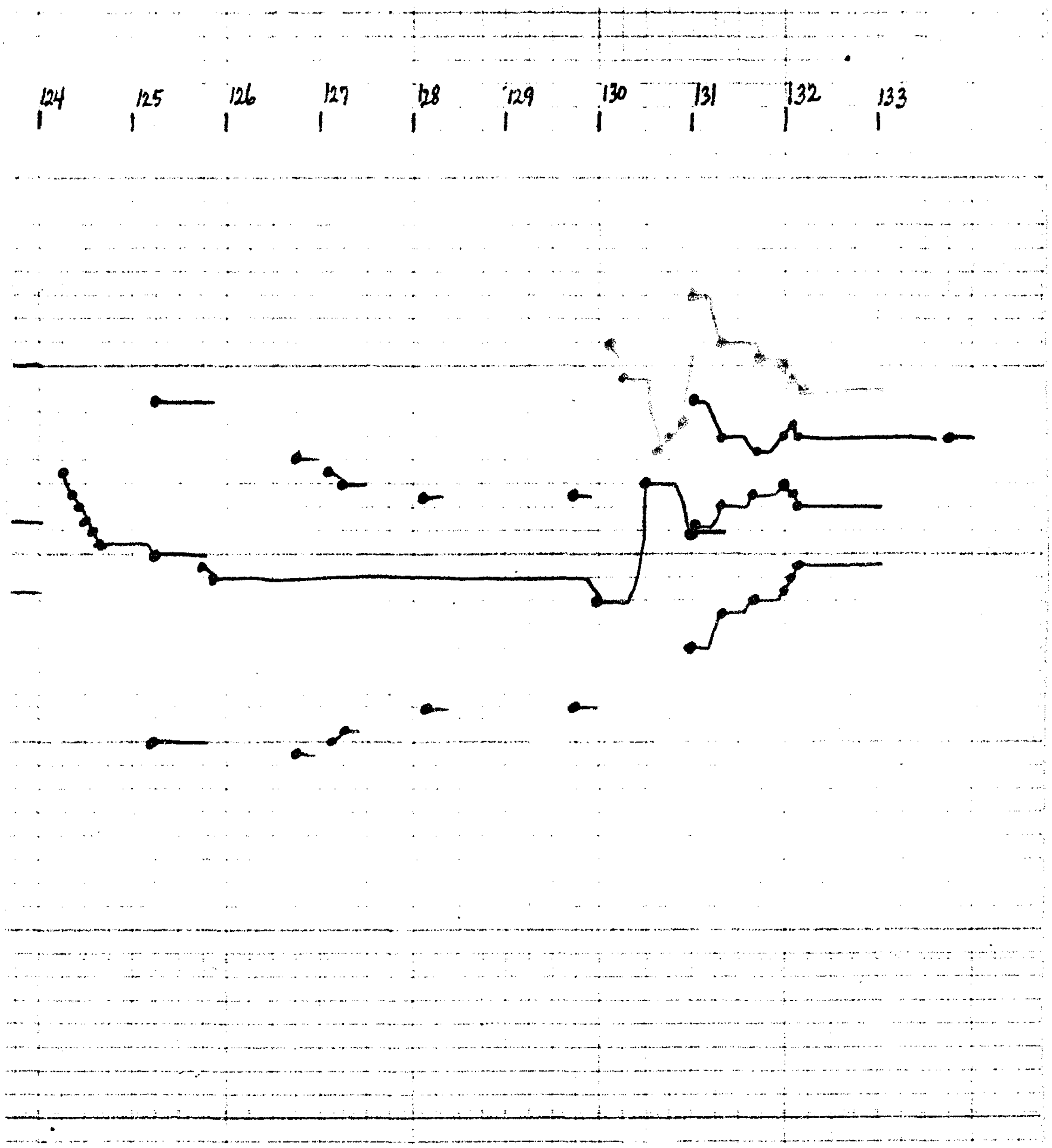
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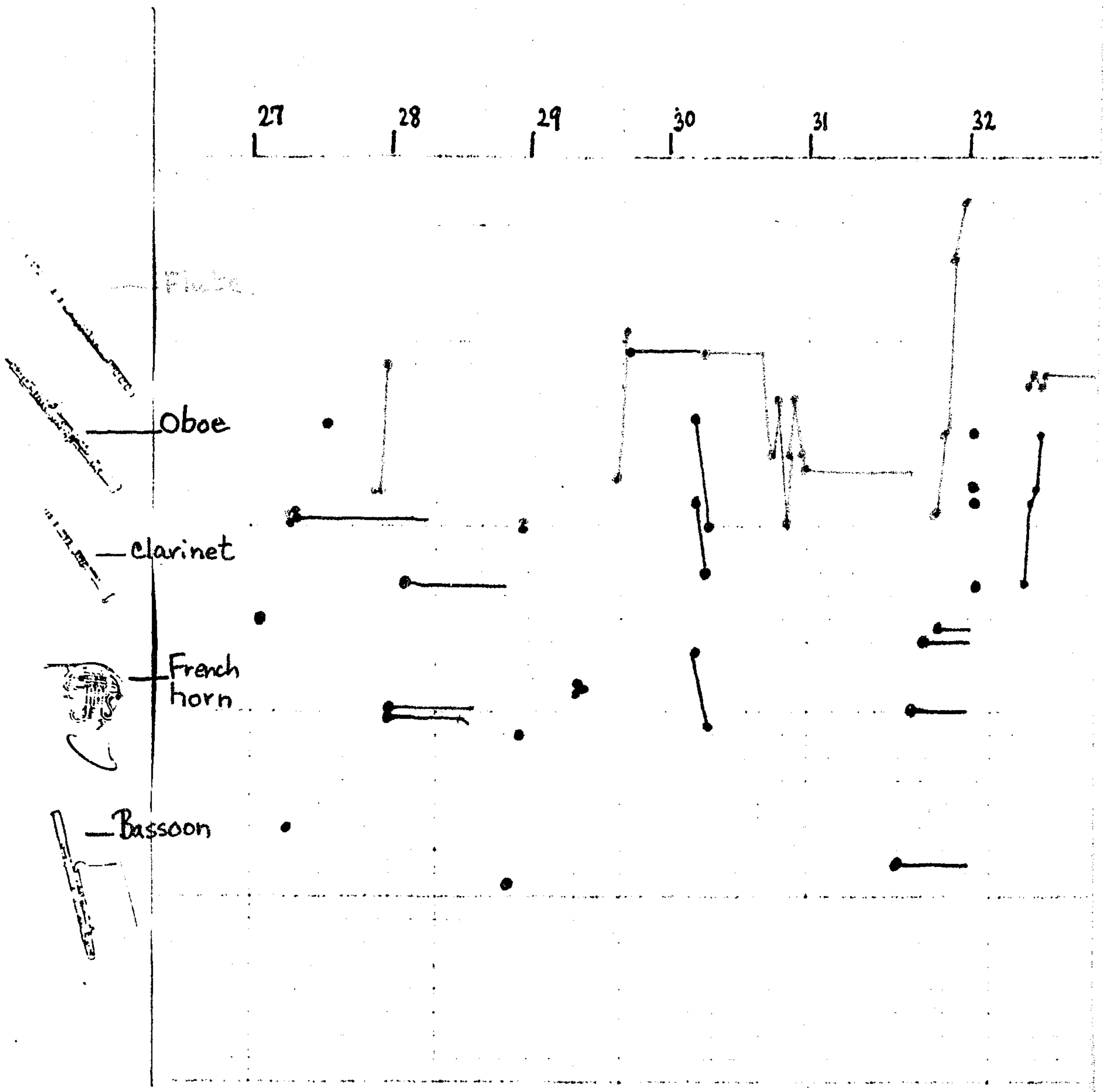
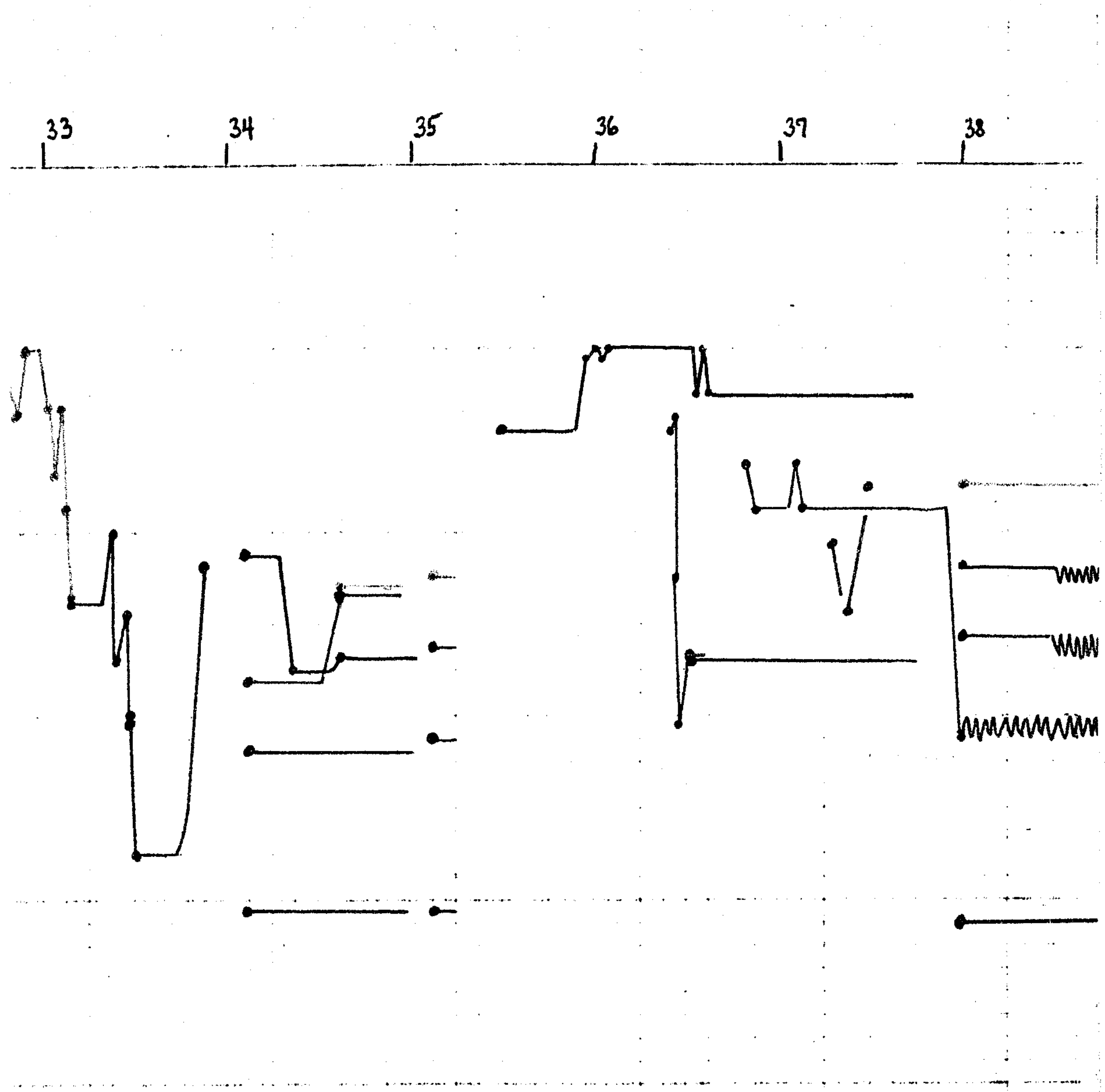
III. Schuller, G. Second movement from <u>Woodwind Quintet</u>, measures 27-49.

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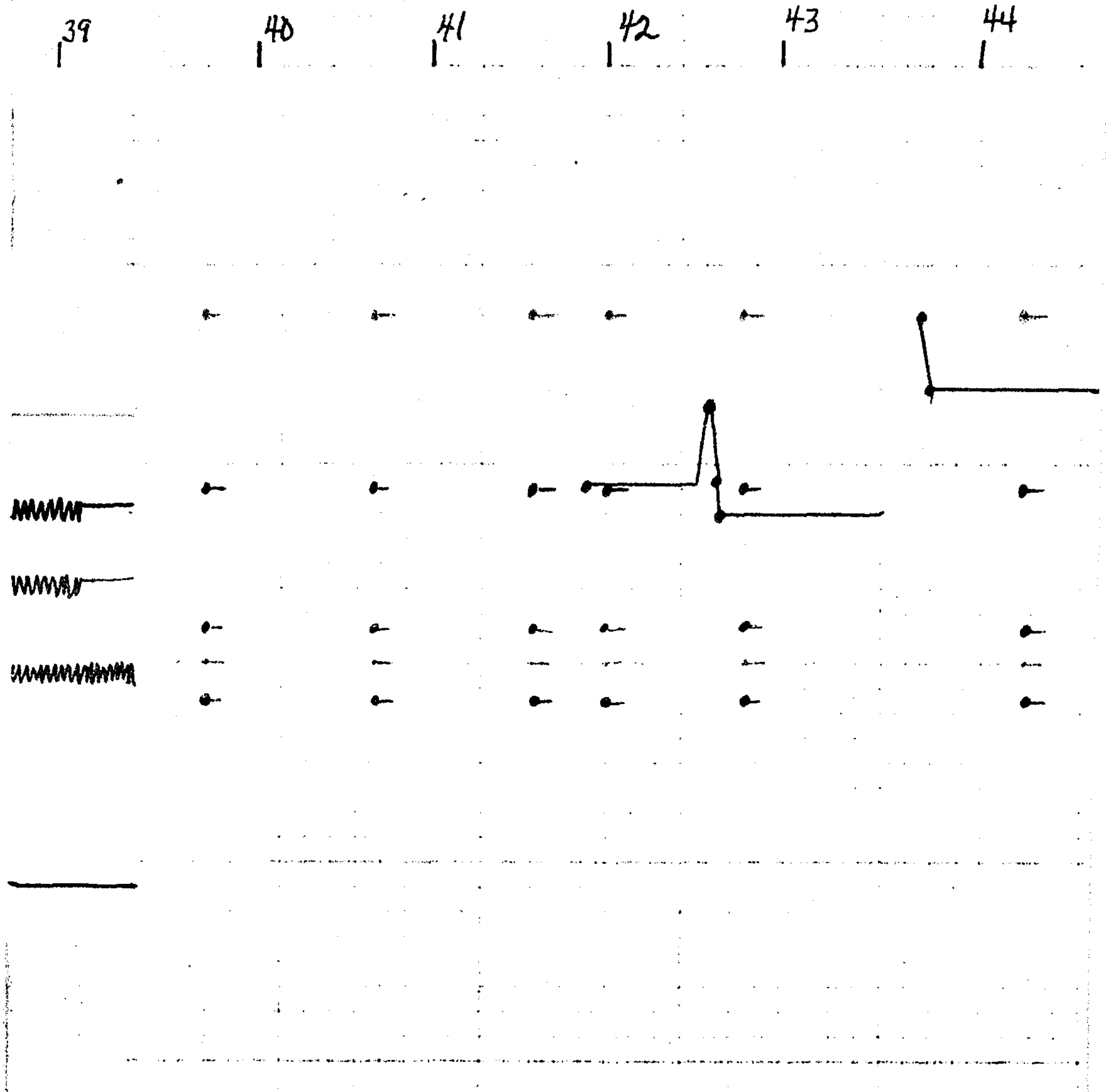
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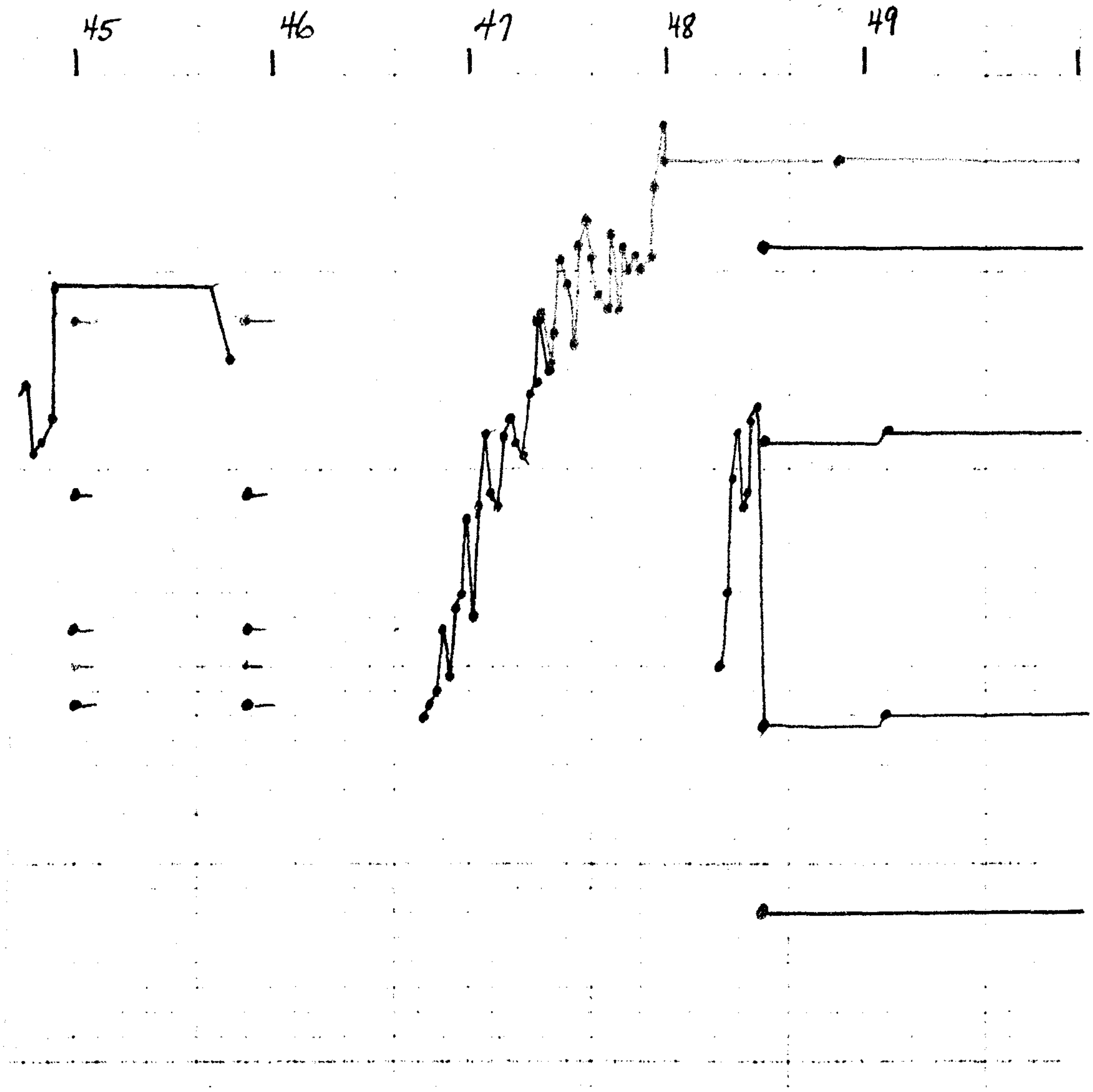
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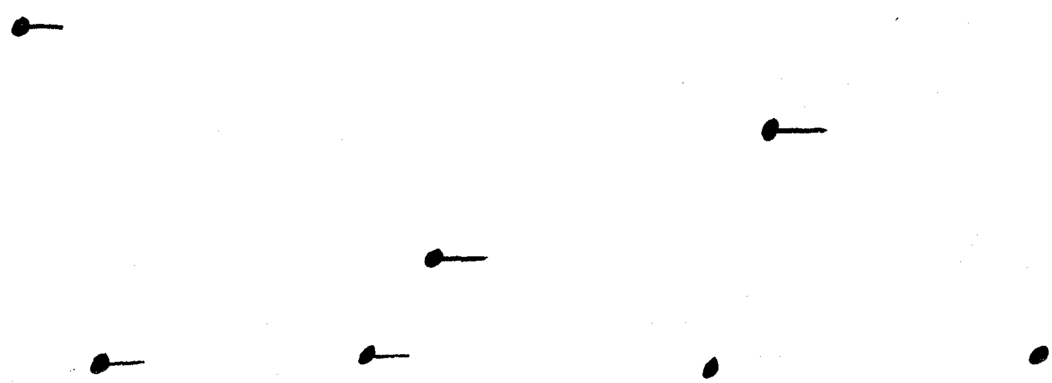
APPENDIX B

Improvisation Charts

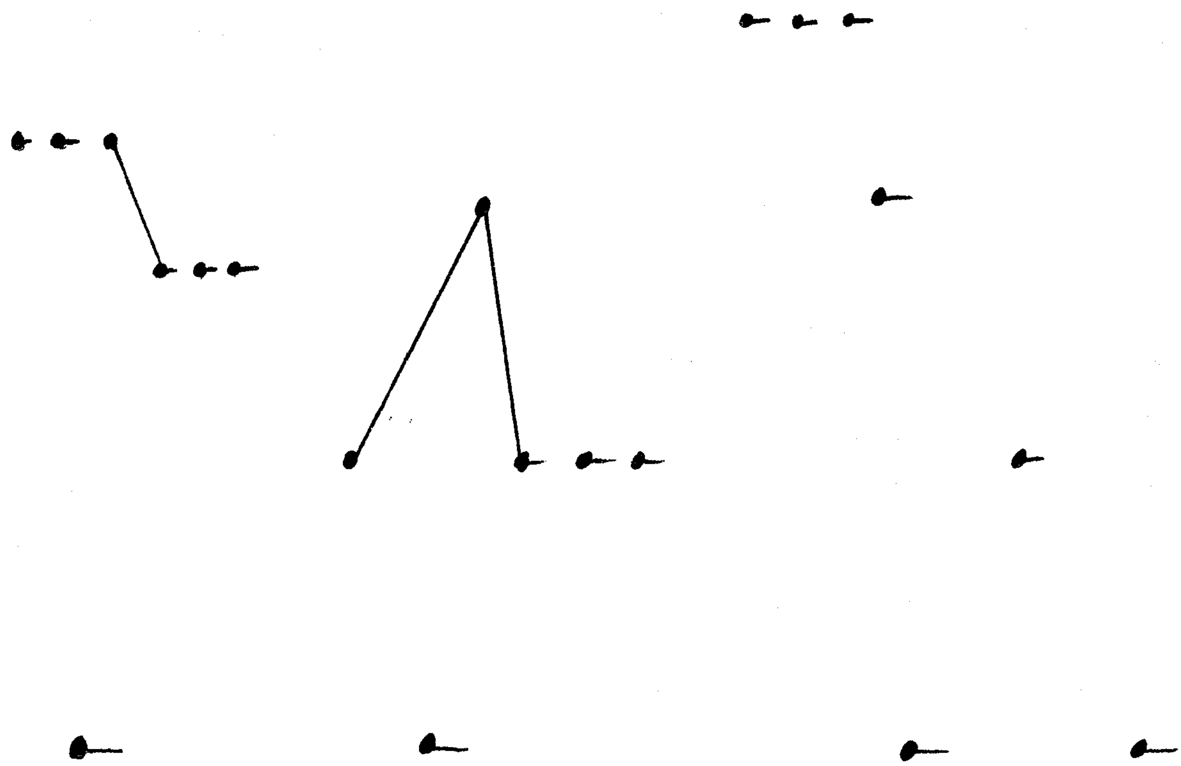
I.

1. 2. 3. 4.



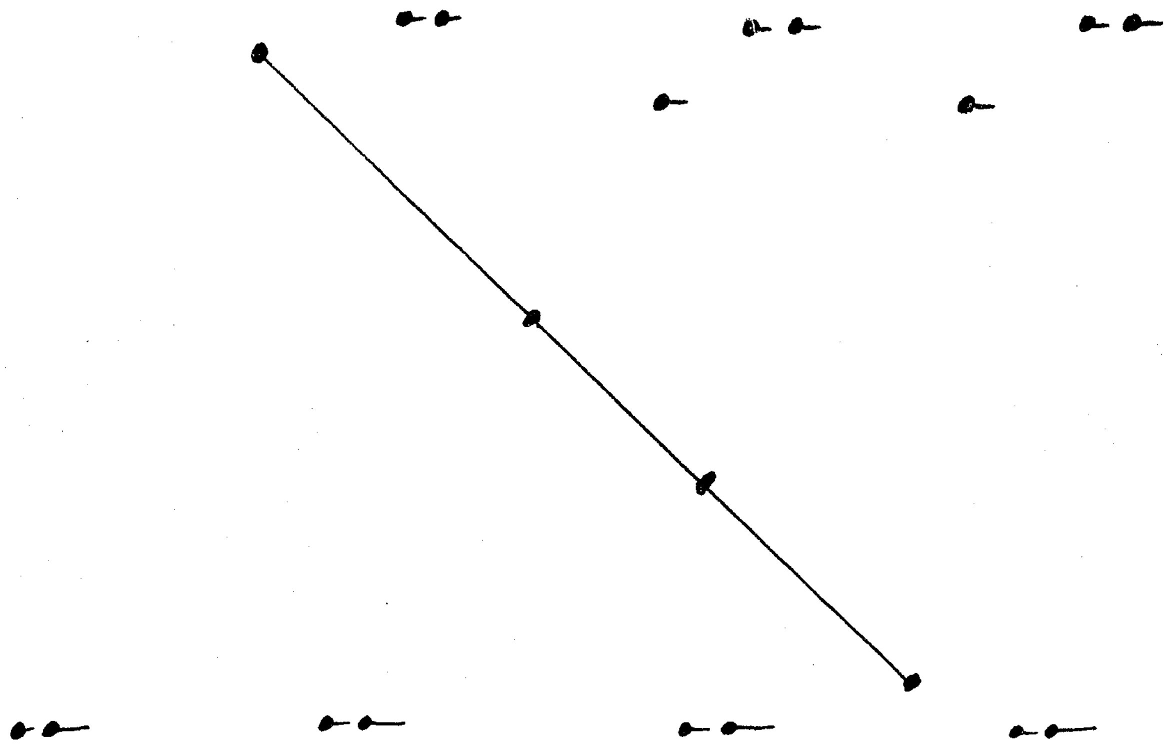
II.

1. 2. 3. 4.



III.

1. 2. 3. 4.



APPENDIX C

ADDITIONAL TABLES

Judges' Rankings of Compositions

Composition	Judge 1		Judge 2		Judge 3		
	Rank	Points	Rank	Points	Rank	Points	Total
A	3	6	5	4	4	5	15
B	6	3	3	5.5	5	4	12.5
C	8	1	3	5.5	8	1	7.5
D	7	2	6	3	6	3	8
E	1	8	1	7.5	1	8	23.5
F	2	7	7	1.5	3	6	14.5
G	4	5	7	1.5	7	2	8.5
H	5	4	1	7.5	2	7	18.5

APPENDIX C

ADDITIONAL TABLES

Answer Sheets

I. Score Reading

When the music stops, find the place in the score. Answer by putting the two numbers between which the music stops.

EXAMPLE 42 43

1. ____ ____
2. ____ ____
3. ____ ____
4. ____ ____

II. Retention

You will hear six short selections. If you think that you are hearing the same work you heard last week while following the score, answer YES; if it is a different work, answer NO.

1.
2.
3.
4.
5.
6.