Lehmann, Sharon F., "Wiggles and Volcanos": An Investigation of Children's Graphing Responses to Music Doctor of Philosophy (Music Education), May, 1993, 284 pp., 11 tables, 9 illustrations, bibliography, 66 titles.

The purpose of this study was to investigate changes in selected children's Graphing Response Patterns to elemental changes in compositions in theme and variation form. The research problems were (1) to determine points and degrees of elemental change in the compositional structure of the musical examples; (2) to determine number, degree, and nature of changes in subjects' graphing response pattern to aurally presented musical examples; (3) to determine percentages of agreement between changes in graphing response patterns and points of elemental change within the compositional structures; (4) to determine the relationship of changes in subjects' graphing response pattern to the quality and magnitude of elemental change within the compositional structure.

Twenty second- and fourth-grade children were individually videotaped as they listened to and graphed a series of aurally-presented musical examples. Each musical example was analysed according to such parameters as timbre, range/interval size, texture, tempo/meter, attack/rhythmic density, key/mode, dynamic level, and melodic presentation.

Lehmann, Sharon F., "Wiggles and Volcanos": An Investigation of Children's Graphing Responses to Music Doctor of Philosophy (Music Education), May, 1993, 284 pp., 11 tables, 9 illustrations, bibliography, 66 titles.

The purpose of this study was to investigate changes in selected children's Graphing Response Patterns to elemental changes in compositions in theme and variation form. The research problems were (1) to determine points and degrees of elemental change in the compositional structure of the musical examples; (2) to determine number, degree, and nature of changes in subjects' graphing response pattern to aurally presented musical examples; (3) to determine percentages of agreement between changes in graphing response patterns and points of elemental change within the compositional structures; (4) to determine the relationship of changes in subjects' graphing response pattern to the quality and magnitude of elemental change within the compositional structure.

Twenty second- and fourth-grade children were individually videotaped as they listened to and graphed a series of aurally-presented musical examples. Each musical example was analysed according to such parameters as timbre, range/interval size, texture, tempo/meter, attack/rhythmic density, key/mode, dynamic level, and melodic presentation.

Change in each parameter was scored using an interval scale reflecting change/no change and degree of change. Changes in graphing response pattern were determined by an interval scale which reflected the presence of change/no change and amount of change, using as analytical units speed, size, shape, type, and pause.

The following conclusions were made: findings showed an observable, quantifiable relationship between changes in children's graphing response patterns and elemental changes in music parameters. This relationship encompassed not only change/no change judgements but also magnitude of response. Overall, frequency and magnitude/degree of student response was proportionate to the frequency and magnitude of change in the music parameter/s. Results indicated the existence of high-ranking correlations between student response and certain parameters regardless of the degree-of-change/ points-of-change ratio. Findings showed that one degree of change in a single music parameter was not sufficient to cause an observable change in the attention of the young listener.

"WIGGLES AND VOLCANOS": AN INVESTIGATION OF CHILDREN'S GRAPHING RESPONSES TO MUSIC

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

Sharon Fincher Lehmann, B.M., M.A.
Denton, Texas

May, 1993

ACKNOWLEDGMENTS

The author wishes to express appreciation to a number of persons: Dr. Hildegard Froehlich, for her invaluable guidance, encouragement from the inception of preliminary research through the final preparation of the manuscript; Dr. William May, Dr. Edward Rainbow, and Dr. Peter Witt, for their helpful suggestions during preparation of the manuscript; Dr. William Brookshire, for his suggestions regarding statistical applications.

Special acknowledgement and appreciation is extended to Dr. Thomas Clark, for his insightful suggestions regarding the construction of scale models reflective of musical change.

In addition, the author wishes to express her gratitude to Ellen Boyd and E. Margo Dillard, for their support through the years; and, finally, to my daughter, Leska, and my parents, Louise Lanham Fincher and Melbourne E. Fincher, for their love, patience, and encouragement throughout the study and preparation of the manuscript.

S.F.L.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

CHAPTER I

INTRODUCTION, PURPOSE, AND PROBLEMS

Those concerned with the teaching of music to children recognize the importance of a learner's ability to attend to and appropriately identify musical characteristics of sound during the auditory presentation of musical sounds. As the perception and processing of musical information is the first step in music learning, it has a direct effect on the success of all subsequent learning and teaching in music (Fiske, 1984; Hofstetter, 1980; Zimmerman, 1986).

Recognizing the importance of knowledge about the musical dimensions to which young listeners may attend at any given time,numerous researchers have conducted investigations whose focus was the perception and/or the processing of musical information. In those studies, the researchers typically sought to control the musical dimensions to which a subject could respond. Most frequently, the control was achieved by presenting the subjects with short, melodic patterns in which pitch and/or rhythm constellations were manipulated. Few researchers have made use of intact musical compositions in which a large number of different musical elements are present simultaneously, interact with each other, and, therefore, allow the subject to respond to more musical dimensions than to pitch, rhythm, or any other researcher-imposed and artificially manipulated musical element.

Increasingly, researchers have expressed concern about the validity of design in perception studies where musical stimuli are manipulated as described above (Demorest, 1992; Heller & Campbell, 1982; Kauffman & Carlson, 1989). As a teacher who works with intact musical compositions in the classroom and who relies on children's reaction to such intact musical stimuli, I share that concern. This study was designed to explore the feasibility of presenting intact musical compositions to young learners and to observe their reactions to changes in the compositions in a learner-directed, unobtrusive way. The focus of this study lies in the methodological considerations inherent in finding out (a) to which musical dimensions children attended with as little guidance as possible; and (b) whether, and, if so, which qualitative and quantitative fluctuations in the musical dimensions within a musical composition coincided with a change in the focus of children's responses as indicated by self-made graphs. Specifically, the purpose of this study was to investigate changes in selected children's responses through graphing to elemental changes in different, aurally presented compositions in theme and variation form.

Background of Study

Studies on auditory perception have been conducted with subjects of virtually every age, gender, musical training, and socioeconomic background (Abel-Struth, 1981; Anastis & Saida, 1985; Bregman, 1978; Bregman & Dannenbring, 1973; Bregman & Rudnicky, 1975; Fiske, 1982; Fyke, 1982). Of particular concern to both the music educator and the music researcher, however, are those investigations which deal specifically with children's auditory perception. The importance of knowing more about children's acquisition of auditory skills is stressed throughout the literature (Andress, 1986; Bennett, 1984; Billingsley & Rotenberg, 1982; Boisen, 1979; Petzold, 1963, 1969). Also documented in a number of studies is the importance of the early acquisition of such skills, possibly by or before the age of 9 years (Andress, 1982; Greenberg, 1976; Heller & Campbell, 1981).

In discussing musical development during the middle childhood years (which approximate those of elementary education) and elementary music curriculum design, Zimmerman (1986) suggested that emphasis on aural discrimination should precede cognitive understanding. In addition, the elementary music curriculum should move from perception of to cognitive reflection on the structural elements of music. Results from a number of studies suggest that there is considerable growth from first to third grades for verbal and musical tasks, and that after third grade these abilities seem to level off or reach a plateau (Billingsley & Rotenberg, 1982; Heller, Campbell & Gibson, 1982; Petzold, 1963, 1969).

The body of studies dealing with auditory perception spans a period of almost four decades and focuses on both product-oriented and process-oriented investigations. Studies which are primarily product oriented address response as an indicator of learning outcome (e.g., Abel-Struth, 1981); Bennett, 1984; Groves, 1965; Jones, 1971; Perney, 1976; Petzold, 1963 and 1969; Rainbow, 1981; Webster & Zimmerman, 1981). Studies whose primary focus lies in the processing of information seek to identify how a learner assimilates and organizes knowledge at any given point. This means they address response as an indicator of the learning process itself (e.g., Billingsly & Rotenberg, 1982; Boisen, 1979; Bregman & Rudnicky, 1975; Deutsch, 1972; Hofstetter, 1980; Krumhansl, 1983; Sergeant, 1983; Sink, 1983; Wapnick, Bourassa & Sampson, 1982).

Characteristic of studies on the processes of perception is the tendency to approach the problem from an atomistic perspective with regard to the stimulus, the response, or to both stimulus and response (Billingsley &

Rotenberg, 1982; Boisen, 1979; Cohen, et al, (1989); Deutsch, 1972; Krumhansl, 1983; Petzold, 1963 and 1969; Sergeant, 1983; Sink, 1983; Wapnick, Bourassa, & Sampson, 1982). This atomistic or elemental approach assumes that the subject actually perceives the music in the same elemental parameters as those used by the analyst to describe the structure of the music. However, as both Serafine (1981) and Fiske (1984) have stated, that teachers and theorists analyze music by breaking it down into such elemental sub-units as rhythm, pitch, and timbre is not to say that this is the way in which the young and/or untrained listener perceives and processes auditory information. In examining the structure of the musical object and the processes of the human subject, Serafine (1981) questions the origin of such musical sub-units or elements. She contends that elemental sub-units are the result of a breaking-down process used for the purpose of scholarly analysis of and reflection on music rather than a preexisting "given" in music. Therefore, they cannot be assumed to be the elements of cognition.

Another characteristic of many studies on perception processing is the tendency of the researchers to employ electronically produced tones (sine tones/pure sound) or sequences as stimuli. These are frequently stated in millisecond durations (Buckton, 1982; Idson & Massaro, 1976; Jones, Kidd, & Wetzel, 1981) and lack such musical characteristics as melody, harmony, or rhythmic flexibility (Heise & Miller, 1951; Kauffman & Carlsen, 1989; Wapnick et al., 1982). This approach has evoked the criticism that the stimulus is non-musical: it does not possess those acoustic characteristics typical of music as we experience it (Heise & Miller, 1951; Kauffman & Carlsen, 1989). Heller and Campbell (1982) contend that "...the inclusion of a skilled performer who intends to convey a musically valid message is a minimum condition for the claim of relevance to music cognition." (p. 14).

Sloboda (1985) identified as the crucial issue in perception research the dilema of finding a valid way of assessing the moment-to-moment history of the listener's mental involvement with the music. He contends that most researchers avoid addressing this issue as they examine responses to segments so brief that the latter are not representative of the complexities experienced when listening to even the simplest short song. Wapnick et al. (1982) and Kauffman & Carlsen (1989) suggest that studies should be of a design which approaches, as closely as possible, realistic musical situations. Nevertheless, very few studies employ complete musical compositions as the stimulus, although Petzold (1969) reported that children were capable of responding to several elements of music presented in combination and/or in complete musical situations.

Sink (1983) suggests that an inherent component of the auditory perception process is the listener's attention to and extraction of certain information from the larger unit of musical structure. Furthermore, the specific musical dimension to which the listener attends may affect the overall perceptual organization of musical events. Sloboda (1989) contends that we must distinguish between effects which are due to the real features of normal listening and those which are effects of the experimental task. For example, success in a same-different discrimination task does not imply either that the listener would or could focus on that particular dimension in a normal, continuous listening situation.

One of the difficulties in conducting perception research with young learners is the response mode by which to ascertain what they hear. Asking the listener to describe, in words, what was heard can be informative when used with older students and adults. Sloboda (1989) suggests, however, that the material to be recalled must be very short or we risk underestimating the amount of mental activity which has occurred. Verbal response mode is not usually satisfactory for use with children as they frequently lack the vocabulary with which to describe most musical events (Abel-Struth, 1981; Andress, 1986; Crowther & Durkin, 1982; McMahon, 1982; Webster & Schlentrich, 1982).

Zimmerman (1986) cited several studies which dealt with the effect of verbal proficiency on music concept identification. She reported general agreement among researchers that perception and discrimination preceded adequate vocabulary and labels. Research difficulties may be encountered as a result of the discrepancy between (a) the ability to perceive and discriminate and, (b) the ability to describe verbally what was perceived. In an effort to minimize or eliminate this effect, some researchers have devised and employed non-verbal response modes, often graphic or performance based (Abel-Struth, 1981; Bamberger, 1975; Bennett, 1984; May, 1985; Rainbow, 1981; Ramsey, 1983). In these and similar studies, the auditory perceptions of children seem to be more accurately reflected than has been the case with verbal response modes. As will be shown in the related literature, however, these graphic response strategies were developed and utilized in conjunction with musical stimuli which usually were very short and/or researcher-manipulated and which required considerable subject training/instruction.

Purpose and Problems of the Study

The purpose of this study was to investigate changes in selected children's Graphing Response Patterns to elemental changes in compositions in theme and variation form. The research problems of the study were

1. To determine points and degrees of elemental change in the compositional structure of the musical examples.

2. To determine number, degree, and nature of changes in subjects' graphing response pattern to aurally presented musical examples.

3. To determine percentages of agreement between changes in graphing response patterns and points of elemental change within the compositional structures.

4. To determine the relationship of changes in subjects' graphing response pattern to the quality and magnitude of elemental change within the compositional structure.

A major component of this study was the development of a methodology that would provide each subject with the opportunity to respond to and interact with intact musical compositions in an unobtrusive, measurement procedure. The methodology grew out of attempts to develop a way of observing and tracking changes in children's auditory attention as they listened to intact musical compositions in the context of a normal classroom listening situation.

Definition of Terms

The following terms were defined for their usage within this study and were separated into two groups: those used in the music analysis, and those which represent behavior observations.

Music Analysis Terminology:

Attack/Rhythmic Density (Ad)-the term used to describe the number of attacks occurring anywhere within the vertical texture of a specified measure of music.

Dynamic Level (Dl)-the term used to describe the varying degrees of volume (loudness or softness) in music.

Elemental Change-change occurring within an element/ parameter (i.e., timbre, texture, attack/rhythmic density, etc.) of the musical stimulus.

Interval Size (Is)-description of a vertical interval by its semitone count, i.e., an octave is 12 semitones, a perfect fifth is 7 semitones.

Key/mode (Km)-tonal center/modality of a musical section or composition.

Melodic Presentation (Mp)-term used to describe the compositional structures and strategies at work within a piece of music, i.e., return of a melodic motive, a change in the registral presentation of a motive, canonic presentation, etc.

Texture (Tx)-term used to describe the thickness or thinness of a musical composition by counting, vertically, the number of active voices or lines at a given point.

Tempo/meter (Tm)-term used to describe the speed and/or the pattern of metric grouping prevalent in a musical composition.

Timbre (Tb)–term used to describe the quality of a tone as it is produced on specific instruments, i.e., the difference between the sound of a specific pitch played on a violin and the same pitch played on a flute.

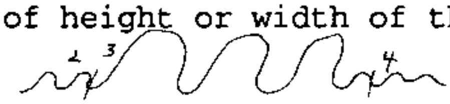
Behavior Observation Terms:

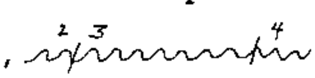
Graphing Degree of Change (GDOC)–the amount/quantity of change (according to GDOC scales, Appendix B) occurring within one or more parameters (i.e., size, speed, type, etc.) of the subject's graphing response pattern (GRP).

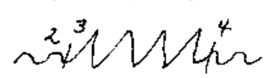
Graphing Response Pattern (GRP)–the drawn, often repetative figure created as the subject responds graphically to the musical stimulus.

GRP Pause (P)–temporary cessation of movement by the hand/pen during the graphing process.

GRP Shape (H)–change in the shape of the subject's graphing pattern, i.e., 

GRP Size (Z)–change of height or width of the subject's graphing pattern, i.e., 

GRP Speed (D)–change in the number of pattern units per measure in the subject's graphing pattern, i.e., 

GRP Type (Y)–change in the kind of pattern, as from a smooth, rounded to a sharp-pointed shape, i.e., 

Musical Degree of Change (MDOC)–amount/quantity of change (according to MDOC scales, Appendix C) occurring within one or more parameters/elements of the musical stimulus.

Delimitations

1. This study included only subjects in grades two and four from public elementary schools in the Dallas-Fort Worth Metroplex area.

2. The compositions used in this study were limited to: Ives' "Variations on 'America'" (theme, variation I), Mozart's "Twelve Variations on 'Ah, vous dirai-je Maman" (theme, variation VIII), Dohnanyi's "Variations on a Nursery Song" (variation I), and Copland's variations on "Simple Gifts" from Appalachian Spring. The reasons for using only compositions in theme and variation form are explained in Chapter III.

3. The student responses were to the first-time hearing of the musical compositions/stimuli.

CHAPTER II

RELATED LITERATURE

Research relevant to this investigation includes two groups of studies: those whose primary focus is (1) on the perception and processing of auditory information (and may be called process oriented), and (2) those whose primary focus appears to be product oriented, with particular emphasis upon various stimulus and/or response strategies.

Perception and Processing: Process-oriented Studies

The auditory perception and processing of musical information is the first step in, and therefore has a direct effect on, music learning (Fiske, 1984; Hofstetter, 1980; Zimmerman, 1986). Beginning in the late 1960s, a number of investigations were conducted which addressed the variables believed to be responsible for the inclusion of information into, or the exclusion of information from, a particular auditory stream/streams (Anstis & Saida, 1985; Bregman, 1978; Bregman & Campbell, 1971; Bregman & Dannenbring, 1973; Bregman & Rudnicky, 1975; Handel, 1973; Handel & Yoder, 1975; Heise & Miller, 1951; Idson & Massaro, 1976; Jones, Kidd, & Wetzel, 1981; Sturges & Martin, 1974). This body of research is of interest here primarily as a means of insight into the question of the quantity and/or quality of change which must be present in order for the listener to perceive change and/or difference. Commonalities which characterize these studies are (a) the use of adult subjects, (b) the use of pure tones, sine tones, or white noise as stimulus, and (c) millisecond stimulus durations.

Other researchers have focussed on the processing of auditory information by investigating the possibility that different listening tasks may involve a unique set of processing stages (Fiske, 1984; Sloboda, 1985; Wuthrich and Tunks, 1989).

Auditory Streaming

The auditory phenomenon of perceptual pattern organization has been referred to as a fluctuating, figure-to-ground relationship which was labeled "trill threshold" by Heise and Miller (1951) and "auditory stream segregation" by Bregman and Campbell (1971). It has been compared to the Gestalt psychologists' visual concept of "line of best fit", "good form", and "figure-ground segregation": the tendency for like or similar elements to be perceived as belonging together.

Heise and Miller (1951), in discussing the possible correspondence between visual and auditory perceptual organization, stated:

> The relations between the shape of the auditory pattern and the threshold for the integration of the variable tone into the pattern are approximately what one would

> expect from corresponding visual figures, if frequency and time coordinates of the auditory figures are replaced by vertical and horizontal spatial coordinates, respectively. (p 76)

The authors continued the comparison of auditory to visual perception organization by stating that the results of their study with auditory stimuli were shown to be a function of two factors:

> 1. Thresholds for inclusion of a tone in a pattern are determined in part by the type of <u>pattern</u> [shape].
>
> 2. The <u>steepness</u>, or magnitude of the ratios of frequencies of successive tones of the sequence, affects the threshold. (p77)

Handel (1973) stated that the segregation of the perceptual world into structured subunits is the critical step in all perceptual apprehension. Investigating auditory perception of temporal patterns (using as dichotomous elements a high tone and a low tone) and the effects of temporal segregation, Handel stated:

> 1. ...temporal segmentation has profound effects on the identification of temporal patterns.
>
> 2. Patterns compatibly segmented [8-element patterns segmented by 2 or 8, i.e., xxooxxoo; 9-element patterns segmented by 3 or 9, i.e., xxxoooxxx] were identified as easily as uniform patterns [patterns without pauses].
>
> 3. Patterns incompatibly segmented [8-element patterns seqmented by 3 or 9; 9-element items segmented by 2 or 8] were not identified as well. (p. 53)

Handel (1973) concluded that the effect of temporal organization was pervasive and that it appeared to be very difficult for the listener not to allow the temporal spacing to dominate organization.

Warren, Obusek, Farmer, and Warren (1969) conducted a study which involved a repeated sequence of three successive sounds (1000-hz tone, broad-band noise, and 600-hz tone). The duration of each sound was 200 msec, which is considerably longer than the 70 to 80 msec which is normal for the average speech sound in discourse or the 50 msec required for perceiving a sequence of successive notes in music. Although listeners could perceive each of the separate sounds clearly, they were unable to tell the order in which they occurred. Even with continued listening, it was impossible to tell whether the low-pitch tone followed the noise or the high-pitch tone.

Warren et al.(1969) cited the fact that previous studies on perception of the order of three or more different sounds had involved only speech or music. The researchers conducted a series of investigations which involved 150 students (5 groups of 30 each) listening to a tape loop of a four-sound repeated pattern: a high tone (1000 hz), a hiss (2000-hz octave band of noise), a low tone (796-hz), and a buzz (40-hz square wave). As was the case in the first study, most subjects perceived each of the sounds but were unable to state their order of occurrence above the level of chance. A subsequent investigation was conducted in order to verify the assumption that the sequence perception of speech sounds could be accomplished easily under the conditions used. Subjects listened to a series of four spoken digits (one, three, eight, and two), with each statement of the four taking the same 800 msec as the previous series. All subjects correctly identified all of the digits and their order after only one or two repetitions. The authors concluded that the duration of each item would have to be increased from 200 msec to 700 msec before even half the inexperienced subjects could verbally identify the correct order.

Bregman and Campbell (1971), citing Warren et al., stated that perhaps the difficulty subjects had encountered in their attempt to identify a four-sound repeated pattern might be related to the phenomenon of auditory stream segregation. The authors described the phenomenon as a condition in which a single, rapid sequence of tones seems to break up perceptually into two or more parallel sequences, or streams. This creates an "auditory illusion" of two or more different instruments speaking, each restricted to a certain class of sounds or range of frequencies, each playing different but interwoven parts. The authors referred to this phenomenon as primary auditory stream formation.

> A stream may be defined as a sequence of auditory events whose elements are related perceptually to one another, the stream being segregated perceptually from other co-occurring auditory events. (Bregman and Campbell, 1971, p. 244)

Bregman and Campbell suggested that musicians may be familiar with stream formation under the names of implied polyphony or compound melodic line, where a single instrument, by alternating high and low tones, gives the effect of two instruments playing. For example, there is a point at which a difference in frequency proximity (distance in frequency between two pitches) or the rate of alteration (distance in time between two events) becomes great enough to cause a perceptual regrouping: what had been perceived as one pitch with vibrato (single stream) subsequently would be perceived as two pitches trilling (split stream). The researchers reported that the higher the presentation rate, the less the frequency difference required for stream splitting.

Using as stimulus six different sine-wave tones, Bregman and Campbell instructed subjects to listen to each tape for as long as they wished and then to write down the order of the six tones. The sine-wave tones used were three high (HHH) tones (2,500, 2000, and 1600 Hz.), and three low (LLL) tones (550, 430, and 350 Hz.) repeated on a tape loop at 300-msec duration per tone. The different ordering of pitches within the triplet subgroups produced only two within-stream triplet combinations: A-B-C (as HHH), D-E-F (as LLL) and eighteen across-stream triplet combinations (i.e. A-B-F [HHL], C-A-D [LLH]). The difference between the within- and across-stream scores for each condition was statistically significant (p<.001, using Wilcoxon's test).

Several observations were made by the researchers: first, there was a consistent superiority of within-stream judgments regardless of how stimuli from the two classes were distributed in the loop. Secondly, every subject reported the items in a stream-by-stream order. For example, the listener first wrote down the items of one stream, high (H) or low (L), and then filled in the items of the other stream. Furthermore, 59% of all subjects actually claimed that the items were in the orders HHHLLL (or LLLHHH) on the tape, although these orders never occurred on the tapes and would be expected from random guessing only 30% of the time. "Such a segregation of the items suggests a complete inability to relate items in the two streams" (p. 246).

In a second study, the same researchers had each subject listen to two tape loops. The first was a standard which contained three tones and three silent gaps. The comparison loop contained six tones (three high, three low), three of which were tones not used in the standard. The subject judged whether the three tones of the standard tape occurred in the same order and temporal spacing as they did on the comparison tape. The tone frequencies were identical to those in the first experiment, and tone and silence durations were 100 msec. Four conditions were constructed from the two variables: (a) within-stream triplet, (b) across-stream triplet, (c) balanced spacing on the tape loop (i.e., tone, silence, tone, silence, tone, silence), and (d) unbalanced spacing (i.e., tone, tone, silence, tone, silence, silence). The resulting conditions were within-balanced, within-unbalanced, and across-balanced. Each subject was asked to register judgement on a continuous 100-mm. rating scale marked as "same" and "different" at either end (indicating the subject's complete confidence in his/her own judgement), the center of the scale indicating lack of confidence.

At the rates used, no ability to relate material from different streams was demonstrated. Secondly, the order of tones in a sequence had no significant effect on performance. Finally, the comparison of across-triplet conditions showed that some subjects were able to detect changes in the temporal pattern of two tones if the tones were in the same subjective stream. This capability, together with the relatively high performance on the within-triplet comparisons, showed that the speeds involved were not too high for accurate order judgments if the comparison were restricted to elements of a single stream. Therefore, it was the shifting of attention from stream to stream, rather than the comparison process itself, which constituted the time-limited process.

Referring to the results reported by Warren et al. (1969), Bregman and Campbell suggested that the three unrelated sounds (high tone, low tone, hiss), when repeated, constituted three seperate streams; therefore, listeners could not switch their attention from stream to stream fast enough to make temporal order judgments. The researchers suggested that the sequence of speech sounds (the four spoken digits) constituted a unitary auditory stream and stated:

> The vocal sound stream may not split into substreams because splitting depends not only on similarities in the component sounds but also on the nature of the transition from sound to sound. The transitions in speech are not instantaneous. (pp.248-249)

Bregman and Dannenbring (1973) conducted experiments to assess the role of acoustic continuity in PASS (Primary Auditory Stream Segregation). From these experiments, the researchers offered results which supported earlier findings regarding the nature of transition from one sound to another. The authors' hypothesis was that stream segregation would be reduced when there was a frequency glide joining successive tones in a sequence even when the sequence consisted of alternating high and low tones.

In the first study, subjects were asked to make order judgments of same or different for two sequences. In the second study, they were asked to judge whether a sequence of two high and two low tones did or did not split into substreams. Three types of transitions were used. The first type contained no connecting frequencies ("discrete transition"). The second type of transition consisted of frequencies which glided part of the way between tones ("semiramped"). The third transition type consisted of tones connected by a gliding, continuous frequency change ("ramped").

Results showed that overall performance in both the ramped and semiramped conditions was superior to that of the discrete condition. Also, performance improved in each condition as the length of the tones increased. Analysis of variance revealed a significant difference between ramping conditions ($p<.001$) and between steady-state times ($p<.025$). Bregman and Dannenbring made the following observations: First, the correct judgments of order in a sequence depended upon the stream's not splitting. Secondly, splitting increased when subsets of sounds occupied different frequency regions, when the tone rate was higher, and when the transitions in frequency were discrete. The researchers further observed that the process that encoded a sequence of auditory events into organized streams seemed to have several describable properties:

> First, it incorporates an input into a stream if it closely resembles inputs previously assigned to the stream (in terms of frequency, loudness, overtone structure, duration, etc.). Secondly, it responds to continuities and discontinuities in a property preferring to assign inputs to the same stream if there are no <u>sudden</u> changes....Thirdly, the coding mechanism

> is describable as a "predictive tracking device".(Bregman & Campbell, 1973, p. 312)

The authors described the encoding mechanism as a "tracking device" because it modified criteria for inclusion of an input into a stream as a function of very recent properties of the stream. The coding mechanism was described as "predictive" because if a change in a signal was preceded by a "pointer" in the direction of the change (i.e., a glide or ramp), the coding process enabled the new input to be more easily incorporated into the stream.

As investigations into the properties and organization of streams continued, the concept of the simultaneous formation of more than one stream was explored: the attended-to stream (target) and the non-attended-to stream. The non-attended-to stream consists of input which the coding mechanism has already excluded from the target stream: it is characteristically more similar to auditory input which is not included into the target stream. As a result, the non-attended-to stream tends to "capture" that information which does not belong to the target stream and, therefore, has been termed "captor stream" by some researchers.

Captor Streams. Bregman and Rudnicky (1975) investigated the possibility that two auditory streams were being organized at the same time, although a listener attended to only one stream at a time. Instead of employing a task in which the unattended stream would interfere with the attended stream, the researchers proposed to have the structure of the to-be-ignored material actually enable the subject to more easily ignore it. This would be accomplished by enabling the distracting/unattended elements to be absorbed into a stream apart and, therefore, easily kept separate from the target stream. Each listener's task was to judge the order of a rapidly presented pair of tones. Judging the order of an isolated pair (i.e., A-B) was usually accomplished with a high degree of success even when the tones were sounded at very high presentation rates. This was believed to be the effect, in part, of noting the change in frequency between the onset and termination of the tone burst. If, however, distractor tones (X) of the same frequency (1460 Hz) were added (i.e., X-A-B-X), then cues derived from the onset of A and the termination of B were no longer helpful. Judgment of frequency order would become much more difficult because the two distractor tones would be perceptually grouped with the target tones.

Bregman and Campbell (1975) were interested in the question of whether a second or "captor" stream (C) could be added which, by reason of frequency proximity, would capture the two distractor tones (X), thus leaving A-B in a stream by itself, again enabling an easy order judgment. The four conditions were: (a) no captor stream, (b) captor stream at 590 Hz, (c) captor stream at 1,030 Hz, and (d) captor stream at 1,460 Hz, with distractor tones constant at 1,460 Hz and A-B at 2,200 Hz and 2,400 Hz, respectively. The frequency of the distractor tone (X) was chosen as "...one which would group with A and B if no other tones were present but which was far enough from the A-B pair that it could be absorbed into other streams" (Bregman & Campbell, 1975, p. 264). The listener heard a warning click followed by A-B played in isolation as a standard, then a sequence of tones (C-C-C-X-A-B-X-C-C or C-C-C-X-B-A-X-C-C). Subjects were to determine whether the AB pairs were in the same or different order and to mark their decision on a 7-point scale which ranged from a "not certain" to a "very certain". Using analysis of variance for repeated measures design, a significant effect of captor condition was found at $p < .001$. Comparison of the means of the different captor conditions was done using the Newman-Keuls procedure, and all differences except the one between the no-captor and 590-Hz conditions reached significance at the .01 level. Bregman and Rudnicky (1975) observed that the task was most difficult when there was no captor stream or when the captor stream was removed in frequency from the XABX pattern. The task was easiest when the captors were at the same frequency as the distractors; it was of intermediate difficulty when the captors were near the X-A-B-X tone pattern.

In discussing their results, Bregman and Rudnicky (1975) hypothesized that the rejection process and the acceptance process were identical. By following sequential patterns of frequencies, these processes structured the auditory input into concurrent streams. After concurrent streams had been formed, other processes, termed attention, could then either select or reject auditory input. Whenever a sequence of tones formed a unified perceptual stream, the task of selecting for pattern recognition purposes was then easy. It became an even easier task to reject a stream, as a whole, without its elements intruding on another concurrent stream which was being accepted. The authors suggested:

> ...this latter effect arises from a "mutual exclusion" property of streams: When a sound is incorporated into one stream, it tends to be unavailable to a second stream....Auditory stream segregation is the nervous system's attempt to decompose a complex input into the simple, separate sources which give rise to it....(p. 267)

Anstis and Saida (1985) referred to the above phenomenon of auditory stream segregation as "temporal coherence" (one pitch repeatedly moving up and down, or vibrato), and "fission" or "segregation" (trilling, or split stream). They confirmed and extended the main findings of earlier studies (Bregman, 1978; Bregman and Campbell, 1971; Bregman and Dannenbring, 1973; Bregman and Rudnicky, 1975; Miller and Heise, 1950) and formed the following conclusions:

> ...coherence, which links together tones that are close in time despite their different frequencies, is in competition with segregation, which separates tones of

> widely different frequencies and leaves the way open for links between tones that are close in frequency despite their temporal gaps. Thus coherence is promoted by temporal proximity, segregation by proximity in audio frequency. (p. 270)

Handel (1973) stated that segregation, the basic process of all perceptual organization, varies with the nature of the stimuli, and that alternate modes of segregation exists for one stimulus. Certain fluctuations within the stimulus, such as change in rate (speed) of presentation or the proximity of frequency (pitch), cause change in the listener's perceptual focus or attention which is termed figure-ground reversal.

Figure-ground Reversal. Although rhythm may be the figure (primary focus of attention) at a given point, some other dimension (or combination of dimensions), such as pitch, might capture the attention of the listener, in which case pitch would become the figure and rhythm the ground. The result of this focal change is, thus, a figure-ground reversal. Sink (1983) contended that the information which is attended to (figure) and the non-attended-to dimensions (ground) comprise a figure-to-ground relationship which fluctuates, depending upon the effects of alterations to the variables in the ground. For example, if rhythmic information is the figure and all other dimensions become the ground, then alteration to any of the ground variables (i.e., pitch) affects the listener's rhythmic perception, although to what extent is unclear.

To examine effects of rhythmic and pitch alterations on rhythmic perception, Sink (1983) administered the Rhythm Dissimilarities Evaluation to fifty-four undergraduate and graduate music students. Subjects used magnitude estimations (assigning numbers to represent amounts of difference) to indicate perception of rhythmic dissimilarities. Analysis of variance showed a significant effect for rhythmic alterations($p<.001$), confirming that rhythmic alterations did have an effect upon the perception of rhythmic dissimilarities. Several of the pitch altered but not rhythmically altered treatments were perceived as being significantly more rhythmically different than the monotonic treatment of no rhythmic alteration. "Apparently, melodic treatments altered subjects' perception of rhythmic dissimilarity" (Sink, 1983, p.107). She suggested that a possible explanation was figure-ground flux/reversal, noting that "...the simultaneous presentation of melody and rhythm may result in reduced attention to the absolute rhythmic structure in music" (Sink, 1983, p.111).

Investigating the effect of melodic context on students' aural perception of rhythm, Boisen (1979) administered a forty-two item test to 2,207 public school students. The test contained 14 rhythmic units: 7 were complete, 7 were incomplete. The subject first heard the rhythmic pattern on one pitch, then as part of a matching melody (whose completeness or incompleteness matched that of the rhythm), and finally, as part of a non-matching melody. Analysis of variance indicated a significant difference between main effects ($p < .001$), differences meeting the standard for practical significance between the mean subtests 1 and 3, and 2 and 3. In discussing the results, the researcher pointed out that "...there was no difference in accuracy between single-pitch melodies and matching melodies. However, there was less accuracy in nonmatching melodies than in either single-pitch or matching melodies" (p. 171).

Processing Stages

In addition to studies focusing on the initial perception of auditory input, researchers have investigated the possibility that different listening tasks involve different stages and/or sequences of processing (Fiske, 1984; Sloboda, 1985; Wuthrich and Tunks, 1989). Investigations into the possible existence of a unique set of processing stages has led to the application of stage-reduction theory to music perception and cognition research. One of the stage-reduction techniques frequently used by cognitive psychologists is chronometric analysis: independently functioning processing stages are isolated based upon the length of time required for the processing to occur.

Fiske (1984) used chronometric methodology to investigate processing stages. He sought to determine whether (during the music decision-making process concerned with the detection of pattern discrepancies) tonal and rhythmic information were examined simultaneously or in sequence. Subjects were twenty-four third- and fourth-year university music students, each of whom was randomly assigned to one of two groups. Prior to the presentation of each paired item, Group A subjects were informed as to the element in which the discrepancy would occur. Group B subjects were told only that either a tonal or rhythmic discrepancy would occur and to respond when they detected either of the two.

A ten-note, diatonic melody was constructed with a melodic range of one octave and a rhythmic pattern comprised of quarter and eighth notes. Ten comparison patterns were also constructed which were identical to the original, except that five patterns contained one tonal discrepancy each and the other five contained one rhythmic discrepancy each. Each of the ten patterns was paired with the original, creating ten pairs of examples containing one discrepancy, either tonal or rhythmic, per pair. All ten pairs were performed on a synthesizer and recorded on track A of the tape, while a signal at the beginning of each discrepancy was recorded on track B. Although not heard by the subjects, the track B signal would trigger a response timer. Subjects were instructed to indicate their detection of a discrepancy by pressing a key which would signal the response timer to stop. The time between the beginning of the discrepancy and the subject's signaled recognition of it was recorded and displayed on the screen of a response timer.

Results of the study showed that the difference in response time between Group A (directed) and Group B (non-directed) was not statistically significant, although the directed students did detect discrepancies faster. Response times for rhythmic discrepancy detections were significantly faster than were those for tonal/pitch discrepancies(p<01). A greater number of subjects detected rhythmic discrepancies faster than they did tonal discrepancies (p<.01), a result which confirmed the findings of an earlier study (Fiske, 1982).

In discussing the findings of the 1984 study, Fiske suggested that the results of his reseach were best represented by a parallel self-terminating model. He stated that "...subjects attended to tonal [pitch] and rhythmic information simultaneously and ...a response to a discrepancy created by either of the two elements was initiated as soon as the discrepancy was detected" (Fiske, 1984, p.22). He also contended, based upon response time results in the study, that if sequential processing of any form were involved, it would have to be rhythm first, tonal second.

With regard to the argument that the relative prominence of one element over another element could bias the order of their process (forced bias), Fiske also noted that all music response time studies conducted so far have determined the rhythmic element as having been processed faster than the tonal element. He suggested that future studies explore (a) whether independent, parallel processing systems might permit the examination of some musical elements more rapidly than others, (b) what effect, if any, instruction has upon this process, (c) whether inexperienced listeners employ different and, perhaps, less efficient listening strategies than do musicians, and (d) whether listening strategies are acquired or “prewired”. The author concluded by stating:

> ...although listening is the foundation of any musical endeavor, to assume that the partitioning of music into its notationally separate components results in either enhanced perception or greater musical understanding may not adequately represent the strategies that are actually employed in music listening or their perceptual products. (p. 24)

Wuthrich and Tunks (1989), investigating the effect of presentation time asynchronies on the identification of intervals, used as subjects both Freshman and Graduate music majors. The presentation of the second tone of each interval was delayed by 0, 10, 20, 70, 500, or 520 milliseconds. In the two-part test, subjects identified both the interval type (i.e., major second, octave, etc.) and whether the interval was presented as melodic or harmonic. Results showed a significant interaction between time delay and subject group ($p < .0105$), and graduate students identified the music intervals significantly more accurately than did freshmen ($p < .0002$). The correct identifications of intervals were significantly different across the six time delay conditions ($p < .0001$). The accuracy of interval identification increased with an increase in time delay between tones for both subject groups, and graduate students scored higher on the interval identification than did freshman. The greatest change in interval identification scores occurred between the 70-msec and the 500-msec delay conditions.

In discussing their results, Wuthrich and Tunks pointed out that the difference between successive (melodic) and simultaneous (harmonic) intervals in this study was evident: (a) confusions of intervals varied with the time delay condition, (b) successive intervals were more likely to be confused with adjacent intervals, while (c) simultaneous intervals were confused with nonadjacent intervals. The latter suggested that the two conditions were based upon different experiences. The findings also suggested that simultaneous tones had to be distinguished before the interval width judgement could be made.

In discussing attentional phenomena, Sloboda (1985) proposed that processes may take place simultaneously, provided they do not use the same kinds of cognitive processing. He cited as an example the study by Allport, Antonis, and Reynolds (1972) in which pianists were asked to sight-read piano music while listening to a prose message played over headphones. Sloboda noted that performance of both tasks together was as good as when each task was performed seperately: Each task required a different type of processing. In experiments where both tasks required the same type of processing, (e.g., Dowling, 1973, discriminating between two, interleaved melodies), subjects were able to monitor only one stream at a time.

Critique and Summary of Process-oriented Studies

Investigations discussed above have been criticized, particularly by music researchers, on the grounds that the listening conditions employed and the frequent use of an atomistic, elemental approach do not approximate those of a true "music listening experience". Although this argument has merit, it also must be recognized that, because of their specificity of approach, these investigations often generate very precise results regarding the way in which sound is processed in a specific listening condition. In discussing the merits of such studies, Wapnick, Bourassa, and Sampson contend that "...such studies are valuable insofar as they provide information about certain types of sensory and perceptual processes and characteristics." (p. 35). It remains to be determined whether the results characterized by these studies can be generalized to more traditional music listening situations. Conversely, however, this collective body of research seems to describe some of the specific conditions and properties inherent in the perception and processing of certain auditory information. These may be summarized as follows:

1. Auditory streaming, the auditory phenomenon of perceptual pattern organization, is characterized by variables believed to be responsible for the inclusion of information into (or the exclusion of information from) a particular stream.

2. Two variables believed to be directly responsible for information's inclusion in or exclusion from a stream are similarity and proximity (both temporal and frequency).

3. Auditory streams may be the auditory correspondant to the Gestalt psychologists' visual concept of "line of best fit", "good form", and "figure-ground segregation".

4. Although only one stream at a time can be "attended to", more than one stream may be formed simultaneously, thereby creating concurrent streams.

5. The mutual exclusion property of streams tends to make the information already incorporated into one stream unavailable to another stream.

6. Certain changes in the stimulus may cause a shift in the listener's attention, thereby creating a figure-ground reversal: the attended-to stream, or figure, now becomes the

ground, while the previously non-attended-to material, now the focus of the listener's attention, becomes the figure.

7. Results of studies investigating processing stages indicated the possibility that more than one element (i.e., rhythm and pitch) may be processed simultaneously. However, discrepancies within the rhythmic element consistently were detected more quickly then were pitch/frequency discrepancies. Therefore, if simultaneous/parallel processing occurrs, then certain elements may be processed more quickly then others. If, however, processing occurrs sequentially, then rhythmic information is probably processed before pitch/frequency information.

8. Certain cognitive processes (i.e., sightreading piano music and listening to a verbal message), may occurr simultaneously provided they do not require the same type of cognitive processing. (i.e., attempting to monitor two melodies simultaneously). Perhaps the duplicity of the processing types involved in subject attention and response in the present study may explain why subjects were able, simultaneously, to listen actively and to respond graphically.

Stimulus and Response Strategies: Product-oriented Studies

The studies presented under this heading are representative of research which has had far-reaching effects on and implications for succeeding investigations, particularly among music researchers. The investigations are relevant to this study, not only because of the research results themselves, but also because of their applicability to one or more of the following methodological strategies: the use of complex, intact musical stimulus, the use of graphic or performance-based response modes, and/or the use of young listeners as subjects. The studies are product-oriented because of their primary focus on the end product rather than on the process of how the product comes about: response is viewed, primarily, as an indicator of learning outcome. All studies will be discussed under the following categories: Ecological Validity of the Stimulus, Performance-based Response Mode, and Response Assessment by Non-verbal, Graphic Strategies.

Ecological Validity of the Stimulus

Ecological validity is a term generally used to indicate the employment of a musical stimulus and testing condition which approaches, as nearly as possible, a natural, normal, continuous listening condition and intact music examples. An ecologically valid listening condition stands in contrast to the experimental listening conditions frequently employed in auditory perception research.

Such musical activities as performing (sound production) and composing (creation of a score) result in some comunicable, musical record. Listening, however, is often a mental activity which is not physically observable either during or after its occurance (Sloboda, 1985). Listener recall is useful only if the amount of material to be recalled is small. Otherwise, "...we are in danger of seriously underestimating the amount of musically related mental activity that has taken place" (p.51). The inability of the listener to recall and verbalize the details of a long piece does not mean that the listener is not fully engaged during its audition. Rather, as Sloboda states:

> The principal problem facing the student of listening processes is to find a valid way of tapping the moment-to-moment history of mental involvement with the music. As we examine research in the field of perception, attention, and memory in music we shall find thatthis problem has not really been solved satisfactorilyMost research evades this crucial issue by examining responses to very brief segments of music, made up of between two and twenty notes. Such segments hardly present listeners with the range of patterns and relationships which they must deal with in even the simplest short song. (p. 152)

One concern noted by Sloboda (1985) is the difference in effect between normal listening and experimental listening tasks. In the latter, the subject's attention is directed toward a specific dimension of the music; however, this does not imply that the listener would attend to the same dimension during a normal, continuous listening of the same material. Furthermore,"Failures of discrimination in the experimental task may be due to lack of cues that would be supplied by a more extended context" (p. 153).

Dowling and Bartlett (1981) tried to achieve "...a greater degree of ecological validity than in our previous work by using excerpts from Beethoven's String Quartets [intact music] as to-be-remembered stimulus material" (p.31). The researchers employed (a) thematic chunks as so-called "targets" (to-be-remembered items); (b) excerpts of the same contour but different interval sizes, termed "related items" (also referred to as "relateds"); and (c) excerpts from different quartets, termed "lures" (distractors). The subjects were asked to discriminate between to-be-remembered input and distractors and between related items and distractors. They also were asked to respond positively to both related and to-be-remembered items but to reject distractors. Expectations for this study were based upon results obtained previously in a series of pilot studies in which "...excerpts drawn from pieces built of short-chunk themes tended to produce positive recognition responses to both identical repetitions and thematically related excerpts from the same pieces" (p. 31).

As a result of efforts by Dowling and Bartlett (1981) to control the stimuli more closely than in previous experiments, the similarity of to-be-remembered and related items depended solely upon melodic contour. Each of sixteen subjects was required to respond to each input item by categorizing it according to one of three encoding schemes:

(a) by contour, which was presented as two patterns of up-and-down dots; (b) by rhythm, which consisted of pairs of Morse-code type dot patterns; or (c) by duration, which required subjects to write down their estimate of the duration of each excerpt in seconds. There were two test blocks of twenty-four items each and each test block consisted of eight to-be-remembered items, eight related items, and eight distractors, with one third of the subjects assigned to each encoding condition.

The subjects were instructed to listen carefully to a series of brief musical excerpts so that they could identify them if they heard them again. Then, the music was presented and subjects recorded their encoding response (contour, rhythm, or duration) on the answer sheet. Subsequently, the response sheet was concealed for the duration of the test, and subjects listened to five minutes of music by John Coltrane and Thelonious Monk, rating the excerpts for pleasantness on a 10-point scale. The subjects were then instructed to indicate on a four-level scale the degree to which they were confident that each test item reminded them of the list items they had already heard. In addition, subjects were asked to place a check by those items which were judged to be identical to the to-be-remembered items (as opposed to related items).

Responses to to-be-remembered or related items were counted as correct (termed *hits*), while responses to distractors were taken as false-alarm rates, with a resulting to-be-remembered vs. distractor and related item vs. distractor area score for each subject for each test block. The two sets of scores for item types were derived from (a) the comparison of recognition rates for to-be-remembered items with false-alarm rates to distractors, and (b) the comparison of recognition rates for related items with false-alarm rates to distractors. The scores were obtained by calculating the area under the Memory Operating Characteristic (Dowling & Bartlett, 1981, pp.33-34).

Contrary to the researchers' expectations, the recognition of to-be-remembered items was much better than recognition of related items ($p < .001$). The recognition of related items was little better than chance. The encoding task had no reliable effect upon recognition performance: subjects' performance on the encoding tasks was not very accurate. According to the researchers, either the difficulty of the encoding tasks mitigated against their effectiveness or the problem was that all three encoding tasks focused on the surface aspects of the music rather than on a more affective, imaginal response.

As part of their published report, a second investigation was conducted which differed from the first only in the encoding tasks used. Contour and rhythm were combined, while two new tasks were designed to "...evoke associations with underlying affective meanings" (p. 37).

One of these new tasks consisted of choosing from two words the one most similar to the meaning or affective quality of the piece. In the second task, subjects were asked to write a few words describing the image or feeling evoked by the excerpt.

Results of both tasks indicated that the effect of item type was significant, with to-be-remembered items better recognized than related items ($p < .001$). The interaction of item type and encoding task was also significant ($p < .01$), the to-be-remembered items best recognized with contour-rhythm encoding and least recognized with the provision of an affective image condition. Performance on the encoding tasks was better than in the first experiment, although responses to stimuli in the image condition were quite varied. The researchers were surprised that there was little generalization to related items, regardless of encoding task. Although the latter (encoding task) interacted with item type, there was no indication that the task influenced the recognizability of related items.

Results of both Dowling and Bartlett (1981) studies failed to support previous results of short-term memory studies in which a great deal of confusion between to-be-remembered items and same-contour related items had been experienced. The authors, therefore, questioned whether the specificity of memory for to-be-remembered items might be a result of using real music for stimulus rather than the artificial, five-note melodies of previous short-term memory investigations. Therefore, Dowling and Bartlett conducted a long-term memory experiment similar to Experiment 2 described above (i.e., contour and rhythm combined and an affective response provided).

Using stimulus materials similar to those used previously for short-term memory, Dowling and Bartlett constructed 50, seven-note contours, with each contour containing two or more reversals of pitch direction (i.e., A-B-C-B-C-E-A). This group of fifty divided into two sets of 25, with one set being the inversion of the other. Subjects were asked to respond positively only to the items which were to be remembered. This task differed from the one described above (Experiment 2) in which subjects had responded to both to-be-remembered items and related items. The results, based upon a 2 x 2 x 2 analysis of variance, showed that the effect of item type was significant ($p<.001$), with to-be-remembered items better recognized than related items. Only the effect of experience approached significance at the .05 level. The authors concluded that the results seemed paradoxical:

> In our previous short-term memory experiments, subjects were very poor at discriminating between transpositions of previously heard melodies and tonal answers....Those experiments employed retention intervals of only a few seconds. Experiment 3 used retention intervals which averaged several minutes, and yet subjects showed above-chance discrimination between transpositions (Targets) and tonal answers (Relateds)....in our previous experiments subjects had been excellent at

> discriminating between either transposition cues or tonal-answer cues on the one hand, and different-contour cues on the other. Yet in Experiments 1, 2, and 3 there was very little discrimination between same-contour tonal answer stimuli (Relateds) and the different contour Lures. (p. 42).

To explain the ovserved paradox, Dowling and Bartlett offered two possibilities. The first explanation suggested that contour information, although having powerful effects in short-term memory tasks, was not as useful in long-term memory tasks. A second possibility, the researchers felt, might be that interval information, not very effectively used in short-term memory tasks, could be functional in some degree with longer retention intervals.

The findings of Dowling and Bartlett's research suggest that long-term memory songs, even if only presented once, may be based on an interval match rather than simply a match of contour. Although previous research has shown relatively untrained subjects to be poor at extracting precise interval information from novel stimuli, perhaps interval information is retained over long time periods when it is extracted. Contour information may be extracted easily, but it also may be forgotten rapidly.

Dowling and Bartlett then designed a fourth study to (a) test the importance of interval information over long and short retention intervals directly, and (b) provide a link between studying the long-term memory situations of the three experiments cited above and the short-term transposition-detection model of their previous work. The researchers summarized the results as follows:

> ...contour information is easily extracted from novel musical stimuli, but contributes to performance only with short (and/or unfilled) retention intervals. In contrast, interval (and/or chroma) information is difficult to extract, but contributes more or less equally to performance over a broad range of retention intervals. (p. 45)

Kauffman and Carlson (1989) proposed areas of concern which should be considered by researchers:

1. The need for research in memory for music which uses ecologically valid stimuli.

2. The need for research which yields data describing memory functions over a wide range of retention intervals.

3. The need for research which rigorously examines differences between various levels of music expertise.

The researchers designed an experiment in which they used common music listening conditions so that the findings could be generalized to real music practices as closely as possible. Their primary method for accomplishing ecological validity was through the use of intact musical examples. The experiment consisted of two types of tests which the authors referred to as Current Test and Delayed Test. In order to investigate the possible relationships between music expertise and music memory, only those subjects who qualified as expert, novice, or nonmusician were used. Subjects, who were tested individually, were asked to register a same/different response, a confidence rating, and a familiarity rating. Recognition accuracy was quantified by converting the response accuracy and confidence ratings into a single score using a six-point scale that ranged from -2.5 to +2.5. The scale reportedly was an adaptation of a measure developed by Bransford and Franks (1971). The main effect for the expertise factor was significant $p=.0061$). Using a Newman-Keuls multiple-comparison test to determine the significance of separation, the only significant difference occurred between the novice and the expert groups ($p<.01$). The retention interval factor was significant ($p=.0001$), but no significant interaction between music expertise and retention interval was found. "The null hypotheses, which can not be rejected here, is that there is no difference between groups of people with various levels of music expertise in the shape of their forgetting curve" (p. 11).

One implication of the study is that short-term memory in music may be at least 180 seconds. The first two retention intervals used were 0 and 20 seconds, both within the short-term memory range. The third and fourth retention intervals used, however, were 60 and 180 seconds, both of which are considered to be within the range of long-term memory. The authors suggested that the process known as "chunking" may be responsible, postulating that"... the chunking of intact music is highly efficient, thereby allowing for a large storage capacity, which in essence extends the boundary of short-term memory when measured in a recognition paradigm." (p. 11). They also proposed the possibility that, because the stimulus was intact music, it was more meaningful than other types of stimuli. The retention interval was filled with a continuation of the musical excerpt, a condition which, depending upon the content of the intervening excerpt, could have had varied effects upon memory for the target.

The second experiment reported in the same publication also used a repeated-measures design, with expertise included as a grouping variable. At the beginning of the second testing session, subjects were presented with comparisons and asked to indicate whether or not each comparison had occurred in the previous session. The same proceedure was used for the third testing session, with the exception that the students were asked whether each comparison had occurred in either of the preceeding sessions. Retention intervals for the Delayed Test were 24-48 hours and 48-96 hours, with comparisons categorized on three levels. Three seperate, repeated measure ANOVAs were performed.

Recognition accuracy for the Delayed Test distractors was significantly greater than recognition accuracy for the Delayed Test targets ($p<.01$). Recognition accuracy for to-be-remembered items out of context was significantly greater than recognition accuracy for targets within context($p<.0$). Recognition accuracy for double-repetition excerpts was significantly greater than that for single-repetition excerpts. No differences were found in recognition accuracy as a function of expertise, and no significant interactions were found between expertise and any of the comparison types. Recognition accuracy (as a function of retention interval) as a main effect was not found to be significant.

Kauffman and Carlsen suggested that the discrepancy posed by the lack of a significant difference in memory for music as a function of expertise may be explained through comparison of the means established for recognition-accuracy:

> ...The scores of the nonmusicians appear to have approached a point of leveling even within the Current Test. The expert musicians, on the other hand, did not reach this point until somewhere between the final time of the Current Test and theDelayed Test. (p.16)

Summarizing their findings, Kauffman and Carlsen noted that (a) music memory can be investigated within the context of intact music, (b) nonmusicians possess delayed memory ability for novel music well above the level of chance, (c) the outer limits of short-term memory for music do not conform well to the data reported in the literature with nonmusic stimuli, and (d) retention curves for different levels of music expertise are remarkably similar over time "...until one's expertise level reaches asymptote" (p. 17). Implications of the findings were that a more conservative theory of music cognition may grow out of research in which high ecological validity has been ensured. Further, the distinction between short-term and long-term memory may need to be reevaluated. Finally, the role of encoding and retrieval, as it pertains to the issue of forgetting, is still far from being well understood.

Demorest (1989), in an investigation of expert and novice perception of pitch and rhythm, used a pitch/rhythm integration measure which asked sixty-nine subjects to judge the degree of difference between a theme and nine variations. The musical theme used as basis for the stimulus set was an intact, four-measure excerpt from the Mozart Clarinet Concerto in A Major,(K 622, movement 1). The nine variations consisted of (1) the original (one each for pitch and rhythm) and (2) two transformations each of the two originals (pitch and rhythm), the four transformations having been constructed by the author. Subjects for the study were students from grades one, five, and eight; adult novices, and experts.

Results of the study indicated significant differences in musical perception between both experts and novices, and novices of different ages. Data also indicated that all judgments were made incorporating both pitch and rhythm dimensions. In the area of pitch and rhythm weighting, experts seemed to weigh pitch and rhythm equally. While novices seemed to develop an increasing sensitivity to rhythm information differences, the same seemed not to be true for pitch information: the were no significant differences from first grade through adult in how novices value pitch information. Demorest suggested that differences between children of different ages "...centers primarily on differences in how they weight rhythm information rather than overall differences in how they combine musical information" (p. 123).

In discussing possible judgement strategies used by first grade subjects, Demorest (1989) stated that subjects may have alternated attention between pitch and rhythm, depending on which dimension showed the greatest amount of change. Data did not seem to support a theory of discrete stages of musical development, although a large difference in perception between grades one and five, and less between grades five and eight, suggested a developmental plateau similar to findings in other developmental studies. Continuing development between grade eight and adult novice, however, suggests that musical development "...is not finished at age thirteen with the achievement of formal operations, but continues into adulthood" (p. 125).

Performance-based Response Mode

Petzold (1963), investigating music reading abilities in the upper elementary grades, found a relatively low level of music reading accomplishment and suggested that part of the difficulty might be attributed to a lack of aural understanding of the musical symbols. Citing a lack of information concerning the development of auditory perception by children, the author's stated purpose was an attempt to determine the differences between first- through sixth-grade children in the ways in which they perceive and respond to the auditory presentation of musical sounds.

The study reported here was the first in a series of investigations extending over a six-year period. The overall project consisted of (a) a longitudinal study of three groups of children, and (b) a series of one-year pilot studies which dealt with rhythm, harmony, melody, and timbre. The subjects for the longitudinal study were randomly selected from the first three grades; the subjects for the annual pilot studies were randomly selected from the first six grades. The tests were developed by the author, based on information gathered from children's song materials (as reported in the first studies). The testing procedure required the subject to make an overt musical response to an aurally-presented test item.

The study was administered individually to approximately 600 children who were randomly selected from grades one through six. After analyzing both pitch and rhythm patterns commonly used in children's song materials, Petzold constructed four seperate tests of approximately fifteen minutes each. They were designed as follows: (a) a 45-item test provided data regarding the auditory perception of short tonal configurations, (b) a 20-item test gave data regarding the consistency of pupil responses to short tonal configurations, (c) a rhythm test, a rewritten version of the 45-item test, included both common rhythmic and tonal configurations, and (d) a phrase test contained two phrases (one in major and one in minor) which were constructed to meet specific criteria imposed by the writer (i.e., the phrase should include a simple, repetitive rhythmic pattern and should encompass a reasonable singing range).

Subjects first listened to the recorded stimulus, then responded by "singing back" (vocally repeating) the stimulus. In order to minimize the risk that an incorrect response might be the result of poor vocal control rather than an inaccuracy of aural perception, a comprehensive scoring system was developed. It was comprised of six possible types of responses, each receiving varying amounts of credit. An example of varying response-credit is as follows: a type F response indicated that the general direction of the stimulus was followed but contained neither the correct pitches nor the correct number of tones;

therefore, it would be awarded only a percentage of the total possible item value.

No significant differences were found between boys and girls in tasks concerning the auditory perception of musical sounds. Age, as defined by grade level, was a significant factor in the development of auditory perception; however, comparisons at one-year intervals yielded significance in only six of 25 comparisons, differences between means at two-year intervals were significant in five of twenty comparisons, and differences between means at three-year intervals significant in seven of fifteen comparisons. The author pointed out, however, that factors other than age probably were responsible for some of the observed differences. Musical training and out-of-school musical experience was a significant factor in 17 of 37 comparisons. Within every grade level, children showed marked differences in musical competence, ability, vocal control, and aural understanding. These differences further emphasized the need for developing teaching methods which would respond to said differences and result in more effective learning outcomes by all children.

Petzold reported the major findings of the six-year series of studies as follows: All tasks showed that differences between grades 1 and 3 were always significant at the .01 level, with the greatest gains noted between grades 1 and 2. Maintainance of an accuracy level in grades

3 through 6 indicated that a plateau had been reached. Older children tended to perform with greater accuracy, although practice would usually overcome the age advantage. Children with low or high scores usually did not change their their ranking during subsequent years, although there was a definite pattern of eliminating incorrect or partially correct responses. For example, non-melodic responses by first graders usually were eliminated by second grade; the second stage (often by grade 4 or 5) was to eliminate responses which indicated only awareness of contour and number of pitches. The final stage was to eliminate partially correct responses in favor of correct ones.

Data for the phrase test showed that the learning of a short musical phrase, without help, was a very difficult task. Only eight out of 90 children were capable of this task by grade 4, and only one third of the sixth grade children learned the phrase in ten trials. Even high scores on the short, melodic item test did not insure that the phrase, even using the same items, could be learned. Melodic accuracy was not significantly affected by harmonic versus nonharmonic treatments; however, children's responses were most accurate when they were accompanied by a simple three-chord progression. A multichord progression used in the same context seriously inhibited melodic accuracy. When harmonic accompaniment was present for both stimulus and response, three levels of accuracy appeared: (a) grades 1 and 2, (b) grades 3 and 4, and (c) grades 5 and 6.

Although responses to rhythmic items were more accurate than those to melodic items on the rhythmic-melodic test, comparisons between rhythmic-melodic and pure rhythmic responses did not produce significant results. Ability to respond accurately to rhythmic patterns of medium difficulty and to maintain a steady beat did not change significantly after second grade. Children found it significantly more difficult to maintain a steady beat at slower tempos (92 and 60 beats per minute). Finally, approximately 85 percent of children had learned how to control the singing voice by grade 2, but the approximately 8 percent who were "problem singers" remained so.

Petzold (1969) suggested that, although age was a significant factor in the development of auditory perception, the greatest changes occured between grades 1 and 2, with a plateau effect no later than grade 3. In summary, the author stated the following:

> Children need to learn how to think musically, how to analyze and evaluate the factors that are present in a musical situation. The fact that performance accuracy is not inhibited when certain of the basic elements of music are presented in combination (i.e.melody-rhythm, melody-harmony, timbre-melody) indicates that children are capable of responding to the more complete musical situations. Children will respond to that which they are asked to respond to, even in complex auditory situations, and it may not be necessary to treat each of these elements as separate entities to be combined into musical wholes at some later time. (pp. 86-87)

Bennett (1981), who studied both graphic and performance-based response modes, investigated the multisensory responses of children to symbolizing musical sound through speech rhythm patterns. Subjects were six students each of five, seven, and nine years of age who received daily thirty-minute lessons over the period of four weeks. Through the use of song-games which included a variety of thirty different sensory tasks overall, the students offered movement, visual, and lingual ideas for symbolizing speech rhythm patterns. Each lesson was video-taped, and a log book of lesson plans and symbolization tasks was kept. Two observers assessed and coded students' responses as to presentation mode, requested response mode, sense mode (i.e., kinesthetic, visual, lingual), accuracy of response, and initiation of response (child- or teacher-suggested). A qualitative interpretation of the data was made using the transcripts of the video-taped lessons.

Results of the study showed that all three age levels used similar proportions of responses within the kinesthetic (59%), visual (13%), and lingual (28%), and that student responses occurred most often in the kinesthetic mode. The making of a visual symbol was the most difficult task for five- and seven-year-olds, and following a prepared visual symbol was easier and more accurate for each age than was making their own. Clapping was the kinesthetic mode most often used and most frequently accurate with all ages.

Although accuracy from lesson to lesson and task to task was generally inconsistent, accuracy did improve with age. Reading, treated as a multi-sensory task, yielded the most frequently accurate responses from the five- and seven-year-olds, and there was less accuracy difference between ages in this task than any other. Use of the visual mode reflected the greatest age differences, and developmental differences among age groups was most apparent when children were asked to draw their own symbol (visual mode) for the sound pattern. Combination of the kinesthetic, visual, and lingual modes for the reading activity provided more accurate responses than any single-mode performance of the same pattern.

Bennett (1981) remarked that "Inefficiency in the kinesthetic sense may provide greater impediments to fluent music reading than the other two senses" (p. 161). She also stated, however, that "...the lingual mode may be the most neglected sensory tool for music learning" (p. 172). Evidence was found in all age groups tested that a child might be able to explain accurately but not perform a pattern, or to perform a pattern accurately but be unable to explain it verbally, suggesting that more than one response mode be used in teaching the young learner. Finally, the researcher pointed out the value of analyzing individual characteristics and tendencies as well as overall group profiles:

> Basing one's teaching techniques only on research results that are statistically significant would suggest that the other results do not exist...This study would have yielded quite limited (and possibly deceptive) results, if individual differences in responding for each group had not beenanalyzed. (p. 177)

Response Assessment by Non-verbal, Graphic Strategies

Bamberger (1975) described two distinct and contrasting strategies which individuals use for making sense of simple rhythmic figures. She suggested the distinctions between the two strategies to be important in the general development of musical intelligence. Deriving the data from children's drawings of simple rhythmic figures, the author referred to the strategies as figural and formal or metric. Figural strategy was described as being most closely related to gesture, and it involved aggregating the events of a rhythmic figure into chunks which reflected either real or imagined bodily movement: "...the individual's 'felt path' through a series of actions" (p. ii).

> The focus of figural strategy is on the contextual functions of events; these derive from and are dependent on the fixed arrangement of durations as given in a particular figure.(p. ii)

Metric/formal strategy focuses on the measuring of durations: the measurement is derived from relationships to a fixed reference. "While metric strategy thus provides a single schema for classifying events, it is not responsive to context" (p. ii). Bamberger reported that, although figural strategy did characterize the behavior of young children, it was not limited to this age group but, rather, extended even into adult behavior. She stated that metric strategy was characteristic of those who played a musical instrument and read regularly from a score, while performers who played by ear spontaneously used figural strategy. "It seems that the two strategies most often function separately even among those who have access to both" (p. iii).

Bamberger grouped the types of representative children's drawings into four categories: Type I, pre-representational; Type II, motivic-gestural; Type III, durational; Type IV, systematically measuring or metrical. For the purposes of my study, in which the subjects are young, untrained listeners, discussion will be limited to Types I and II (figural strategy).

According to Bamberger, the mode of representation in Type I drawings was derived directly from sensory-motor mapping. The child making a Type I drawing actually played the rhythm on the paper with the crayon. This resulted in a drawing which left a trace of each event but no trace of the changes of pace: the drawing itself did not describe what the child actually did, and the child's own "knowing" remained in the sensorimotor mode (p. 4).

Type II strategy was influenced by sensory-motor factors but there was also an explicit grouping of contiguous events into chunks or motives. These drawings were like Type I drawings only in that they captured the number of events and the articulation of the whole figure. Type II drawings differed from Type I in the following ways:

1. The child did not "play-draw" the figure, and, therefore, the representation of the felt path was somewhat distanced from direct sensorimotor behavior. "The drawing is the result of thought actions rather than simply a copy of the actions put on paper" (p. 4).

2. The drawings captured a further articulation of the two repeated segments. The drawings were hierarchical in the sense that they were divided into smaller, inner groups/motives.

3. Type II drawings captured the change of pace in a functional way. Durations were not, however, compared across motivic groups.

> ...while Type II drawings are the result of thought actions rather than immediately performed actions, the focus is still on the articulation and clustering of actions which are contiguous—the grouping of events along the child's felt path as he moves through the figure....Durational means are salient only in their contextual effect; the result of their particular position in the chain of events....

Abel-Struth (1981) conducted a series of investigations into the perceptual abilities of five- to seven-year-old children. The methodology employed, specifically the stimulus and response types used, is more germane to the present investigation than are the specific questions addressed within the studies themselves. Each of the studies employed complex music as the stimulus and graphic procedures as the response mode. In discussing the problems encountered with methods that elicited either performance-based or verbal response modes, Abel-Struth remarked that they often lead to lack of agreement between the performance ability and real musical capacity. In order to avoid this inconsistency, the author employed testing materials, such as colored pencils or symbols to be marked, and the method of investigation included only graphic procedures known to be within the understanding of young children.

Summary of Stimulus and Response Strategies: Product-oriented Studies

The investigations discussed under the preceding headings are representative of much of the music perception research conducted by music educators and researchers over the past twenty years. As such, a number of researchers have attempted to address the issues for which the "processing" studies have been criticized. Their attempts often entail the application of one or more of the following methodological strategies: the use of complex, intact/ ecologically valid musical stimulus, the use of graphic or performance-based response modes, and/or the use of young listeners as subjects. Pertinent results may be summarized as follows:

1. Ecological validity of the stimulus is considered by a number of researchers to be a requisite concern for anyone

who attempts to carry out research in such a way that the findings may be generalized to real music practices.

2. Music memory can be investigated using intact/ ecologically valid music.

3. Nonmusicians possess delayed memory ability for novel music well above the level of chance.

4. Retention curves for different levels of music expertise are remarkably similar over time, and the outer limits of short-term memory for music do not conform well to the data reported in the literature with nonmusic stimuli.

5. Several studies showed a significant difference between first- and third-grade students, with the greatest gains occurring between grades 1 and 2 and a plateau effect no later than grade 3. Others reported a significant difference between first- and fifth-grade students, less difference between fifth- and eighth-grade students (suggesting a possible plateau effect), and continuing development between eighth-grade students and adult novices.

6. Awareness, ability, and accuracy increase with age/ maturity.

7. Children are capable of responding to complete (ecologically valid), even complex, musical situations: elements can be presented in combination.

8. When subjects are asked to graphically symbolize an auditory experience, there are at least two distinct and contrasting strategies for making sense of simple rhythmic

figures: figural and formal/metric. Figural strategy, most closely related to gesture, reflects the individual's "felt path" through the music. It focuses on the contextual functions of events as the child "plays" the pattern with crayon/pencil on paper and is a direct derivative of sensory-motor mapping. Formal or metric strategy focuses on measuring durations in relation to a fixed reference, a strategy which characterizes those who play a musical instrument and read regularly from a musical score.

9. Figural strategies characterize the behavior of younger children. They are not limited to that age group, however, but extend even into adult behavior. The use of figural strategies can be observed in the graphing response patterns of the present study.

Summary

A review of pertinent literature has revealed a considerable body of research which may be divided into two categories, depending upon primary focus: (1) perception and processing, or process-oriented studies, and (2) product-oriented studies which represent a variety of stimulus/response strategies. Results achieved through these investigations have broadened our knowledge of how we perceive and process auditory information. Perhaps even more important, they lend confirmation to the belief that auditory perception and processing, in general, and the auditory perception and processing of music, specifically, can be investigated through observation, description, and quantification.

Further research investigating the auditory-perception strategies of music learners is needed. If results of additional studies are to be music-specific and more generally applicable to normal music listening situations, they will necessarily attempt to employ intact, ecologically valid musical stimuli. An additional advantage in using ecologically valid stimuli will be the possibility of obtaining results based upon a subject's attention to musical elements/components as determined by the individual's own auditory selection process rather than by the researcher's *a priori* selection and extraction of elements to-be-attended. Even as the listener is provided an intact musical stimulus, however, the music researcher, for the purpose of study and analysis, must be willing to disassemble the musical object, thereby breaking the whole into component elements which are observable, describable, and quantifiable. This will enable the researcher to compare listener response, obtained under the most natural music listening conditions possible, to a measure specific, element-component schematic of the musical composition. From this may come insight into the specifics of attention in the music listener.

CHAPTER III

METHODOLOGY

The purpose of this study was to investigate changes in selected children's Graphing Response Patterns (GRP) to elemental changes in compositions in theme and variation form. The research problems were (1) to determine points and degrees of elemental change in the compositional structure of the musical examples; (2) to determine number, degree, and nature of changes in subjects' graphing response pattern (GRP) to aurally presented musical examples; (3) to determine percentages of agreement between changes in graphing response patterns (GRPs) and points of elemental change within the compositional structures; (4) to determine the relationship of changes in subjects' graphing response pattern (DCGR) to the quality and magnitude of elemental change (DCMP) within the compositional structure.

In order to develop and test measurement and evaluation tools appropriate for carrying out the research problems, two pilot studies were conducted at public elementary and middle schools in the Dallas-Ft.Worth Metroplex area, beginning in March, 1987. Following the description of both pilot studies, the research plan for the main study will be presented.

Pilot Study 1

In 1987, in an effort to determine the musical parameters to which the inexperienced listener attended, my students in music classes (from grades one through eight) participated in a music listening and graphing activity over a time span of several months. Different observational approaches were attempted, the first of which was to have an entire class of students graph as they listened to a piece. Each student was given paper and crayons and was instructed to make a graph or map as he or she listened to different musical compositions. Each composition exemplified variation (or theme and variation) form. The resulting graphs typically consisted of numerous lines repeatedly crisscrossing themselves. This response format prevented investigation of all but the most general, superficial responses. From that point, subjects were asked to graph from left to right, across the page, in much the same directional manner as they would write. Instructions were minimal and included remarks to the effect that their graph should be a visual picture of what they heard and that their individual graphs might differ as a result of varying listening strategies.

The decision to use as stimuli only works which employed variation form was based on the premise that (a) aurally-prominent change did occur as each theme was modified and restated, and (b) those points at which aurally-prominent change occurred were often more measure-specific and, therefore, more easily discernible than might be the case in a form where more gradual, subtle change was typical. This is not to imply that audible change occurs only at points of theme restatement but, rather, that the quantity and quality of change at those points may be more readily accessible to the untrained listener.

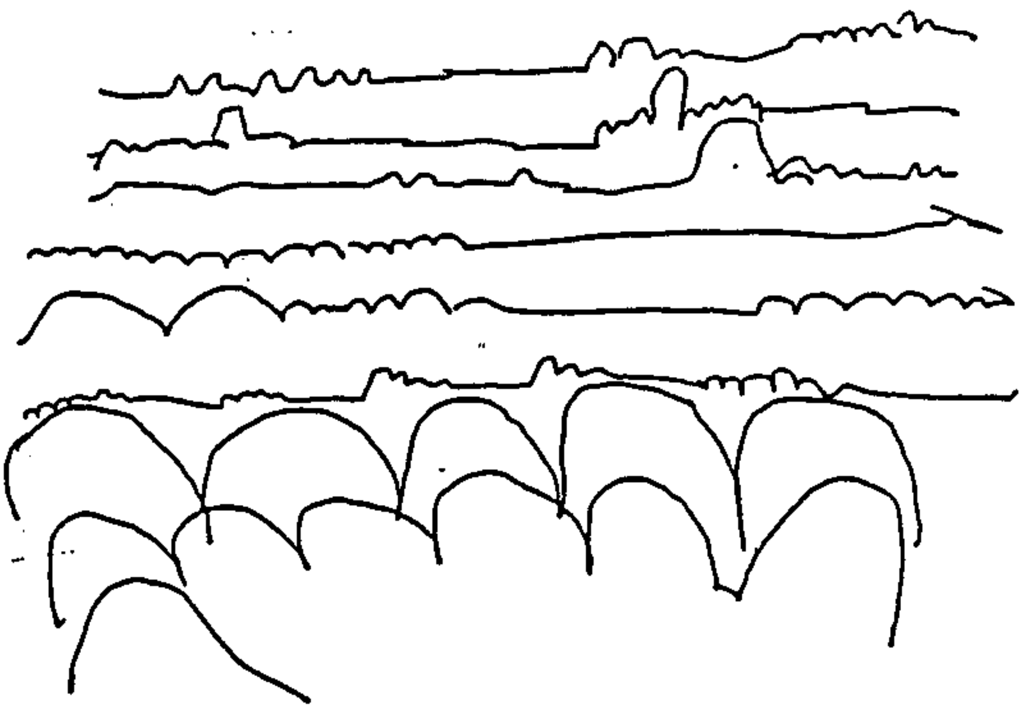
Audio-taped interviews, conducted with individual students after they had listened to and graphed a selection, showed students' lack of vocabulary necessary to describe either the music or their own graphing response pattern. For example, one first grader, asked whether he had noticed any changes in what he had just heard, responded affirmatively. Asked to describe what had changed, the child, after careful thought, replied, "...mostly the music.". A sixth grade student, immediately after having listened to and graphed the "Simple Gifts" variations from Copland's Appalachian Spring seemed very pleased to report, "Boy, there were some real big ones!".

Various classes of children were observed in the manner described, and an attempt was made to analyze some of the graphs done by the children. Very little, if anything, was evident from studying the graphs alone, as there was no way of correlating points on the graphs with the corresponding measures in the music. The need to watch the actual graphing process led to the decision to videotape each child as the graph was being created: both the type and the speed of the graphing motion could be observed. Videotaping would yield repeatable, moment-to-moment data, enabling me to study the movement of each child's hand/marker as he or she progressed through the graphs. Furthermore, the graphing process could be viewed as many times as was necessary to analyze it.

A non-verbal, graphic response mode was devised and employed. The graphing response pattern (GRP) created by the student while listening to a musical composition resembled an ink-on-paper graph or map (see Figure 1). The actual graphing process revealed itselfas being more closely akin to the activity of<u>conducting</u> in the air or <u>tracing</u> the musical events on paper: graphic movement evolved and changed as its progress paralleled the continuum of the musical stimulus. Bamberger (1971) had referred to this response type as figural or sensory-motor mapping. The videotapes of these movements, together with the graphs themselves and an analysis of the type and location of change in the musical stimulus, seemed to indicate patterns of responses (see Figure 1) which suggested a need for further and more detailed study and analysis.

Figure 1. Unmarked Graph of Copland "Simple Gifts" Variations

Subject 2, Grade 2



Pilot Study 2

Several subjects were individually videotaped as they listened to and graphed a series of aurally-presented musical examples whose total length (including the six-second pauses between examples) was approximately fourteen minutes.

Music Stimulus

The musical compositions originally used as stimuli were: Ives' "Variations on 'America'" (theme, variations I and IV), Mozart's "Twelve Variations on Ah, vous dirai-je Maman'" (theme, variations V and VIII), Dohnanyi's "Variations on a Nursery Song" (variation I and "Finale Fugato"), Copland's variations on "Simple Gifts" from Appalachian Spring and Paine's "Variations on 'Austria'". It became apparent, both from the subjects' comments and restless behavior toward the end of the tape, that the listening period was too long, even for the middle school students. The music example tape was shortened by removing complete variations or compositions, retaining, however, intact variations as stimulus. In order to shorten the example tape to a total length of approximately seven minutes, one variation from each of the first three examples (variation IV from the Ives, V from the Mozart, and "Finale Fugato" from the Dohnanyi) and all of the Paine composition were removed (see Appendix A for musical scores and discography).

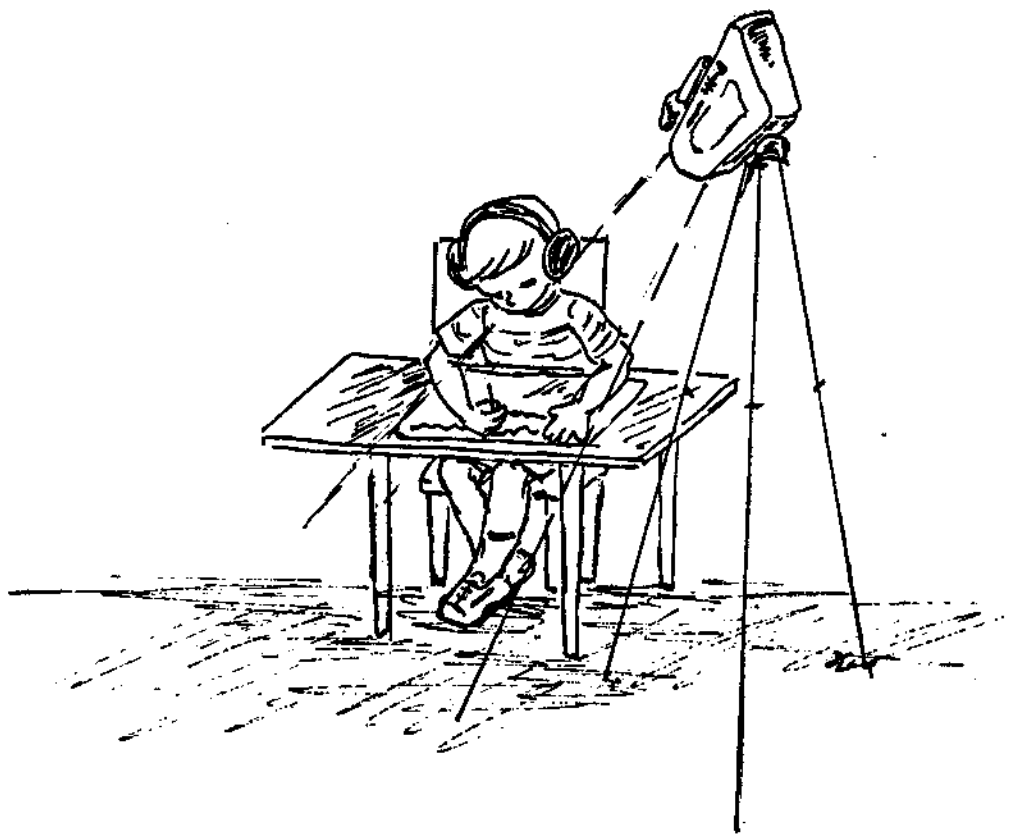
Test Equipment

Each subject was seated at a typing table and given a large, spiral pad of blank, white paper (10"x 14") and a black, felt-tip marker. In an effort to minimize time loss resulting from page turns, several alternative kinds of paper were considered, such as a continuous, butcher-type paper, or pads containing much larger sheets. In either case, however, there was no assurance that the subject's hand, marker, and graph would remain constantly in camera view. It was necessary, therefore, even with the 10" x 14" spiral pads, to tape the back cover of a pad to the table so that it could not be moved or angled during the graphing process.

Videotape Preparation and Analysis

After having been given the same instructions as those which had been given in the previous classroom situation, the child put on headphones (Sony Stereo) and signaled when ready to begin. The music example tape (played through a Sharp Stereo Cassette Deck [Model RF-W500] and re-recorded, simultaneously, onto the video tape) was begun, and the child began to graph. The video camera (Panasonic) was positioned above and in front of the table so that only the hand, wrist, and extreme lower portion of the forearm were visible (see Figure 2). The videotape recording was made using a MultiTech Video Cassette Recorder (Model MV-070). The tape was then prepared and analyzed as follows:

Figure 2. Video Camera Positioning



1. The videotape was played back through the VCR to a ten-inch TV (Quasar, Model XP2117NW). Because the camera had been placed in such a way that it would film from a position above and in front of the subject, playback on an upright TV resulted in a backward, upside-down view of the graphing process. To enable me to view the graphs from top to bottom and left to right, the TV was turned upside down. While the video was running, a copy of each graph was made by tracing (with a Staedtler Lumocolor permanent pen) the graph onto a clear, acetate sheet which was placed over the TV screen.

2. The videotape was replayed until all measures of the musical example could be marked on the graph. Not until this step had been accomplished could points of fluctuation/change in the child's graphing response pattern (GRP) be correlated with and compared to points of change in the music (see Figure 3): this step revealed temporal information not accessable in the graph alone.

3. Early attempts at marking the measures by simultaneously using auditory cues (listening to the music) and visual cues (watching/following the movement of the subject's pen point) had proved either difficult or impossible when a composition's tempo exceeded a moderate rate of speed. In order to facilitate the measure-marking process, a red light, which blinked at the beginning of each new measure, was added to the original video tape. This

addition was accomplished by using a tripod-mounted minicam to tape the original videotape as the latter was played through the VCR and onto the TV screen (14" Toshiba CF319). A small red light (controlled by my activation of a hand-held, on/off switch) was taped to the corner of the TV screen. As the videotape was played and re-filmed, I activated the on/off switch, causing the light to blink and, in so doing, to signal visually, rather than aurally, the beginning of each measure. The addition of the visual cue enabled me to see the precise point on the graph where the bar line should be placed (see Figure 3). Each dot on the graph represents a bar line.

4. After all measures were marked and the graph-tracing was completed, the audio portion of the tape was turned off. This allowed a trained observer to base the change/no change decisions only upon the subject's GRP, rather than on change in the music stimulus.

Analysis of Degrees of Change in Music Parameters

Each of the six musical examples was analysed using eight parameters: timbre (Tb), range/interval size (Is), texture (Tx), tempo/meter (Tm), attack/rhythmic density (Ad), key/mode (Km), dynamic level (Dl), and melodic presentation (Mp) (see Figures 5 and 6; also Appendix). An interval scale, reflecting not only change/no change within a parameter but also the degree of change, was constructed for each parameter (see Appendix C, Degree of Change in Music Parameters Scales, or DCMP).

Each of the eight music parameters was analyzed separately. Examples showing the method of application of the Degree of Change in Music Parameters Scales (DCMP) to the music itself may be seen in Figures 4 and 5. A determination was made regarding what change/s, if any, had occured within the music parameters within any given measure and, if change had occurred, how much. (See Figure 4 and Examples 1 through 8 below for a detailed description of the music analysis by individual parameters.) Three (3) degrees of change (Level 4, DCMP) was the maximum score possible for any one parameter in a single measure. Following (Table 2) are examples of the analysis techniques which were used to determine the Degree of Change in the Musical Parameters (DCMP). The eight examples refer to Figure 4 (Analysis: Degree of Change in Music Parameters) and Figure 5 (Music Example: Dohnanyi variation, Measures 21-28, excerpt from the score).

Figure 3. Marked Graph of Copland "Simple Gifts" Variations Subject 2, Grade 2

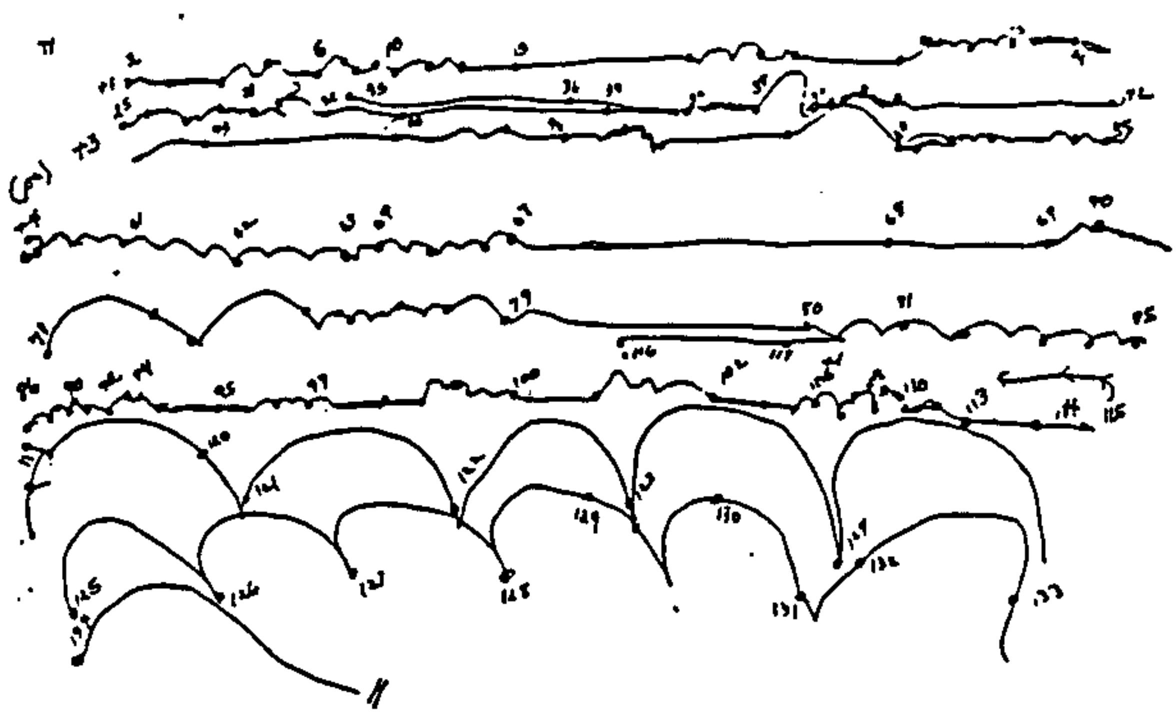


Figure 4. Analysis: Degree of Change in Music Parameters

DOHNANYI #3

Analysis Examples

Parameters	MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
						P2				P3					P4				P5							P6			
Timbre/Color (Within, between & substitution of families)	Tb	(Pf, S)																				+B(hns F +W(bsn) +P(tim) -S		-B -W	+H -sW -P +sS	-H			
	DOC																					3		3	3	1			
Range/Interval Size (Semitones)	Is	(24)	45	49	62	32	45	52	72	46	52	62	56	57	36	41	37	72	54	70	51	70	69	69	48	36	43	53	72
	DOC		1		1	2	1		1	2					1			3	1	1	1	1			1	1			1
Texture Tot. # active vs.	Tx*	(6)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	10	5	5	7	6	6	6	6
	DOC																						1						
Tempo/Meter (NC,PL,SD,MS,Mr)	Tm	12/8																(12/8)						SD -PL	SD	SD +PL			
(Tot. RT: 35 secs)	DOC																							2	1	2			
Attack/Rhythmic Density	Ad *	(12)	12	12	10	12	12	12	10	12	12	12	12	12	12	12	12	10	12	12	12	12	12	23	29	10	12	12	10
	DOC																									1			
Key/Mode (by no. of pitch class differences)	Km	(C Maj)										trns	dm	trns	C				trns			D-fl		trns		C			
	DOC											1	2	1	2				1			3		1		3			
Dynamic Level (Sc, PP, MM, FF)	Dl	(p)					mp	p						mf 1	p 1					mp	p				f	p			
	DOC						1	1												1	1				2	2			
Melodic Presentation	Mp	a ____	____	____	____	a' ____	____	____	cad	b ____	____	- 1 cmpr		+ 1 expn frag	a ____	____	____	____	sagm		alt	+3m(trans) alt				a ____	____	____	cad
	DOC					1			1	2		3		3	1				2		3	3				1			1
	MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28

Ex. 1a (m 21) greatest level of change is deletion of strings (-St), a Level 3 on the MDOC scale (≠ family), which is 3 Degrees of Change (DOC).

Ex. 1b (m 25) greatest level of change is deletion of horns (-H), a Level 1 on the MDOC scale, which is 1 DOC.

Ex. 2 (m 24) inverval size is decreased from 69 to 48 semitones, a Level 1 change (≠ at least 12 but fewer than 24 semitones), which is 1 DOC.

Ex. 3 (m 22) texture is decreased to 5 voices (from 10 in m 21), a Level 1 change (ratio of 1 : 1/2), which is 1 DOC.

Ex. 4 (m 23) change of both subdivision of the pulse and number of pulses per measure unit, a Level 2 change (Chg of two of PL, SD, MS, or MR), which is 2 DOC.

Ex. 5 (m 25) attack/rhythmic density decreased from 29 (m 24) to 10, a Level 1 change (chg. of at least 2:1 or 1:1/2 but less than 3:1 or 1:1/3), which is 1 DOC.

Ex. 6 (m 21) tonal center to D-flat from C (chg. to key or mode with 5 or more pitch class differences), a Level 3 change which is 3 DOC.

Ex. 7 (m 24) a change to forte (from piano), a Level 2 change (chg. of 2 dynamic levels), which is 2 DOC.

Ex. 8a (m 25) repeat/return to a previously heard motive, a Level 1 change, which is 1 DOC.

* Normal typeface numbers are raw data

**Bold numbers are Degree of Change totals

<u>Figure 5.</u> Musical Example: Dohnanyi Variation, Measures 21-28

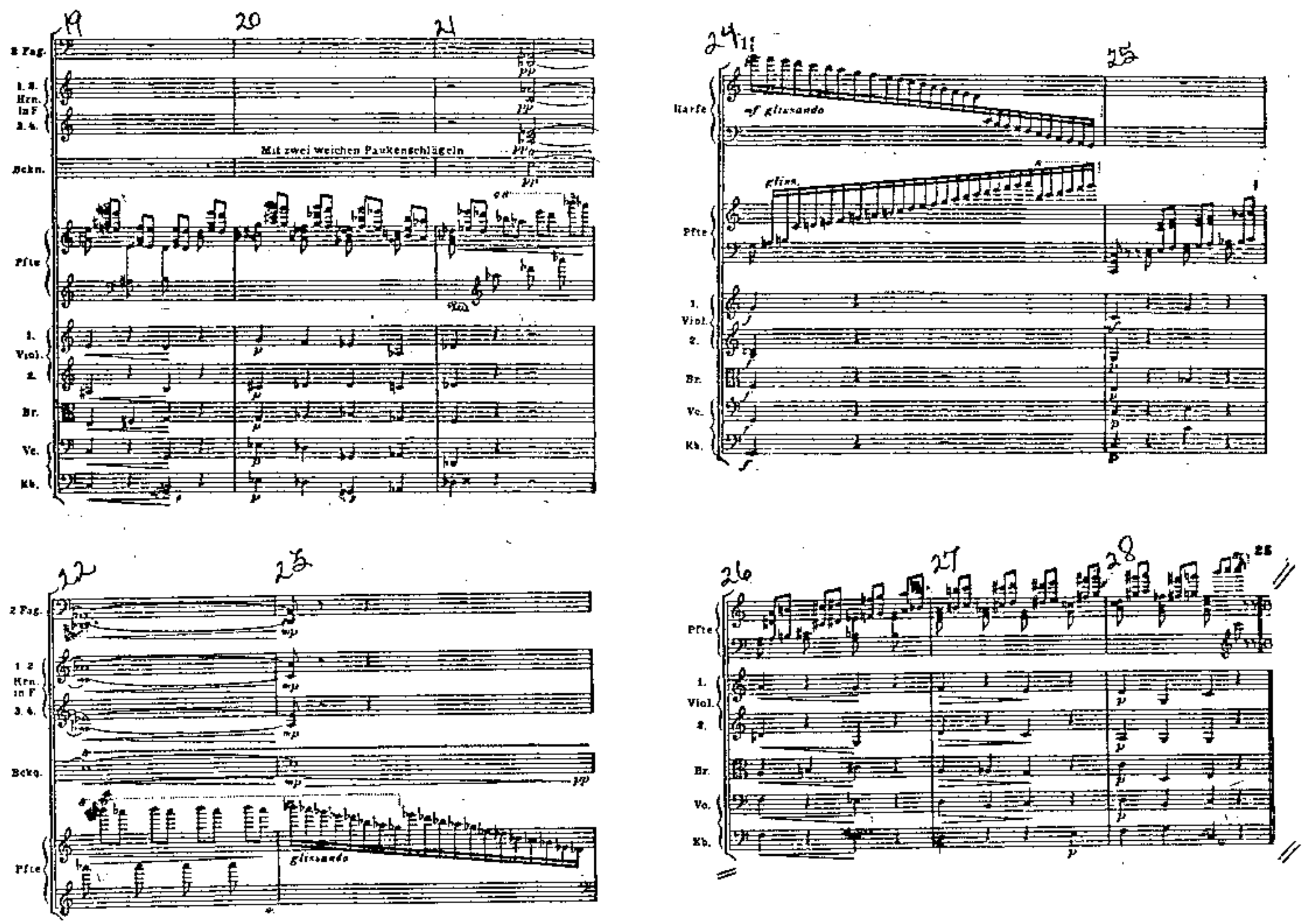


Table 1

Analysis: Degree of Change in Music Parameters

Ex	MM	Parameter	Change type	Level	DOC
1	21	Timbre/ Color	deletion of strings	4	3
2	24	Interval Size	decrease from 65 to 48 semitones	2	1
3	22	Texture	decrease from 10 to 5 voices	2	1
4	23	Tempo/ Meter	subdivision of pulse and no. pulses per measure unit	3	2
5	25	Attack/ Rhythmic Density	decrease of attack no. from 29 to 10	2	1
6	21	Key/Mode	tonal center from C to D-flat	4	3
7	24	Dynamic Level	from _piano_ to _forte_	3	2
8	25	Melodic Pres.	return to a previously heard motive	2	1

Note: The parameter representing greatest DOC is used when more than one parameter changes within a measure.

Calculating Degrees of Change in Graphing Response (DCGR)

During repeated viewings of the videotape, each point of change in the subject's Graphing Response Pattern was marked by me with a Staedtler Lumocolor non-permanent pen. Then changes in GRP were determined by means of an interval scale which reflected not only the presence of change/no change but also the amount of change [see Appencix B, Degree of Change in Graphing Response (DCGR) Scale]. Using as graphing dimensions speed, size, shape, type, and pause, the DCGR scale includes four possible levels of change and four possible degrees-of-change scores, as seen in Table 2.

Table 2

Degree of Change in Graphing Response Scale

Level 1: No Change	0 DOC
Level 2: Change in any one of speed (D), size (Z), shape (H), type (Y), or pause (P)	1 DOC
Level 3: Change in any two of speed, size, shape, type, or pause	2 DOC
Level 4: Change in any three or more of speed, size, shape, type, or pause	3 DOC

Note. DOC: Degree of Change

A change in any single graphing dimension was scored as one degree of change (DCGR); therefore, if more than one parameter changed in a measure, the one-point changes were added and the total became the total degree of change (DCGR) score for that subject in that measure. For example, in measure 22 of the Dohnanyi composition (see Figure 6), Subject 16 presented graphing response

changes in three parameters: speed, size, and shape. This was a level-four change (three, one-point dimension changes) represented by 3 degrees of change in the score for Subject 16, measure 22. Three (3) degrees of change (four levels, 0 - 3 DCGR) was the maximum score possible for any single measure.

A second observer was trained to determine and evaluate subjects' GRP changes (as described in step 5 above), establishing a reliability of 0.90 (two observers, three subjects, six musical examples), using Pearson's Product-Moment Correlation Coefficient (see Appendix D).

Comparison and Evaluation of DCGR and DCMP Scores

Resulting scores from both Degree of Change in Graphing Response (DCGR) and Degree of Change in Music Parameters (DCMP) were compared. For example, Subject 16, in measure 22 of the Dohnanyicomposition (Figure 6), showed a level 4 change in Graphing Response Pattern. The Degree of Change in Music Parameters scores (Figure 4) showed a level 2 change in Texture (Tx) in measure 22. I sought to ascertain whether the change which occurred in the music at measure 22 might account for the observed change in the student's graph.

Conversely, change which occurred within the music parameters but which was not accompanied by perceived change as reflected in the child's graphing response was also examined. For example, in measure 21, the DCMP scores show level 4 changes in three music parameters (Timbre, Key/Mode, and Melodic Presentation), and a level 2 change in Interval Size, but no change was shown in the DCGR score for Subject

Figure 6. Degree of Change in Graphing Response (DCGR)

Debnenyl #3

Sub/Gr/Sx	NM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
S13/4/F																													
D						1						1							1				1	1					
Z																													
H				1*										1							1			1					
Y																		1			1		1	1					
P																									1				
DOC						1**						1		1				1		1	2		2	3	1				
S14/4/M																													
D			1	1		1							1											1		1			
Z			1		1	1						1	1										1	1					
H													1		1											1			
Y																								1		1			
P																									1				
DOC			2	1	1	2						1	3		1								1	3	1	3			
S15/4/F																													
D														1						1				1					
Z											1			1	1					1			1	1		1	1		
H							1																		1	1			
Y																													
P								1													1							1	
DOC							1	1			1			2	1					2	1		1	2	1	2	1	1	
S16/4/F																													
D									1	1				1		1	1		1				1				1		1
Z									1	1				1		1	1		1				1				1		1
H										1													1						
Y									1																				
P													1												1				
DOC									3	3			1	2		2	2		2				3		1		2		2
S17/4/F																													
D				1		1																							1
Z						1																			1	1			1
H																									1	1			
Y																									1	1			
P					1					1														1					
DOC				1	1	2				1														1	3	3			2
S18/4/F																													
D					1				1														1						
Z					1				1														1						
H																													
Y										1				1						1									
P																						1							
DOC					2				2	1				1						1		1	2						

*numbers in normal type face represent change within a single response type

**numbers in bold type face represent total degrees of change

Speed (D) Shape (H) Pause (P)

16 in M 21. The possible ramifications of these comparisons are addressed in the discussion of data analysis.

Data Analysis

Final data from the pilot study included (a) one set of Degree of Change in Graphing Response (DCGR) scores for each child for each piece of music, and (b) one set of Degree of Change in Music Parameters (DCMP) scores for each parameter of each piece of music. For each child a DCGR score was entered for each measure of the music; therefore, in a musical example containing 133 measures there were 133 DCGR scores for each child. Likewise, for each musical example, an DCMP score was entered for each of the eight parameters for each measure of the music, resulting in a total of 1,064 DCMP scores for a musical example 133 measures in length.

Percentage of Change/No Change Agreement. Several different methods of data analysis were explored during the early stages of the project. Initially, the scoring procedures for both the subject responses and the music had consisted of two judgements: (a) whether there was change, and (b) if change existed, to what degree. As the first step in an effort to ascertain whether the children actually had responded to changes in the music, both DCMP and DCGR scores were converted to zeros and ones: scores for measures containing no change became zeros, while scores for measures containing change (regardless of amount/degree) became ones. Then each child's DCGR scores were compared both to DCMP scores for individual parameters and the combined DCMP scores for each of the six musical examples presented. Two conditions (in the DCMP scores only) were used in computing the percentages of agreement across combined parameters: (a) DCMP scores in which less than 1 degree of change in a parameter was scored as 0, while 1, 2, or 3 degrees of change (in any single parameter or combination of parameters) was scored as 1; and (b) DCMP scores in which a degree of change of 1 in only a single parameter was scored as zero degrees of change, while 1 (when occurring in more than one parameter simultaneously), 2, or 3 degrees of change was scored as 1 (see Table 3).

Table 3

Conversion of DCMP and DCGR Scores

Raw DCMP			Converted to 0 or 1			Total Condition a	Total Condition b
Tb	Is	Tx	Tb	Is	Tx	Parameters	Parameters
2	0	0	1	0	0	1	1
3	1	0	1	1	0	1	1
0	3	2	0	1	1	1	1
0	0	0	0	0	0	0	0
0	1	0	0	1	0	1	0

Each time that the DCGR and the DCMP were in agreement on either change or no change, regardless of degree or number of parameters, it was scored as agreement or "1", while for each disagreement between the two, regardless of degree, a "0" was scored. The results were tallied and converted into percentages of agreement for each child on each of the six musical examples, using both comparisons to each individual parameter and across all eight parameters. An example of percentages of agreement for foursubjects across each of six musical examples may be seen in Table 4. The Ives theme contained no DCMP scores which met the criteria for the second condition (a change of 1 in only a single parameter), so percentages of measures of agreement are identical to those in the first condition (see Table 4).

Overall percentage of agreement scores for each subject on each piece of music increased in percentage amounts of from 5 points (Subject 1, Copland variation 4a) to 33 points (Subjects 2 and 4, Copland variation 4e). The only exceptions to this increase were example 2a (Mozart, Subjects 1, 2, and 3), Subject 3 in example 4a (Copland), and Subject 4 in example 2b, (Mozart). These results suggested that one degree of change in only one parameter may not have been enough change to cause a response in the music listener, particularly if the musical composition was one in which change occurred frequently and in considerable magnitude, such as in the Copland variations. A possible exception to this, however, may be seen in scores for example 2a (Mozart). No change occurred in six of the eight musical parameters and, with the exception of measure 17, the two parameters which did change did so simultaneously. Three of the four subjects registered change in measure 17, which was the only measure in the Ives theme which met the criterion for the second condition. It is also possible that the changes in two parameters (Attack density and Melodic presentation) in each of the immediately previous two measures accounted for a delayed subject-response in measure 17. Delayed subject-response time, a condition which was observed frequently throughout the process of analyzing the videotapes, might also account for the apparent disparity between the DCMP and DCGR scores in the example cited earlier (Subject 16, measures 21-22, Dohnanyi): One questions whether the level-two change in a single parameter (Range/Interval Size) in measure 22 was of sufficient magnitude to have elicited a level-four change in Subject 16's response pattern. Another explanation might be that the level-four change in response pattern was the result, at least in part, of a delayed subject-response to the relatively high degree of change which occurred in the measure immediately previous (M 21, 3 parameters at level 4, 1 at level 2 DOC). Results seemed to suggest that the fewer and smaller the degrees of change which occurred in the music stimulus, the fewer and smaller the degrees of change

Table 4

Percentage of Agreement: Change/No Change

	Ives		Mozart		Dohnanyi	Copland					
	Th	V	Th	V	V	Th	V1	V2	V3	V4	All
Condition 1	29%	64%	83%	50%	75%	53%	50%	55%	43%	60%	50%
Condition 2	**29%**	**64%**	**79%**	**63%**	**75%**	**58%**	**56%**	**74%**	**65%**	**80%**	**66%**
Condition 1	50%	64%	83%	42%	39%	47%	44%	42%	53%	67%	50%
Condition 2	**50%**	**73%**	**79%**	**71%**	**54%**	**53%**	**61%**	**55%**	**63%**	**100%**	**63%**
Condition 1	64%	64%	88%	63%	50%	74%	44%	58%	51%	73%	57%
Condition 2	**64%**	**64%**	**83%**	**58%**	**57%**	**68%**	**61%**	**77%**	**69%**	**93%**	**72%**
Condition 1	93%	50%	83%	42%	54%	47%	67%	48%	53%	67%	54%
Condition 2	**93%**	**68%**	**88%**	**71%**	**68%**	**74%**	**72%**	**68%**	**76%**	**100%**	**75%**

Condition 1 indicates percentage scores in which only DCMP of less than 1 are equal to 0 degrees of change

Condition 2 indicates percentage scores using only music degrees of change (MDOC) which are equal to 2 or more, i.e., a change of 1 in only a single parameter is considered 0 degrees of change.

which were required to elicit a change in response from the listener. Conversely, the more numerous and greater the degrees of change which occurred in the music stimulus, the more numerous and greater the degrees of change which were required to to elicit a change response from the listener.

Subject-response Delay.

Although the musical stimulus and the listener response existed, from beginning to end, as temporal continuum, the data gathered to represent them were not a continuous curve but, rather, many seperate points - in this case, single measures - in time. To account for this data characteristic, as well as for observed subject-response delay, an overlapping device was employed for both DCGR and DCMP scores for all six stimulus/response sets. For example, the final score for measure 1 was comprised of the mean of the combination of the scores for measures 1 and 2 [m 1 = (m 1 + m 2) / 2], resulting in a reduction of total N by 1. Both overlapped and raw scores may be seen in Appendices F and G, respectively. This device was used for both Degree of Change in Music Parameters scores and Degree of Change in Graphing Response scores. Due to the length of the Copland example, the DCGR and DCMP scores were examined in two ways: (a) for the entire work (i.e., measures 1 - 133 or 1 - 132 with overlap), and (b) within the work as it was parcelled into five smaller sections/divisions. The divisions used for the parcelled condition were as follows:

Theme and Bridge/4a (19 mm), Variation I and Bridge/4b (18 mm), Variation II and Bridge/4c (31 mm), Variation III/4d (49 mm), and Variation IV/4e (16 mm, or 15 mm with overlap). Appendix D (D-1 to D-6) presents results for both whole and parcelled conditions.

Statistical Analysis

Since both Degree of Change in Graphing Response and Degree of Change in Music Parameters scores consisted of interval data, the first statistical procedure considered was the Pearson's Product-Moment Correlation Coefficient. Results obtained through the use of Pearson's r may be seen in Appendix D, using the mean (per measure) of combined GRDC scores for four subjects, the individual MPDC scores (per measure) for each of the eight parameters, with an N of 132 measures.

The primary problem encountered in using this statistic concerned the scores for all musical analyses: DCMP scores for single parameters could be investigated but individual parameter scores should not be combined. For example, although the DCMP scores for each individual parameter were interval data, I could not make the assumption that a DCMP measure-score of 3 for Timbre was the same as, and therefore could be combined with, an DCMP measure-score of 3 in Attack/rhythmic Density. One general characteristic of intact musical compositions, even if consideration is being limited to variation form, is that change rarely occurs in only a single parameter, but, more frequently, in two or more parameters simultaneously, although perhaps not to the same degree.

A second statistical procedure employed was Hierarchical Cluster Analysis (SPSS/PC+). The procedure employed the squared Euclidian distance measure described by Aldenderfer and Blashfield (1984) as one of the more popular representations of distance. In order to avoid the use of the square root, the value of distance is often squared (referred to as squared Euclidian distance) and defined as follows: $d_{ij} = \sqrt{\sum_{k=1}^{p} (x_{ik} - x_{jk})^2}$

The authors state that distance measures are best described as dissimilarity measures, for unlike most coefficients which demonstrate similarity by high values within their ranges, "...distance measures are scaled in the reverse. The cases are identical if each one is described by variables with the same magnitudes. In this case, the distance between them is zero" (p. 25). The method is described as being "agglomerative" because of the sequential merging of the most similar cases. According to Alenderfer and Blashfield (1984), some general characteristics of hierarchical agglomerative methods are as follows:

> ...these methods all search for N x N similarity matrix (where N refers to the number of entities) and sequentially merge the most similar cases. That is, the methods are agglomerative...The sequence of mergers of clusters can be represented visually by a tree

> diagram, often called a dengrogram. Each step where a pair of cases was merged is represented as a branch in this tree....they all require exactly N - 1 steps to cluster a similarity matrix...These clusters...are nested, in that each cluster can be subsumed as a member of a larger, more inclusive cluster at a higher level of similarity. (pp. 36-37)

The same overlapping device as that discussed earlier was used for all six data sets; only the parcelled condition was used for the Copland. The cases consisted of each of the four sets of subject-response (DCGR) scores and each of the eight sets of music-parameter (DCMP) scores, with twelve total cases possible (N=12) in all. Centroid method was applied. The number of stages in the clustering process is equal to N-1. The single linkage method forms clusters by the following rule: "Cases will be joined to existing clusters if at least one of the members of the existing cluster is of the same level of similarity as the case under consideration for inclusion" (Aldenderfer and Blashfield, p. 38).

In some of the shorter compositions, such as Ives' "Variations on 'America'", theme (1a) and variation I (1b) and Mozart's "Twelve Variations on 'Ah, vous dirai-je Maman'" theme (2a) and variation VIII (2b), the most prominent characteristic is the absence of change in several of the music parameters. As a result, the two cases which are most similar and which, therefore, are linked in the first stage, are music parameters in which no change occurs - all scores are zeros. From that point, each case is chosen for linkage based upon its similarity to the first cluster. In an effort to avoid comparing zeros to zeros, parameters which contained no changes were not included in the data to be clustered. This resulted in N's which varied from piece to piece. For example, the first Ives selection (1a) contained thirteen measures and 12 parameters: scores for each of four subjects and each of eight music parameters for each of 13 measures. Six of the eight music parameters, however, contained only zeros - no change. Therefore, only the four sets of subject scores (DCGR) and the two sets of music-parameter scores (DCMP) which contained change were entered as data to be clustered, resulting in a total of 6 cases (5 stages). Conversely, in the Dohnanyi variations, some degree of change occurred, at some point, within every parameter; therefore, twelve cases (11 stages) were clustered (see Appendix H).

The absence of change (a score of zero), whether occurring in stimulus (DCMP) or response (DCGR) scores, was important information, but it was also easily observed. Conversely, a DCGR and DCMP score agreement was as valid when it represented agreement that no change(0 DOC) had occurred as when it represented agreement that change had occurred (1,2,or 3 DOC). I therefore eliminated from the data sets those parameters in which no change occurred, thereby allowing the clustering process to begin by linking those cases (parameters and/or subjects) whose degrees of change (rather than the absence of change) were being compared.

The Main Study

Based upon previous research results which have indicated significant differences between the abilities of second- and fourth-grade children, together with the possible "plateau" effect which has been placed at or about the age of nine, subjects for the main study were selected both from the group previously videotaped and from second- and fourth-grade students at two public elementary schools in the Metroplex area. Scores from subject 4 (a sixth-grader from the second pilot study) were dropped from the data and only second- and fourth-grade students were used as subjects. The two groups consisted of five boys and five girls in the second-grade group, and four boys and six girls in the fourth-grade group. The non-verbal, graphing response mode described in pilot study 2 was used for the main study, and seventeen additional sets of subject data were gathered and analyzed, resulting in twenty sets.

Data collection proceeded according to methods described in the pilot studies, and the music stimulus utilized was the same as that which had been used for the second pilot study [Ives' "Variations on 'America'" (theme, variation I), Mozart's "Twelve Variations on 'Ah, vous dirai-je Maman'" (theme, variation V), Dohnanyi's

"Variations on a Nursery Song" (variation I), and Copland's variations on "Simple Gifts" from Appalachian Spring. Determination as to change/no change and degree of change in the music stimulus (DCMP), which had been made previously for the pilot studies, was employed again for the main study (see Appendix C-1 to C-8).

Twenty children's sets of graphs (GRP) were gathered and analyzed to determine number, type, and nature of change according to the Degree of Change in Graphing Response (DCGR) scales previously established (see Appendix B).

Data analysis proceeded according to methods described in the pilot studies. Comparison of changes in the graphing response pattern (GRP) to points of change in the music stimulus was made by establishing percentages of agreement between DCGR scores and DCMP scores with regard to change/no change. Percentages of agreement scores were compiled for subjects on each musical composition. On the Copland composition, percentage of agreement scores were obtained using both the intact example and the parcelled condition. Pearson's Product-Moment Correlation Coefficient (Pearson's r), Hierarchical Cluster Analysis, and qualitative, observational comparisons of music stimulus to student response patterns were used to determine the relationship of changes in subjects' graphing response pattern (DCGR) to the quality and magnitude of the elemental change (DCMP) within the music stimulus.

CHAPTER IV

RESULTS OF THE STUDY

The purpose of this study was to investigate changes in selected children's Graphing Response Patterns (GRP) to elemental changes in compositions in theme and variation form. The research problems were:

1. To determine points and degrees of elemental change in the compositional structure of the musical examples.

2. To determine number, degree, and nature of changes in subjects' graphing response pattern (GRP) to aurally presented musical examples.

3. To determine percentages of agreement between changes in graphing response patterns (GRPs) and points of elemental change within the compositional structures.

4. To determine the relationship of changes in subjects' graphing response pattern (DCGR) to the quality and magnitude of elemental change (DCMP) within the compositional structure.

Both quantitative and qualitative analyses were conducted to investigate the research problems. Results of the analysis of change in music parameters include comparisons within and between music examples. Results of the graphing response analysis include comparisons of both number and degree of subject-response change within and across all music examples. Comparison of changes in the graphing response pattern (Degree of Change in Graphing Response or DCGR) to points of change in the music stimulus (Degree of Change in Music Parameters or DCMP) was made by establishing percentages of agreement between both types of scores with regard to change/no change. To determine the relationship of changes in subjects' graphing response pattern (DCGR) to the quality and magnitude of elemental change (DCMP) within the compositional structure, Pearson's Product-Moment Correlation Coefficient and Hierarchical Cluster Analysis were utilized. Qualitative analysis included observational comparisons of music stimulus to student response patterns. Results of the quantitative analyses will be presented according to the research problems, followed by an overall qualitative analysis of the data.

Points and Degrees of Elemental Change in the Compositional Structure of the Musical Examples

The analysis and evaluation procedures for the music parameters consisted of two judgements: (1) whether change had occurred, and (2) if change had occurred, to what degree. Final scores for the individual music parameters (DCMP) in each of the six compositions may be seen in Appendix K. Results showing total number of measures/points of change and total degree of change per music parameter per variation may be seen in Tables 6 and 7, as well as the totals possible for both points and degrees of change (see also Appendix J: Analysis of Musical Change).

The Music Compositions

Tables 5 and 6 illustrate the variety of change exihibited in the music compositions, ranging from those in which change occurs in only two parameters (Ives theme, Mozart theme) to those inwhich change occurs in all eight parameters (Dohnanyi, Copland variations 1 and 2). Table 5 shows, based upon total number of measures, that the Ives variation contains the largest percentage of measures with change (77%), followed by the Dohnanyi (75%) and the Copland theme (73%). The music example containing the smallest percentage of measures with change is the Ives theme (21%), followed by the Mozart theme with 33% and the second Copland variation with 48% of measures containing change. Table 6 indicates, based upon the total degree of change possible, the Dohnanyi variation as containing the largest percentage of degree of change (12%), followed by the first Copland variation with 10% and the Copland theme with 9% of the total degree of change possible. The smallest percentages of degree of change are in the Ives theme (3%) and variation (5%).

A comparison of the total degrees of change (Table 6) with the total points of change (Table 5) revealed a view of

Table 5

Ives, Mozart, Dohnanyi, and Copland: Total Number of Measures/Points of Change per Music-Parameter per Variation

Parameters	Ives		Mozart		Dohnanyi	Copland					All
	Th	V	Th	V	V	Th	V1	V2	V3	V4	Th-V4
Timbre	0	0	0	0	4	7	6	9	12	6	**40**
Interval Size	0	4	0	6	15	7	5	8	9	1	**30**
Texture	0	0	0	4	1	0	2	1	5	2	**10**
Tempo/Meter	0	4	0	3	3	0	2	2	2	1	**7**
Attack	3	11	7	13	1	2	5	2	16	4	**29**
Key/Mode	0	0	0	0	8	1	1	1	0	0	**3**
Dynamic Level	0	0	0	0	8	2	4	4	3	2	**15**
Melodic Presentation	3	5	8	9	10	7	7	9	10	3	**36**
Total Points of Change	**6**	**24**	**15**	**35**	**50**	**26**	**32**	**36**	**57**	**19**	**170**
Total Points of Change Possible	112	176	192	192	224	152	144	248	392	128	1064
Actual Percentage of Points of Change	**5%**	**14%**	**8%**	**18%**	**22%**	**17%**	**22%**	**15%**	**15%**	**15%**	**16%**

(table continues)

Table 5, continued

Parameters	Ives		Mozart		Dohnanyi	Copland					All
	Th	V	Th	V	V	Th	V1	V2	V3	V4	Th-V4
Total Measures with Change	**3**	**17**	**8**	**17**	**21**	**14**	**11**	**15**	**27**	**8**	**75**
Total Measures	14	22	24	24	28	19	18	31	49	16	133
Actual % Measures with Change	**21%**	**77%**	**33%**	**71%**	**75%**	**73%**	**61%**	**48%**	**55%**	**50%**	**56%**

Note: Each point of change is in a single parameter in 1 measure; therefore, it is possible for each measure to have 8 points of change

Table 6

Ives, Mozart, Dohnanyi, and Copland:

Total Degree of Change per

Music-Parameter per Variation

Parameters	Ives		Mozart		Dohnanyi	Copland					All
	Th	V	Th	V	V	Th	V1	V2	V3	V4	Th-V4
Timbre	0	0	0	0	10	12	10	13	30	10	75
Interval Size	0	4	0	7	19	7	5	10	11	3	36
Texture	0	0	0	7	1	0	2	2	8	4	16
Tempo/Meter	0	4	0	3	5	0	2	3	4	3	12
Attack Density	7	11	15	13	1	2	5	4	20	5	36
Key/Mode	0	0	0	0	14	2	2	3	0	0	7
Dynamic Level	0	0	0	0	10	5	5	5	3	3	21
Melodic Presentation	3	5	14	15	21	12	11	15	14	4	56
Total Degree of Change (DCMP)	**10**	**24**	**29**	**45**	**81**	**40**	**42**	**55**	**90**	**32**	**259**
Total DOC Possible	336	528	576	576	672	456	432	744	1176	384	3192
Actual Percentage of Possible DOC	**3%**	**5%**	**5%**	**8%**	**12%**	**9%**	**10%**	**7%**	**8%**	**8%**	**8%**

Note: Total Degree of Change Possible is derived from the total number of measures x 8 parameters x 3 possible degrees of change.

Theme: Th; Variation: V

the overall level of change in each composition. For example, in the Ives variation both the total degree of change and the total points of change are 24, indicating that all changes are level-two (1 DOC) changes. This explains why 1b has the highest percentage of measures containing change (77%) but ranks ninth in percentage of possible points of change (Table 5) and tenth in actual percentage of possible degree of change (Table 6): each of a large number of measures contains a small amount of change. Conversely, in the Mozart composition only 33% of the measures contain change, but there are twenty-nine degrees of change and only 15 points of change, a relationship of almost two to one: each of a small number of measures contains an average DOC-level approaching three (1.9 average DOC). The Dohnanyi exemplifies a high percentage of possible degree of change (81 DOC or 12%, ranked first), a high percentage of possible points of change (50 points or 22%, ranked first), and a high percentage of measures with change (21 measures or 75%, ranked second), while the average level of change (1.6 average DOC) falls near the middle of a range from 1.0 average DOC (Ives variation) to 1.9 average DOC (Mozart theme).

Of the eight individual music parameters which describe each composition, attack/rhythmic density and melodic presentation are responsible for the majority of change which occurs in both the Ives (theme 70%; variaion, 46%) and the Mozart (theme, 52%; variation, 29%) compositions. As mentioned earlier, however, in both the Ives and Mozart themes, only two parameters contain any change, and only four parameters each in the Ives and Mozart variations contain change. With the exception of the third Copland variation, the prominence of attack/rhythmic density is balanced, if not replaced, by other parameters which contain change. Melodic presentation, however, continues to account for a considerable amount of the total degree of change across all parameters regardless of the number of parameters present. The importance of the magnitude of parameter change will be addressed in the discussion of the relationship between the music parameter and graphing response degrees of change.

Number, Degree, and Nature of Change in Subjects' Graphing Response Pattern

The analysis and evaluation procedures which were applied to the students' graphing response patterns paralleled those applied to the music parameters with reference to the judgements addressed: whether change had occurred and, if so, to what degree. Final student response scores (DCGR) may by seen in Appendix L. Results showing total number and degree of subject-response change across all subjects, all measures, as well as percentages of subject-response and degrees of change possible, may be seen in Table 7. The highest percentage of subject-response change occurred in the Ives variation with 48% of possible change, followed by the Ives theme with 38% and the Dohnanyi variation with 31%. The music composition with the smallest percentage of subject-response change was the third Copland variation with only 16% of possible response change. The largest percentage of possible degree of change occured in the Ives variation with 27% of possible degree of change, followed by the Dohnanyi variation with 20%. The composition with the smallest percentage of possible degree change was the third Copland variation with only 9%.

Comparison of the percentage of possible subject-response change and the percentage of possible degree of change gives an overview of the nature of the change present. For example, although the Ives theme ranked second in number of subject-responses (38%), it ranked fourth in percentage of possible degree change: subjects made frequent but small changes in their graphing response pattern. Conversely, the Mozart variation ranks third in percentage of possible degree change (17%) but seventh in percentage of possible response changes: the occurrence of graphing-response change was infrequent but the magnitude, when change did occur, was relatively large. The import of these and other examples will be addressed in the comparison of graphing-response change to change in the music parameters.

Table 7

Ives, Mozart, Dohnanyi, and Copland: Total Number and Degree of Subject-Response Change Across All Subjects, All Measures

Music Example	Number Subject-Response Changes	Number of Changes Possible	Percentage of Possible Response Change	Degree of Subject-Response Change	Degree of Change Possible	Percentage of Possible Degree of Change
Ives						
Theme	105	280	**38%**	142	840	**17%**
Variation	210	440	**48%**	362	1320	**27%**
Mozart						
Theme	112	480	**23%**	180	1440	**13%**
Variation	144	480	**24%**	245	1440	**17%**
Dohnanyi						
Variation	175	560	**31%**	334	1680	**20%**
Copland						
Theme	101	380	**27%**	160	1140	**14%**
Variation 1	104	360	**29%**	182	1080	**17%**
Variation 2	148	620	**24%**	261	1860	**14%**
Variation 3	159	980	**16%**	270	2940	**9%**
Variation 4	87	320	**27%**	158	960	**17%**
All Th-V4	599	2660	**23%**	1031	7980	**13%**

Note: Total number of Subject-response changes possible across all subjects, all measures is twenty (20) per measure x total number of measures.

Total degrees of change in subject-response possible across all subjects, all measures is sixty (60) DOC per measure x total number of measures.

Percentages of Agreement Between Changes in Graphing Response Patterns and Points of Elemental Change within the Compositional Structure

In order to ascertain whether change in children's graphing response pattern actually reflected a response to change in the music, percentages of agreement between changes in graphing response pattern and points of change in the music parameters were established. Results included percentages of agreement for: (1) individual subject graphing response, graphing response grouped by subjects' age/grade (second- and fourth-grade students), and combined subjects graphing responses to points of musical change across all parameters, as well as (2) individual, grouped, and combined subject graphing responses to points of change in individual parameters (see Appendix M). Total percentage of agreement between graphing-response and music-parameter change across all subjects and parameters may be seen in Table 8.

Based upon results of the pilot study which showed a possible lack of response to changes of only 1 DOC in a single parameter, condition two (in which a score of zero was recorded for any measure in which the DCMP score was only 1 DOC in a single parameter) was used throughout for combined parameters (see Appendix M). As shown in Table 8, percentages of agreement between subject-response change and

Table 8

<u>Ives, Mozart, Dohnanyi, and Copland: Total Percentage of Agreement Between Subject-Response and Music-Parameter Change Across All Subjects, All Parameters</u>

Music Example	Percentage of Agreement Grade 2	Percentage of Agreement Grade 4	Percentage of Agreement All
Ives			
Theme	64%	65%	65%
Variation	40%	54%	47%
Mozart			
Theme	68%	72%	70%
Variation	63%	63%	63%
Dohnanyi			
Variation	63%	62%	63%
Copland			
Theme	64%	71%	68%
Variation 1	66%	68%	67%
Variation 2	72%	73%	73%
Variation 3	75%	78%	77%
Variation 4	73%	68%	70%
All (Th-V4)	71%	73%	72%

music-parameter change were well above the level of chance, and overall scores for condition two were from as little as a few percentage points to as much as thirty-one percentage points higher in percentage of agreement than the same comparison using condition one. This would seem to indicate that a level-two change (1 DCMP) in a single parameter was not sufficient to cause an observable change in the attention of the young listener; some exceptions to this observation, however, will be noted in subsequent discussion.

Comparisons of children's responses grouped by age/ grade showed no substantial differences; rather, subject scores spanning a wide range of percentage of agreement were found in each group. This suggests the possibility that perceptual attention is more individualized to the listener than characteristic of a particular age group.

Percentage of Agreement Across All Subjects, Combined Parameters

Overall percentage of agreement between subject-response and music-parameter change across all music ranged from 47% to 77%. A difference of sixteen percentage points seperated the two lowest scores. Agreement was highest in the third Copland variation (77%), followed by the second variation with 73% and the complete Copland (Th-V4) with 72% agreement. With the exception of the Mozart theme in which the percentage of agreement ranked fifth in the group of eleven, the highest percentages of agreement were found in the Copland theme and variaions. Ranked next to the bottom was the percentage of agreement in the Dohnanyi variation, while the Ives variation contained the lowest percentage of agreement and a score which was sixteen percentage points below that of the Dohnanyi composition. Excluding the Ives variation, however, the lowest and highest ranking scores were separated by only fourteen percentage points.

Percentage of Agreement Across All Subjects, Single Parameters

Results indicating those parameters with the highest ranking percentage of agreement between graphing response and music parameter may be seen in Table 9. Combining the number of the highest and second-highest ranking percentages of agreement between graphing response (DCGR) and music parameters (DCMP) in the individual Copland variations, the percentage of agreement was highest in the third variation in eighteen of the twenty subjects. In ranking percentage of agreement between subjects' graphing responses and the eight music parameters, 18 subject-responses had the highest percentage of agreement with tempo/meter. In the Ives theme, attack density and melodic presentation are the only two parameters in which any change occurs; in the Ives variation, however, interval size has the highest ranking percentage of agreement with subjects' graphing response score. The highest ranking parameter/graphing scores in both the Mozart and the Dohnanyi compositions are in melodic presentation and texture. Percentage of agreement results for combined subjects to singleparameters may be seen in Appendix M.

The Relationship of Changes in Subjects' Graphing Response Pattern to the Quality and Magnitude of Elemental Change Within the Compositional Structure

The relationship of change in subjects' graphing response patterns to the quality and magnitude of elemental change in the music parameters may be seen in results of both Pearson's Product-Moment Correlation Coefficient and Hierarchical Cluster Analysis (see Appendix N and Appendix O).

Correlation between Music Parameters and Graphing Response

Results of the Pearson's Product-Moment Correlation Coefficient may be seen in Appendix N. Table 10 shows the level of correlation between changes in subject graphing responses and music parameters across all subjects using individual parameters, as well as the total degree and number of measures/points of change in each parameter. A comparison of parameters representing the highest correlations with parameters containing the highest degrees of change indicated that often the two were not the same. Although this condition manifested itself in all compositions, it was particularly evident in the Dohnanyi

Table 9

Highest Ranking Percentage of Agreement of Change Between Subjects'Graphing Responses and Individual Music Paramenters/Variations

	Rank	Theme Variation: Th	V1	V2	V3	V4	Parameter: Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	
Number of Highest Ranking Responses	1st	Copland 0	0	4	11	6	1	1	4	12	0	6	4	4	
Number of Second-Highest Ranking Responses	2nd	3	6	6	7	3	0	0	7	6	0	5	7	1	
					# Ss										# Ss
Rank from Highest to Lowest Percentage of Agreement using two highest-ranking scores only, all Ss	1st	V3			18		Tempo/meter								18
	2nd	V2			10		Key/mode, Texture, Dynamic level								11 ea
	3rd	V4			9		Melodic presentation								5
	4th	V1			6		Interval size, Timbre								1 ea
	5th	Th			3		Attack density								0
							Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	
Highest Ranking Parameters using Individual Examples (Excluding Parameters which contain no change: all zeros)		Ives													
		Th									65%			65%	
		V						54%							
		Mozart													
		Th												72%	
		V							69%						
		Dohnanyi							69%					69%	

Note: "# Ss" denotes number of subject scores ranking 1st or 2nd and Copland compositions. For instance, in the Copland theme, attack density had a correlation of 28% although there were only 2 degrees of change and 2 points of change (indicating two level-two changes). Timbre, which ranked third in correlation in 4a, had 12 degrees of change over 7 measures, while dynamic level ranked second in correlation with 5 degrees of change over 2 measures. In the third Copland variation,tempo/meter ranked third in correlation although it represented only 4 degrees of change over 2 measures. Similar situations werefound in every composition. It should be noted that the correlation between student response and timbre, regardless of the ration degree-of-change/points-of-change, was in the top three ranks in every music composition in which timbre contained any degree of change.

As seen in Appendix N, results show a higher correlation in comparisons between a single subject and a single parameter than for the mean of all subjects to individual parameters. The inability to make comparisons using combined parameter scores, due to the nature of the statistic, resulted in comparisons which showed only relationships to a single parameter, although the subjects were being presented with all parameters simultaneously. Rarely does a single parameter dominate an entire composition to the exclusion of all others. The one composition which approaches single-parameter domination is

Table 10

Ives, Mozart, Dohnanyi, and Copland: Correlation Between Changes in Subject Graphing Response and Music Parameter Across All Subjects, Individual Parameters

Music Example	Timbre	Interval Size	Texture	Tempo/ Meter	Attack Density	Key/ Mode	Dynamic Level	Melodic Presentation
Ives								
Theme	NC	NC	NC	NC		NC	NC	
Variance					14%			16%
Total DCMP					7			3
# Points of Chg					3			3
Variation	NC		NC			NC	NC	
Variance		12%		13%	11%			8%
Total DCMP		4		4	11			5
# Points of Chg		4		4	11			5
Mozart								
Theme	NC	NC	NC	NC		NC	NC	
Variance					31%			33%
Total DCMP					15			14
# Points of Chg					7			8
Variation	NC					NC	NC	
Variance		6%	8%	9%	8%			8%
Total DCMP		7	7	3	13			15
# Points of Chg		6	4	3	13			9
Dohnanyi								
Variation								
Variance	9%	7%	19%	19%	9%	6%	12%	3%
Total DCMP	10	19	1	5	1	14	10	21
# Points of Chg	4	15	1	3	1	8	8	10

Note: Scores Using r : Pearson's Product-Moment Correlation Coefficient

Table 10 continued

Music Example	Timbre	Interval Size	Texture	Tempo/ Meter	Attack Density	Key/ Mode	Dynamic Level	Melodic Presentation
Copland Theme								
Variance	21%	0%	NC	2%	28%	19%	22%	16%
Total DCMP	12	7		1	2	2	5	12
# Points of Chg	7	7		1	2	1	2	7
Variation 1								
Variance	59%	17%	40%	54%	30%	0%	20%	47%
Total DCMP	10	5	2	2	5	2	5	11
# Points of Chg	6	5	2	2	5	1	4	7
Variation 2								
Variance	20%	19%	10%	22%	19%	1%	20%	13%
Total DCMP	13	10	2	3	4	3	5	15
# Points of Chg	9	8	1	2	2	1	4	9
Variation 3								
Variance	33%	5%	21%	28%	3%	NC	27%	34%
Total DCMP	30	11	8	4	20		3	14
# Points of Chg	12	9	5	2	16		3	10
Variation 4								
Variance	71%	27%	27%	57%	38%	NC	68%	66%
Total DCMP	10	3	4	3	5		3	4
# Points of Chg	6	1	2	1	4		2	3
All (Th-V4)								
Variance	27%	11%	10%	21%	6%	5%	29%	31%
Total DCMP	75	36	16	12	36	7	21	56
# Points of Chg	40	30	10	7	29	3	15	36

Table 10 continued

Music Example	Timbre	Interval Size	Texture	Tempo/ Meter	Attack Density	Key/ Mode	Dynamic Level	Melodic Presentation
Ives								
Theme	NC	NC	NC	NC	2	NC	NC	1
Variation	NC	2	NC	1	3	NC	NC	4
Mozart								
Theme	NC	NC	NC	NC	2	NC	NC	1
Variation	NC	3	2	1	2	NC	NC	2
Dohnanyi								
Variation	3	4	1	1	3	5	2	6
Copland								
Theme	3	7	NC	6	1	4	2	5
Variation 1	1	7	4	2	5	8	6	3
Variation 2	2	3	5	1	3	6	2	4
Variation 3	2	6	5	3	7	NC	4	1
Variation 4	1	6	6	4	5	NC	2	3
All (Th-V4)	3	5	6	4	7	8	2	1

NOTE: Numbers 1-6 are RANK of Variance

the Mozart theme: change occurs in only two of the eight parameters, and correlation between change in those two parameters and graphing response was higher than in any of the first three music compositions.

Varying magnitudes of correlation were found across the group of twenty subjects, with no indication that one group had notably higher or lower results than did the other.

Hierarchical Cluster Analysis

Hierarchical Cluster Analysis was utilized to see which music parameters (DCMP) and graphing responses (DCGR) were least different or most similar. Results, plotted as dendrograms, may be seen in Appendix O. They suggest that the variables which were most similar, that is, had the least distance between them, were the music parameters (represented by the numbers 1 through 8 in the dendrograms). In general, the subjects' graphing responses, represented by numbers 9 through 28 in the dendrograms, were not clustered until several stages after the initial clustering of the music parameters. This pointed toward an overall condition wherein there existed less initial distance/difference between the relationships of music parameter to music parameter and graphing response to graphing response than of parameter to response. There were exceptions to this general tendency which will be noted in discussion of the individual compositions.

Ives Composition. In the Ives theme and variation, the parameters Key/mode (6), Dynamic Level (7), Timbre (1), and Texture (3) contain no change and, therefore, have scores of zero. As a result, they were the most similar and were clustered first. The two parameters which contain only 4 degrees of change each [Interval Size (2) and Tempo/meter (4)] were joined to the original cluster. Melodic Presentation (8), a parameter which contained 8 degrees of change, was clustered with the original before the first two subject responses were joined (Subjects 4 and 9). The last music parameter to be clustered was Attack Density (5), which had the greatest degree of change (18 DOC). From that point, the subject responses were clustered according to their distance from zero: graphing response scores representing fewer occurrances of change and containing fewer degrees of change were clustered earlier, while those which represented more occurrances of change and contained the greatest degree of change were not clustered until the final stages of agglomeration.

Mozart Composition. The clustering process began by first clustering those variables which had no change (i.e., Key/mode, Dynamic Level, and Timbre), then joining Tempo/meter, Interval Size, and Texture (3, 7 and 7 DOC respectively). The similarity of scores between subjects 2, 7, 10, 17, and 9, and parameters 5 and 8 (Attack Density and Melodic Presentation) is shown by the large cluster which begins in stage ten and continues through stage seventeen. The two sets of subject responses which were joined to the original cluster in the final two stages were Subjects 3 and 1, representing 39 and 35 DOC, respectively.

Dohnanyi Composition. The Dohnanyi work had no parameters without some change. Texture and Attack Density (1 DOC each) formed the original cluster, followed by the inclusion of Tempo/meter and Dynamic Level (5 and 10 DOC, respectively). Beginning in stage three and continuing through stage twelve, results indicated similarity among graphing-response scores for seven subjects (3, 17, 15, 9, 13, 20, and 6) and parameter 1 (Timbre). Interval Size (19 DOC) and Timbre (10 DOC) were in an overlapped cluster with Subjects 20, 6, 5, 18, 10, and 19. Parameters 6 and 8 (Key/mode and Melodic Presentation) showed the least similarity either to other parameters or to subjects and were clustered near the end of the process.

Copland Composition. The clustering process in Copland's theme and variations example was very similar to those previously discussed. First clustered were the most similar music parameters (Texture, Tempo/meter, Dynamic Level, and Key/mode, with 16, 12, 21, and 7 DOC, respectively), then Interval Size and Attack Density (36 DOC each). Five sets of subject graphing-responses (Subjects 19, 4, 13, 10, and 16) were joined to the original cluster before parameter 8 (Melodic Presentation, 56 DOC) was included. This was followed by the clustering of six sets of subject graphing-response scores (Subjects 20, 17, 18, 12, 11, and 14). Parameter 1 (Timbre), which contained 75 degrees of change, was not joined in a cluster until stage twenty-three, followed by Subjects 2, 15, 1, and 3 (61, 84, 80, and 91 DOC, respectively). This supports results discussed earlier which point to the strong relationship between overall subject response and timbre.

Observed Relationship of Graphing Response to Music Parameters

Upon closely examining all data, the number and magnitude/degree of student response seemed to be proportionate to the number and magnitude of change in the music parameter/s. In general, those measures in which the most change occurred in the music parameters (DCMP), both in number of parameters changing and in magnitude/degree of change, were also the measures in which the greatest number and degree of change was observed in the children's graphing responses (DCGR) (see Table 11 and Appendix J). The reverse was also true in most cases: those measures in which the least amount of change occurred in the music parameters, both in number of parameters changing and in degree of change, were the measures in which the fewest number and least degree of change was observed in the children's graphing responses.

As was noted in an earlier discussion of correlation, there were exceptions to these general rules, most notably with regard to children's responses to specific types of change such as certain timbral and motivic/melodic alterations, cadence points, andspecific situations such as the very first occurance of a particulartype of change.

Table 11 presents comparison examples of measures with a relatively high degree of change in both music parameters and graphing response. For example, in measure 6 of the Ives Variation, 13 children responded with twenty-three degrees of change; the only change in the music parameters at that point, however, is in melodic presentation: the first cadence (1 DCMP) occurs in measure 6. (There is also a trill in the obligato accompaniment in the top register, but the magnitude of the change is less than 1 on the DCMP scale.) A full cadence also occurs in measure 14, but only two children's response patterns changed and then only by 3 DCGR. Two measures later in the same work, a response of 23 DCGR by eleven children was recorded. The only change in the music parameters in measure eight is in attack/rhythmic density: a level-two change of 1, which is also, however, the first change in attack density in the piece. The nature of these results would seem to indicate that subject's perceptual attention was captured by a certain level of

Table 11

Ives, Mozart, Dohnanyi, and Copland: Comparison of Change in Music Parameter with Change in Graphing Response

Music Example	Measure Number in Music	Degree of Change	Number of Parameters Changing	Measure Number in Graph	Degree of Change	Number of Responses Changing
Ives Theme	M 6	3	2	M 6	14	3
	M 7	3	2	M 7	9	7
	M 14	4	2	M 14	16	13
Ives Variation	M 11	2	2	M 11	17	11
	M 12	2	2	M 12	24	13
	M 13	2	2	M 13	26	14
	M 15	2	2	M 15	25	12
	M 20	2	2	M 20	25	17
	M 21	2	2	M 21	28	15
Mozart Theme	M 7	5	2	M 7	19	10
	M 8	4	2	M 8	18	14
	M 9	2	2	M 9	15	8
	M 15	5	2	M 5	19	10
	M 16	4	2	M 16	13	9
	M 23	4	2	M 23	23	11
	M 24	4	2	M 24	7	6

Table continues

Table 11 continued

Music Example	Measure Number in Music	Degree of Change	Number of Parameters Changing	Measure Number in Graph	Degree of Change	Number of Responses Changing
Mozart	M 3	7	5	M 3	6	4
Variation	M 9	6	5	M 9	24	14
	M 13	3	2	M 13	10	7
	M 17	2	2	M 17	20	10
	M 18	7	4	M 18	17	8
	M 19	5	3	M 19	12	9
	M 24	2	2	M 24	11	8
Dohnanyi	M 5	3	2	M 5	15	10
	M 6	4	2	M 6	10	15
	M 9	4	2	M 9	21	11
	M 13	4	2	M 13	14	8
	M 14	4	3	M 14	12	7
	M 18	4	3	M 18	16	9
	M 23	6	3	M 23	24	12
	M 24	7	4	M 24	28	16
	M 25	11	7	M 25	21	9
Copland						
Theme	M 9	9	3	M 9	14	10
	M 13	7	3	M 13	15	9
Variation 1	M 20	9	6	M 20	24	12
	M 28	8	4	M 28	13	9
	M 36	11	7	M 36	20	10
Variation 2	M 38	7	5	M 38	16	7
	M 63	12	6	M 63	26	15
	M 67	8	4	M 67	12	7

Table continues

Table 11 continued

Music Example	Measure Number in Music	Degree of Change	Number of Parameters Changing	Measure Number in Graph	Degree of Change	Number of Subjects Changing
Variation 3	M 69	13	7	M 69	22	10
	M 77	12	6	M 77	10	8
	M 85	5	2	M 85	17	8
	M 93	5	3	M 93	11	6
	M 100	5	3	M 100	15	9
	M 101	9	4	M 101	17	9
	M 117	2	1	M 117	16	8
Variation 4	M 118	11	5	M 118	34	13
	M 126	2	2	M 126	14	9
	M 133	13	6	M 133	12	8

Note: Table shows highest scores in DCM in both DCGR and DCMP novelty or "newness" within the music parameters, rather than merely by the change itself.

Responses to Changes in Melodic Line and Tonal Center.

Results indicated that young listeners are sensitive both to alterations/changes in the melodic line and to instability, ambiguity, or shift in tonal center, two types of change which frequently occur together or in close proximity to each other. Forexample, in the Dohnanyi variation, compression of the melodic line (3 degrees of change in music parameter) and an unstable, transitional tonal center (1 DCMP) in measure 11 correspond to a total degree of change in graphing response (DCGR) of eight by 6 children. A short, transitory move through d-minor in measure 12 (2 DCMP) caused a response change of 14 DCGR by eight children, while the melodic fragment expansion (3 DCMP) with transitional tonal material (1 DCMP) which occurs in measure 13 also caused a response change by eight children of 14 DCGR.

Another example of attention to alterations in the melodic line occurred in the Mozart theme (2a) when the top voice produces a melodic embellishment/ornament (turn, or Doppelschlag) in measures 7, 15, and 23. The graphing responses to those three measures was 19 DCGR by 10 children in both measures 7 and 15, and 23 DCGR by eleven children in measure 23. The increased number of attacks resulting from the turns cause change in the attack density parameter, as well. The only measures with any degree of change are measures 7, 8, 9, 15, 16, 17, 23 and 24. Other than the three measures containing turns, one measure contains an alteration in the melodic line (m 16), two measures contain cadences (mm 8, 24), and the remaining two contain the introduction or return of a melodic motive (mm 9, 17), none of which constitutes an unusually large degree of change. These are, however, the only changes which occur in the piece, and they elicit responses of relatively large magnitude: fourteen responses of 18 degrees of change in graphing response (DCGR), eight responses of 15 DCGR, nine responses of 13 DCGR, twelve responses of 25 DCGR, and six responses of 7 DCGR (measures 8, 9, 16, 17, and 24, respectively). This seems to be an example wherein the smaller the amount of change occurring in the music parameters, the smaller the amount of change required to cause a change-response in the listener. Conversely, there are areas in the Copland example where the frequency and magnitude of change occurring from measure to measure is such that any additional change must be relatively large to become aurally prominent. For example, in measure 67, four parameters change 8 DCMP. Two of the four parameters contain level-four changes, one of which is a change of tonal center from G-flat to C-major.

In the earlier example of change-response to a shifting tonal center (Dohnanyi, measure 12, one parameter, a level-three change) there were eight responses at 14 DCGR. In the Copland composition, however, there were seven responses at 12 DCGR. One explanation may lie in what had occurred in the measures immediately previous to the measures in question. Three measures previous to the key change in the Copland was the beginning measure of a section of bridge material in which 12 DCMP occurred in six parameters. The DCGR for that particular measure was fifteen responses of 26 DCGR. Also, the shift in tonal center was not the first: there had been a shift in tonality from A-flat to G-flat in measure 20. In measure 12 of the Dohnanyi variation, however, the tonal shift was the first and was preceded by a measure of tonally ambiguous transitional material. The change in question was in a single parameter and represented 2 DCMP; however, no change of a magnitude greater than 2 had occurred in the previous measures: it was a first-time occurrance.

An example of increased change where a large degree of change has been the norm occurs at the beginning of the final Copland variation. There is a level-two change in texture in measure 117, followed by 11 DCMP in 5 parameters. The tempo is halved, the dynamic level is fff, and timpani are added to an already full orchestra. The highest degree of change from the largest number of children occurs in measure 117: 34 DCGR, 13 responses.

Delayed Response Time and Changes in Tempo/Meter

The problem of response delay was noted early in the pilot study and several attempts were made to account for it. One difficulty in attempting to account for the response delay, however, stemmed from the fact that the delay seemed to increase as tempo increased, while below a certain level of speed, the delay was neglible.

For example, response delay was not prevalent in the Copland composition until the beginning of the third variation in measure 69. At this point the tempo doubles, and almost immediately what appeared to be response delay began to occur, i.e., in measure 77, a change of 12 DCMP in six parameters occurs; the response was 10 DCGR by eight children. In measure 78, however, where only one DCMP occurs, the response was 15 DCGR by eight children. A similar example may be seen in the Dohnanyi, measures 21-22, in which 10 DCMP over 4 parameters received a response of only 7 DCGR by 6 children. In the following measure, however, although only 1 DCMP occurred, the response was of 30 DCGR by fourteen children. These results would seem to indicate the possibility of a response delay of at least one measure.

Qualitative Analysis: Characteristic Dimensions of the Graphing Response Pattern

To this point, results of subject's graphing-response patterns have been quantified and evaluated collectively, using the mean of a combination of twenty sets of graphing-response scores. There are, however, some general observations which can be made regarding both individual and group response patterns which are visible only from viewing the original graphs and/or graphing process.

Graphing Size

The predeliction toward the specific, overall size (i.e., large or small) of a subject's graphs seemed to be as individualistic as was the overall size of their handwriting. Consequently, graph size varied considerably from child to child. Comparisons of size, therefore, could not be made between subjects without first establishing relative sizes within individual student's graphs. Changes in graph size within a piece seemed to coincide with music-parameter changes in dynamic level and tempo/meter. One example of graph size change of this nature frequently occurred in the Copland at the end of the third and/or beginning of the final variation (mm 118) in which the music becomes "large" in several parameters: Dynamic Level (fff), Timbre (tutti section, full orchestra), Tempo change (from q = 132 to q = 66), Meter change (from 2/4 to 2/2), and Melodic Presentation (full statement of primary theme 1a in doubled note values in unison/octaves). Subject's graphing responses literally became larger at that point and remained so through the final measures of the composition (see Figure 7).

Graphing Speed/Rate

Size change within a graph pattern was frequently accompanied by a change in the speed/rate of the pattern. In the example cited above, just as the music itself is presented in slower, broaderunits, so the graphing responses tended to be not only larger but also broader pattern units (see Figure 7). Acceleration in the speed/ rate of the graphing pattern frequently was not the result of an actual tempo change in the music but, rather, the result of an increase in attack density: an increase in the ratio of notes/attacks to a temporally constant measure unit was reflected in graphing response as an increase in overall speed. This was apparant even in situations wherein the attack density was increased while the actual tempo/speed of the metric unit was decreased (i.e., Ives variation) or remained the same.

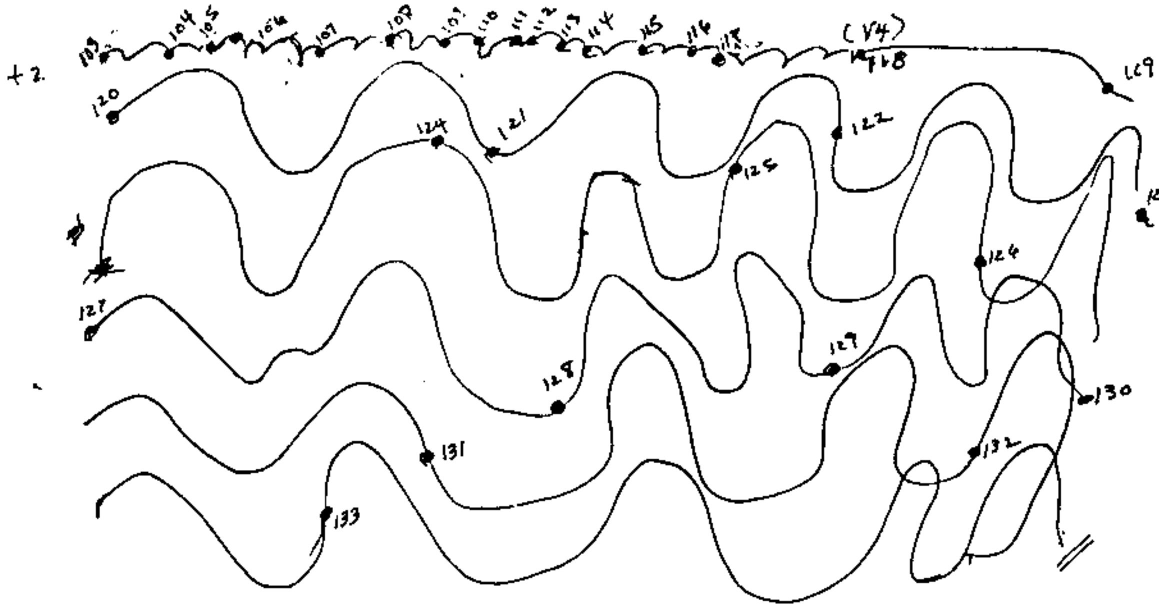
Graphing Shape

Not unlike the variance in overall size of the response graphs, the overall shape within the basic graphing pattern seemed to be individualized to the student. Comparisons of shape, therefore, could not be made between subjects without first establishing relative shapes within individual

Figure 7. Differences in Graphing Speed and Size

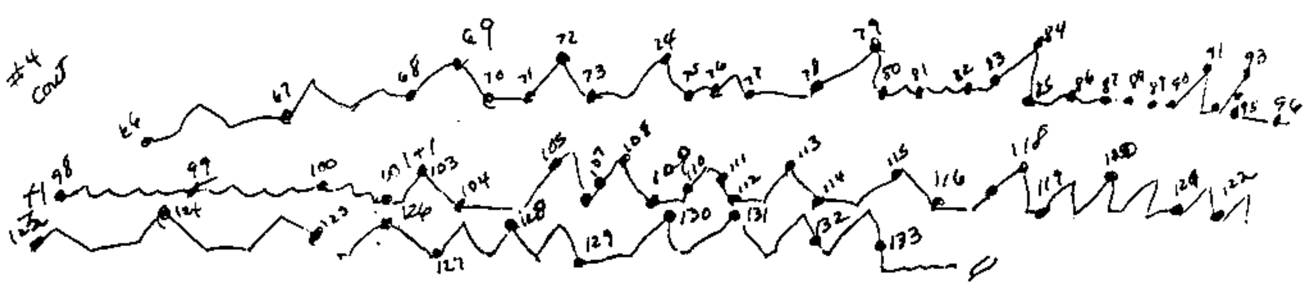
Subject 6, Grade 2

Copland, MM 103-133



Subject 9, Grade 2

Copland, MM 66-133

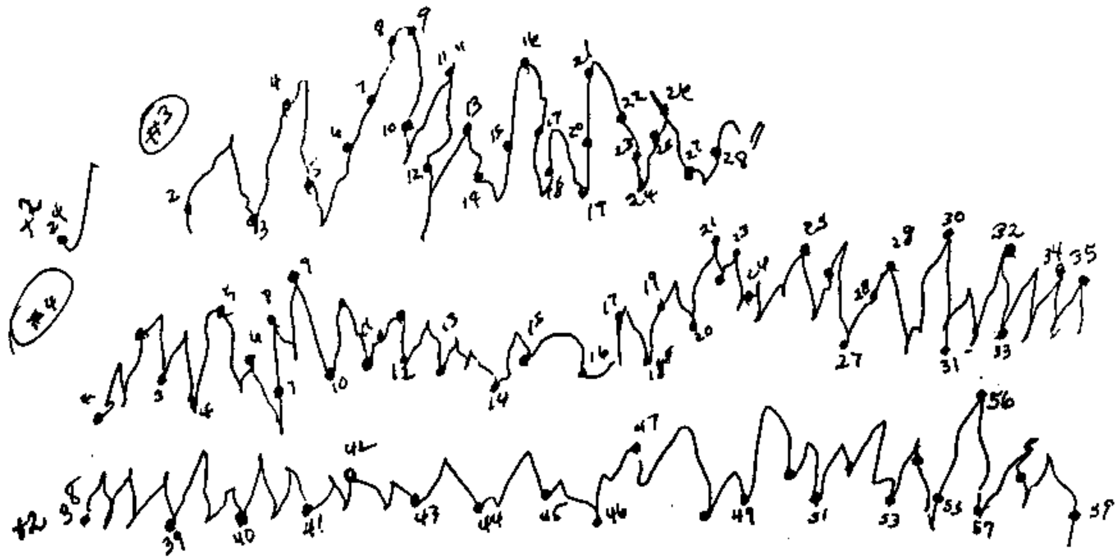


Note: All measure numbers were inserted by the researcher during the analysis process.

Figure 8. Rounded, Zig-zag Shape in Graphing Pattern

Subject 18, Grade 4

Dohnanyi Variation; Copland MM 1-59



Subject 4, Grade 2

Copland, Theme and Variations 1-4

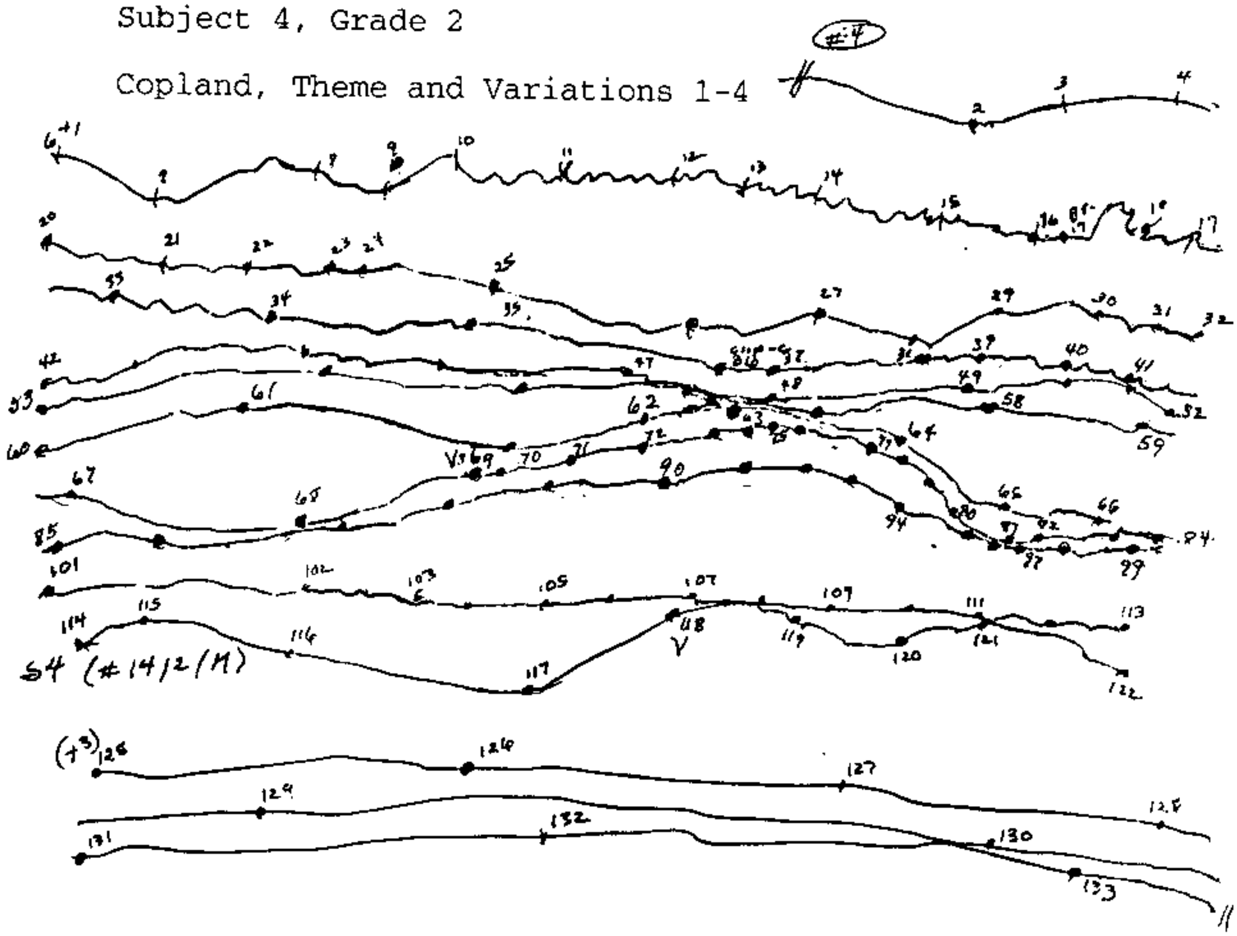
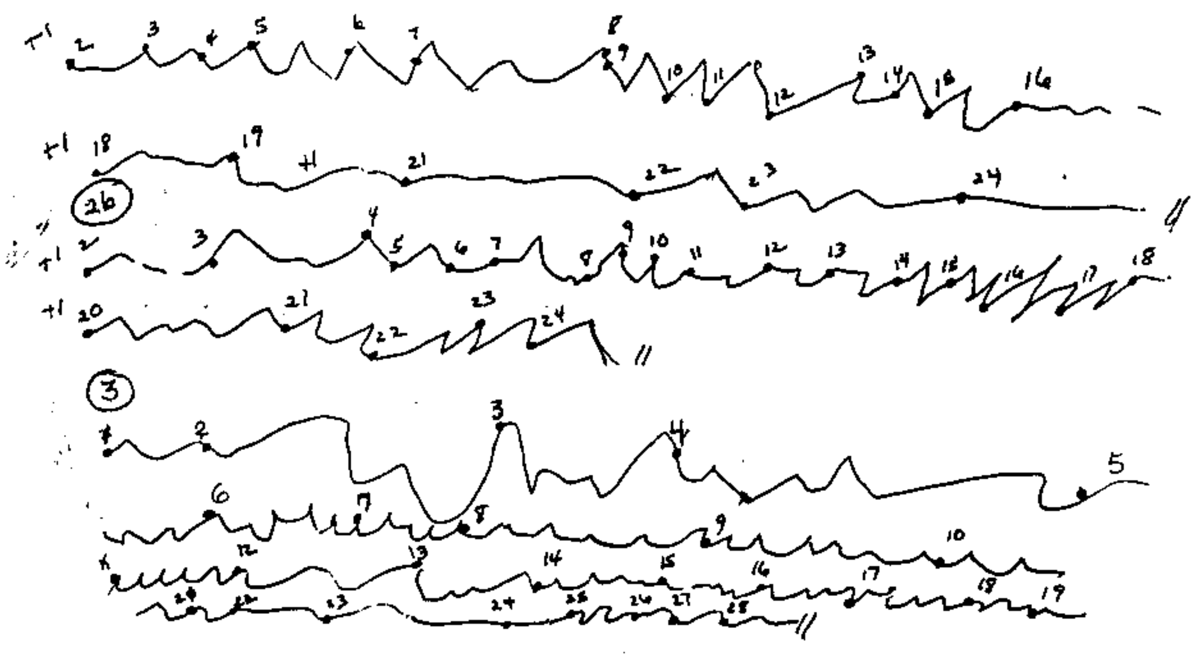


Figure 9 Pointed Combined with Rounded Shape in Graphing Pattern

Subject 14, Grade 4

Mozart Theme and Variation; Dohnanyi Variation



student's graphs. Graphs seemed to be one of two basic shapes: (1) a rounded series of humps andscoops describing a gradual change from an ascending to a descending motion, or (2) a pointed, zig-zag shape describing a definite point of change in direction from ascending to descending (see Figure 8). Once a basic pattern shape was established it tended to continue, with other dimensions of possible graphing change occurring within that basic shape (see Figure 8). There were also instances, however, where specific aspects of the two basic pattern shapes were integrated, i.e., v-shaped points replace the scoops between rounded humps (see Figure 9).

Graphing Type

Graphing size, speed, and shape are dimensions which can be seen on the graphs themselves; graphing type and pause, however, can be observed only through viewing the videotaped account of the actual graphing process. Graphing type was the designation used toindicate the articulation of the graphing motion. For example, ifthe motion changed from a smooth, regular line, evenly-spaced temporally to a line of the same shape but drawn with unequally-spaced points of accent/stress, these fluctuations would constitute a change in type. Although type changes cannot be seen by looking at the graphs alone, they are easily observed from the videotape.

Graphing Pause

The second category of change which could not be seen on the graphs alone was the pause, which occurred in temporal durations varying from very short to several measures in length. The pause was a change which was exhibited by every child at some point in the graphing process. There were several students, however, for whomthe pause seemed to be an integral part of the judgement-making process: "when in doubt, pause", and whether the response pattern changed after the pause seemed to be dependent upon the decision made during the pause. For others, the prevailing behavior seemed to be to continue a pattern until some input resulted in a pause which was, itself, indicitive of change's having occurred and after which the graphing pattern was changed. Whatever the individual strategy employed, every child exhibited one or more occurrences of both type change and pause.

CHAPTER V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS FOR FURTHER STUDY

Summary

This study was designed to explore the feasibility of presenting intact musical compositions to young learners and to observe their reactions to changes in the compositions in a learner-directed, unobtrusive way. The specific purpose of the study was to investigate changes in selected children's Graphing Response Patterns (GRP) to elemental changes in compositions in theme and variation form. The research problems were (1) to determine points and degrees of elemental change in the compositional structure of the musical examples; (2) to determine number, degree, and nature of changes in subjects' graphing response pattern (GRP) to aurally presented musical examples; (3) to determine percentages of agreement between changes in graphing response patterns (GRP) and points of elemental change within the compositional structures; and (4) to determine the relationship of changes in subjects' graphing response pattern (DCGR) to the quality and magnitude of elemental change (DCMP) within the compositional structure. A major component of addressing all research problems was the development of a methodology that would provide all subjects with the opportunity to respond to and interact with intact musical compositions in an unobtrusive, measurement procedures.

The primary focus of the study lay in the methodological considerations inherent in finding out (a) to which musical dimensions children attended with as little guidance as possible; and (b) whether, and, if so, which qualitative and quantitative fluctuations in the musical dimensions within a musical composition coincided with a change in the focus of children's responses as indicated by self-made graphs.

Methodology

A non-verbal, graphic response mode was developed which allowed me to videotape twenty second- and fourth-grade children individually as they listened to and graphed a series of aurally-presented musical examples whose total length was approximately seven minutes. The stimulus consisted of intact, non-manipulated music compositions, in theme and variation form, by Ives, Mozart, Dohnanyi, and Copland. A copy of each graph was made by tracing the graph onto a clear, acetate sheet which was placed over the TV screen, and the videotape was replayed until all measures of the musical example could be marked on the graph. This step having been accomplished, points of fluctuation/change in the child's graphing response pattern (GRP) could be correlated with and compared to points of change in the music.

During repeated viewings of the videotape, each point of change in the subject's Graphing Response Pattern was marked. Changes in GRP were determined by means of an interval scale which reflected not only the presence of change/no change but also the amount of change. Using as graphing dimensions speed, size, shape, type, and pause, the Degree of Change in Graphing Response (DCGR) scale included four possible levels of change and four possible degrees-of-change scores.

A second observer was trained to determine and evaluate subjects' GRP changes establishing a reliability of 0.90 (two observers, three subjects, six musical compositions), using Pearson's Product-Moment Correlation Coefficient.

Findings based on student response scores included the total number and degree of subject-response change across all subjects, all measures, as well as percentages of subject-response and degrees of change possible. (Percentage of subject-response change was based on the total number of measures/chances to change as 100%.) The highest percentage of subject-response change occurred in the Ives variation with 48% of possible change, followed by the Ives' theme with 38% and the Dohnanyi variation with 31%. The composition which elicited the smallest percentage of subject-response change was the third Copland variation with

16% of the total response change possible. The largest percentage of the possible degree of change (DCGR) occurred in the Ives variation with 27% of possible degree of change, followed by the Dohnanyi variation with 20%. The composition with the smallest percentage of possible degree of change was the third Copland variation with only 9%.

Music Analysis. Each of the six musical compositions was analysed using eight parameters: timbre (Tb), range/ interval size (Is), texture (Tx), tempo/meter (Tm), attack/ rhythmic density (Ad), key/mode (Km), dynamic level (Dl), and melodic presentation (Mp). An interval scale, reflecting not only change/no change within a parameter but also the degree of change, was constructed for each parameter (DCMP scale). Each of the eight music parameters was analyzed separately, and a determination was made regarding what change/s, if any, had occured within the music parameters within any given measure and, if change had occurred, how much. Three (3) degrees of change (Level 4, DCMP) was the maximum score possible for any one parameter in a single measure.

The variety of change exihibited in the music compositions ranges from those in which change occurs in only two parameters (the Ives and the Mozart themes), to those in which change occurs in all eight parameters (Dohnanyi variation and Copland variations 1 and 2). Based upon the total number of measures in a work as 100% of the possible change, the Ives variation contains the largest percentage of measures with change (77%), followed by the Dohnanyi variation (75%) and and the Copland theme (73%). The composition containing the smallest percentage of measures with change is the Ives theme (21%), followed by the Mozart theme with 33% and the second Copland variation with 48% of possible measures with change. Based upon the total degree of change possible, the Dohnanyi variaiton contains the largest percentage of degree of change with 12%, followed by the first Copland variation (10%) and the Copland theme (9%), while the smallest percentages of degree of change occur in the Ives theme (3%) and variation (5%).

A comparison of the total degrees of change to the total number/points of change in a composition shows the general magnitude of change which characterizes the piece as a whole: if the scores represent a one to one ratio, then the level of change would be level 2 or no changes larger than 1 degree of change.

Of the eight individual music parameters which describe each composition, attack/rhythmic density and melodic presentation are responsible for the majority of change which occurs in both the Ives theme (70%) and variation (46%), and the Mozart theme and variation (52% and 29%, respectively). The prominence of attack/rhythmic density is balanced or replaced by other parameters, however, in those compositions which contain change in other parameters.

Melodic presentation continues to account for a considerable amount of the total degree of change across all parameters regardless of the number of parameters present.

Percentage of Agreement Between Graphing Response (DCGR) and Music Parameter (DCGR Scores Scores from both Degree of Change in Graphing Response (DCGR) and Degree of Change in Music Parameters (DCMP) were compared and analyzed in an effort to ascertain whether a change which occurred in the music at a specific point might account for an observed change in the student's graph. Change which occurred within the music parameters but which was not accompanied by perceived change as reflected in the child's graphing response was also examined.

For each child a DCGR score was entered for each measure of the music, and for each musical composition, a DCMP score was entered for each of the eight parameters for each measure of the music. The scoring procedures for both the subject responses and the music had consisted of two judgements: (a) whether there was change, and (b) if change existed, to what degree.

In an effort to ascertain whether the children actually had responded to changes in the music, both DCMP and DCGR scores were converted to dichotomous data (i.e., zeros and ones), and each child's DCGR scores were compared to DCMP scores for individual parameters and to combined DCMP scores for each of the six musical compositions presented. Each time that the DCGR and the DCMP were in agreement on either change or no change, regardless of degree or number of parameters, it was scored as agreement or "1", while for each disagreement between the two, regardless of degree, a "0" was scored. The results were tallied and converted into percentages of agreement for each child on each of the six musical compositions, using comparisons to each individual parameter and across all eight parameters. Change occurring across parameters was taken into account, and the question of whether change in students' graphing response pattern was in response to perceived change in music parameter/s seemed to be answered by the high percentages of agreement in comparisons of both individual response to individual parameter and combined response across music parameters.

Results included percentages of agreement for: individual subject graphing response, graphing response grouped by subjects' age/grade (second- and fourth-grade students), and combined subjects graphing responses to points of musical change across all parameters, as well as to points of change in individual parameters.

Based upon results of the pilot study which showed a possible lack of response to changes of only 1 DOC in a single parameter, condition two (in which a score of zero was recorded for any measure in which the DCMP score was only 1 DOC in a single parameter) was used throughout for combined parameters percentages of agreement between subject-response change and music-parameter change.

Percentages of agreement were well above the level of chance, and overall scores for condition two were from as little as a few percentage points to as much as thirty-one percentage points higher in percentage of agreement than the same comparison using condition one. This seemed to indicate that, as a general rule, a level-two change (1 DCMP) in a single parameter was not sufficient to cause an observable change in the attention of the young listener.

Overall percentage of agreement between subject-response and music-parameter change across all music, all subjects ranged from 47% to 77%, with sixteen percentage points separating the two lowest scores. Agreement was highest in the third Copland variation (77%), followed by the second variation with 73% and the complete Copland (theme and four variations, 72% agreement). Ranked next to the bottom was the percentage of agreement in the Dohnanyi variation, while the Ives variation ranked the lowest in percentage of agreement.

Results indicating those parameters with the highest ranking percentage of agreement between graphing response and music parameter in the Copland composition are as follows:

1.tempo/meter; 2. key/mode, texture, and dynamic level; 3. melodic presentation; interval size and timbre; 4. attack density (from highest to lowest, respectively). Parameters which ranked first in percentage of agreement in the remaining compositions are as follows: Ives theme: attack density and melodic presentation (65% each); Ives variation: interval size; Mozart theme: melodic presentation; Mozart variation: texture; Dohnanyi: texture and melodic presentation (65% each).

Overall percentage of agreement scores for all subjects all parameters in the Copland theme and variations are as follows: theme, 67%; first variation, 66%; second variation, 73%; third variation, 77%; and fourth variation, 71%. The percentage of agreement for all subjects across all music (theme and variations combined) is 71%. Overall percentage of agreement scores for the remaining compositions (including only those parameters which contain some degree of change), are as follows: Ives theme, 65%; Ives variation, 47%; Mozart theme, 70%; Mozart variation, 62%; Dohnanyi variation, 63%. Of note with regard to the Mozart theme and variation and the Ives variation: the percentage of agreement scores for those parameters containing no change (all zeros) are higher than are the scores for those parameters containing change. This indicates a high percentage of agreement between DCMP and DCGR scores on the lack of change extant in those particular compositions.

Comparisons of children's responses grouped by age/ grade showed no substantial differences; rather, subject scores spanning a wide range of percentage of agreement were found in each group. This suggests the possibility that perceptual attention is more individualized to the listener than characteristic of a particular age group.

Correlation Between DCGR and DCMP

Two statistical procedures were employed in the quantitative analysis: Pearson's Product-Moment Correlation Coefficient and Hierarchical Cluster Analysis.

Results of the Pearson's Product-Moment Correlation Coefficient showed a strong relationship between certain individual subject responses and individual music parameters. A comparison of parameters representing the highest correlations with parameters containing the highest degrees of change indicated that often the two were not the same. This condition manifested itself in all compositions, but it was particularly evident in the Dohnanyi and Copland compositions. Results seemed to indicate that neither the degree of change alone nor the ratio of degree of change to points of change (magnitude to frequency) could fully explain the consistently high correlations of student graphing response to music parameter in particular instances. Rather, results indicated the existence of high-ranking correlations between student response and certain parameters whenever change occurred in that parameter. This was particularly evident in timbre: the correlation for timbre, regardless of the degree-of-change/points-of-change ratio, was in the top three ranks in every music composition in which timbre contained any degree of change. A similar tendency was exhibited in the Copland Theme, although to a lesser degree: attack density had a correlation of 28% although there were only 2 degrees of change and 2 points of change (indicating two level-two changes). Results revealed a definite relationship in a number of comparisons between both combined or individual subjects and single parameters, although the latter comparison revealed a stronger relationship.

Hierarchical Cluster Analysis was utilized to see which music parameters and graphings responses were least different or most similar. Results indicated numerous similarities between subject responses, between music parameters, and between responses and parameters. The music parameters tended to be clustered first, followed by the individual student responses, with each of the four analyses characterized by a clustering process which began by clustering those parameters and/or responses with the least magnitude and frequency of change and ended by clustering those parameters and/or responses with the greatest magnitude and frequency of change.

Qualitative Analysis

Qualitative analysis included investigation of specific relationships between the degree of change in the graphing response and the degree of change in the music parameters.

Many such relationships could be seen only by a return to and close observation of the actual number, magnitude, and context of changes as they occurred, both in the music parameters and the graphing responses. The number and magnitude/degree of student response seemed to be proportionate to the number and magnitude of change in the music parameter/s. In general, those measures in which the most change occurred in the music parameters (DCMP), both in number of parameters changing and in magnitude/degree of change, were also the measures in which the greatest number and degree of change was observed in the children's graphing responses (DCGR). The reverse was also true in most cases: those measures in which the least amount of change occurred in the music parameters, both in number of parameters changing and in degree of change, were also the measures in which the fewest number and least degree of change was observed in the children's graphing responses.

Responses to Changes in Melodic Line and Tonal Center

As was noted earlier in the discussion of correlation, there were exceptions to these general rules, most notably with regard to children's responses to specific types of change such as certain timbral and motivic/melodic alterations, cadence points, and specific situations such as the very first occurance of a particular type of change. This last would seem to indicate that subject's perceptual attention was captured by a certain level of novelty or "newness" within the music parameters. Results also indicated that young listeners were sensitive both to alterations/changes in the melodic line and to instability, ambiguity, or shift in tonal center, two types of change which frequently occur together or in close proximity to one another.

Delayed Response Time and Changes in Tempo/Meter
Results supported the earlier findings of the pilot study with regard to the identification of response delay as a factor in the actual placement/recording of change in graphing response pattern. Response delay seemed to increase as tempo increased, while below a certain level of speed, the delay was neglible.

Characteristic Dimensions of the Graphing Response Pattern

There were some general observations which could be made regarding both individual and group response patterns which were visible only by viewing the original graphs and/ or graphing process.

Graphing Size. The predeliction toward the specific, overall size (i.e., large or small) of a subject's graphs seemed to be as individualistic as is the overall size of their handwriting and varied considerably from child to child. Comparisons of size, therefore, could not be made between subjects without first establishing relative sizes within individual student's graphs. Changes in graph size within a piece seemed to coincide with music-parameter changes in dynamic level and tempo/meter.

Graphing Speed/Rate. Size change within a graph pattern was frequently accompanied by a change in the speed/rate of the pattern: as the music itself was presented in slower, broader units, or faster, more narrow groupings/chunks, so the graphing responses tended to be in larger, broader pattern units in response to the former, and smaller, faster pattern units in response to the latter. Acceleration in the speed/rate of the graphing pattern frequently was not the result of an actual tempo change in the music but, rather, the result of an increase in attack density: an increase in the ratio of notes/attacks to a temporally constant measure unit was reflected in graphing response as an increase in overall speed. This was apparant even in situations wherein the attack density was increased while the actual tempo/speed of the metric unit was decreased or remained the same.

Graphing Shape. Not unlike the variance in overall size of the response graphs, the overall shape within the basic graphing pattern seemed to be individualized to the student. Comparisons of shape, therefore, could not be made between subjects without first establishing relative shapes within individual student's graphs. Graphs tended to be one of two basic shapes: (1) a rounded series of humps and scoops describing a gradual change from an ascending to a descending motion, or (2) a pointed, zig-zag shape describing a definite point of change in direction from ascending to descending. Once a basic pattern shape was established it tended to continue, with other dimensions of possible graphing change occurring within that basic shape. There were also instances where specific aspects of the two basic pattern shapes were integrated, i.e., v-shaped points replace the scoops between rounded humps.

Graphing Type and Pause Graphing size, speed, and shape are dimensions which can be seen on the graphs themselves; graphing type and pause, however, can be observed only through viewing the videotaped account of the actual graphing process. Graphing type was the designation used to indicate the articulation of the graphing motion: a change in graphing motion from a smooth, regular line which was evenly-spaced temporally to a line of the same shape but drawn with unequally-spaced points of accent/stress, would constitute a change in type. Although type changes could not be seen by looking at the graphs alone, they were easily observed from the videotape.

The second category of change which could not be seen on the graphs alone was the pause, which occurred in temporal durations varying from very short to several measures in length. The pause, a change which was exhibited by most of the children at some point in the graphing process, seemed for some to be an integral part of the judgement-making process. Whatever the overall strategy employed, every child exhibited one or more occurrences of both type change and pause.

Conclusions

Researchers have long been aware of the problems inherent in creating a testing environment which, on the one hand, will enable valid testing procedures to take place but which, on the other hand, will be as close as is possible to a normal/natural listening situation. Sloboda (1985) stated concern regarding the probable difference in effect between normal listening and experimental listening tasks, noting that although in the latter the subject's attention is directed toward a specific dimension of the music, it does not imply that the listener would attend to the same dimension during a normal, continuous listening of the same material. Dowling and Bartlett (1981) addressed this same concern in their writings and used the term "ecological validity" to describe their efforts to "normalize" the experimental listening task. They sought to accomplish this by using as stimulus small, intact excerpts from Beethoven String Quartets. Petzold (1963), in reporting the results of his six-year series of studies, indicated not only that children were capable of responding to complete musical situations but also that it might not be necessary to treat music elements/parameters as separate entities. Frequently, however, researchers have sought to control the musical dimensions to which a subject could respond, a control often achieved by presenting subjects with short, melodic patterns in which pitch and/or rhythm constellations were manipulated. Few researchers have made use of intact musical compositions in which a large number of different musical elements are present simultaneously, interact with each other, and, therefore, allow the subject to respond to more musical dimensions than to pitch, rhythm, or any other researcher-imposed and artificially manipulated musical element. Furthermore, brevity of the musical excerpt often precludes the presence of change in those musical parameters which, by their nature, require a certain amount of temporal space to accomplish change, i.e., key/mode: tonality must be established before tonal ambiguity or shift of tonal center can be heard. The same conditions apply to changes in timbre: few if any very short musical examples contain aurally prominent timbral changes to which the listener has opportunity to respond.

Counterpart to the dilemma of the stimulus used in the experimental listening situation is the response mode employed. Abel-Struth (1981), in discussing the use of both performance-based and verbal response modes with young children, remarked that they often lead to lack of agreement between the performance ability and real musical capacity. Verbal response mode is not usually satisfactory for use with children as they frequently lack the vocabulary with which to describe most musical events (Abel-Struth, 1981; Andress, 1986; Crowther & Durkin, 1982; McMahon, 1982; Webster & Schlentrich, 1982). Thus, findings support Zimmerman's (1986) warning that, since perception and discrimination preceded adequate vocabulary and labels, research difficulties might be encountered as a result of the discrepancy between (a) the ability to perceive and discriminate and, (b) the ability to describe verbally what was perceived. In an effort to minimize or eliminate this effect, some researchers have devised and employed non-verbal response modes, often graphic or performance based (Abel-Struth, 1981; Bamberger, 1975; Bennett, 1984; May, 1985; Rainbow, 1981; Ramsey, 1983).

Bamberger (1975) described as figural those graphing strategies most closely related to gesture. Noting that they involved the grouping of rhythmic figures into chunks which reflected either real or imagined bodily movement, she referred to figural stragegy as the individual's "felt path" through a series of actions. Unlike metric/formal strategy which focuses on measuring durations, motivic-gestural strategy focuses on clustering contiguous events, their durations meaningful only in their contextual effect. Although the graphing response mode developed for and utilized in the present study incorporates response not only to rhythm (attack densiy, tempo/meter) but also to timbre, range/interval size, texture, key/mode, dynamic level, and melodic presentation, it is best described as a motivic-gestural strategy. As Bamberger noted and as I discussed previously in describing the graphing technique used in the present study, the graph alone, a result of motivic-gestural strategy, shows change of pace/duration only in a functional way and not across motivic groups: it does not reveal temporal relationships. The method of analysis employed in this study, however, allows the observer to see those temporal relationships. This is accomplished by studying the videotaped account of the actual graphing-in-progress rather than the graph on paper alone. Once the graph tracing has been marked with measures corresponding to the measures in the music, that which previously had been a graph reflecting only motivic-gestural strategy becomes, for analysis purposes, reflective of metric strategy as the temporal relationships are revealed.

The findings of this study, produced by means of a different measurement device than those previously employed by other researchers, showed the existence of an observable, quantifiable relationship between changes in children's graphing response patterns and elemental changes in music parameters within intact compositions. This relationship may be said to encompass not only change/no change judgement responses but also magnitude of response. Results are encouraging for the future use of both a non-verbal, graphing response mode and an intact musical stimulus in the experimental listening situation as a means of continued investigation into the area of children's auditory perception and attention.

Supported by the results of the study, the following are some general observations with regard to change in children's graphing response pattern, change in music parameter, and the relationship between the two:

1. The number and magnitude/degree of student response seemed to be proportionate to the number and magnitude of change in the music parameter/s.

2. In general, those measures in which the most change occurred in the music parameters (DCMP), both in number of parameters changing and in magnitude/degree of change, were also the measures in which the greatest number and degree of change was observed in the children's graphing responses.

3. Those measures in which the least amount of change occurred in the music parameters, both in number of parameters changing and in degree of change, were also the measures in which the smallest number and least degree of change was observed in the children's graphing responses.

4. The young listener was particularly sensitive to alterations/changes in timbre, in the melodic line, to tonal instability, ambiguity, and to shift of tonal center. Students also exibited responses indicating attention to change occurring in other parameters, as well, the magnitude of the response seemingly dependent upon such factors as

context and degree of newness in addition to the frequency/ magnitude of the change/s.

5. The degree of "newness" or novelty of an occurrence may be as influential to the young listener as is change in any music parameter. Several examples were cited in which children responded noticibly to the first occurrence of an event but responded either to a lesser degree or not at all to recurrences of the same or similar event.

6. The smaller the amount of change occurring in the music parameters, the smaller the amount of change required to cause a change-response in the listener; the greater the amount of change already extant, the greater the magnitude of change required for it to be perceived as such.

7. Although even a relatively small change in certain specific parameters seemed to elicit a change-response from listeners, there was no single parameter or group of parameters whose impact was invariably pervasive across all music. Rather, listener's attention seemed to focus on various parameters depending upon context.

8. A level-two change (1 Degree of Change) in a single music parameter was not sufficient to cause an observable change in the attention of the young listener.

9. Neither the degree of change alone nor the ratio of degree of change to points of change (magnitude to frequency) could fully explain the consistently high correlations of student graphing response to music parameter

in particular instances, namely timbre and attack density: both reflected high-ranking correlations regardless of the degree-of-change/points-of-change ratio.

10. The graphing response mode which was employed enabled the children to respond to what they were hearing without being asked to verbalize and with very little teacher direction. The children seemed to enjoy the experience and to feel comfortable with the listening/ graphing task, which reinforces the importance of continued efforts by researchers to provide a listening/testing environment which approaches ecological validity as nearly as is possible. The fact that the graphing process was videotaped and, therefore, could be viewed and studied repeatedly was of immeasurable value in analyzing and evaluating the children's responses. A great deal of the information acquired from the graphs was gained through observation of the actual motion and articulation of the graphing process which provided access to temporal relationships not observable in the graphs alone.

Although the term "ecological validity" was originally coined to describe a more natural or "musical" stimulus, the use of the term might be expanded to include response mode as well, resulting in a term which could be defined as follows: Ecological validity is a contextual listening/ testing condition in which the stimulus consists of intact musical compositions which have not been artificially manipulated and in which a number of different musical elements are present simultaneously, while the response mode is one which is learner-directed, unobtrusive, and in which the processes of listening and responding progress concurrently. This is the meaning which the use of the term ecological validity implies in the present study and these are the conditions which the present research has sought to fulfill through the development of a methodology incorporating whole, intact musical compositions as stimulus and a non-verbal, non-performance-based response mode which is largely student directed and appropriate for use with the young and/or untrained listener.

The methodology used in this study was developed as a result of attempts to observe and evaluate changes in the young listener's attention/focus to intact musical compositions presented in a natural classroom listening situation. As a teacher who works with intact musical compositions in the classroom and who relies on children's reaction to such intact musical stimuli, I share the concern of many researchers that results from investigations whose design does not approach a more natural and complete listening/ response condition may not be reflective of the young listener's perceptual ability and/or attention.

Implications for Further Research

It is hoped that this study will serve as a point of departure for further investigations into the various facets of listener attention/focus and how that focus is impacted by changes occurring in the musical stimulus. Results pointed to the presence of listener attention to changes in certain music parameters, such as timbre, which frequently have been dismissed as being imperceptible to the young and/or untrained listener. Recognizing that the listener cannot perceive that which is not presented, it is hoped that future research will begin to focus on research design which will permit the presentation of a stimulus example naturally replete with a variety of musical dimensions to which the young listener may attend. Further investigation into the specifics of auditory attention and the possible influence of novelty, or "newness" is indicated, as is investigation into the role played by the pause in the response process. Finally, it is hoped that the methodology developed for and through this study might serve as a springboard for further research into the development of an experimental listening/testing environment/condition which can claim ecological validity as defined above.

APPENDIX A

SCORES AND DISCOGRAPHY

APPENDIX A

MUSICAL SCORES AND DISCOGRAPHY

Scores

Copland, Aaron (1945). Appalachian Spring London: Boosey & Hawks. [M1045/C77A7]

Dohnanyi, Erno (1922). "Variations on a Nursery Song". (N. Simrock, Richard Schauer, London: WC 2.in Eng. by Augener Ltd., Action Lane, London, W. 4.)

Ives, Charles (1891). "Variations on 'America' for organ". Mercury Music Corporation, Bryn Mawr, Penn.

Mozart, W.A. (1973). Variation uber,,Ah, vous dirai-je, Maman" KV300e (265) [Urtext Edition (UT50096), Schott/ Edited from autograph to 1st edition by Hans-Christian Muller/ Universal Ed. by Wiener Urtext Ed]

Discography

[Copland] Appalachian Spring: Ballet for Martha (1978). RCA Red Seal: ARL1-2862.[Edwardo Mata cond. DSO (LPZ25177)

[Dohnanyi, Erno] "Variations on a Nursary Song", Op. 25. (1955). London: LL.1018 [Julius Katchen, Piano/Sir Adrian Boult, Conductor]

[Ives, Charles] Yankee Organ Music. Nonsuch Records: H-71200
[Richard Ellsasser, Organ]

[Mozart] The Ringve Music-Historic Museum presents Jorg Demus playing 18th-century HammerKlaviere(1977). Musical Heritage Society: MHS3698.

APPENDIX B

DCGR SCALES

APPENDIX B

DEGREE OF CHANGE IN GRAPHING RESPONSE SCALE (DCGR)

Graphing Parameters

D = Speed (i.e.,

Z = Size (i.e.,

H = Shape (i.e.,

Y = Type (i.e.,

P = Pause (in graph and/or hand motion)

NC = No change

Levels of Change	Types of Change		Degrees of Change
Level 1	No change	=	**0**
Level 2	Chg of any one of D, Z, H, Y or P	=	**1**
Level 3	Chg of any two of D, Z, H, Y or P	=	**2**
Level 4	Chg of any three or more of D, Z, H, Y, or P	=	**3**

APPENDIX C

DCMP SCALES

APPENDIX C

DEGREE OF CHANGE IN MUSIC PARAMETER SCALE (DCMP)

Table C-1

Tempo/meter (Tm)

Tempo/Meter Type Variables:

PL = Pulses (PL)/beats per measure unit
SD = Subdivision (SD) of pulse (simple to compound)
MS = Measure unit speed/tempo (MS)
MR = Melodic rhythm ratio

Levels of Change	Types of Change		Degrees of Change
Level 1:	No chg	=	0
Level 2:	Chg of one of PL, SD, MS or MR	=	1
Level 3:	Chg of two of PL, SD, MS or MR	=	2
Level 4:	Chg of three or more of above	=	3

Table C-2
DCMP

Texture (Tx): *

Level of Change	Type of Change		Degree of Change
Level 1	No change	=	0
Level 2	Any change of less than a 2:1 (or 1:1/2) (i.e., chg. from 2 to 4 voices)	=	1
Level 3	Any change of at least 2:1 (or 1:1/2) but less than 3:1 (or 1:1/3)	=	2
Level 4	Any change of at least 3:1(or 1:1/3) or more	=	3

*** Number of active lines/voices at any point (vertically)**

Table C-3
DCMP

<u>Timbre/color (Tb)</u>

Level of Change	Type of Change	Degree of Change
Level 1	No change	= 0
Level 2 (Within)	Addition or deletion (±) of instrument class (in cl.) within a family, as violins (vio.) ± cellos	= 1
	± more than 1 instr. cl. within a family/s	= 1
	Substitution of instr. cl. within a family, as -vio. + cello	= 1
Level 3 (Between)	± instr. cl. between families, as vio. + trumpe (tr.) or vio. & tr. - tr.	= 2
	± more than 1 instr. cl. between families	= 2
	Substitution of instr. cl. between families, as -vio. + tr.	= 2
Level 4 (Entire Families)	± family, as strings (st.) & brasses (br.), + woodwinds (ww)	= 3
	Substitution of families, as st. & br., -br. + ww	= 3

***If two or more levels of change occur simultaneously, the greater degree of change is used.**

Table C-4
DCMP

Range/Vertical Interval Size (Is)

Level of Change	Type of Change		Degree of Change
Level 1	No change (including any change of fewer than 12 semitones), i.e., addition or deletion (±) of fewer than 12 semitones	=	0
Level 2	± at least 12 but fewer than 24 semitones, i.e. 24±12 =12, 24±19=36	=	1
Level 3	± at least 24 but fewer than 36 semitones, i.e., 24+25=49, or 49-33=16	=	2
Level 4	± at least 36 (or more) semitones	=	3

*** Most extreme vertical interval per measure (based on octaves by semitone count)**

**** Each measure compared to the immediately previous measure**

Table C-5
DCMP

Melodic Presentation (Mp)

Level of Change	Type of Change	Degree of Change
Level 1	No change	= 0
Level 2	Chg of registeral placement/range	= 1
(Intact)	Chg of timbral presentation (color)	= 1
	Repeat to previously heard motive, including return	= 1
Level 3	Addition or deletion (±) of a melodic segment	= 2
(Segmented)	Simultaneous, stretto, or canonic-style presentation of melodic elements	= 2
	Chg from motivic motion to repose (i.e., cad. pt.)	= 2
Level 4	Alteration of intervalic relationships (contour)	= 3
(Within)	Alteration of temporal relationships (rhythm)	= 3
	(i.e., smooth, even attack pattern to dotted, irregular pattern	= 3
	Fragmented, non-motivic, transitional, or "new"	= 3

***If two or more levels of change occur simultaneously, the greater degree of change is used.**

Table C-6
DCMP

Dynamic Level (Dl) *

Dynamic Level (Dl) Variables:

SC	=	Silence/absence of sound, i.e., measures rest
PP	=	All "piano" levels, i.e., ppp - p
MM	=	All "mezzo" levels, i.e., mp - mf
FF	=	All "forte" levels, i.e., f - fff

Level of Change	Type of Change	Degree of Change
Level 1	No chg	= **0**
Level 2	Chg of one level (i.e.,PP - MP)	= **1**
Level 3	Chg of two levels (i.e., PP - F)	= **2**
Level 4	Chg of three levels (i.e., Silence/SC	= **3**

* Auditory judgements regarding the extent to which the recorded performance complied with the composer's dynamic markings in the score were made prior to application of the above scale.

Table C-7
DCMP

Attack/Rhythmic Density (Ad)*

Level of Change	Type of Change	Degree of Change
Level 1	No change or any change of less than a 2:1 (or 1:1/2)	= 0
Level 2	Any change of at least 2:1 (or 1:1/2) but less than 3:1 (or 1:1/3)	= 1
Level 3	Any change of at least 3:1(or 1:1/3) or more	= 2
Level 4	Any change of at least 4:1 (or 1:1/4) or more	= 3

***Number of attacks, per measure, throughout the vertical texture**
****Comparing each measure to the immediately previous measure**

Table C-8
DCMP

Key/Mode (KM)

Level of Change	Type of Change	Degree of Change
Level 1	No change (chg)	= 0
Level 2	Chg of key/mode to a parallel or relative minor/major, i.e., C - a or C - c.	= 1
	Chg to key/mode with 1 pitch class difference, i.e., C - F or C - G.	= 1
	Chg to unstable/non- established tonal center, i.e., transitional material	= 1
Level 3	Chg to key/mode with 2 to 4 pitch class differences, i.e., C - E-flat.	= 2
Level 4	Chg to key/mode with 5 or more pitch class differences, i.e., C - D-flat	= 3
	Chg to polytonality	= 3

*** Based on number of pitch classes which differ**

APPENDIX D

CORRELATION

APPENDIX D

PEARSON'S PRODUCT-MOMENT CORRELATION COEFFICIENT

Table D-1
Ives 1a

Parameters		Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
		r2	r2	r2	r2	r2	r2	r2	r2
Subject	S 1	NC	NC	NC	NC	9%	NC	NC	6%
	S 2					21%			20%
	S 3					0%			0%
	S 4					63%			79%
	ALL					0%			0%

Table D-2
Ives, 1b

		Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
Subject	S 1	NC	0%	NC	4%	0%	NC	NC	16%
	S 2		2%		10%	1%			37%
	S 3		2%		2%	7%			2%
	S 4		1%		2%	13%			14%
	ALL		0%		7%	2%			23%

ABBREVIATIONS

Tb: Timbre
Is: Interval size
Tx: Texture
Tm: Tempo/meter
S: Subject
Ad: Attack density
Km: Key/mode
Dl: Dynamic level
Mp: Melodic presentation
NC: No change
r2 : r is squared and reported as percentage

Table D-3
Mozart 2a

Parameters		Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
		r2	r2	r2	r2	r2	r2	r2	r2
Subject	S 1	NC	NC	NC	NC	64%	NC	NC	64%
	S 2					38%			36%
	S 3					60%			69%
	S 4					58%			34%
	ALL					72%			69%

Table D-4
Mozart 2b

Subject	S 1	NC	9%	2%	10%	1%	NC	NC	5%
	S 2		21%	28%	19%	13%			25%
	S 3		0%	4%	4%	28%			21%
	S 4		11%	32%	25%	8%			19%
	ALL		16%	14%	5%	3%			18%

Table D-5
Dohnanyi 3

Parameters		**Tb**	**Is**	**Tx**	**Tm**	**Ad**	**Km**	**Dl**	**Mp**
		r 2	**r 2**	**r 2**	**r 2**	**r 2**	**r 2**	**r 2**	**r 2**
Subject	**S 1**	2%	13%	2%	2%	0%	15%	4%	16%
	S 2	10%	6%	5%	3%	0%	4%	1%	10%
	S 3	55%	6%	74%	77%	50%	11%	48%	1%
	S 4	65%	1%	33%	29%	5%	51%	15%	19%
	ALL	43%	8%	35%	33%	12%	31%	22%	14%

Table D-6
Copland 4 *

Parameter mm	Tb r2	Is r2	Tx r2	Tm r2	Ad r2	Km r2	Dl r2	Mp r2
(Theme & Bridge) MM 2-20	21%	0%	NC	2%	28%	19%	22%	16%
mm (V I & Bridge) MM 21-38	59%	17%	40%	54%	30%	0%	20%	47%
mm (V II & Bridge) MM 39-69	20%	19%	10%	22%	19%	1%	20%	13%
mm (V III) MM 70-118	33%	5%	21%	28%	3%	NC	27%	34%
mm (V IV) MM 119-133	71%	27%	27%	57%	38%	NC	68%	66%
mm (Intact) MM 1-133	27%	11%	10%	21%	6%	5%	29%	31%

* parcelled, all subjects

Note: r is squared and reported as percentage

APPENDIX E

INTEROBSERVER RELIABILITY

APPENDIX E

INTER-OBSERVER RELIABILITY

Mus. Ex.s	S 20	S 16	S 17	S 16, 17, 20
1 a	1.00	0.95	0.12	0.86
1 b	0.91	0.98	0.62	0.86
2 a	0.99	0.71	0.55	0.81
2 b	0.98	1.00	0.30	0.90
3	1.00	0.99	0.79	0.92
4	0.98	1.00	0.82	0.94
All Music	0.98	0.96	0.73	0.91

N = Total Measures
X = Observer A
Y = Observer B
0-6 = Possible score per measure

Note: 2 observers, 3 subjects, 6 music examples.

PEARSON PRODUCT-MOMENT COEFFICIENT OF CORRELATION

APPENDIX F

OVERLAPPED SUBJECT SCORES

APPENDIX F
SUBJECT & MUSIC PARAMETER SCORES

Table F-1
Ives 1a *

	S1	S2	S3	S4	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
mm 1	0.0	0.0	0.0	0.0	NC	NC	NC	NC	0.0	NC	NC	0.0
2	1.5	0.0	0.0	0.0					0.0			0.0
3	2.5	0.5	0.0	0.0					0.0			0.0
4	1.5	0.5	0.0	0.0					0.0			0.0
5	1.0	0.0	0.5	0.5					1.0			0.5
6	1.0	0.0	0.5	1.5					2.0			1.0
7	2.0	0.0	0.0	1.0					1.0			0.5
8	2.5	0.0	0.5	0.0					0.0			0.0
9	2.0	0.5	0.5	0.0					0.0			0.0
10	1.5	1.5	0.5	0.0					0.0			0.0
11	1.0	1.5	2.0	0.0					0.0			0.0
12	1.0	0.5	2.5	0.0					0.0			0.0
13	0.5	0.0	1.5	0.0					1.5			0.5

* all scores overlapped

Parameter Abbreviations:

S:	Subject	Ad:	Attack Density
Tb:	Timbre	Km:	Key/mode
Is:	Interval size	Dl:	Dynamic level
Tx:	Texture	Mp:	Melodic presentation
Tm:	Tempo/meter		

Table F-2
Ives 1b *

mm	S1	S2	S3	S4	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
1	0.5	0.0	0.0	0.0	NC	0.0	NC	0.0	0.0	NC	NC	0.0
2	0.5	0.0	0.0	0.0		0.0		0.0	0.0			0.0
3	1.5	0.0	0.5	0.0		0.0		0.0	0.0			0.0
4	1.5	0.0	1.5	0.0		0.0		0.0	0.0			0.0
5	1.5	1.5	1.0	0.0		0.0		0.0	0.0			0.0
6	2.5	1.5	0.5	0.0		0.0		0.0	0.0			0.5
7	2.0	0.0	0.5	0.5		0.0		0.0	0.5			1.0
8	1.0	0.0	0.0	0.5		0.0		0.0	1.0			0.5
9	0.5	0.5	1.0	0.5		0.0		0.0	1.0			0.0
10	1.0	0.5	2.0	0.5		0.5		0.0	1.0			0.0
11	2.0	0.5	1.5	0.5		0.5		0.0	1.0			0.0
12	2.5	1.0	1.5	0.5		0.5		0.5	1.0			0.0
13	1.0	0.5	1.0	0.5		0.5		1.0	0.5			0.0
14	1.5	1.0	1.5	1.5		0.0		0.5	0.0			0.5
15	3.0	1.0	2.5	1.0		0.0		0.0	0.5			1.0
16	1.5	0.5	2.0	0.0		0.0		0.0	1.0			0.5
17	0.0	0.5	1.0	0.0		0.0		0.0	1.0			0.0
18	0.0	0.0	0.0	0.0		0.5		0.0	1.0			0.0
19	1.0	0.5	0.5	0.5		0.5		0.0	1.0			0.0
20	1.5	1.0	1.0	0.5		0.5		0.5	1.0			0.0
21	0.5	1.0	1.5	0.0		0.5		1.0	0.5			0.0

* all scores overlapped

Table F-3
Mozart 2a *

		S1	S2	S3	S4	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
mm	1	0.0	0.0	0.0	0.0	NC	NC	NC	NC	0.0	NC	NC	0.0
	2	0.0	0.0	0.0	0.0					0.0			0.0
	3	0.0	0.0	0.0	0.0					0.0			0.0
	4	0.0	0.0	0.0	0.0					0.0			0.0
	5	0.0	0.0	0.0	0.0					0.0			0.0
	6	1.5	0.5	1.5	1.0					1.0			1.5
	7	3.0	1.0	2.0	1.5					2.5			2.0
	8	1.5	0.5	2.0	0.5					2.0			1.0
	9	0.0	0.0	1.5	0.0					0.5			0.5
	10	0.0	0.0	0.0	0.0					0.0			0.0
	11	0.0	0.5	0.0	0.0					0.0			0.0
	12	0.0	0.5	0.0	0.0					0.0			0.0
	13	0.0	0.0	0.0	0.0					0.0			0.0
	14	1.0	0.0	1.5	0.0					1.0			1.5
	15	1.0	0.5	1.5	0.0					2.0			2.5
	16	1.5	1.5	1.5	0.0					1.0			1.5
	17	1.5	1.0	1.5	0.0					0.0			0.5
	18	0.0	0.0	0.0	0.0					0.0			0.0
	19	0.0	0.0	0.5	0.0					0.0			0.0
	20	0.0	0.0	0.5	0.0					0.0			0.0
	21	0.5	0.0	0.0	0.0					0.0			0.0
	22	2.0	1.5	1.0	1.0					1.0			1.0
	23	1.5	1.5	1.0	1.5					2.5			1.5

* all scores overlapped

Table F-4
Mozart 2b*

mm	S1	S2	S3	S4	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
1	0.0	0.0	0.0	0.0	NC	0.0	0.0	0.0	0.5	NC	NC	0.0
2	0.0	0.5	0.5	1.5		0.5	1.0	0.5	1.0			1.0
3	1.0	0.5	2.0	1.5		0.5	1.0	0.5	1.0			1.0
4	2.0	0.0	1.5	0.0		0.5	0.0	0.0	1.0			0.0
5	1.0	0.0	1.5	0.0		0.5	0.0	0.0	0.5			0.0
6	0.0	0.0	1.5	0.0		0.0	0.0	0.0	0.0			0.0
7	0.0	0.0	0.5	0.0		0.0	0.0	0.0	0.5			0.5
8	0.0	1.0	2.0	0.0		0.0	0.5	0.5	1.0			1.5
9	0.0	1.0	1.5	0.0		0.0	0.5	0.5	1.0			1.0
10	1.0	0.0	1.5	0.0		0.0	0.0	0.0	1.0			1.0
11	1.0	0.0	2.5	0.0		0.0	0.0	0.0	1.0			1.0
12	0.0	0.0	1.5	0.5		0.0	0.0	0.0	1.0			1.0
13	0.0	0.0	1.0	0.5		0.0	0.0	0.0	1.0			1.0
14	1.5	0.0	1.0	0.0		0.0	0.0	0.0	1.0			0.0
15	3.0	0.0	1.0	0.0		0.0	0.0	0.0	0.5			0.0
16	3.0	1.5	0.5	0.0		0.5	0.0	0.0	0.0			0.5
17	1.5	1.5	1.5	0.5		1.5	1.0	0.0	0.0			1.5
18	0.5	1.0	1.5	0.5		1.5	2.0	0.5	0.0			2.0
19	0.5	1.0	0.0	0.0		0.5	1.0	0.5	0.0			1.0
20	0.0	0.0	0.0	0.0		0.5	0.0	0.0	0.0			0.0
21	0.5	0.0	0.0	0.0		0.5	0.0	0.0	0.0			0.0
22	0.5	1.0	0.0	0.0		0.0	0.0	0.0	0.0			0.0
23	1.5	1.0	0.0	0.0		0.0	0.0	0.0	0.5			0.5

*** all scores overlapped**

Table F-5
Dohnanyi 3*

		S1	S2	S3	S4	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
mm	1	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	2	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	3	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	4	1.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.5
	5	2.5	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.5	0.5
	6	2.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	1.0	0.0
	7	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.5
	8	1.5	1.5	0.5	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	1.5
	9	2.0	1.5	0.5	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
	10	0.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	1.5
	11	1.5	1.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	1.5
	12	3.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	1.5	0.0	1.5
	13	2.5	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	1.5	0.0	2.0
	14	1.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	1.0	0.0	0.5
	15	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	16	1.5	1.0	1.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0
	17	3.0	1.5	1.0	0.5	0.0	2.0	0.0	0.0	0.0	0.5	0.0	1.0
	18	2.5	1.5	0.0	0.5	0.0	1.0	0.0	0.0	0.0	0.5	0.5	1.0
	19	2.0	0.0	0.5	0.5	0.0	1.0	0.0	0.0	0.0	0.0	1.0	1.5
	20	1.5	1.0	0.5	2.0	1.5	1.0	0.0	0.0	0.0	1.5	0.5	3.0
	21	1.5	1.0	0.5	1.5	1.5	0.5	0.5	0.0	0.0	1.5	0.0	1.5
	22	2.5	0.0	1.0	1.0	1.5	0.0	0.5	1.0	0.0	0.5	0.0	0.0
	23	1.5	1.5	2.0	2.0	3.0	0.5	0.5	1.5	0.0	0.5	1.0	0.0
	24	1.5	1.5	3.0	1.5	2.0	1.0	1.0	1.5	0.5	1.5	2.0	0.5
	25	1.5	0.0	1.5	0.5	0.5	0.5	0.5	1.0	0.5	1.5	1.0	0.5
	26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	27	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5

* all scores overlapped

Table F-6
Copland 4

		S1	S2	S3	S4	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
mm	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	3	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
	4	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.5
	5	0.5	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5
	6	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	7	0.0	0.0	1.5	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5
	8	0.5	0.0	2.5	2.0	1.5	0.5	0.0	0.0	0.0	0.0	1.5	2.0
	9	2.0	0.0	1.5	1.5	2.5	0.5	0.0	0.0	0.5	0.0	1.5	2.5
	10	3.0	1.0	2.0	0.0	1.0	0.5	0.0	0.0	0.5	0.0	1.0	1.0
	11	1.5	2.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
	12	0.0	2.0	0.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
	13	1.5	1.0	2.0	0.0	1.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5
	14	2.5	1.0	2.5	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0
	15	1.0	1.0	1.5	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.5
	16	0.0	0.0	1.5	1.5	1.5	0.5	0.0	0.0	0.0	0.0	0.0	2.0
	17	1.5	1.5	1.0	2.0	1.0	0.0	0.0	0.0	0.0	1.0	0.0	1.5
	18	1.5	2.5	1.5	0.5	0.5	0.5	0.0	0.0	0.0	1.0	0.0	0.0
V1	20	1.0	0.5	1.0	1.0	1.0	0.5	0.0	0.5	0.5	1.0	0.5	1.0
	21	1.0	0.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	22	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	23	0.0	1.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5
	24	0.0	1.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5
	25	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	26	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
	27	0.0	1.0	1.5	0.5	1.0	0.0	0.5	0.0	0.0	0.0	1.0	1.5
	28	0.0	1.0	1.5	2.0	1.0	0.0	0.5	0.0	0.5	0.0	1.0	1.0
	29	0.0	0.0	0.0	1.5	0.5	0.0	0.0	0.0	0.5	0.0	0.5	0.0
	30	0.0	1.5	1.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0
	31	1.0	1.5	1.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5
	32	2.0	0.5	1.5	0.0	1.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5
	33	2.0	0.5	1.5	0.0	0.5	1.0	0.0	0.0	0.5	0.0	0.0	0.0
	34	1.0	0.0	1.5	0.5	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5
	35	0.0	1.5	3.0	1.5	1.5	0.5	1.0	0.5	1.0	0.0	0.5	2.0
	36	1.5	2.5	1.5	1.0	1.5	0.5	1.0	0.5	0.5	0.0	0.5	1.5

V2	38	0.0	1.0	1.5	1.5	0.5	0.5	0.0	1.0	0.0	0.0	0.5	1.0
	39	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	40	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	42	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	43	1.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	44	1.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	45	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0	0.5	0.5
	46	1.5	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.5	1.5
	47	2.5	0.0	1.5	1.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
	48	1.0	0.0	1.5	1.5	0.5	1.0	0.5	0.0	0.0	0.0	0.0	0.0
	49	0.0	1.0	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0
	50	0.0	1.0	0.0	1.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	51	0.0	0.0	0.0	1.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	1.0
	52	0.0	0.0	1.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	1.0
	53	0.0	0.0	1.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	54	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
	55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
	56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	57	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	58	0.0	1.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	59	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
	60	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
	61	1.0	0.0	1.0	1.5	0.5	0.5	0.0	0.0	1.0	0.0	0.0	0.5
	62	1.0	0.0	2.0	0.5	2.0	0.5	0.5	0.5	2.0	0.0	1.0	2.0
	63	1.5	0.0	2.5	1.5	1.5	0.0	0.5	0.5	1.0	0.0	1.0	1.5
	64	1.5	0.0	1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	65	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	66	0.5	1.5	0.0	0.0	1.5	0.0	0.0	0.0	0.0	1.5	0.5	0.5
	67	0.5	0.0	1.5	1.0	2.0	1.0	0.0	0.0	0.0	1.5	0.5	0.5

V3	69	1.5	1.5	0.0	0.0	1.5	0.5	1.5	1.5	0.5	0.0	0.5	1.0
	70	0.0	1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
	71	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	72	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	73	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
	76	1.5	0.0	0.5	0.0	1.5	1.0	0.5	0.0	1.0	0.0	0.0	0.5
	77	1.5	1.5	1.0	0.0	1.5	1.5	0.5	0.0	0.5	0.0	0.0	0.5
	78	0.0	1.5	0.5	0.0	1.5	0.5	0.0	0.0	0.5	0.0	0.0	0.0
	79	1.5	1.5	0.0	0.0	1.5	0.0	0.5	0.0	0.5	0.0	0.0	0.0
	80	1.5	1.5	0.0	0.0	1.5	0.0	1.5	0.0	0.0	0.0	0.0	0.0
	81	0.0	0.0	0.0	0.0	1.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0
	82	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	83	0.0	0.0	0.0	0.0	1.5	1.0	0.0	0.0	1.5	0.0	0.0	0.0
	84	0.0	1.0	1.0	1.5	3.0	0.5	0.0	0.0	1.5	0.0	0.5	1.0
	85	0.0	1.0	1.0	1.5	1.5	0.0	0.0	0.0	0.5	0.0	0.5	1.0
	86	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
	87	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
	88	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
	89	1.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	90	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	91	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	92	2.0	0.5	0.0	1.0	1.5	0.0	1.0	0.0	0.5	0.0	0.0	0.5
	93	1.5	0.5	0.0	1.0	1.5	0.5	1.0	0.0	1.0	0.0	0.0	0.5
	94	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0
	95	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	96	0.0	0.5	0.5	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
	97	1.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	98	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	99	1.5	0.0	0.0	0.0	1.5	0.0	0.0	0.0	1.5	0.0	0.5	0.5
	100	1.5	0.0	0.5	1.5	3.0	1.0	0.0	0.5	1.5	0.0	0.5	2.0
	101	0.0	0.0	2.0	1.5	1.5	1.0	0.0	0.5	0.0	0.0	0.0	1.5
	102	0.0	1.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	103	0.0	1.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.5
	104	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.5
	105	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	106	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	107	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	108	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
	109	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	1.0	0.0	0.0	1.0
	110	1.0	0.0	1.5	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	1.0
	111	1.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	112	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	113	0.5	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	114	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	115	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5
	116	0.0	0.0	2.0	0.0	0.0	0.0	1.0	0.0	0.5	0.0	0.0	0.5

V4	118	1.5	1.5	1.5	1.5	2.0	0.0	0.0	1.5	1.0	0.0	0.5	1.0
	119	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	120	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	121	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	122	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	123	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
	124	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
	125	0.0	0.0	1.5	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.5
	126	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5
	127	1.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	128	1.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	129	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	130	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	131	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	132	3.0	0.5	0.0	1.0	1.5	1.5	1.5	0.0	0.5	0.0	1.0	0.5

*** all scores overlapped**

APPENDIX G

RAW SUBJECT SCORES

APPENDIX G
SUBJECT & MUSIC PARAMETER RAW SCORES

Table G-1
Ives 1a

		S1	S2	S3	S4	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
mm	1	0	0	0	0	NC	NC	NC	NC	0	NC	NC	0
	2	0	0	0	0					0			0
	3	3	0	0	0					0			0
	4	2	1	0	0					0			0
	5	1	0	0	0					0			0
	6	1	0	1	1					2			1
	7	1	0	0	2					2			1
	8	3	0	0	0					0			0
	9	2	0	1	0					0			0
	10	2	1	0	0					0			0
	11	1	2	1	0					0			0
	12	1	1	3	0					0			0
	13	1	0	2	0					0			0
	14	0	0	1	0					3			1

All scores original, raw subject and music parameter sc

Parameter Abbreviations:

S: Subject
Tb: Timbre
Is: Interval size
Tx: Texture
Tm: Tempo/meter
Ad: Attack Density
Km: Key/mode
Dl: Dynamic level
Mp: Melodic presentation

Table G-2
Ives 1b

	1b	S1	S2	S3	S4	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
mm	1	0	0	0	0	NC	0	NC	0	0	NC	NC	0
	2	1	0	0	0		0		0	0			0
	3	0	0	0	0		0		0	0			0
	4	3	0	1	0		0		0	0			0
	5	0	0	2	0		0		0	0			0
	6	3	3	0	0		0		0	0			1
	7	2	0	1	0		0		0	0			1
	8	2	0	0	1		0		0	1			0
	9	0	0	0	0		0		0	1			0
	10	1	1	2	1		0		0	1			0
	11	1	0	2	0		1		0	1			0
	12	3	1	1	1		0		1	1			0
	13	2	1	2	0		1		1	0			0
	14	0	0	0	1		0		0	0			1
	15	3	2	3	2		0		0	1			1
	16	3	0	2	0		0		0	1			0
	17	0	1	2	0		0		0	1			0
	18	0	0	0	0		0		0	1			0
	19	0	0	0	0		1		0	1			0
	20	2	1	1	1		0		1	1			0
	21	1	1	1	0		1		1	0			0
	22	0	1	2	0		0		0	0			1

All scores original, raw subject and music parameter scores.

Table G-3
Mozart 2a

		S1	S2	S3	S4	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
mm	1	0	0	0	0	NC	NC	NC	NC	0	NC	NC	0
	2	0	0	0	0					0			0
	3	0	0	0	0					0			0
	4	0	0	0	0					0			0
	5	0	0	0	0					0			0
	6	0	0	0	0					0			0
	7	3	1	3	2					2			3
	8	3	1	1	1					3			1
	9	0	0	3	0					1			1
	10	0	0	0	0					0			0
	11	0	0	0	0					0			0
	12	0	1	0	0					0			0
	13	0	0	0	0					0			0
	14	0	0	0	0					0			0
	15	2	0	3	0					2			3
	16	0	1	0	0					2			2
	17	3	2	3	0					0			1
	18	0	0	0	0					0			0
	19	0	0	0	0					0			0
	20	0	0	1	0					0			0
	21	0	0	0	0					0			0
	22	1	0	0	0					0			0
	23	3	3	2	2					2			2
	24	0	0	0	1					3			1

All scores original, raw subject and music parameter scores.

Table G-4
Mozart 2b

	S1	S2	S3	S4	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
mm 1	0	0	0	0	NC	0	0	0	0	NC	NC	0
2	0	0	0	0		0	0	0	1			0
3	0	1	1	3		1	2	1	1			2
4	2	0	3	0		0	0	0	1			0
5	2	0	0	0		1	0	0	1			0
6	0	0	3	0		0	0	0	0			0
7	0	0	0	0		0	0	0	0			0
8	0	0	1	0		0	0	0	1			1
9	0	2	3	0		0	1	1	1			2
10	0	0	0	0		0	0	0	1			0
11	2	0	3	0		0	0	0	1			2
12	0	0	2	0		0	0	0	1			0
13	0	0	1	1		0	0	0	1			2
14	0	0	1	0		0	0	0	1			0
15	3	0	1	0		0	0	0	1			0
16	3	0	1	0		0	0	0	0			0
17	3	3	0	0		1	0	0	0			1
18	0	0	3	1		2	2	0	0			2
19	1	2	0	0		1	2	1	0			2
20	0	0	0	0		0	0	0	0			0
21	0	0	0	0		1	0	0	0			0
22	1	0	0	0		0	0	0	0			0
23	0	2	0	0		0	0	0	0			0
24	3	0	0	0		0	0	0	1			1

All scores original, raw subject and music parameter scores.

Table G-5
Dohnanyi 3*

	S1	S2	S3	S4	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
mm 1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	1	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	1	0	0	0	0	0	0
5	2	0	0	0	0	2	0	0	0	0	0	1
6	3	0	0	0	0	1	0	0	0	0	1	0
7	1	0	0	0	0	0	0	0	0	0	1	0
8	0	0	0	0	0	1	0	0	0	0	0	1
9	3	3	1	0	0	2	0	0	0	0	0	2
10	1	0	0	0	0	0	0	0	0	0	0	0
11	0	3	0	0	0	0	0	0	0	1	0	3
12	3	0	0	2	0	0	0	0	0	2	0	0
13	3	0	0	1	0	0	0	0	0	1	0	3
14	2	0	0	0	0	1	0	0	0	2	0	1
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	2	0	0	0	0	0	0	0	0	0	0
17	3	0	2	0	0	3	0	0	0	0	0	0
18	3	3	0	1	0	1	0	0	0	1	0	2
19	2	0	0	0	0	1	0	0	0	0	1	0
20	2	0	1	1	0	1	0	0	0	0	1	3
21	1	2	0	3	3	1	0	0	0	3	0	3
22	2	0	1	0	0	0	1	0	0	0	0	0
23	3	0	1	2	3	0	0	2	0	1	0	0
24	0	3	3	2	3	1	1	1	0	0	2	0
25	3	0	3	1	1	1	1	2	1	3	2	1
26	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	1	0	0	0	0	0	1

All scores original, raw subject and music parameter scores.

Table G-6
Copland 4

		S1	S2	S3	S4	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
mm	1	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	1	0	0	0	0	0	0
	4	0	0	0	0	0	1	0	0	0	0	0	0
	5	0	0	0	0	1	0	0	0	0	0	0	1
	6	1	0	1	0	0	0	0	0	0	0	0	0
	7	0	0	0	0	0	0	0	0	0	0	0	0
	8	0	0	3	1	0	1	0	0	0	0	0	1
	9	1	0	2	3	3	0	0	0	0	0	3	3
	10	3	0	1	0	2	1	0	0	1	0	0	2
	11	3	2	3	0	0	0	0	0	0	0	2	0
	12	0	2	0	0	0	0	0	0	0	0	0	0
	13	0	2	1	0	2	0	0	0	0	0	0	1
	14	3	0	3	0	0	0	0	0	1	0	0	0
	15	2	2	2	0	0	1	0	0	0	0	0	0
	16	0	0	1	0	2	1	0	0	0	0	0	1
	17	0	0	2	3	1	0	0	0	0	0	0	3
	18	3	3	0	1	1	0	0	0	0	2	0	0
	19	0	2	3	0	0	1	0	0	0	0	0	0
V1	20	2	0	0	2	2	1	0	1	1	2	1	2
	21	0	1	2	0	0	0	0	0	0	0	0	0
	22	2	0	0	0	0	0	0	0	0	0	0	0
	23	0	0	0	0	0	0	0	0	0	0	0	0
	24	0	2	0	0	0	1	0	0	0	0	0	1
	25	0	0	0	0	0	0	0	0	0	0	0	0
	26	0	0	3	0	0	0	0	0	0	0	0	0
	27	0	0	0	0	0	0	0	0	0	0	0	1
	28	0	2	3	1	2	0	1	0	0	0	2	2
	29	0	0	0	3	0	0	0	0	1	0	0	0
	30	0	0	0	0	1	0	0	0	0	0	1	0
	31	0	3	2	0	0	0	0	0	0	0	0	0
	32	2	0	0	0	1	0	0	0	0	0	0	1
	33	2	1	3	0	1	1	0	0	1	0	0	0
	34	2	0	0	0	0	1	0	0	0	0	0	0
	35	0	0	3	1	0	0	0	0	1	0	0	1
	36	0	3	3	2	3	1	1	1	1	0	1	3
	37	3	2	0	0	0	0	0	0	0	0	0	0
V2	38	0	2	3	3	1	1	0	2	0	0	1	2
	39	0	0	0	0	0	0	0	0	0	0	0	0
	40	0	3	0	0	0	0	0	0	0	0	0	0
	41	0	0	0	0	0	0	0	0	0	0	0	0
	42	0	0	0	0	0	0	0	0	0	0	0	0
	43	0	0	0	0	1	0	0	0	0	0	0	0
	44	2	1	0	0	0	0	0	0	0	0	0	0
	45	0	0	0	0	0	1	0	0	0	0	0	0

	46	0	0	0	0	1	0	0	0	0	0	1	1
	47	3	0	0	0	0	0	0	0	0	0	0	2
	48	2	0	3	3	1	2	0	0	0	0	0	0
	49	0	0	0	0	1	0	0	0	0	0	0	0
	50	0	2	0	0	0	1	0	0	0	0	0	0
	51	0	0	0	2	0	0	0	0	0	0	0	0
	52	0	0	0	0	0	1	0	0	0	0	0	2
	53	0	0	3	0	0	0	0	0	0	0	0	0
	54	0	0	0	2	0	0	0	0	0	0	0	0
	55	0	0	0	0	0	0	0	0	0	0	0	1
	56	0	0	0	0	0	0	0	0	0	0	0	0
	57	0	0	0	0	0	0	0	0	0	0	0	0
	58	0	0	0	0	0	1	0	0	0	0	0	0
	59	0	2	0	0	0	0	0	0	0	0	0	0
	60	0	0	0	0	0	0	0	0	0	0	0	2
	61	0	0	0	2	0	0	0	0	0	0	0	0
	62	2	0	2	1	1	1	0	0	2	0	0	1
	63	0	0	2	0	3	0	2	1	2	0	2	3
	64	3	0	3	3	0	0	0	0	0	0	0	0
	65	0	0	0	0	0	0	0	0	0	0	0	0
	66	0	3	0	0	0	0	0	0	0	0	0	0
	67	1	0	0	0	3	0	0	0	0	3	1	1
	68	0	0	3	2	1	2	0	0	0	0	0	0
V3	69	3	0	0	0	3	1	3	3	1	0	1	1
	70	0	3	0	0	0	0	0	0	0	0	0	1
	71	0	0	3	0	0	0	0	0	0	0	0	0
	72	0	0	0	0	0	0	0	0	0	0	0	0
	73	0	2	0	0	0	0	0	0	0	0	0	0
	74	0	0	0	0	0	0	0	0	0	0	0	0
	75	0	0	0	0	0	0	0	0	1	0	0	0
	76	0	0	0	0	0	0	0	0	1	0	0	0
	77	3	0	1	0	3	2	1	0	1	0	0	1
	78	0	3	1	0	0	1	0	0	0	0	0	0
	79	0	0	0	0	3	0	0	0	1	0	0	0
	80	3	3	0	0	0	0	1	0	0	0	0	0
	81	0	0	0	0	3	0	1	0	0	0	0	0
	82	0	0	0	0	0	0	0	0	0	0	0	0
	83	0	0	0	0	0	1	0	0	0	0	0	0
	84	0	0	2	0	3	1	0	0	3	0	0	0
	85	0	2	2	3	3	0	0	0	0	0	1	2
	86	0	0	0	0	0	0	0	0	1	0	0	0
	87	0	0	0	1	0	0	0	0	1	0	0	0
	88	0	0	0	0	0	0	0	0	1	0	0	0
	89	3	0	0	0	0	0	0	0	0	0	0	0
	90	0	0	1	0	0	0	0	0	0	0	0	0
	91	1	0	0	0	0	0	0	0	0	0	0	0
	92	1	0	0	0	0	0	0	0	0	0	0	0
	93	3	1	0	2	3	0	0	0	1	0	0	1
	94	0	0	0	0	0	1	0	0	1	0	0	0
	95	0	0	0	0	0	0	0	0	0	0	0	0
	96	0	0	1	0	0	1	0	0	0	0	0	0
	97	0	1	0	0	0	1	0	0	0	0	0	0

	98	2	0	0	0	0	0	0	0	0	0	0	0
	99	0	0	0	0	0	0	0	0	0	0	0	0
	100	3	0	0	0	3	0	0	0	3	0	1	1
	101	0	0	1	3	3	2	0	1	0	0	0	3
	102	0	0	3	0	0	0	0	0	0	0	0	0
	103	0	2	0	0	0	0	0	0	0	0	0	0
	104	0	0	0	0	1	0	0	0	1	0	0	1
	105	0	0	0	0	0	0	0	0	0	0	0	0
	106	0	0	0	0	0	0	0	0	0	0	0	0
	107	0	0	0	0	1	0	0	0	0	0	0	0
	108	0	0	0	0	0	0	0	0	0	0	0	0
	109	0	0	0	0	0	0	0	0	1	0	0	0
	110	0	0	0	0	1	0	0	0	1	0	0	2
	111	2	0	3	0	0	0	0	0	0	0	0	0
	112	0	0	0	0	0	0	0	0	0	0	0	0
	113	0	0	3	0	0	0	0	0	0	0	0	0
	114	1	0	0	0	0	0	0	0	0	0	0	0
	115	0	0	0	0	0	0	0	0	0	0	0	0
	116	0	0	3	0	0	0	0	0	1	0	0	1
	117	0	0	1	0	0	0	2	0	0	0	0	0
V4	118	3	3	3	3	3	0	0	3	2	0	1	2
	119	0	0	0	0	1	0	0	0	0	0	0	0
	120	0	0	0	0	0	0	0	0	0	0	0	0
	121	0	0	0	0	1	0	0	0	0	0	0	0
	122	0	0	0	0	0	0	0	0	0	0	0	0
	123	0	0	0	0	0	0	0	0	0	0	0	0
	124	0	0	0	0	0	0	0	0	1	0	0	0
	125	0	0	2	0	0	0	0	0	1	0	0	0
	126	0	0	1	0	1	0	1	0	0	0	0	1
	127	0	0	0	0	0	0	0	0	0	0	0	0
	128	2	0	0	0	1	0	0	0	0	0	0	0
	129	0	0	0	0	0	0	0	0	0	0	0	0
	130	2	0	0	0	0	0	0	0	0	0	0	0
	131	0	0	0	0	0	0	0	0	0	0	0	0
	132	3	0	0	0	0	0	0	0	0	0	0	0
	133	3	1	0	2	3	3	3	0	1	0	2	1

All scores original, raw subject and music parameter scores.

APPENDIX H

HIERARCHIAL CLUSTER ANALYSIS

HIERARCHICAL CLUSTER ANALYSIS

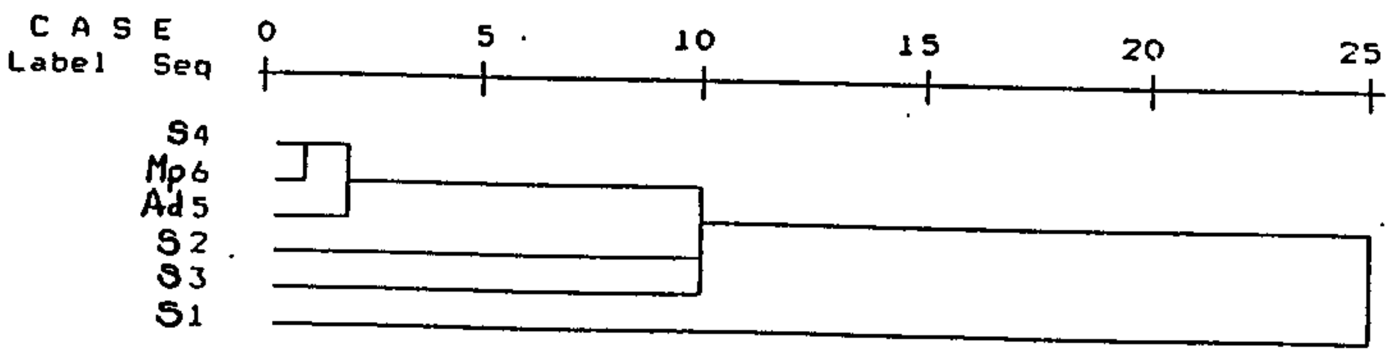
IVES 1a

Agglomeration Schedule using Centroid Method

Stage	Clusters Combined Cluster 1	Clusters Combined Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Stage Cluster 1st Appears Cluster 2	Next Stage
1	S4	Mp6	.750000	0	0	2
2	4	Ad5	2.437500	1	0	4
3	S2	S3	8.750000	0	0	4
4	S2	4	9.187500	3	2	5
5	S1	2	22.970001	0	4	0

Dendrogram using Centroid Method

Rescaled Distance Cluster Combine



HIERARCHICAL CLUSTER ANALYSIS

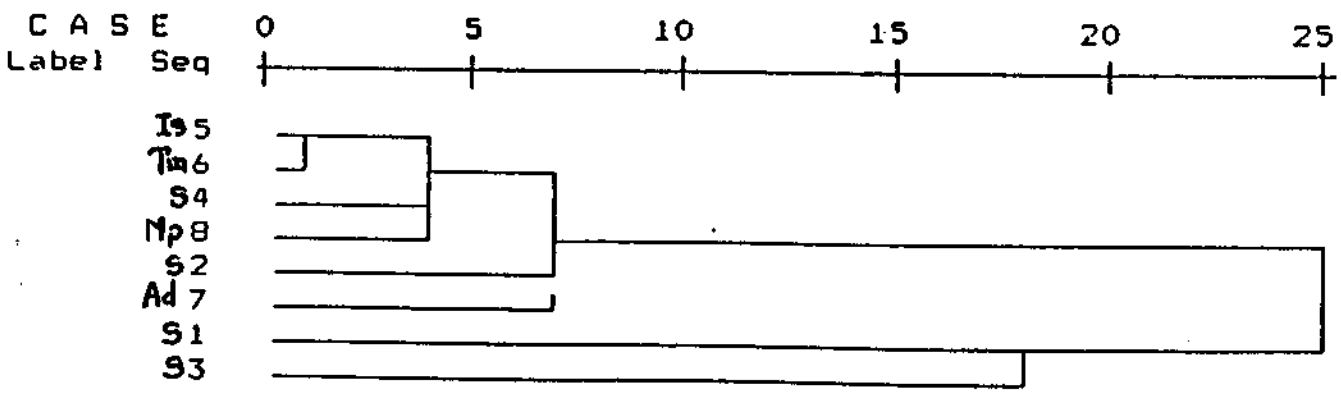
IVES 1b

Stage	Clusters Cluster 1	Combined Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Stage Cluster 1st Appears Cluster 2	Next Stage
1	Is 5	Tm 6	1.000000	0	0	3
2	S 4	Mp 8	3.750000	0	0	3
3	4	5	3.562500	2	1	4
4	S 2	4	5.703125	0	3	5
5	2	Ad 7	6.400000	4	0	7
6	S 1	S 3	14.500000	0	0	7
7	1	2	20.319445	6	5	0

Page 25 SPSS/PC+ 8/7/91

Dendrogram using Centroid Method

Rescaled Distance Cluster Combine



HIERARCHICAL CLUSTER ANALYSIS

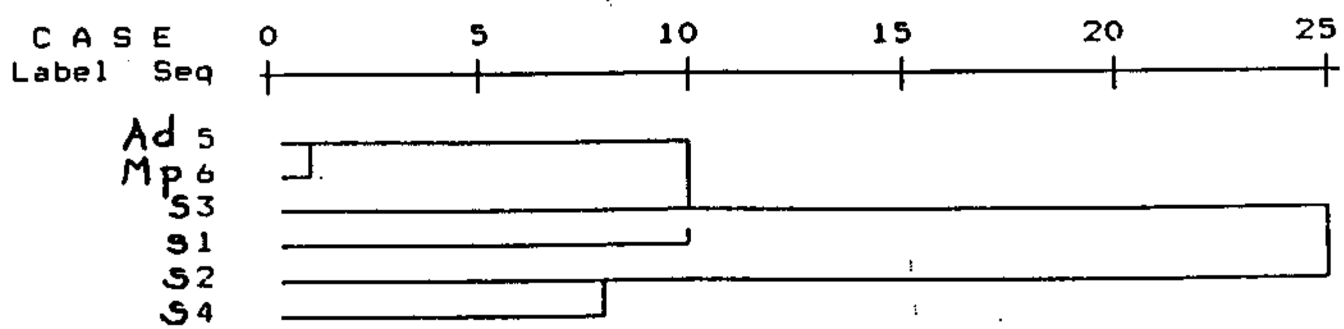
MOZART 2a

Stage	Clusters Cluster 1	Combined Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2	Next Stage
1	Ad 5	Mp 6	3.500000	0	0	3
2	S2	S4	4.750000	0	0	5
3	S3	5	5.125000	0	1	4
4	S1	3	4.611111	0	3	5
5	1	2	7.843750	4	2	0

SPSS/PC+

Dendrogram using Centroid Method

Rescaled Distance Cluster Combine



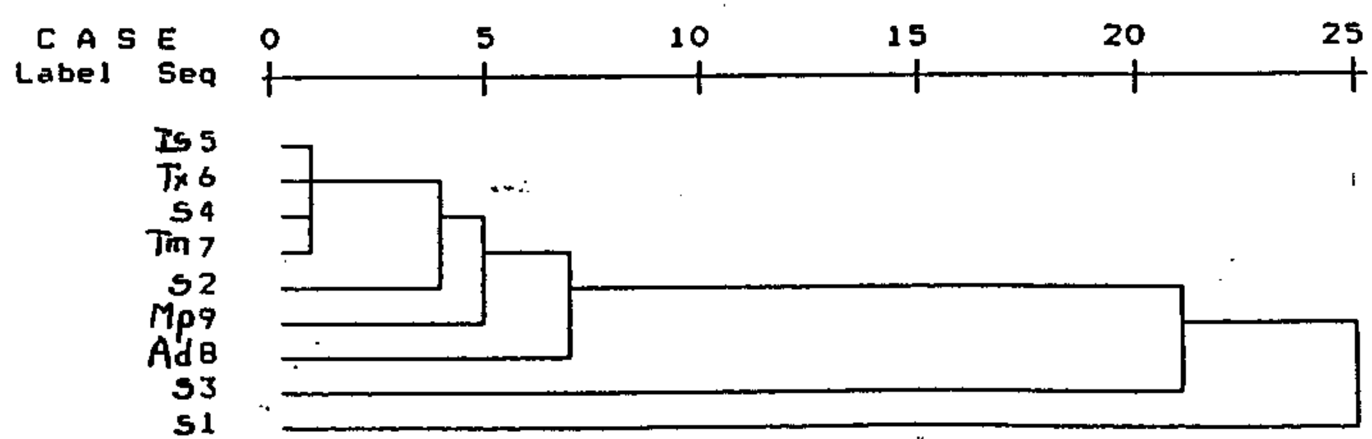
HIERARCHICAL CLUSTER ANALYSIS

MOZART 2b

Stage	Clusters Cluster 1	Combined Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2	Next Stage
1	Is 5	Tx 6	3.000000	0	0	3
2	S4	Tm 7	3.500000	0	0	3
3	4	5	3.375000	2	1	4
4	S2	4	6.218750	0	3	5
5	2	Mp9	7.030000	4	0	6
6	2	Ad8	8.965278	5	0	7
7	2	S3	20.765305	6	0	8
8	S1	2	24.898439	0	7	0

Dendrogram using Centroid Method

Rescaled Distance Cluster Combine

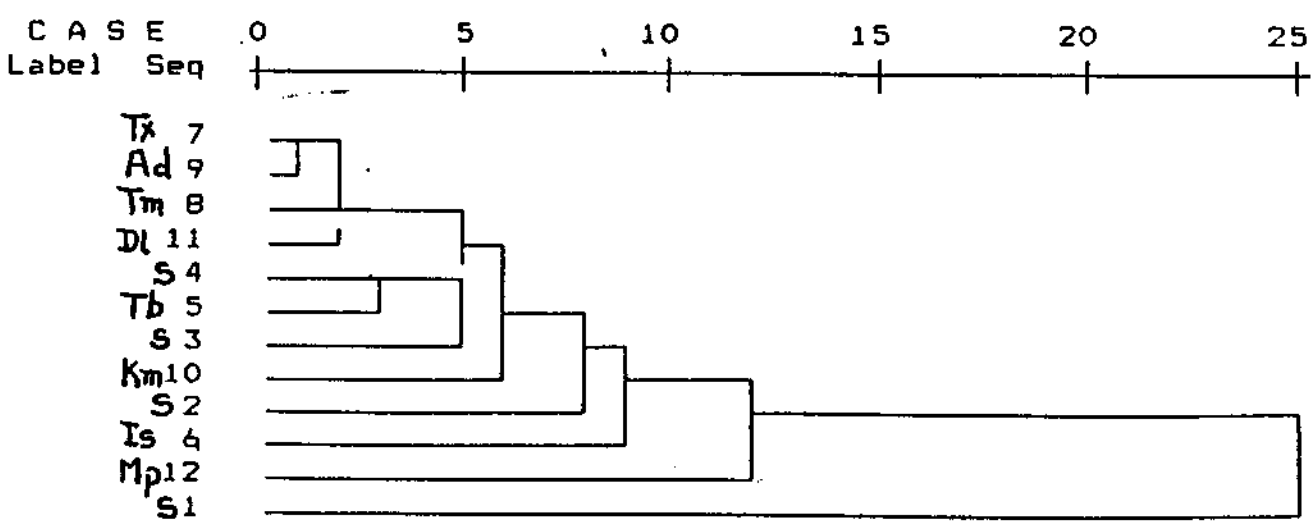


DOHNANYI 3

HIERARCHICAL CLUSTER ANALYSIS

Stage	Clusters Combined Cluster 1	Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2	Next Stage
1	Tx 7	Ad 9	1.000000	0	0	2
2	7	Tm 8	3.000000	1	0	3
3	7	Dl 11	4.500000	2	0	6
4	S 4	Tb 5	6.000000	0	0	5
5	S 3	4	8.500000	0	4	6
6	3	7	7.434028	5	3	7
7	3	Km 10	10.173470	6	0	8
8	S 2	3	14.414063	0	7	9
9	2	Is 6	15.416667	8	0	10
10	2	Mp 12	20.587500	9	0	11
11	S 1	2	45.446281	0	10	0

Rescaled Distance Cluster Combine



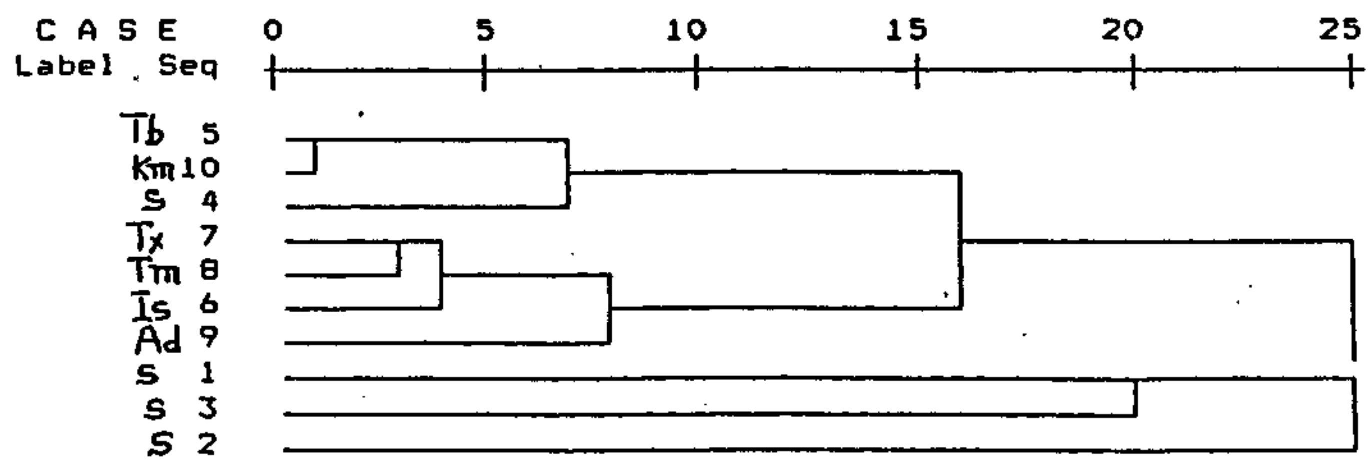
COPLAND 4a

Stage	Clusters Cluster 1	Combined Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2	Next Stage
1	Tb 5	Km 10	2.000000	0	0	4
2	Tx 7	Tm 8	3.000000	0	0	3
3	Is 6	7	3.750000	0	2	5
4	S 4	5	5.000000	0	1	6
5	6	Ad 9	5.416667	3	0	6
6	4	6	8.977430	4	5	9
7	S 1	S 3	10.750000	0	0	8
8	1	S 2	16.437500	7	0	9
9	1	4	13.205216	8	6	0

SPSS/PC+

Dendrogram using Centroid Method

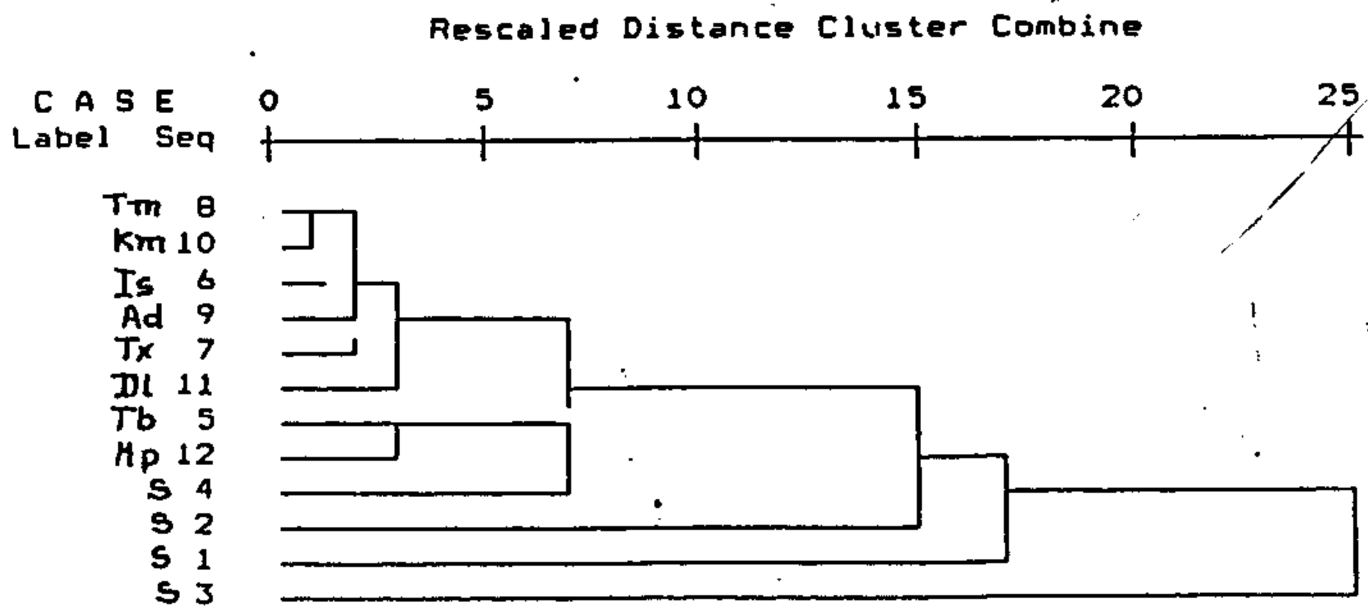
Rescaled Distance Cluster Combine



HIERARCHICAL CLUSTER ANALYSIS

COPLAND 4b

Stage	Clusters Cluster 1	Combined Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2	Next Stage
1	Tm 8	Km 10	.750000	0	0	3
2	Is 6	Ad 9	1.500000	0	0	3
3	6	8	1.687500	2	1	4
4	6	Tx 7	1.734375	3	0	5
5	6	Dl 11	2.060000	4	0	8
6	S 3	Mp 12	2.500000	0	0	7
7	S 4	Tb 5	4.625000	0	6	8
8	4	6	4.236111	7	5	9
9	S 2	4	9.641976	0	8	10
10	S 1	2	11.510000	0	9	11
11	1	3	16.580580	10	0	0



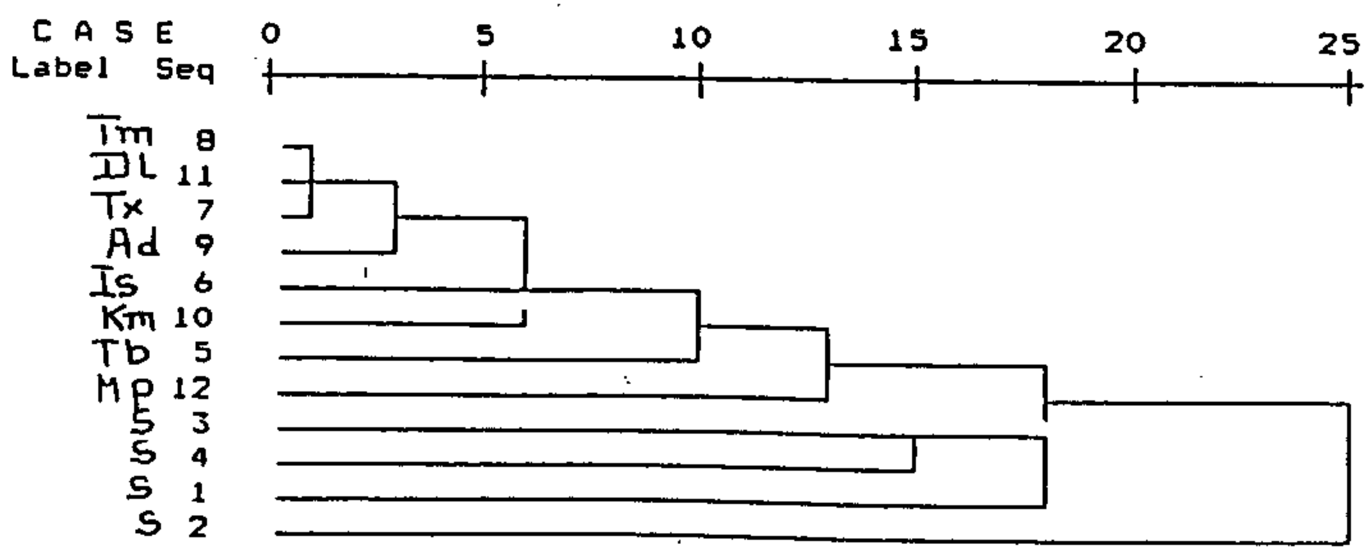
COPLAND 4c

HIERARCHICAL CLUSTER ANALYSIS

Stage	Clusters Cluster 1	Combined Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2	Next Stage
1	Tm 8	Dl 11	1.750000	0	0	2
2	Tx 7	8	1.437500	0	1	3
3	7	Ad 9	3.472222	2	0	4
4	Is 6	7	5.203125	0	3	5
5	6	Km 10	5.180000	4	0	6
6	Tb 5	6	7.180556	0	5	7
7	5	Mp 12	9.204082	6	0	10
8	S 3	S 4	10.250000	0	0	9
9	S 1	3	12.062500	0	8	10
10	1	5	9.699653	9	7	11
11	1	S 2	16.163223	10	0	0

Dendrogram using Centroid Method

Rescaled Distance Cluster Combine



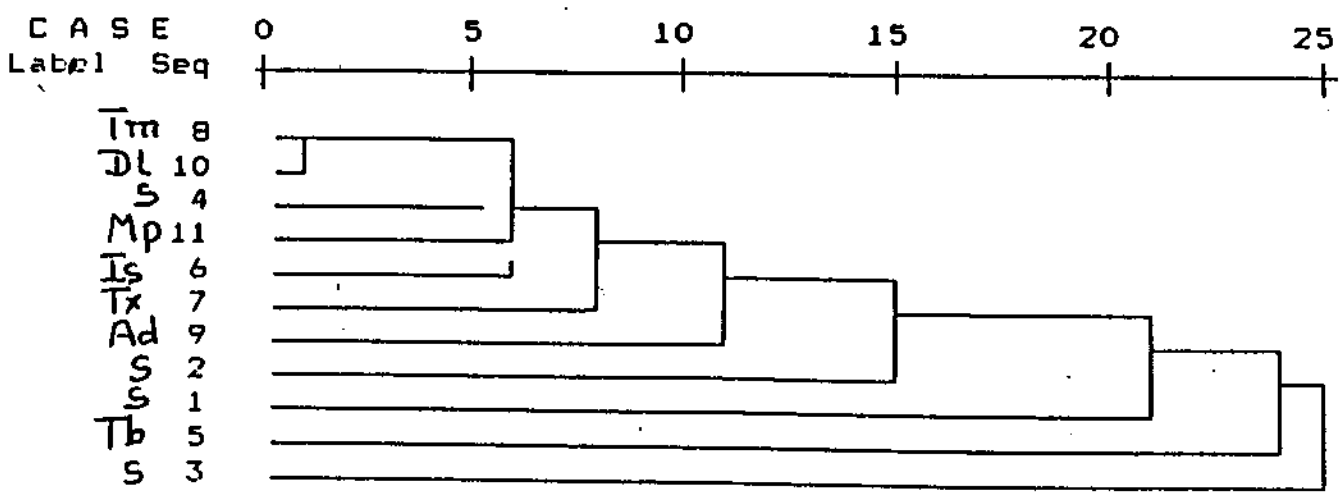
HIERARCHICAL CLUSTER ANALYSIS

COPLAND 4d

Stage	Clusters Cluster 1	Combined Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2	Next Stage
1	Tm 8	Dl 10	2.000000	0	0	3
2	S 4	Mp 11	6.750000	0	0	3
3	4	8	7.562500	2	1	4
4	4	Is 6	7.078125	3	0	5
5	4	Tx 7	9.030000	4	0	6
6	4	Ad 9	11.604166	5	0	7
7	S 2	4	15.704082	0	6	8
8	S 1	2	21.710938	0	7	9
9	1	Tb 5	24.598766	8	0	10
10	1	S 3	25.725000	9	0	0

Dendrogram using Centroid Method

Rescaled Distance Cluster Combine



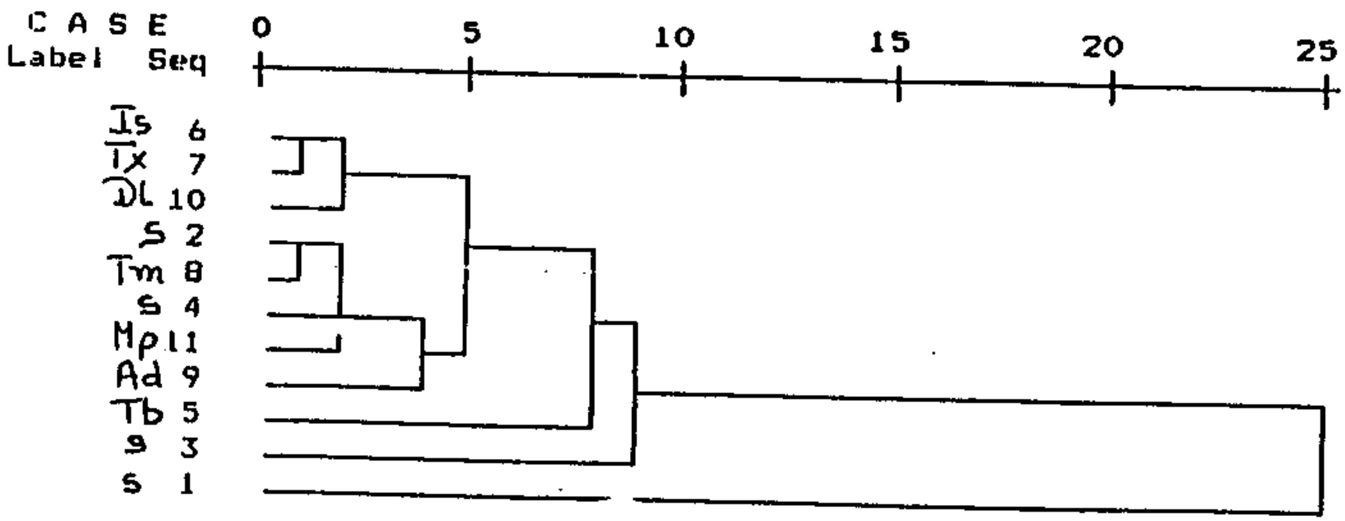
COPLAND 4e

HIERARCHICAL CLUSTER ANALYSIS

Stage	Clusters Cluster 1	Combined Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Stage Cluster 1st Appears Cluster 2	Next Stage
1	Is 6	Tx 7	.000000	0	0	3
2	S 2	Tm 8	.250000	0	0	4
3	6	DL 10	.500000	1	0	7
4	2	S 4	.562500	2	0	5
5	2	Mp 11	.750000	4	0	6
6	2	Ad 9	1.546875	5	0	7
7	2	6	2.078889	6	3	8
8	2	Tb 5	3.339844	7	0	9
9	2	S 3	3.777778	8	0	10
10	S 1	2	11.259999	0	9	0

Dendrogram using Centroid Method Agglomeration Schedule using Centroid Method

Rescaled Distance Cluster Combine

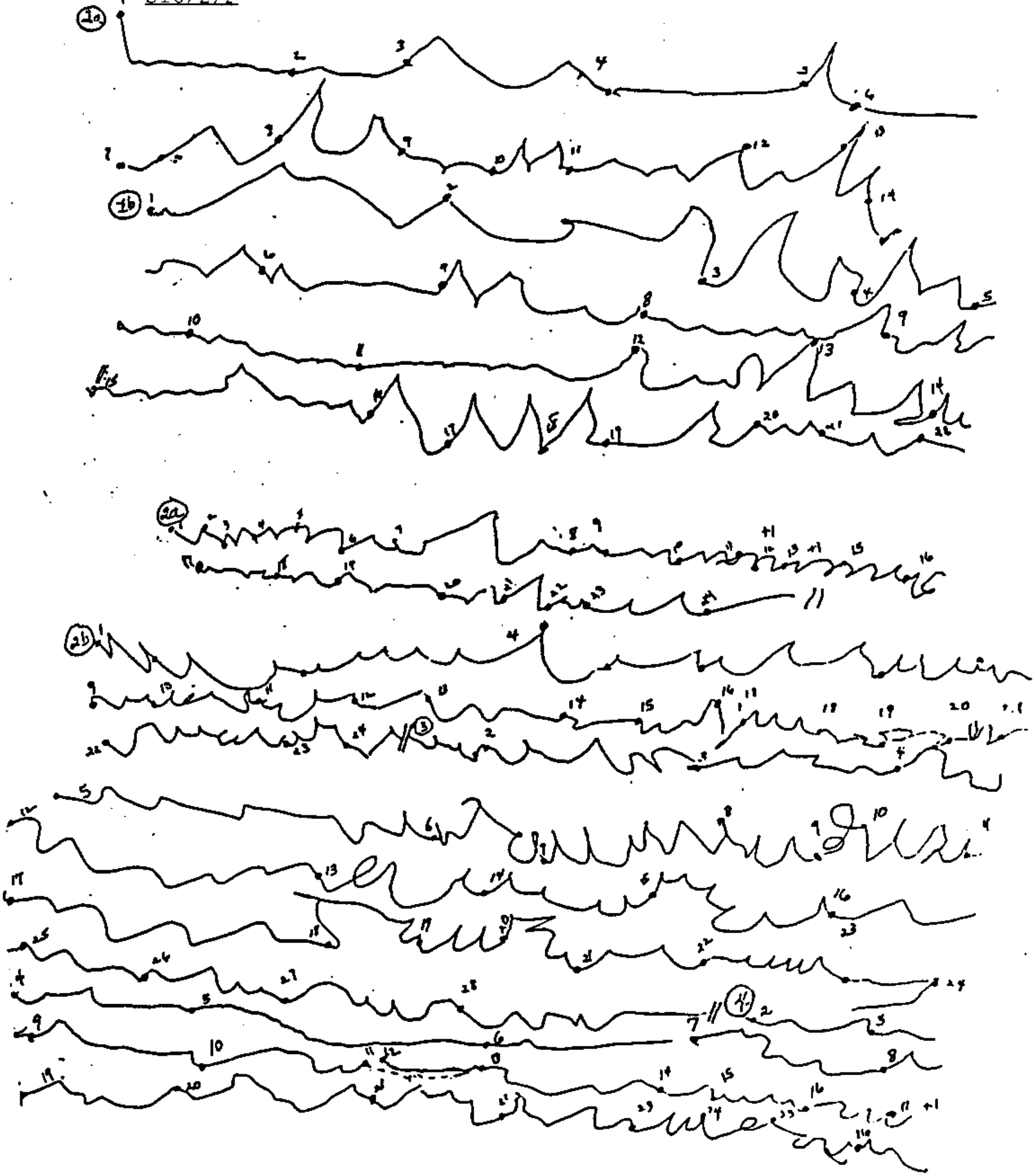


APPENDIX I

ORIGINAL SUBJECT GRAPHING RESPONSE PATTERNS

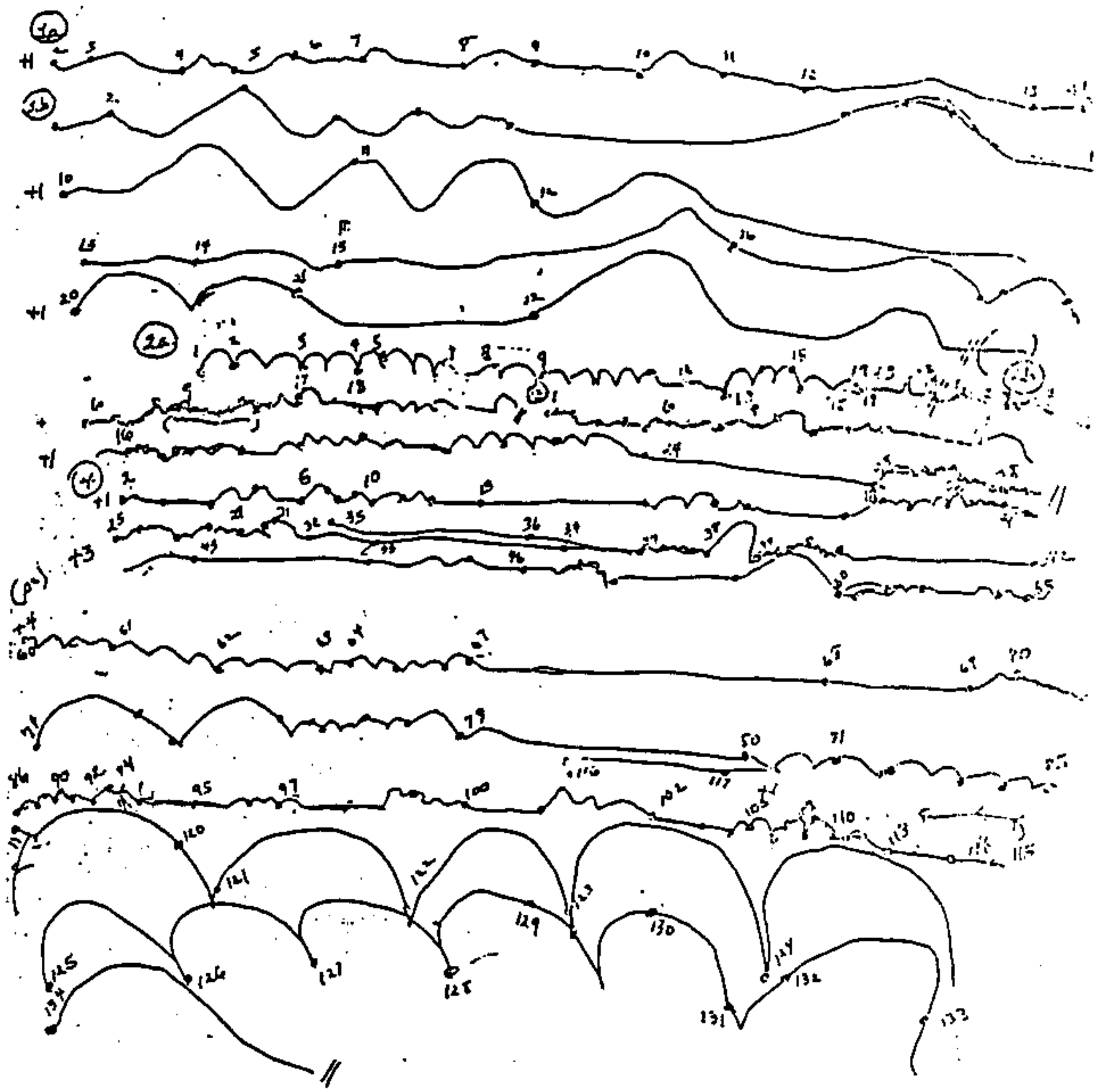
ORIGINAL SUBJECT GRAPHING RESPONSE PATTERNS

S16/2/F



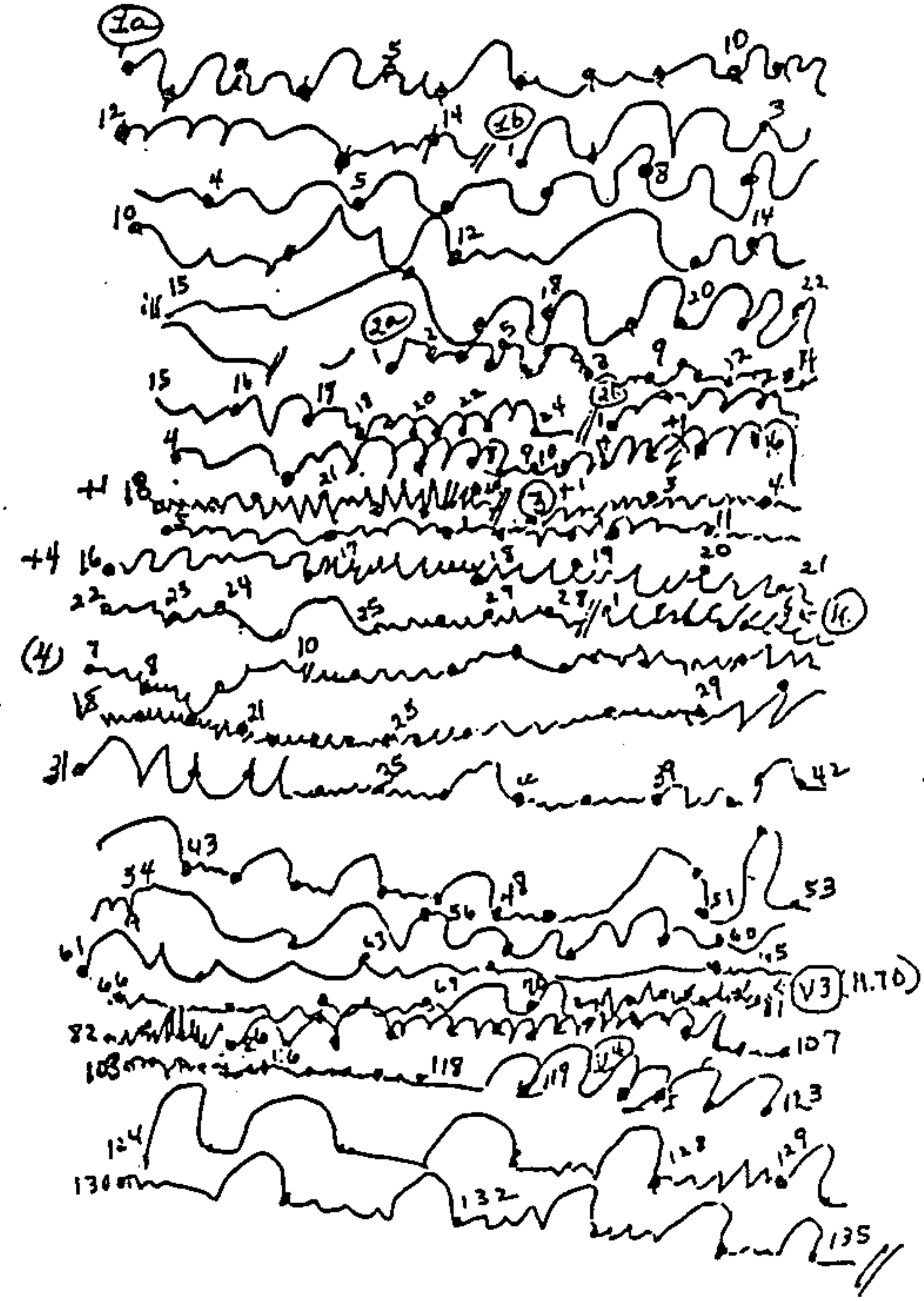
ORIGINAL SUBJECT GRAPHING RESPONSE PATTERNS

S17/2/F



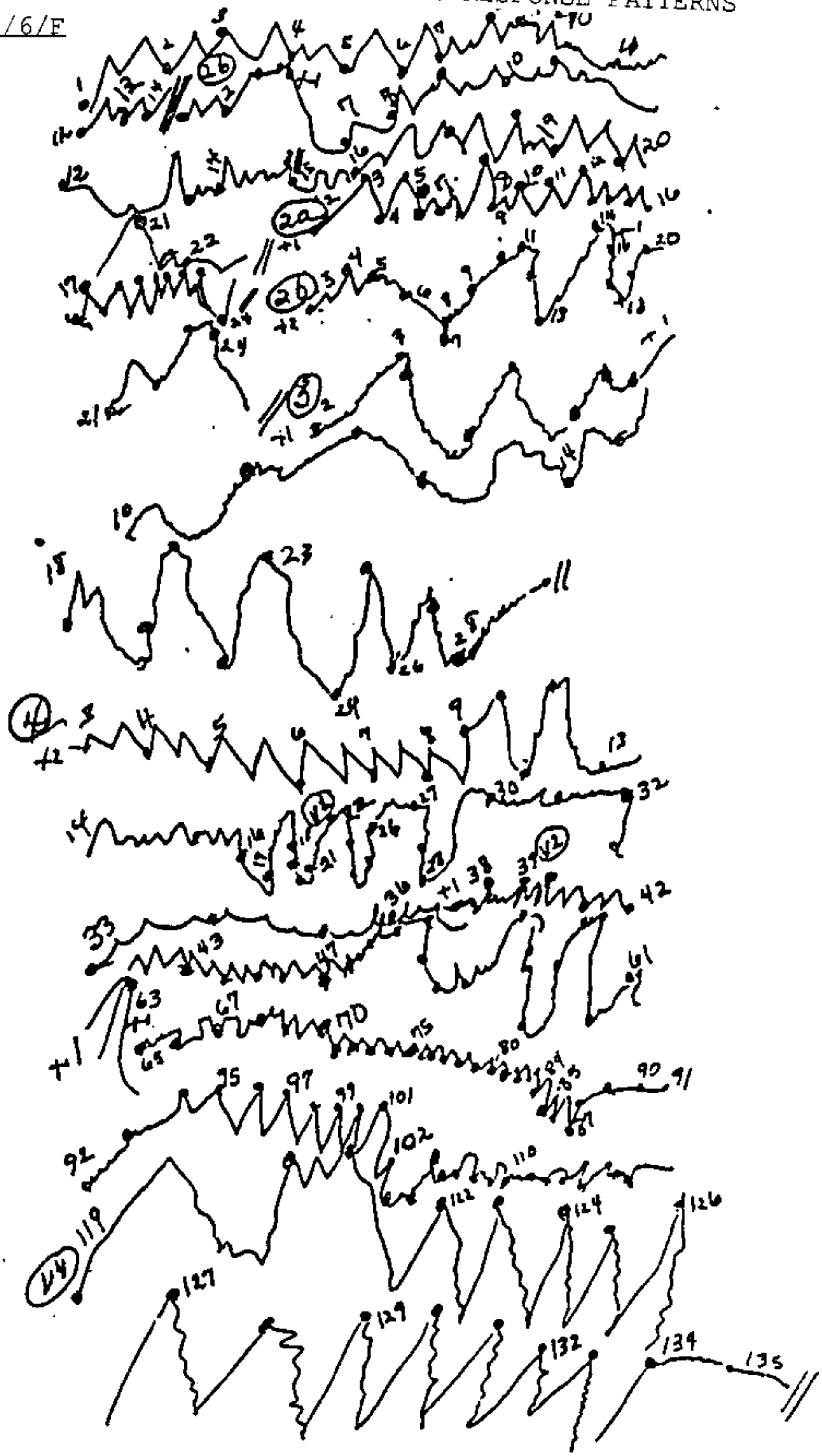
ORIGINAL SUBJECT GRAPHING RESPONSE PATTERNS

S20/2/M



ORIGINAL SUBJECT GRAPHING RESPONSE PATTERNS

S21/6/F



APPENDIX J

ANALYSIS OF MUSICAL CHANGE

Ives, 1a

DCMP

	MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Timbre/Color (Within, between & substitution of families)	Tb	ORGAN (Sw. 8' Gt. 8')													
	DOC	NC													
Range/Interval Size (Semitones)	Is	(20)	19	10	8	9	6	12	19	10	10	9	12	16	8
	DOC														
Texture Tot. # active voices Ratio-level	Tx #	(4)													3
	DOC														
Tempo/Meter (Types of Chg: NC, PL, SD, MS, MR)	Tm	3/4 Mod.													
	DOC	NC													
Attack/Rhythmic Density Ratio-level	Ad #	(3)					1	3				5	3	4	1
	DOC						2	2							3
Key/Mode (by # of pitch class differences)	Km	(F)													
	DOC	NC													
Dynamic Level (PP, MM, FF, & Silence (SC)	Dl	(f)													
	DOC	NC													
Melodic Presentation Levels: Intact, Segmented, Within	Mp	(Orig.) 1a					cad	1b							cad
	DOC						1	1							1
	MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Ives, 1b

DCMP

	MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Timbre/Color (Within, between & substitution of families)	Tb	ORGAN Sw 8', 4' Gt 8'																					
	DOC	NC																					
Range/Interval Size (Semitones)	Is	(35)	43	40	43	44	48	48	48	43	52	32	36	50	48	48	48	43	52	32	36	50	48
	DOC											1		1						1		1	
Texture Tot. # active voices Ratio-level	Tx #	(5)																					
	DOC	NC																					
Tempo/Meter (Types of Chg: NC,PL, SD, MS, MR)	Tm	(3/4) (Mod.)											MS rit.	MS a tempo							MS rit	MS a tempo	
	DOC												1	1							1	1	
Attack/Rhythmic Density Ratio-level	Ad #	(12)					20	24	11	24	11	24	9	15	12	24	11	24	11	24	9	15	18
	DOC								1	1	1	1	1			1	1	1	1	1	1		
Key/Mode (by # of pitch class differences)	Km	(F)																					
	DOC	NC																					
Dynamic Level (PP,MM,FF, Silence/SC)	Dl	(f-ff)																					
	DOC	NC																					
Melodic Presentation Levels: Intact, Segmented, Within	Mp	(Orig.) 1a					cad	1b							cad	Seg (repeat) 1b							cad
	DOC						1	1							1	1							1
	MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

Mozart 2a
DCMP

	MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	21	23	24
Timbre/Color (Within, between & substitution of families/colors)	Tb	PIANO																							
	DOC	NC																							
Range/Interval Size (Semitones)	Is	(24)	19	21	19	18	19	21	24	24	22	21	19	24	22	16	19	24	19	21	19	18	19	21	24
	DOC	NC																							
Texture Tot. # active vs. Ratio-level	Tx	(2)															3	2							
	DOC	NC																							
Tempo/Meter Types of Chg.: NC,PL, SD, MS, MR	Tm	2/4																							
	DOC	NC																							
Attack/Rhythmic Density	Ad	(2)						6	1	2						6	2							6	1
Ratio-level	DOC							2	3	1						2	2							2	3
Key/Mode (by no. of pitch class differences)	Km	(C)																							
	DOC	NC																							
Dynamic Level (Sc, PP, MM, FF)	Dl	(MM)																							
	DOC	NC																							
Melodic Presentation Levels: Intact Segmented, Within	Mp	1a Orig.						alt	cad	1b						alt	alt	1a						alt	cad
	DOC							3	1	1						3	2	1						2	1
	MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	21	23	24

Mozart 2b
DCMP

	MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Timbre/Color (Within, between & substitution of families/colors)	Tb	PIANO																							
	DOC	NC																							
Range/Interval Size (Semitones)	Ia	0 Single Voice		16	7	22	24	31	36	38	35	21	20	31	30	37	45	24	0	16	8	22	24	31	36
	DOC			1		1												1	2	1		1			
Texture Tot. # active voices Ratio-level	Tx	(1)		3					2	4		3	4		5	4		3	1	3	3	4	3		2
	DOC			2						1									2	2					
Tempo/Meter Types of Chg: NC,PL, SD, MS, MR	Tm	(2/4) 1a		MR						MR									MR						
	DOC			1						1									1						
Attack/Rhythmic Density Ratio-level	Ad	(4)	2	4	2	4	4	4	2	4	2	4	2	4	2	4	4	4	4	4	4	4	4	4	2
	DOC		1	1	1	1			1	1	1	1	1	1	1	1									1
Key/Mode (by # of pitch class differences)	Km	(c min.)																							
	DOC	NC																							
Dynamic Level (PP, MM, FF, Silence/SC)	Dl	(MM)																							
	DOC	NC																							
Melodic Presentation Levels: Intact Segmented, Within	Mp	1a		Seg. Imm.					cad	1b Int rel		Imm Rg		Imm Rg				1a cad	alt	Imm					cad
	DOC			2					1	2		2		2				1	2	2					1
	MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Dohnanyi #3
DCMP

	MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Timbre/Color (Within, between & substitution of families)	Tb	(Pf, S)				P2				P3					P4				P5			+B(hns F +W(bsn) +P(tim) -S		-B -W	+H -aW -P +aS	P6 -H			
	DOC																					3		3	3	1			
Range/Interval Size (Semitones)	Is	(24)	45	49	62	32	45	52	72	46	52	62	56	57	36	41	37	72	54	70	51	70	69	69	48	36	43	53	72
	DOC		1		1	2	1		1	2					1			3	1	1	1	1			1	1			1
Texture Tot. # active voices	Tx*	(6)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	10	5	5	7	6	6	6	6
	DOC																						1						
Tempo/Meter (NC,PL,SD,MS,Mr)	Tm	12/8																						SD -PL	SD	SD +PL			
(Tot. RT: 35 secs)	DOC																							2	1	2			
Attack/Rhythmic Density	Ad #	(12)	12	12	10	12	12	12	10	12	12	12	12	12	12	12	12	10	12	12	12	12	12	23	29	10	12	12	10
	DOC																									1			
Key/Mode (by # of pitch class differences)	Km	(C Maj)										tms	dm	tms	C				tms			D-II		tms		C			
	DOC											1	2	1	2				1			3		1		3			
Dynamic Level (PP, MM, FF, Silence/SC)	Dl	(p)					mp	p						mf	p					mp	p				f	p			
	DOC						1	1						1	1					1	1				2	2			
Melodic Presentation	Mp	a ____				a' ____			cad	b ____		- 1 cmpr		+ 1 expn frag	a ____				segm		alt	alt +3(trans)				a ____			cad
	DOC					1			1	2		3		3	1				2		3	3				1			1
	MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28

Copland #4
DCMP

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
																					V1																	
	MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Timbre/Color (Within, between & substitution of families)	Tb	P1 W,H cl,fl				P2 +W pic				P3 -H +P tri	-P -tri			P4 +H			-H	Brg ±W	±W	±W	P5 ±W +B				P6				P7 +W +B +P tri		-W ob		P8 +W ob	-W ob			Bdg -W +H,pf +P +S	-W
	DOC					1				3	2			2			2	1	1		2								2		1		1	1			3	
Range/Interval Size (Semitone Count)	Is#	(12)		24	12	20	19	24	12	17	5	16	24	19	12	24	12	19	28	12	34	24	19	21	34	24	21	17	24					12	24		36	
	DOC			1	1				1		1					1	1			1	1				1									1	1		1	
Texture Tot. # active voices (Ratio-level)	Tx#	(3)				5		4		5				4			3			solo	3								8		5		6	5			11	14
	DOC																												1								1	
Tempo/Meter (Types of chg: NC,PL,SD,MS,MR)	Tm	2/4 (4-meas. ph.s) (q=72) 1.9																			q=80 1.6																2	0
	DOC																				1																1	
Attack/Rhythmic Density (ratio-level)	Ad#	7	6	4	6	8	6	5	3	3	7	6	5	3	6	4	3	3	3	3	7	6	4	6	8	6	5	3	3	7	6	5	3	6	4	3	6	6
	DOC										1				1						1									1				1			1	
Key/Mode (by # of pitch class differences)	Km	(A-flat)																	trans		G flat																	
	DOC																		2		2																	
Dynamic Level (PP, MM, FF, Silence/SC)	Dl	(p)								fsf		p					(p)				mp								sff		mf						p	
	DOC									3		2									1								2		1						1	
Melodic Presentation Levels:Intact, Segmented, Within	Mp	1a'	W (cl, s)			1a"			cad	1b'	W (cl. s)			1ab			cad	trans. 3			1a' 2 ret	W (ob, bsn)			1a"			cad	1b' ob,cl,bsn)	W(f	-ob		1ab +ob,-cl			cad	trans	
	DOC					1			1	3				1			1	3			2				1			1	2				1			1	3	
	MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37

COPLAND, #4

		V2																		
	MM	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
Timbre/Color (Within, between & substitution of families)	Tb	P9 +W ob ±B			("clip-clop")		-B trb			P10 +B trb tr		can +S vc, cb							P11	
	DOC	1					1			1		1								
Range/Interval Size (Semitone Count)	Is#	48	40	36	43	41	40	49	32	40	43	72		60		72	65	69	65	72
	DOC	1							1			2		1		1				
Texture Tot. # active voices (Ratio-level)	Tx#	15								17			18							
	DOC												0							
Tempo/Meter (Types of chg: NC,PL,SD,MS,MP)	Tm			(8-meas. ph.s)																
	MS	1.9 :1/2 (note val.s = x2)																		
	DOC	2																		
Attack/Rhythm Density (ratio-level)	Ad	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8	8
	DOC																			
Key/Mode (by # of pitch class differences)	Km																			
	DOC																			
Dynamic Level (PP, MM, FF, Silence/SC)	Dl	mf								f								(f)		
	DOC	1								1										
Melodic Presentation Levels: Intact, Segmented, Within	Mp	1a' B,S (Trb, Vla)								1a* stretto	1a' (B,S, Cor, Vio)				(trb. alt.)				1a*	
	DOC	2								1	2					2			1	
	MM	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56

													V3							
	MM	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Timbre/Color (Within, between & substitution of families)	Tb						-W	Bdg +W -aB -H -Pf				+aB +S	-W	P12 -aW -B -aS						
	DOC						1	3				3	1	3						
Range/Interval Size (Semitone Count)	Is#		60	65	69	64	48	43	36	43	36	31	5	24		22	17	21	19	21
	DOC		1				1						2	1						
Texture Tot. # active voices (Ratio-level)	Tx#					19	11	4	7	8		12	8	2						
	DOC							1						3						
Tempo/Meter (Types of chg: NC,PL,SD,MS,MP)	Tm																			
	MS							1.7						0.8 1:2						
	DOC							1						3						
Attack/Rhythm Density (ratio-level)	Ad	8	8	8	8	8	2	6	8	6	8	6	6	3	4	3	3	2	2	4
	DOC						2	2						1						1
Key/Mode (by # of pitch class differences)	Km											C Maj								
	DOC											3								
Dynamic Level (PP, MM, FF, Silence/SC)	Dl							p				mf		f						
	DOC							2				1		1						
Melodic Presentation Levels: Intact, Segmented, Within	Mp				(1a* alt.)		trans. (W,S) cad					trans. (B,S)		1a' (B: Tr.) ret						
	DOC				2		1	3				1		1	1					
	MM	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75

COPLAND
DCMP

	MM	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109
Timbre/Color (Within, between & substitution of families)	Tb		P13 +S		-S		+S			-aS	P14 +W +B								P15 -aW +S								P16 (Brg-like) +W -aB ±S			+W			-W		
	DOC		3		3		3			3	3								3								3			1			1		
Range/Interval Size (Semitone Count)	Isd	12	36	24	24	23	14	24	39	24	24	14	17	10	12	15	12	12	17	36	26	41	25	36	25	24	55	52	44	39	48	50	43		36
	DOC		2	1					1	1										1		1	1				2								
Texture Tot. # active voices (Ratio-level)	Tx#		4			2	4				6								4									4		5					
	DOC		1			1	1																												
Tempo/Meter (Types of chg: NC,PL,SD,MS,MR)	Tm																										slight rit, 1	q=132 0							
	DOC																										1								
Attack/Rhythmic Density (ratio-level)	Ad #	2	5	8	3	3	5	8	8	1	1	2	4	2	3	3	3	2	5	8	8	8	8	8	8	2	3	4	4	2	3	3	3	2	1
	DOC	1	1		1					3		1	1	1					1	1						3				1					1
Key/Mode (by # of pitch class differences)	Km																																		
	DOC																																		
Dynamic Level (PP, MM, FF, Silence/SC)	Dl										fsf									(f)						mf									
	DOC																									1									
Melodic Presentation Levels: Intact, Segmented, Within	Mp		1a"								1b' (W,B)								1ab (Tr)							cad	1a' (seg, W) 1b' (stretto)			+ob.					
	DOC		1								2								1							1	3			1					
	MM	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109

	MM	110	111	112	113	114	115	116	117	V4 118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133
Timbre/Color (Within, between & substitution of families)	Tb	P17 ±W								P18 +aS +B +H,Pl +P	-W cl		+W cl					P19 -W cl		+W cl					-aW -Pf -H -aS
	DOC	1								3	1		1					1		1					3
Range/Interval Size (Semitone Count)	Is#	38	44	46	45	47		48	55	50	56	62	57	53	55	59	53	60	53	58	57		60	58	60-24
	DOC																								3
Texture Tot. # active voices (Ratio-level)	Tx#					(5)			13	19	17	19						17		19					4
	DOC								2																3
Tempo/Meter (Types of chg: NC,PL,SD,MS,MR)	Tm								2/2	q=66 2.1 1:2															
	DOC									3															
Attack/Rhythm Density (ratio-level)	Ad#	2	3	3	2	2	2	1	1	3	4	3	3	2	2	4	2	3	4	3	3	2	3	2	1
	DOC	1						1		2						1	1								1
Key/Mode (by # of pitch class difference)	Km																								
	DOC																								
Dynamic Level (PP, MM, FF, Silence/SC)	Dl					(mf)				fff															sf-p
	DOC									1															2
Melodic Presentation Levels;Intact, Segmented, Within	Mp	1ab (+fl,cl,-ob)						cad		1a' (W,B, aS)								1a"							cad
	DOC	2						1		2								1							1
	MM	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133

APPENDIX K

RAW MUSIC PARAMETER SCORES

Appendix K

Music Parameter Raw Scores

Ives 1a

	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
1	NC	NC	NC	NC	0	NC	NC	0
2					0			0
3					0			0
4					0			0
5					0			0
6					2			1
7					2			1
8					0			0
9					0			0
10					0			0
11					0			0
12					0			0
13					0			0
14					3			1

Ives 1b

	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
1	NC	0	NC	0	0	NC	NC	0
2		0		0	0			0
3		0		0	0			0
4		0		0	0			0
5		0		0	0			0
6		0		0	0			1
7		0		0	0			1
8		0		0	1			0
9		0		0	1			0
10		0		0	1			0
11		1		0	1			0
12		0		1	1			0
13		1		1	0			0
14		0		0	0			1
15		0		0	1			1
16		0		0	1			0
17		0		0	1			0
18		0		0	1			0
19		1		0	1			0
20		0		1	1			0
21		1		1	0			0
22		0		0	0			1

-

Mozart 2a

	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
1	NC	NC	NC	NC	0	NC	NC	0
2					0			0
3					0			0
4					0			0
5					0			0
6					0			0
7					2			3
8					3			1
9					1			1
10					0			0
11					0			0
12					0			0
13					0			0
14					0			0
15					2			3
16					2			2
17					0			1
18					0			0
19					0			0
20					0			0
21					0			0
22					0			0
23					2			2
24					3			1

Mozart 2b

	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
1	NC	0	0	0	0	NC	NC	0
2		0	0	0	1			0
3		1	2	1	1			2
4		0	0	0	1			0
5		1	0	0	1			0
6		0	0	0	0			0
7		0	0	0	0			0
8		0	0	0	1			1
9		0	1	1	1			2
10		0	0	0	1			0
11		0	0	0	1			2
12		0	0	0	1			0
13		0	0	0	1			2
14		0	0	0	1			0
15		0	0	0	1			0
16		0	0	0	0			0
17		1	0	0	0			1
18		2	2	0	0			2
19		1	2	1	0			2
20		0	0	0	0			0
21		1	0	0	0			0
22		0	0	0	0			0
23		0	0	0	0			0
24		0	0	0	1			1

Dohnanyi 3

	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
1	0	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	1	0	0	0	0	0	0
5	0	2	0	0	0	0	0	1
6	0	1	0	0	0	0	1	0
7	0	0	0	0	0	0	1	0
8	0	1	0	0	0	0	0	1
9	0	2	0	0	0	0	0	2
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	1	0	3
12	0	0	0	0	0	2	0	0
13	0	0	0	0	0	1	0	3
14	0	1	0	0	0	2	0	1
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	3	0	0	0	0	0	0
18	0	1	0	0	0	1	0	2
19	0	1	0	0	0	0	1	0
20	0	1	0	0	0	0	1	3
21	3	1	0	0	0	3	0	3
22	0	0	1	0	0	0	0	0
23	3	0	0	2	0	1	0	0
24	3	1	1	1	0	0	2	0
25	1	1	1	2	1	3	2	1
26	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
28	0	1	0	0	0	0	0	1

Copland 4a-4e

	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	1	0	0	0	0	0	0
4	0	1	0	0	0	0	0	0
5	1	0	0	0	0	0	0	1
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	1	0	0	0	0	0	1
9	3	0	0	0	0	0	3	3
10	2	1	0	0	1	0	0	2
11	0	0	0	0	0	0	2	0
12	0	0	0	0	0	0	0	0
13	2	0	0	0	0	0	0	1
14	0	0	0	0	1	0	0	0
15	0	1	0	0	0	0	0	0
16	2	1	0	0	0	0	0	1
17	1	0	0	0	0	0	0	3
18	1	0	0	0	0	2	0	0
19	0	1	0	0	0	0	0	0
20	**2**	**1**	**0**	**1**	**1**	**2**	**1**	2
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	1	0	0	0	0	0	1
25	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	1
28	2	0	1	0	0	0	2	2
29	0	0	0	0	1	0	0	0
30	1	0	0	0	0	0	1	0
31	0	0	0	0	0	0	0	0
32	1	0	0	0	0	0	0	1
33	1	1	0	0	1	0	0	0
34	0	1	0	0	0	0	0	0
35	0	0	0	0	1	0	0	1
36	3	1	1	1	1	0	1	3
37	0	0	0	0	0	0	0	0
38	**1**	**1**	**0**	**2**	**0**	**0**	**1**	2

39	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0
43	1	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0
45	0	1	0	0	0	0	0	0
46	1	0	0	0	0	0	1	1
47	0	0	0	0	0	0	0	2
48	1	2	0	0	0	0	0	0
49	1	0	0	0	0	0	0	0
50	0	1	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0
52	0	1	0	0	0	0	0	2
53	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	1
56	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0
58	0	1	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	2
61	0	0	0	0	0	0	0	0
62	1	1	0	0	2	0	0	1
63	3	0	2	1	2	0	2	3
64	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0
67	3	0	0	0	0	3	1	1
68	1	2	0	0	0	0	0	0
69	**3**	**1**	**3**	**3**	**1**	**0**	**1**	1
70	0	0	0	0	0	0	0	1
71	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0
75	0	0	0	0	1	0	0	0
76	0	0	0	0	1	0	0	0
77	3	2	1	0	1	0	0	1
78	0	1	0	0	0	0	0	0
79	3	0	0	0	1	0	0	0

80	0	0	1	0	0	0	0	0
81	3	0	1	0	0	0	0	0
82	0	0	0	0	0	0	0	0
83	0	1	0	0	0	0	0	0
84	3	1	0	0	3	0	0	0
85	3	0	0	0	0	0	1	2
86	0	0	0	0	1	0	0	0
87	0	0	0	0	1	0	0	0
88	0	0	0	0	1	0	0	0
89	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0
93	3	0	0	0	1	0	0	1
94	0	1	0	0	1	0	0	0
95	0	0	0	0	0	0	0	0
96	0	1	0	0	0	0	0	0
97	0	1	0	0	0	0	0	0
98	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0
100	3	0	0	0	3	0	1	1
101	3	2	0	1	0	0	0	3
102	0	0	0	0	0	0	0	0
103	0	0	0	0	0	0	0	0
104	1	0	0	0	1	0	0	1
105	0	0	0	0	0	0	0	0
106	0	0	0	0	0	0	0	0
107	1	0	0	0	0	0	0	0
108	0	0	0	0	0	0	0	0
109	0	0	0	0	1	0	0	0
110	1	0	0	0	1	0	0	2
111	0	0	0	0	0	0	0	0
112	0	0	0	0	0	0	0	0
113	0	0	0	0	0	0	0	0
114	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	0
116	0	0	0	0	1	0	0	1
117	0	0	2	0	0	0	0	0
118	**3**	**0**	**0**	**3**	**2**	**0**	**1**	2
119	1	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0	0

121	1	0	0	0	0	0	0	0
122	0	0	0	0	0	0	0	0
123	0	0	0	0	0	0	0	0
124	0	0	0	0	1	0	0	0
125	0	0	0	0	1	0	0	0
126	1	0	1	0	0	0	0	1
127	0	0	0	0	0	0	0	0
128	1	0	0	0	0	0	0	0
129	0	0	0	0	0	0	0	0
130	0	0	0	0	0	0	0	0
131	0	0	0	0	0	0	0	0
132	0	0	0	0	0	0	0	0
133	3	3	3	0	1	0	2	1

APPENDIX L

RAW SUBJECT RESPONSE SCORES

Appendix L

Subject Raw Scores

Ives 1a

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0
3	3	0	0	0	3	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0
4	2	1	0	0	3	1	0	0	1	0	0	0	1	1	0	2	0	0	0	0
5	1	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
6	1	0	1	1	2	1	1	0	1	1	1	0	0	0	1	0	1	1	1	0
7	1	0	0	0	0	0	0	1	1	2	0	1	0	1	2	0	0	0	0	0
8	3	0	0	0	2	0	2	0	0	1	2	0	1	0	1	0	1	1	0	0
9	2	0	1	0	2	2	0	1	1	2	0	1	0	0	1	1	0	0	1	0
10	2	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2	0	0	0
11	1	2	1	0	2	0	0	0	0	1	0	2	0	1	2	2	1	0	0	2
12	1	1	3	1	1	1	1	0	0	0	1	0	1	1	2	0	0	0	2	1
13	1	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	2	1	0	0
14	0	0	1	1	1	0	1	0	1	1	0	2	1	1	1	2	0	0	1	2

Ives 1b

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	0	1	0	0	0	0	0	1	0	1	2	2	0	0	0	0	0	0
3	0	0	0	0	2	0	0	0	0	0	0	0	2	1	1	2	1	0	0	2
4	3	0	1	0	0	0	2	0	0	0	0	0	0	2	1	0	0	2	0	0
5	0	0	2	1	0	0	0	0	1	0	0	2	0	0	1	0	0	0	0	0
6	3	3	0	1	2	2	1	0	0	0	0	2	1	2	2	1	0	0	1	2
7	2	0	1	0	1	0	0	0	1	2	0	1	0	2	2	2	0	2	0	2
8	2	0	0	0	3	3	3	0	0	0	0	0	2	2	1	2	0	2	1	2
9	0	0	0	1	2	2	0	3	0	2	0	2	1	0	1	2	0	0	3	0
10	1	1	2	2	0	0	0	0	0	2	0	0	1	0	1	0	2	1	0	1
11	1	0	2	0	0	0	0	1	1	2	3	1	2	0	2	0	1	1	0	0
12	3	1	1	1	3	0	0	0	1	1	1	0	2	2	2	0	0	0	3	3
13	2	1	2	0	0	1	0	2	2	3	0	0	3	1	1	1	2	1	3	0
14	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
15	3	2	3	1	0	3	0	1	0	2	0	0	0	2	2	2	0	2	0	2
16	3	0	2	0	3	2	0	2	0	1	3	1	1	0	0	0	0	0	2	0
17	0	1	2	1	0	2	0	0	2	3	0	0	1	0	2	2	1	3	0	0
18	0	0	0	0	0	1	0	0	1	2	0	2	1	2	2	0	0	0	0	3
19	0	0	0	1	2	0	0	3	0	1	2	0	2	2	0	2	0	0	2	0
20	2	1	1	1	1	1	0	0	1	1	3	2	1	1	2	2	2	1	0	2
21	1	1	1	1	3	0	0	1	2	0	0	1	2	3	3	2	2	3	0	2
22	0	1	2	0	0	1	1	0	0	2	2	2	0	0	2	0	0	0	1	1

Mozart 2a

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
7	3	1	3	0	3	1	1	2	1	0	0	0	0	3	1	0	0	0	0	0
8	3	1	1	1	1	0	0	0	1	1	1	0	1	0	1	1	0	1	1	3
9	0	0	3	1	3	0	0	0	2	2	0	2	0	2	0	0	1	0	0	2
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
12	0	1	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0	0
13	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
14	0	0	0	0	0	2	0	0	0	0	0	0	0	0	3	0	1	1	0	0
15	2	0	3	0	0	0	3	3	0	1	3	0	0	1	1	1	0	0	0	1
16	0	1	0	0	2	1	0	0	2	2	0	1	0	2	0	0	1	0	1	0
17	3	2	3	1	2	3	0	3	1	0	2	2	0	0	0	0	2	1	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	1	0	0	0	0	0	1	0	2	0	1	1	0	0	0	0	1
20	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0
21	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
22	1	0	0	0	0	0	0	0	1	0	0	0	0	2	3	0	0	0	0	0
23	3	3	2	0	3	3	3	2	0	1	0	0	0	0	0	1	1	0	0	1
24	0	0	0	0	1	0	0	0	1	2	1	1	0	0	0	0	1	0	0	0

Mozart 2b

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
3	0	1	1	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
4	2	0	3	0	0	1	3	1	2	0	0	0	1	3	0	2	2	0	0	0
5	2	0	0	0	0	0	0	2	0	1	0	2	1	0	0	0	2	2	0	0
6	0	0	3	1	1	2	0	2	0	0	2	2	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0
8	0	0	1	0	0	0	0	0	0	0	3	0	1	1	1	0	1	1	1	0
9	0	2	3	0	0	2	2	0	3	1	0	1	1	2	1	1	2	1	0	2
10	0	0	0	0	0	0	0	0	0	1	0	2	0	0	2	0	0	0	0	0
11	2	0	3	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0
12	0	0	2	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0	0	0
13	0	0	1	0	0	1	0	0	0	0	2	2	1	0	2	0	0	1	0	0
14	0	0	1	0	0	0	1	0	2	2	0	0	0	0	1	2	0	0	0	3
15	3	0	1	0	1	3	0	2	0	0	1	0	0	2	0	0	2	2	0	0
16	3	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
17	3	3	0	1	0	0	0	2	2	0	0	0	0	0	2	2	2	0	2	1
18	0	0	3	0	2	3	0	0	0	2	3	1	0	1	0	2	0	0	0	0
19	1	2	0	0	0	0	1	1	1	0	1	0	2	0	1	0	0	2	0	0
20	0	0	0	0	0	2	0	0	0	0	0	0	0	2	1	0	0	0	0	3
21	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0
22	1	0	0	0	0	0	0	0	3	2	0	3	0	0	1	0	2	0	0	0
23	0	2	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
24	3	0	0	0	1	0	0	0	0	1	0	0	0	0	2	0	0	0	1	1

Dohnanyi 3

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
3	0	0	0	1	0	0	0	1	0	0	0	1	1	1	0	0	1	0	0	0
4	0	0	0	0	0	1	3	0	1	0	1	0	0	1	0	0	1	2	0	0
5	2	0	0	0	2	1	0	2	0	1	1	1	1	2	0	0	2	0	0	0
6	3	0	0	0	0	2	0	2	2	0	0	0	0	0	1	0	0	0	0	0
7	1	0	0	2	0	0	3	0	0	0	3	0	0	0	1	0	0	0	0	0
8	0	0	0	0	1	0	0	2	0	0	0	1	0	0	0	3	0	2	0	0
9	3	3	1	1	2	0	0	0	0	1	3	0	0	0	0	3	1	1	2	0
10	1	0	0	0	0	0	2	2	0	0	0	2	0	0	1	0	0	0	0	2
11	0	3	0	1	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0
12	3	0	0	1	1	0	2	2	0	0	0	1	0	3	0	1	0	0	0	0
13	3	0	0	2	0	0	0	2	0	0	0	0	1	0	2	2	0	1	1	0
14	2	0	0	0	0	2	0	0	0	1	2	0	0	1	1	0	0	0	3	0
15	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0
16	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
17	3	0	2	0	2	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
18	3	3	0	0	1	1	1	0	1	0	3	0	0	0	0	2	0	0	0	1
19	2	0	0	1	1	1	2	0	0	2	3	0	1	0	2	0	0	1	0	0
20	2	0	1	0	0	0	0	0	3	0	0	0	2	0	1	0	0	0	0	0
21	1	2	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0
22	2	0	1	0	0	1	0	3	3	3	0	3	2	1	1	3	0	2	2	3
23	3	0	1	0	1	2	0	0	3	0	1	1	3	3	2	0	1	0	0	3
24	0	3	3	0	1	0	2	1	2	1	3	1	1	1	1	1	3	0	1	3
25	3	0	3	0	1	0	1	0	0	2	3	0	0	3	2	0	3	0	0	0
26	0	0	0	3	2	1	0	2	0	0	0	2	0	0	1	2	0	0	2	0
27	0	0	0	0	0	0	2	0	0	0	0	1	0	0	1	0	0	0	0	0
28	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	2	2	0	0	0

Copland 4a-4e

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	1	0	0	1	0	2	0	2	0	0	0	0	0	0
6	1	0	1	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2
7	0	0	0	0	0	0	0	0	0	2	0	1	0	1	0	0	0	0	0	0
8	0	0	3	1	1	0	1	0	1	0	0	0	1	0	1	0	0	1	1	0
9	1	0	2	1	2	2	0	0	0	1	1	1	0	1	0	2	0	0	0	0
10	3	0	1	2	2	0	1	0	1	0	0	1	0	0	2	0	0	0	0	0
11	3	2	3	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0
12	0	2	0	0	0	0	1	2	0	0	2	0	0	0	0	0	0	0	0	0
13	0	2	1	1	0	0	0	0	0	2	0	2	0	1	0	0	2	2	2	0
14	3	0	3	0	1	1	0	0	0	0	0	0	1	0	1	0	2	0	0	0
15	2	2	2	1	2	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0
16	0	0	1	0	0	1	2	0	0	0	0	0	0	2	3	0	1	0	0	0
17	0	0	2	2	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0
18	3	3	0	0	2	0	2	0	0	0	0	0	0	0	2	1	0	0	0	0
19	0	2	3	0	0	3	0	0	1	0	0	1	1	0	1	1	0	0	0	1
20	**2**	**0**	**0**	**1**	**3**	**1**	**1**	**3**	**1**	**0**	**2**	**3**	**0**	**0**	**3**	**2**	**0**	**0**	**2**	**0**
21	0	1	2	2	0	0	0	0	0	0	0	0	0	1	0	2	1	2	0	0
22	2	0	0	0	2	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0
23	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
24	0	2	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	2	0	0	0	0	0	3	0	0	0	0	0
26	0	0	3	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0
27	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2	0	1	0	0	0
28	0	2	3	0	1	0	1	1	0	1	0	0	1	0	0	0	0	0	1	2

29	0	0	0	0	0	1	0	0	1	0	0	2	2	1	1	2	1	0	0	0
30	0	0	0	0	0	1	0	0	0	0	0	0	1	3	2	0	0	0	2	0
31	0	3	2	0	0	2	1	0	2	0	0	0	0	0	0	0	1	0	0	0
32	2	0	0	0	1	0	0	3	1	1	0	1	0	0	2	0	0	0	0	1
33	2	1	3	2	0	0	1	0	0	0	0	0	0	0	0	2	0	1	0	0
34	2	0	0	1	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0
35	0	0	3	0	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
36	0	3	3	0	0	1	0	0	1	2	0	0	2	3	2	0	0	0	1	2
37	3	2	0	2	0	0	0	0	3	0	3	2	3	0	0	0	0	0	0	0
38	**0**	**2**	**3**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**2**	**0**	**2**	**0**	**0**	**2**	**0**	**0**
39	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	3	1	0	1	0
40	0	3	0	0	3	0	3	0	0	2	0	0	0	0	0	0	1	0	0	2
41	0	0	0	0	0	1	0	2	0	0	0	0	0	0	1	0	0	0	0	0
42	0	0	0	1	1	1	0	0	0	1	0	0	0	0	1	0	0	1	1	0
43	0	0	0	0	0	0	1	0	1	0	0	0	0	0	3	0	0	0	0	0
44	2	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	1	1	0	0	0	1	2	1	0	0	0	0	0	1	0	0
46	0	0	0	0	0	3	0	1	0	0	0	0	0	0	3	0	0	0	0	0
47	3	0	0	0	0	0	3	3	2	0	0	2	0	0	0	3	3	2	1	0
48	2	0	3	1	2	0	0	0	0	1	3	0	2	1	1	0	0	0	1	3
49	0	0	0	0	0	2	0	0	0	0	0	0	0	2	1	0	0	0	2	0
50	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
51	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
52	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	3	0	0	0	0	3	0	0	0	1	0	2	0	0	0	0	0	0
54	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	1	0	0
56	0	0	0	0	0	0	1	0	0	0	0	0	0	1	2	0	0	0	0	0

57	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	2	0	0	0	0	2	3	0	0	0	0	0
59	0	2	0	0	0	0	1	0	0	2	0	0	0	0	1	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0
61	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
62	2	0	2	0	3	1	1	0	0	0	0	1	0	0	0	1	0	0	1	1
63	0	0	2	1	0	0	3	2	1	3	1	2	0	1	1	3	1	1	2	2
64	3	0	3	0	0	0	0	0	0	3	0	0	0	2	0	0	2	1	0	0
65	0	0	0	0	0	0	1	0	0	0	2	1	0	0	2	0	0	0	0	0
66	0	3	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	3
67	1	0	0	2	0	0	1	0	0	2	0	2	2	0	2	0	0	0	0	0
68	0	0	3	0	0	3	1	1	0	0	0	1	0	0	1	0	0	0	0	0
69	**3**	**0**	**0**	**1**	**3**	**0**	**0**	**0**	**0**	**2**	**0**	**2**	**3**	**1**	**0**	**0**	**3**	**0**	**2**	**2**
70	0	3	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
71	0	0	3	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
72	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	1	2	0	0
73	0	2	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
74	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	1	0	0	0
76	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
77	3	0	1	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1
78	0	3	1	0	0	3	2	0	0	0	0	1	0	1	0	0	0	3	1	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
80	3	3	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0
81	0	0	0	0	1	0	0	0	0	1	0	0	0	2	0	0	2	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
83	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
84	0	0	2	0	0	0	0	0	0	0	0	0	2	0	2	1	0	0	0	0

85	0	2	2	0	2	0	2	0	3	2	0	0	0	2	0	0	0	0	0	2
86	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0
89	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	1	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0
91	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
92	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
93	3	1	0	0	0	0	1	0	0	0	0	0	2	0	0	0	1	3	0	0
94	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0
96	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0
97	0	1	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
98	2	0	0	0	2	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	0	2	0	0	0
100	3	0	0	0	1	0	3	0	1	0	0	0	1	0	1	0	1	0	1	3
101	0	0	1	0	0	1	0	1	0	2	3	0	0	2	0	1	0	3	3	0
102	0	0	3	0	0	0	0	2	0	0	0	2	0	0	0	0	2	0	0	0
103	0	2	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0
104	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
108	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
110	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
111	2	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
112	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

113	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
114	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
115	0	0	0	0	0	0	2	0	1	0	0	0	1	0	0	0	2	0	0	2
116	0	0	3	0	0	0	0	0	0	1	0	2	0	0	0	0	0	1	0	0
117	0	0	1	0	0	1	3	0	3	0	1	3	0	0	0	2	0	2	0	0
118	**3**	**3**	**3**	**3**	**0**	**3**	**0**	**2**	**0**	**3**	**0**	**1**	**2**	**0**	**2**	**0**	**3**	**0**	**3**	**3**
119	0	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	1	0	0	0	0	3	0	1	0	0	2	0	1	3	0
121	0	0	0	0	2	0	2	3	0	0	1	3	0	1	0	0	0	0	0	0
122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	3	0	0
123	0	0	0	1	0	0	0	2	1	0	1	1	0	0	0	0	0	0	0	0
124	0	0	0	3	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0
125	0	0	2	0	0	0	1	0	0	0	1	0	0	0	0	2	0	0	0	0
126	0	0	1	0	2	0	0	1	1	0	0	2	1	2	2	0	2	0	0	0
127	0	0	0	0	0	2	0	2	0	0	0	0	2	0	0	0	0	0	0	0
128	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
129	0	0	0	0	1	0	3	0	0	0	3	0	0	0	1	0	0	0	0	0
130	2	0	0	0	0	0	0	0	1	1	0	1	0	0	2	0	0	0	0	0
131	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	1	2
132	3	0	0	0	3	0	2	2	0	0	0	1	0	1	1	2	0	1	0	0
133	3	1	0	1	0	0	0	0	2	1	0	0	1	0	1	0	2	0	0	0

APPENDIX M

PERCENTAGE OF AGREEMENT

APPENDIX M
PERCENTAGE OF AGREEMENT

Single Subjects, Single & Combined Parameters

Ives (1a)

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	G2	G4	All
Tb	71%	50%	36%	14%	57%	50%	21%	21%	14%	21%	29%	29%	43%	36%	36%	50%	43%	29%	29%	29%	36%	35%	35%
Is	71%	50%	36%	14%	57%	50%	21%	21%	14%	21%	29%	29%	43%	36%	36%	50%	43%	29%	29%	29%	36%	35%	35%
Tx	71%	50%	36%	14%	57%	50%	21%	21%	14%	21%	29%	29%	43%	36%	36%	50%	43%	29%	29%	29%	36%	35%	35%
Tm	71%	50%	36%	14%	57%	50%	21%	21%	14%	21%	29%	29%	43%	36%	36%	50%	43%	29%	29%	29%	36%	35%	35%
Ad	**29%**	**50%**	**64%**	**86%**	**43%**	**50%**	**79%**	**79%**	**86%**	**79%**	**71%**	**71%**	**57%**	**64%**	**64%**	**50%**	**57%**	**71%**	**71%**	**71%**	**64%**	**65%**	**65%**
Km	71%	50%	36%	14%	57%	50%	21%	21%	14%	21%	29%	29%	43%	36%	36%	50%	43%	29%	29%	29%	36%	35%	35%
Dl	71%	50%	36%	14%	57%	50%	21%	21%	14%	21%	29%	29%	43%	36%	36%	50%	43%	29%	29%	29%	36%	35%	35%
Mp	**29%**	**50%**	**64%**	**86%**	**43%**	**50%**	**79%**	**79%**	**86%**	**79%**	**71%**	**71%**	**57%**	**64%**	**64%**	**50%**	**57%**	**71%**	**71%**	**71%**	**64%**	**65%**	**65%**

Ives (1b)

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	G2	G4	All
Tb	41%	59%	41%	68%	50%	55%	82%	68%	59%	36%	73%	45%	32%	41%	23%	59%	68%	55%	64%	50%	56%	51%	53%
Is	**50%**	**59%**	**59%**	**64%**	**50%**	**55%**	**77%**	**68%**	**59%**	**0%**	**50%**	**59%**	**59%**	**64%**	**50%**	**55%**	**77%**	**68%**	**59%**	**0%**	**51%**	**54%**	**54%**
Tx	41%	59%	41%	68%	50%	55%	82%	68%	59%	36%	73%	45%	32%	41%	23%	59%	68%	55%	64%	50%	56%	51%	53%
Tm	**59%**	**55%**	**41%**	**50%**	**55%**	**55%**	**82%**	**0%**	**55%**	**59%**	**59%**	**50%**	**64%**	**50%**	**41%**	**64%**	**73%**	**55%**	**73%**	**50%**	**12%**	**58%**	**35%**
Ad	**55%**	**59%**	**41%**	**45%**	**50%**	**55%**	**0%**	**55%**	**64%**	**68%**	**50%**	**59%**	**59%**	**50%**	**36%**	**55%**	**50%**	**45%**	**45%**	**55%**	**49%**	**50%**	**50%**
Km	41%	59%	41%	68%	50%	55%	82%	68%	59%	36%	73%	45%	32%	41%	23%	59%	68%	55%	64%	50%	56%	51%	53%
Dl	41%	59%	41%	68%	50%	55%	82%	68%	59%	36%	73%	45%	32%	41%	23%	59%	68%	55%	64%	50%	56%	51%	53%
Mp	**45%**	**59%**	**41%**	**0%**	**55%**	**68%**	**41%**	**55%**	**45%**	**64%**	**64%**	**50%**	**55%**	**50%**	**32%**	**41%**	**64%**	**59%**	**41%**	**64%**	**47%**	**52%**	**50%**

Percentages in bold type face indicate parameters with change

Percentages in regular type face indicate parameters without change: all zeros

Single Subjects, Single & Combined Parameters

Mozart (2a)

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	G2	G4	All
Tb	75%	75%	71%	83%	67%	75%	88%	83%	63%	67%	83%	67%	88%	71%	67%	83%	71%	83%	92%	79%	75%	78%	76%
Is	75%	75%	71%	83%	67%	75%	88%	83%	63%	67%	83%	67%	88%	71%	67%	83%	71%	83%	92%	79%	75%	78%	76%
Tx	75%	75%	71%	83%	67%	75%	88%	83%	63%	67%	83%	67%	88%	71%	67%	83%	71%	83%	92%	79%	75%	78%	76%
Tm	75%	75%	71%	83%	67%	75%	88%	83%	63%	67%	83%	67%	88%	71%	67%	83%	71%	83%	92%	79%	75%	78%	76%
Ad	63%	63%	67%	63%	67%	58%	71%	67%	58%	67%	67%	54%	63%	63%	50%	67%	63%	58%	71%	71%	64%	69%	67%
Km	75%	75%	71%	83%	67%	75%	88%	83%	63%	67%	83%	67%	88%	71%	67%	83%	71%	83%	92%	79%	75%	78%	76%
Dl	75%	75%	71%	83%	67%	75%	88%	83%	63%	67%	83%	67%	88%	71%	67%	83%	71%	83%	92%	79%	75%	78%	76%
Mp	71%	71%	75%	71%	79%	63%	67%	71%	71%	71%	79%	63%	63%	58%	50%	67%	71%	67%	71%	71%	71%	73%	72%

Mozart (2b)

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	G2	G4	All
Tb	63%	79%	42%	79%	63%	54%	67%	71%	67%	54%	67%	63%	63%	58%	46%	67%	58%	71%	71%	58%	64%	62%	63%
Is	54%	88%	58%	71%	71%	71%	83%	63%	75%	63%	75%	71%	71%	67%	46%	75%	58%	71%	71%	67%	70%	67%	68%
Tx	58%	92%	54%	75%	67%	67%	88%	67%	79%	58%	71%	67%	75%	68%	50%	71%	63%	75%	75%	71%	70%	68%	69%
Tm	50%	42%	71%	33%	50%	50%	54%	50%	46%	50%	46%	50%	75%	54%	50%	46%	63%	58%	50%	46%	50%	54%	52%
Ad	54%	88%	58%	71%	71%	71%	83%	63%	75%	63%	75%	71%	71%	67%	46%	75%	58%	71%	71%	67%	70%	67%	68%
Km	54%	88%	58%	71%	71%	71%	83%	63%	75%	63%	75%	71%	71%	67%	46%	75%	58%	71%	71%	67%	70%	67%	68%
Dl	58%	75%	63%	58%	58%	58%	63%	58%	63%	50%	71%	58%	75%	54%	58%	63%	54%	67%	75%	63%	60%	64%	62%
Mp	54%	88%	58%	71%	71%	71%	83%	63%	75%	63%	75%	71%	71%	67%	46%	75%	58%	71%	71%	67%	70%	67%	68%

Single Subjects, Single & Combined Parameters

Dohnanyi

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	G2	G4	All
Tb	50%	79%	82%	57%	71%	57%	71%	54%	71%	71%	68%	64%	64%	68%	61%	54%	79%	68%	71%	82%	66%	68%	67%
Is	61%	54%	57%	32%	68%	54%	54%	43%	61%	61%	71%	32%	46%	50%	43%	43%	61%	57%	46%	43%	54%	49%	52%
Tx	46%	75%	86%	61%	61%	61%	68%	64%	75%	75%	64%	68%	68%	71%	64%	64%	75%	71%	82%	86%	67%	71%	69%
Tm	46%	75%	86%	61%	68%	61%	68%	57%	75%	68%	71%	68%	68%	71%	64%	57%	82%	64%	75%	86%	66%	71%	69%
Ad	46%	75%	79%	68%	61%	61%	68%	57%	68%	68%	64%	61%	61%	64%	57%	57%	75%	71%	75%	79%	65%	66%	66%
Km	64%	71%	61%	64%	64%	64%	64%	46%	57%	64%	61%	50%	57%	68%	54%	54%	57%	61%	64%	68%	62%	59%	61%
Dl	57%	64%	75%	64%	57%	57%	71%	54%	71%	64%	68%	50%	64%	54%	75%	46%	64%	61%	64%	68%	64%	61%	63%
Mp	61%	68%	57%	54%	61%	54%	46%	50%	54%	68%	57%	39%	54%	50%	43%	57%	61%	64%	61%	50%	57%	54%	55%

Percentage of Agreement Between
Single Subjects, Single & Combined Parameters

Copland Variations

S1	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	58%	47%	63%	63%	74%	68%	74%	47%	62%
4b	67%	72%	56%	67%	61%	72%	56%	50%	63%
4c	71%	68%	77%	74%	81%	84%	74%	71%	75%
4d	69%	67%	80%	78%	61%	78%	80%	73%	73%
4e	69%	75%	69%	75%	69%	69%	81%	75%	73%
All	68%	66%	72%	73%	68%	76%	74%	66%	70%

S2	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	53%	53%	68%	68%	58%	74%	68%	42%	61%
4b	61%	67%	72%	61%	56%	56%	61%	56%	61%
4c	58%	68%	77%	81%	74%	77%	74%	58%	71%
4d	67%	73%	78%	80%	55%	84%	82%	76%	74%
4e	75%	94%	88%	94%	88%	88%	100%	94%	90%
All	63%	71%	77%	77%	64%	77%	77%	66%	72%

S3	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	58%	58%	42%	42%	53%	37%	53%	68%	51%
4b	61%	56%	72%	61%	67%	56%	61%	56%	61%
4c	81%	77%	81%	84%	84%	74%	77%	68%	78%
4d	65%	76%	71%	73%	53%	73%	71%	69%	69%
4e	69%	75%	81%	88%	81%	81%	81%	88%	80%
All	68%	71%	71%	71%	65%	67%	70%	69%	69%

S4	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	68%	58%	63%	63%	63%	58%	63%	79%	64%
4b	56%	72%	56%	67%	61%	72%	56%	50%	61%
4c	77%	68%	90%	87%	87%	90%	87%	71%	82%
4d	73%	84%	88%	90%	65%	90%	88%	78%	82%
4e	63%	81%	75%	81%	88%	75%	88%	81%	79%
All	70%	74%	79%	81%	72%	81%	80%	73%	76%

Subject
Measures
Mean of combined parameters
Copland variations on
Simple Gifts", (Appalachian
Spring), MM 1-133

All: 4a-4e intact
4a: MM 1-19
4b: MM 20-37
4c: MM 38-68
4d: MM 69-117
4e: MM 118-133

Tb: Timbre
Is: Interval size
Tx: Texture
Tm: Tempo/meter
Ad: Attack density
Km: Key/mode
Dl: Dynamic Lev.
Mp: Melodic presentation

(table continues)

S5	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	58%	58%	63%	63%	74%	68%	74%	58%	**64%**
4b	72%	56%	72%	72%	67%	78%	72%	78%	**71%**
4c	61%	71%	68%	71%	71%	68%	65%	55%	**66%**
4d	78%	76%	84%	82%	65%	82%	88%	78%	**79%**
4e	69%	63%	69%	63%	44%	69%	56%	63%	**62%**
All	**69%**	**68%**	**74%**	**73%**	**65%**	**74%**	**74%**	**68%**	**71%**

S6	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	53%	63%	68%	68%	68%	63%	79%	53%	**64%**
4b	67%	61%	67%	78%	83%	72%	78%	61%	**71%**
4c	65%	61%	65%	61%	68%	65%	61%	52%	**62%**
4d	67%	82%	82%	88%	59%	88%	82%	71%	**77%**
4e	50%	69%	63%	81%	63%	75%	75%	69%	**68%**
All	**62%**	**70%**	**71%**	**77%**	**66%**	**75%**	**76%**	**62%**	**70%**

S7	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	74%	63%	68%	68%	68%	74%	58%	74%	**68%**
4b	72%	78%	72%	72%	67%	78%	72%	67%	**72%**
4c	68%	58%	68%	65%	71%	68%	65%	68%	**66%**
4d	73%	67%	76%	78%	61%	82%	84%	78%	**75%**
4e	50%	69%	63%	69%	63%	75%	63%	56%	**63%**
All	**69%**	**66%**	**71%**	**71%**	**65%**	**76%**	**71%**	**71%**	**70%**

S8	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	47%	58%	74%	74%	63%	68%	74%	47%	**63%**
4b	72%	56%	72%	72%	56%	78%	72%	67%	**68%**
4c	68%	58%	81%	77%	77%	74%	77%	68%	**73%**
4d	65%	76%	80%	82%	61%	82%	76%	69%	**74%**
4e	69%	50%	56%	63%	44%	56%	56%	63%	**57%**
All	**65%**	**63%**	**75%**	**76%**	**62%**	**74%**	**73%**	**65%**	**69%**

S9	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	47%	89%	74%	74%	74%	68%	63%	58%	**68%**
4b	61%	56%	61%	72%	67%	67%	61%	56%	**63%**
4c	61%	65%	81%	77%	77%	74%	71%	68%	**72%**
4d	65%	63%	80%	78%	57%	82%	84%	69%	**72%**
4e	63%	81%	88%	69%	63%	75%	75%	81%	**74%**
All	**61%**	**68%**	**77%**	**75%**	**66%**	**75%**	**74%**	**67%**	**70%**

S10	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	74%	42%	79%	79%	68%	74%	79%	74%	**71%**
4b	78%	61%	89%	78%	61%	72%	78%	72%	**74%**
4c	65%	61%	77%	74%	74%	77%	74%	58%	**70%**
4d	78%	76%	80%	86%	69%	82%	84%	82%	**79%**
4e	69%	88%	81%	88%	81%	81%	94%	88%	**84%**
All	**73%**	**67%**	**80%**	**81%**	**71%**	**78%**	**81%**	**74%**	**76%**

S11	Tb	Is	Tx	Tm	Ad	Km	DI	Mp	All
4a	58%	47%	84%	84%	74%	79%	84%	58%	71%
4b	67%	72%	78%	89%	72%	94%	78%	61%	76%
4c	71%	74%	90%	87%	87%	84%	81%	65%	80%
4d	69%	76%	84%	90%	61%	90%	84%	78%	79%
4e	44%	63%	56%	63%	56%	69%	56%	50%	57%
All	65%	69%	81%	85%	70%	85%	79%	66%	75%
Tot	75%								

S12	Tb	Is	Tx	Tm	Ad	Km	DI	Mp	All
4a	74%	53%	68%	68%	68%	63%	68%	74%	67%
4b	61%	56%	61%	72%	67%	78%	61%	56%	64%
4c	74%	71%	74%	77%	77%	74%	77%	74%	75%
4d	65%	76%	84%	86%	61%	86%	84%	73%	77%
4e	63%	56%	63%	69%	50%	63%	63%	69%	62%
All	68%	66%	74%	77%	65%	76%	74%	71%	71%

S13	Tb	Is	Tx	Tm	Ad	Km	DI	Mp	All
4a	47%	68%	84%	84%	84%	79%	74%	58%	72%
4b	61%	56%	72%	61%	56%	56%	72%	44%	60%
4c	77%	74%	84%	87%	81%	90%	87%	77%	82%
4d	76%	73%	78%	84%	67%	84%	86%	76%	78%
4e	56%	63%	69%	63%	69%	56%	69%	75%	65%
All	68%	69%	78%	79%	71%	77%	80%	69%	74%

S14	Tb	Is	Tx	Tm	Ad	Km	DI	Mp	All
4a	74%	42%	68%	68%	58%	63%	79%	74%	66%
4b	50%	67%	61%	61%	56%	56%	61%	56%	58%
4c	61%	58%	74%	71%	71%	68%	65%	55%	65%
4d	73%	76%	80%	86%	53%	82%	84%	73%	76%
4e	63%	69%	75%	69%	63%	75%	63%	69%	68%
All	66%	65%	74%	74%	59%	71%	73%	66%	69%

S15	Tb	Is	Tx	Tm	Ad	Km	DI	Mp	All
4a	63%	74%	68%	68%	79%	74%	58%	63%	68%
4b	56%	50%	44%	56%	61%	50%	56%	61%	54%
4c	71%	48%	52%	55%	48%	52%	61%	52%	55%
4d	71%	78%	73%	76%	63%	80%	78%	67%	73%
4e	56%	50%	56%	50%	56%	44%	56%	63%	54%
All	66%	63%	62%	64%	61%	64%	65%	62%	63%

S16	Tb	Is	Tx	Tm	Ad	Km	DI	Mp	All
4a	74%	53%	79%	79%	68%	84%	79%	63%	72%
4b	67%	72%	67%	78%	83%	83%	67%	50%	71%
4c	68%	65%	87%	84%	90%	81%	77%	74%	78%
4d	78%	84%	88%	94%	65%	94%	88%	78%	83%
4e	44%	75%	69%	75%	69%	81%	69%	63%	68%
All	69%	72%	81%	85%	74%	86%	79%	69%	77%

(table continues)

S17	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	68%	58%	84%	84%	84%	79%	74%	68%	75%
4b	44%	50%	67%	67%	61%	72%	56%	50%	58%
4c	61%	58%	87%	84%	84%	81%	77%	68%	75%
4d	69%	67%	76%	78%	61%	78%	80%	69%	72%
4e	75%	81%	88%	81%	75%	75%	88%	94%	82%
All	65%	63%	80%	79%	71%	77%	76%	69%	73%

S18	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	58%	68%	84%	84%	74%	79%	74%	68%	74%
4b	67%	72%	78%	78%	72%	83%	67%	50%	71%
4c	61%	65%	81%	84%	77%	74%	77%	74%	74%
4d	69%	76%	80%	86%	61%	86%	80%	78%	77%
4e	44%	75%	69%	75%	56%	81%	69%	63%	66%
All	62%	71%	79%	83%	68%	81%	75%	70%	74%

S19	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	68%	58%	84%	84%	74%	79%	74%	79%	75%
4b	89%	72%	89%	89%	72%	83%	100%	72%	83%
4c	71%	61%	77%	74%	81%	71%	68%	65%	71%
4d	80%	86%	86%	92%	71%	88%	90%	84%	84%
4e	56%	75%	69%	88%	69%	81%	81%	75%	74%
All	74%	73%	82%	86%	74%	81%	83%	76%	79%

S20	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	53%	63%	89%	89%	79%	84%	79%	53%	74%
4b	83%	67%	94%	83%	67%	78%	83%	78%	79%
4c	71%	74%	84%	81%	87%	77%	74%	65%	77%
4d	76%	73%	82%	84%	67%	84%	90%	80%	79%
4e	63%	81%	75%	94%	75%	88%	88%	81%	80%
All	71%	72%	84%	85%	74%	82%	83%	72%	78%

Combined and Grouped Subjects,
Combined Parameters

	G2	G4	All
4a	64%	71%	68%
4b	66%	68%	67%
4c	72%	73%	72%
4d	75%	78%	77%
4e	73%	68%	70%
All	71%	73%	72%

Combined Subjects, Single Parameters, Copland 4a-4e

	Tb	Is	Tx	Tm	Ad	Km	Dl	Mp	All
4a	61%	58%	73%	68%	70%	71%	71%	63%	67%
4b	66%	58%	70%	72%	66%	72%	68%	60%	66%
4c	68%	66%	78%	78%	77%	75%	74%	65%	73%
4d	71%	75%	81%	84%	62%	84%	83%	75%	77%
4e	61%	72%	71%	75%	69%	73%	71%	73%	71%
4a-e	Combined Subjects, Single Parameters, All Var.s								
	65%	66%	75%	75%	69%	75%	73%	67%	

Overall Percentage of Agreement, All Ss, All Ps 71%

Single Subjects, Groups, and Combined Subjects
Across All Parameters

Copland		Grade 2										Grade 4										Mean %		
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	G2	G4	ALL
4a-4e	C1	50%	50%	57%	52%	53%	52%	43%	50%	52%	52%	45%	51%	51%	53%	57%	50%	47%	47%	53%	48%	51%	50%	51%
	C2	66%	63%	72%	68%	69%	62%	67%	62%	61%	73%	62%	68%	68%	63%	63%	69%	63%	65%	73%	68%	66%	66%	66%
4a	C1	53%	47%	74%	53%	63%	58%	26%	42%	53%	37%	21%	47%	42%	47%	58%	47%	42%	42%	42%	26%	51%	42%	47%
	C2	58%	53%	68%	68%	68%	53%	53%	47%	47%	63%	47%	63%	47%	74%	63%	63%	58%	58%	68%	42%	58%	58%	58%
4b	C1	50%	44%	44%	50%	56%	61%	39%	44%	44%	50%	39%	44%	56%	67%	72%	50%	39%	39%	61%	56%	48%	52%	47%
	C2	56%	61%	61%	44%	72%	67%	56%	61%	50%	67%	56%	50%	50%	50%	56%	56%	33%	56%	78%	72%	59%	56%	58%
4c	C1	55%	42%	58%	55%	45%	48%	48%	52%	65%	48%	55%	65%	61%	52%	61%	52%	45%	58%	55%	55%	52%	56%	54%
	C2	74%	55%	77%	74%	58%	55%	68%	71%	58%	61%	68%	77%	81%	52%	61%	71%	65%	65%	68%	68%	65%	67%	66%
4d	C1	43%	53%	51%	47%	51%	53%	45%	51%	47%	59%	51%	47%	45%	47%	49%	51%	47%	51%	57%	49%	50%	49%	50%
	C2	65%	63%	69%	69%	78%	67%	71%	61%	65%	82%	69%	69%	71%	69%	67%	78%	65%	73%	76%	71%	69%	71%	70%
4e	C1	56%	63%	69%	63%	56%	38%	50%	56%	50%	56%	44%	50%	56%	63%	56%	44%	63%	31%	44%	50%	56%	50%	53%
	C2	75%	94%	88%	81%	63%	69%	81%	63%	81%	88%	50%	69%	75%	69%	63%	63%	94%	63%	75%	81%	78%	70%	74%

C1: Condition 1, using all 8 music parameters, all scores
C2: Condition 2, using all 8 music parameters, deleting scores of "1" occurring in only a single parameter
S: Subject
Para: Parameter
G2: Grade 2 group (S's 1-10)
G4: Grade 4 group (S's 11-20)

4a-4e: Copland, variations on "Simple Gifts" from Appalachian Spring, measures 1-133.
4a: Measures 1-19
4b: Measures 20-37
4c: Measures 38-68
4d: Measures 69-117)
4e: Measures 118-133

Percentage of Agreement

Single Subjects, Groups, and Combined Subjects
Across All Parameters

		Grade 2										Grade 4										Mean %'s		
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	G2	G4	All
1a IVES	C 1	29%	50%	64%	86%	43%	50%	79%	79%	86%	79%	71%	71%	57%	64%	64%	50%	57%	71%	71%	71%	64%	65%	65%
	C2	29%	50%	64%	86%	43%	50%	79%	79%	86%	79%	71%	71%	57%	64%	64%	50%	57%	71%	71%	71%	64%	65%	65%
1b IVES	C 1	64%	64%	64%	36%	64%	68%	32%	55%	55%	77%	50%	59%	73%	55%	73%	55%	45%	59%	59%	64%	58%	59%	59%
	C2	64%	73%	64%	55%	55%	50%	50%	82%	73%	59%	77%	41%	55%	64%	45%	55%	73%	68%	59%	55%	62%	59%	61%
2a MOZ	C 1	83%	83%	88%	67%	92%	75%	79%	83%	79%	83%	83%	67%	63%	71%	58%	75%	79%	67%	75%	79%	81%	72%	77%
	C2	83%	83%	88%	67%	92%	75%	79%	83%	79%	83%	83%	67%	63%	71%	58%	75%	79%	67%	75%	79%	81%	72%	77%
2b MOZ	C 1	50%	42%	63%	33%	42%	42%	46%	50%	46%	42%	46%	42%	67%	54%	58%	46%	54%	58%	42%	38%	45%	50%	48%
	C2	63%	71%	68%	54%	54%	54%	58%	63%	58%	54%	67%	63%	79%	50%	54%	58%	58%	71%	71%	58%	59%	63%	61%
#3 DOH	C 1	75%	39%	50%	39%	61%	54%	46%	43%	54%	54%	64%	32%	54%	57%	50%	43%	46%	50%	39%	36%	51%	47%	49%
	C2	75%	54%	57%	46%	75%	54%	46%	50%	54%	61%	64%	39%	61%	50%	59%	50%	54%	50%	46%	43%	57%	51%	54%

1a, 1b: Ives, "Variations on 'America'", measures 33-46, 47-68 with repeat.
2a, 2b: Mozart, "Twelve Variations on <u>'Ah, voos dirar-le Maman'"</u>, measures 1-24,
3: Dohnanyi, "Variations on a Nursary Song"
4a-4e: Copland, variations on "Simple Gifts" from Appalachian Spring

C1: Condition 1, using all 8 music parameters, all scores
C2: Condition 2, using all 8 music parameters, deleting scores of "1" occurring in only a single parameter.
S: Subject
Para: Parameter
G2: Grade 2 group (S's 1-10)
G4 Grade 4 group (S's 11-20)

APPENDIX N

PEARSON'S PRODUCT-MOMENT CORRELATION COEFFICIENT

APPENDIX N

PEARSONS' PRODUCT-MOMENT CORRELATION COEFFICIENT: SINGLE, COMBINED, AND GROUPED SUBJECTS

Ives Variations (1a)

Parameters		Timbre	Interval Size	Texture	Tempo/ Meter	Attack Density	Key/ Mode	Dynamic Level	Melodic Presentation
Subjects		NC	NC	NC	NC		NC	NC	
	S 1					9%			6%
Grade	S 2					21%			20%
2	S 3					0%			0%
	S 4					31%			28%
	S 5					5%			3%
	S 6					5%			5%
	S 7					18%			19%
	S 8					10%			15%
	S 9					48%			52%
	S 10					25%			30%
	S 11					6%			10%
Grade	S 12					2%			18%
4	S 13					13%			18%
	S 14					0%			0%
	S 15					7%			10%
	S 16					19%			28%
	S 17					2%			1%
	S 18					46%			44%
	S 19					2%			2%
	S 20					0%			2%
Mean	G 2					17%			18%
Mean	G 4					10%			13%
Mean	ALL					14%			16%

Abbreviations

S: Subject
NC: No change

Ives
Variations
(1b)

Parameters		Timbre	Interval Size	Texture	Tempo/ Meter	Attack Density	Key/ Mode	Dynamic Level	Melodic Presentation
Subjects		NC		NC			NC	NC	
	S 1		0%		4%	0%			16%
Group 2	S 2		2%		10%	1%			37%
	S 3		2%		2%	7%			2%
	S 4		1%		1%	13%			5%
	S 5		2%		13%	3%			3%
	S 6		21%		9%	20%			10%
	S 7		15%		8%	6%			1%
	S 8		11%		4%	43%			4%
	S 9		31%		48%	1%			3%
	S 10		7%		1%	49%			2%
	S 11		38%		17%	31%			8%
Group 4	S 12		0%		0%	2%			6%
	S 13		37%		33%	6%			31%
	S 14		2%		8%	10%			4%
	S 15		12%		19%	1%			3%
	S 16		1%		1%	4%			2%
	S 17		43%		47%	2%			12%
	S 18		0%		2%	2%			2%
	S 19		10%		18%	12%			2%
	S 20		4%		10%	1%			7%
Mean	G 2		9%		10%	14%			8%
Mean	G 4		15%		15%	7%			8%
Mean	All		12%		13%	11%			8%

Mozart
Variations
(2a)

Parameters		Timbre	Interval Size	Texture	Tempo/ Meter	Attack Density	Key/ Mode	Dynamic Level	Melodic Presentation
Subjects		NC	NC	NC	NC		NC	NC	
	S 1					64%			64%
Grade	S 2					38%			36%
2	S 3					60%			69%
	S 4					4%			0%
	S 5					64%			53%
	S 6					10%			19%
	S 7					44%			54%
	S 8					35%			70%
	S 9					34%			31%
	S 10					56%			41%
	S 11					30%			55%
Grade	S 12					0%			0%
4	S 13					1%			0%
	S 14					34%			48%
	S 15					2%			3%
	S 16					45%			32%
	S 17					13%			19%
	S 18					4%			5%
	S 19					48%			47%
	S 20					44%			18%
Mean	G 2					41%			44%
Mean	G 4					22%			23%
Mean	ALL					31%			33%

Mozart
Variations
(2b)

Parameters		Timbre	Interval Size	Texture	Tempo/ Meter	Attack Density	Key/ Mode	Dynamic Level	Melodic Presentation
Subjects		NC					NC	NC	
	S 1		2%	2%	10%	1%			5%
Group	S 2		21%	28%	19%	13%			25%
2	S 3		0%	4%	4%	28%			21%
	S 4		14%	2%	12%	39%			9%
	S 5		10%	18%	4%	2%			1%
	S 6		15%	16%	5%	2%			3%
	S 7		1%	10%	30%	20%			6%
	S 8		3%	2%	9%	0%			2%
	S 9		2%	2%	7%	0%			2%
	S 10		3%	0%	1%	3%			0%
	S 11		14%	16%	2%	3%			23%
Group	S 12		0%	4%	2%	0%			2%
4	S 13		4%	35%	57%	22%			26%
	S 14		1%	4%	14%	4%			1%
	S 15		1%	1%	0%	0%			12%
	S 16		22%	10%	0%	1%			9%
	S 17		0%	4%	0%	7%			1%
	S 18		1%	2%	4%	1%			0%
	S 19		9%	0%	2%	8%			6%
	S 20		1%	0%	1%	1%			0%
Mean	G 2		7%	8%	10%	11%			7%
Mean	G 4		5%	8%	8%	5%			8%
Mean	All		6%	8%	9%	8%			8%

Dohnanyi
Variation (3)

Parameters		Timbre	Interval Size	Texture	Tempo/ Meter	Attack Density	Key/ Mode	Dynamic Level	Melodic Presentation
Subjects									
	S 1	2%	13%	2%	2%	0%	15%	4%	16%
Grade	S 2	10%	6%	5%	3%	0%	4%	1%	10%
2	S 3	55%	6%	74%	77%	50%	11%	48%	1%
	S 4	12%	18%	3%	1%	3%	4%	0%	1%
	S 5	4%	36%	8%	11%	13%	0%	7%	0%
	S 6	2%	0%	1%	3%	3%	0%	0%	2%
	S 7	0%	0%	1%	1%	2%	0%	16%	0%
	S 8	0%	6%	2%	0%	0%	3%	1%	0%
	S 9	58%	0%	27%	30%	0%	1%	13%	0%
	S 10	21%	1%	38%	15%	12%	21%	7%	3%
	S 11	6%	22%	15%	21%	18%	0%	42%	0%
Grade	S 12	17%	15%	22%	16%	1%	1%	1%	3%
2	S 13	44%	0%	17%	2%	2%	3%	3%	1%
	S 14	22%	7%	32%	41%	15%	14%	5%	5%
	S 15	23%	6%	30%	39%	19%	14%	38%	1%
	S 16	0%	0%	0%	0%	0%	0%	8%	0%
	S 17	30%	4%	50%	59%	44%	1%	37%	9%
	S 18	1%	2%	0%	2%	5%	0%	5%	9%
	S 19	3%	3%	7%	5%	3%	18%	1%	3%
	S 20	64%	2%	47%	52%	1%	2%	6%	2%
Mean	G 2	16%	9%	16%	14%	8%	6%	10%	3%
Mean	G 4	21%	6%	22%	24%	10%	5%	15%	3%
Mean	ALL	19%	7%	19%	19%	9%	6%	12%	3%

Copland: All Subjects, Single Parameters, Parcelled

Parameter	Timbre	Interval Size	Texture	Tempo/ Meter	Attack Density	Key/ Mode	Dynamic Level	Melodic Presentation
				mm 1-19				
Theme & Bridge (4a)	21%	0%	NC	2%	28%	19%	22%	16%
				mm 20-37				
Var I & Bridge (4b)	59%	17%	40%	54%	30%	0%	20%	47%
				mm 38-68				
Var II & Bridge (4c)	20%	19%	10%	22%	19%	1%	20%	13%
				mm 69-117				
Var III (4d)	33%	5%	21%	28%	3%	NC	27%	34%
				mm 118-132				
Var IV (4e)	71%	27%	27%	57%	38%	NC	68%	66%
				mm 1-132				
Intact 4a-e)	27%	11%	10%	21%	6%	5%	29%	31%

CONDITIONS:

Music parcelled by variation
Mean of combined subjects
Overlapped scores

Pearson's Product-Moment Correlation Coefficient:
Single Subject, Single Parameter, Parcelled & Intact

Copland Variations	Timbre	Interval Size	Texture	Tempo/ Meter	Attack Density	Key/ Mode	Dynamic Level	Melodic Presentation
S1								
4a-e	14%	9%	8%	6%	5%	1%	10%	5%
4a	7%	0%	***	0%	52%	4%	18%	3%
4b	3%	31%	5%	9%	4%	1%	9%	1%
4c	23%	14%	18%	7%	13%	0%	12%	12%
4d	17%	2%	15%	10%	3%	***	8%	6%
4e	29%	54%	32%	7%	2%	***	63%	12%
S2								
4a-e	5%	0%	2%	7%	0%	5%	4%	2%
4a	0%	3%	***	1%	1%	27%	0%	5%
4b	33%	5%	24%	35%	0%	1%	17%	35%
4c	3%	6%	5%	0%	6%	3%	2%	9%
4d	15%	1%	22%	12%	0%	***	9%	2%
4e	75%	6%	3%	90%	38%	***	45%	67%
S3								
4a-e	12%	6%	4%	9%	6%	1%	17%	25%
4a	16%	2%	***	1%	30%	1%	23%	16%
4b	33%	4%	28%	14%	28%	0%	8%	36%
4c	34%	18%	31%	25%	30%	0%	30%	20%
4d	2%	2%	1%	4%	0%	***	4%	14%
4e	17%	2%	1%	35%	57%	***	2%	52%
S4								
4a-e	9%	4%	1%	10%	3%	8%	11%	10%
4a	49%	2%	***	0%	11%	0%	19%	59%
4b	6%	32%	1%	16%	5%	21%	0%	1%
4c	62%	11%	12%	4%	6%	52%	25%	3%
4d	0%	4%	19%	36%	0%	***	8%	1%
4e	3%	0%	0%	20%	64%	***	6%	6%
S5								
4a-e	11%	6%	4%	8%	2%	3%	16%	7%
4a	30%	13%	***	9%	44%	11%	44%	26%
4b	3%	0%	0%	19%	6%	26%	2%	9%
4c	9%	7%	8%	12%	18%	0%	2%	0%
4d	7%	4%	6%	5%	0%	***	18%	5%
4e	38%	12%	16%	12%	0%	***	22%	28%

*** No change in parameter
r2: r is squared, reported as percentage

4a-e: all measures
4a: MM 1-19 parcelled
4b: MM 20-37 "
4c: MM 38-68 parcelled
4d: MM 69-117 "
4e: MM 118-133 "

Copland
Variations

	Timbre	Interval Size	Texture	Tempo/ Meter	Attack Density	Key/ Mode	Dynamic Level	Melodic Presentation
S6								
4a-e	7%	5%	1%	10%	1%	4%	8%	3%
4a	16%	32%	***	43%	20%	29%	18%	8%
4b	13%	5%	3%	0%	12%	1%	11%	1%
4c	14%	14%	2%	8%	0%	1%	10%	0%
4d	3%	5%	4%	10%	1%	***	1%	2%
4e	12%	5%	4%	31%	0%	***	0%	16%
S7								
4a-e	7%	1%	3%	0%	4%	1%	5%	13%
4a	23%	3%	***	0%	6%	22%	1%	22%
4b	0%	7%	1%	9%	4%	2%	0%	0%
4c	9%	0%	10%	0%	18%	0%	15%	33%
4d	22%	0%	2%	3%	19%	***	24%	27%
4e	0%	5%	2%	6%	4%	***	1%	5%
S8								
4a-e	0%	2%	1%	2%	0%	1%	1%	1%
4a	3%	6%	***	20%	0%	3%	0%	3%
4b	0%	4%	4%	2%	2%	19%	3%	0%
4c	3%	0%	4%	0%	3%	1%	10%	17%
4d	0%	13%	1%	4%	4%	***	0%	2%
4e	20%	1%	2%	11%	0%	***	6%	15%
S9								
4a-e	2%	0%	4%	1%	1%	0%	4%	2%
4a	4%	66%	***	32%	18%	10%	10%	3%
4b	12%	0%	2%	26%	0%	0%	2%	6%
4c	0%	1%	0%	2%	0%	1%	1%	1%
4d	5%	5%	6%	1%	2%	***	9%	1%
4e	0%	40%	53%	5%	0%	***	23%	6%
S10								
4a-e	19%	0%	16%	17%	9%	0%	13%	15%
4a	1%	18%	***	3%	0%	11%	0%	0%
4b	45%	1%	54%	3%	16%	4%	8%	36%
4c	27%	0%	33%	8%	23%	4%	36%	8%
4d	22%	1%	18%	42%	7%	***	42%	50%
4e	49%	4%	1%	75%	24%	***	34%	49%

(table continues)

Copland
Variations

	Timbre	Interval Size	Texture	Tempo/ Meter	Attack Density	Key/ Mode	Dynamic Level	Melodic Presentation
S11								
4a-e	2%	1%	0%	5%	0%	0%	2%	3%
4a	3%	4%	***	21%	0%	1%	17%	1%
4b	16%	11%	3%	74%	1%	14%	8%	18%
4c	1%	8%	0%	1%	0%	2%	0%	0%
4d	6%	4%	4%	25%	1%	***	9%	32%
4e	5%	6%	10%	6%	9%	***	11%	18%
S12								
4a-e	6%	2%	12%	24%	1%	7%	12%	10%
4a	13%	0%	***	43%	20%	7%	4%	5%
4b	8%	0%	0%	56%	0%	13%	13%	4%
4c	57%	20%	30%	41%	22%	16%	61%	32%
4d	0%	0%	32%	27%	0%	***	4%	7%
4e	0%	0%	1%	0%	4%	***	0%	2%
S13								
4a-e	11%	2%	7%	22%	4%	1%	9%	5%
4a	0%	4%	***	12%	13%	11%	0%	0%
4b	21%	1%	22%	41%	8%	4%	29%	19%
4c	33%	39%	9%	29%	0%	21%	7%	3%
4d	14%	1%	5%	22%	9%	***	27%	7%
4e	13%	0%	4%	11%	5%	***	2%	30%
S14								
4a-e	6%	3%	3%	0%	0%	2%	4%	6%
4a	10%	0%	***	7%	4%	24%	0%	8%
4b	12%	2%	9%	0%	29%	0%	10%	2%
4c	0%	2%	4%	0%	1%	6%	0%	0%
4d	23%	8%	3%	2%	1%	***	21%	15%
4e	0%	2%	20%	6%	3%	***	0%	7%
S15								
4a-e	2%	2%	0%	1%	0%	7%	4%	3%
4a	29%	27%	***	26%	14%	37%	2%	22%
4b	7%	0%	0%	7%	7%	9%	2%	5%
4c	0%	2%	3%	0%	6%	2%	0%	0%
4d	3%	3%	0%	0%	0%	***	10%	0%
4e	1%	2%	6%	2%	0%	***	5%	10%

(table continues)

Copland
Variations

	Timbre	Interval Size	Texture	Tempo/ Meter	Attack Density	Key/ Mode	Dynamic Level	Melodic Presentation
S16								
4a-e	7%	3%	5%	4%	6%	5%	15%	16%
4a	34%	7%	***	32%	5%	56%	17%	38%
4b	6%	3%	2%	0%	15%	44%	2%	2%
4c	9%	0%	11%	10%	29%	2%	32%	44%
4d	3%	4%	15%	22%	1%	***	16%	24%
4e	0%	11%	12%	5%	5%	***	4%	0%
S17								
4a-e	5%	0%	13%	14%	2%	1%	2%	2%
4a	2%	4%	***	1%	15%	5%	8%	1%
4b	0%	41%	0%	6%	3%	7%	17%	1%
4c	12%	3%	30%	24%	7%	2%	21%	17%
4d	3%	1%	9%	20%	0%	***	9%	2%
4e	42%	8%	19%	27%	11%	***	25%	62%
S18								
4a-e	5%	3%	1%	2%	1%	0%	0%	2%
4a	0%	0%	***	2%	4%	8%	3%	1%
4b	0%	10%	10%	24%	0%	25%	0%	0%
4c	2%	1%	2%	5%	3%	4%	20%	24%
4d	32%	13%	3%	4%	3%	***	0%	14%
4e	1%	1%	0%	3%	11%	***	0%	7%
S19								
4a-e	22%	6%	6%	25%	10%	0%	8%	16%
4a	11%	1%	***	21%	5%	7%	0%	8%
4b	28%	4%	10%	3%	13%	21%	47%	5%
4c	30%	18%	28%	17%	38%	4%	16%	14%
4d	41%	26%	12%	48%	12%	***	28%	53%
4e	15%	3%	7%	26%	0%	***	1%	5%
S20								
4a-e	12%	0%	6%	12%	12%	4%	8%	3%
4a	4%	4%	***	6%	4%	29%	18%	8%
4b	66%	0%	86%	2%	66%	1%	11%	1%
4c	20%	7%	14%	4%	20%	1%	10%	0%
4d	23%	0%	3%	15%	23%	***	1%	2%
4e	11%	2%	4%	50%	11%	***	0%	16%

APPENDIX O

HIERARCHICAL CLUSTER ANALYSIS

Ives

1a, 1b

H I E R A R C H I C A L   C L U S T E R   A N A L Y S I S

Agglomeration Schedule using Centroid Method

Stage	Clusters Combined Cluster 1	Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2	Next Stage
1	6	7	.000000	0	0	2
2	1	6	.000000	0	1	3
3	1	3	.000000	2	0	4
4	1	4	3.999996	3	0	5
5	1	2	3.359996	4	0	6
6	1	8	8.333331	5	0	7
7	1	12	14.836693	6	0	8
8	1	17	17.859268	7	0	9
9	1	5	21.111008	8	0	10
10	1	15	20.699905	9	0	11
11	1	10	21.380035	10	0	12
12	1	25	22.798492	11	0	16
13	22	28	24.999985	0	0	14
14	22	23	24.249985	13	0	19
15	16	27	24.999985	0	0	16
16	1	16	24.983597	12	15	17
17	1	26	29.515427	16	0	18
18	1	20	30.691284	17	0	19
19	1	22	29.533096	18	14	20
20	1	21	28.159897	19	0	21
21	1	24	29.160843	20	0	22
22	1	14	29.388290	21	0	23
23	1	19	33.366577	22	0	24
24	1	11	34.727280	23	0	25
25	1	18	33.764633	24	0	27
26	9	13	60.999985	0	0	27
27	1	9	49.274918	25	26	0

Dendrogram using Centroid Method

```
                       Rescaled Distance Cluster Combine

    C A S E      0         5        10        15        20        25
  Label  Seq     +---------+---------+---------+---------+---------+

            6     -+
            7     -+
            1     -+---+
            3     -+   I
            4     -----+---+
            2     -----+   +-----+
            8     ---------+     +---+
           12     ---------------+   +-+
           17     -------------------+ I
            5     ---------------------+
           15     ---------------------+-+
           10     ---------------------+ +-+
           25     -----------------------+ +---+
           16     -------------------------+   +-+
           27     -------------------------+   I I
           26     -----------------------------+ I
           20     -------------------------------+
           22     -------------------------+     I
           28     -------------------------+-----+
           23     -------------------------+     I
           21     -------------------------------+-+
           24     -------------------------------+ +-+
           14     -------------------------------+ I I
           19     ---------------------------------+ +-------------+
           11     -----------------------------------+             I
           18     -----------------------------------+             I
            9     -------------------------------------------------+
           13     -------------------------------------------------+
```

<u>Parameters</u>

1... Timbre
2... Interval Size
3... Texture
4... Tempo/meter
5... Attack Density
6... Key/mode
7.... Dynamic Level
8.... Melodic Presentation

9 - 28...Subjects

Mozart

2a, 2b H I E R A R C H I C A L   C L U S T E R   A N A L Y S I S

Agglomeration Schedule using Centroid Method

Stage	Clusters Combined Cluster 1	Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2	Next Stage
1	6	7	.000000	0	0	2
2	1	6	.000000	0	1	3
3	1	4	2.999997	2	0	5
4	2	3	5.999999	0	0	5
5	1	2	7.937497	3	4	6
6	1	27	8.861105	5	0	7
7	1	12	7.938770	6	0	8
8	1	21	13.828105	7	0	9
9	1	26	15.370300	8	0	10
10	1	24	21.849884	9	0	11
11	1	10	29.694092	10	0	12
12	1	15	28.784576	11	0	13
13	1	18	29.218781	12	0	14
14	1	25	29.050858	13	0	16
15	5	8	30.999985	0	0	16
16	1	5	29.189835	14	15	17
17	1	17	30.152084	16	0	18
18	1	28	33.339325	17	0	19
19	1	19	34.185471	18	0	20
20	1	22	35.852310	19	0	21
21	1	23	37.090546	20	0	22
22	1	20	38.067993	21	0	23
23	1	13	37.742722	22	0	24
24	1	16	38.079651	23	0	25
25	1	14	41.614182	24	0	26
26	1	11	60.166901	25	0	27
27	1	9	59.866684	26	0	0

Dendrogram using Centroid Method

```
                         Rescaled Distance Cluster Combine

    C A S E      0         5        10        15        20        25
  Label  Seq     +---------+---------+---------+---------+---------+

          6       -+
          7       -+-+
          1       -+ +----+
          4       ---+    I
          2       -----+--+
          3       -----+ +----+
         27       -------+    +-+
         12       -------+    I +-----+
         21       -----------+ I      +-----+
         26       -------------+      I     I
         24       -------------------+      I
         10       --------------------------+
         15       --------------------------+
         18       --------------------------+
         25       --------------------------+
          5       --------------------------+-+
          8       --------------------------+ +-+
         17       --------------------------+ I I
         28       ----------------------------+ +-+
         19       ------------------------------+ I
         22       ------------------------------+ I
         23       --------------------------------+
         20       --------------------------------+---+
         13       --------------------------------+   +--------------+
         16       --------------------------------+   I              I
         14       ------------------------------------+              I
         11       ---------------------------------------------------+
          9       ---------------------------------------------------+
```

__Parameters__

1... Timbre
2... Interval Size
3... Texture
4... Tempo/meter
5... Attack Density
6... Key/mode
7.... Dynamic Level
8.... Melodic Presentation

9 - 28...Subjects

H I E R A R C H I C A L   C L U S T E R   A N A L Y S I S

Dohnanyi

Agglomeration Schedule using Centroid Method

Stage	Clusters Combined Cluster 1	Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2	Next Stage
1	3	5	2.000000	0	0	2
2	3	4	5.499998	1	0	3
3	3	7	6.777776	2	0	4
4	3	11	12.812491	3	0	6
5	2	13	12.999999	0	0	14
6	3	25	15.399954	4	0	9
7	17	21	15.999999	0	0	8
8	17	28	15.999986	7	0	10
9	3	23	16.361084	6	0	10
10	3	17	16.607635	9	8	11
11	1	3	15.959954	0	10	12
12	1	14	16.553635	11	0	14
13	16	20	16.999985	0	0	18
14	1	2	18.159622	12	5	15
15	1	26	17.306030	14	0	16
16	1	18	17.008789	15	0	17
17	1	27	19.449081	16	0	18
18	1	16	20.419403	17	13	19
19	1	12	22.623108	18	0	20
20	1	6	24.117355	19	0	21
21	1	22	24.779892	20	0	22
22	1	15	32.760178	21	0	23
23	1	10	37.147324	22	0	24
24	1	8	38.282791	23	0	25
25	1	24	38.641449	24	0	26
26	1	19	38.803055	25	0	27
27	1	9	57.796753	26	0	0

Dendrogram using Centroid Method

Rescaled Distance Cluster Combine

```
C A S E      0         5        10        15        20        25
Label  Seq   +---------+---------+---------+---------+---------+

         3    -+-+
         5    -+ +-+
         4    ---+ +---+
         7    -----+   +---+
        11    ---------+   I
        25    -------------+
        23    -------------+
        17    -------------+
        21    -------------+
        28    -------------+-+
         1    -------------+ I
        14    -------------+ I
         2    ---------+-----+
        13    ---------+     I
        26    ---------------+-+
        18    ---------------+ +-+
        27    ---------------+ I I
        16    -------------+---+ I
        20    -------------+     +-+
        12    -------------------+ +-----+
         6    -------------------+ I     +---+
        22    ---------------------+     I   +-+
        15    ---------------------------+   I I
        10    -------------------------------+ I
         8    ---------------------------------+---------------+
        24    ---------------------------------+               I
        19    ---------------------------------+               I
         9    -------------------------------------------------+
```

Parameters

1... Timbre
2... Interval Size
3... Texture
4... Tempo/meter
5... Attack Density
6... Key/mode
7.... Dynamic Level
8.... Melodic Presentation
9 - 28...Subjects

H I E R A R C H I C A L   C L U S T E R   A N A L Y S I S

Copland

Agglomeration Schedule using Centroid Method

Stage	Clusters Combined Cluster 1	Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2	Next Stage
1	3	4	33.999985	0	0	2
2	3	7	27.499969	1	0	3
3	3	6	31.555511	2	0	4
4	2	3	44.749939	0	3	5
5	2	5	44.239944	4	0	6
6	2	27	48.388840	5	0	7
7	2	12	48.693802	6	0	8
8	2	21	52.031174	7	0	9
9	2	18	54.444351	8	0	10
10	2	24	62.699805	9	0	11
11	2	8	64.363525	10	0	12
12	2	28	66.416550	11	0	13
13	2	25	68.668518	12	0	14
14	2	26	71.209030	13	0	15
15	2	20	69.964310	14	0	16
16	2	19	70.742020	15	0	17
17	2	22	70.899506	16	0	18
18	2	14	86.462784	17	0	19
19	2	17	89.758804	18	0	20
20	2	16	95.007294	19	0	21
21	2	15	97.079147	20	0	22
22	2	13	99.363403	21	0	23
23	1	2	106.084869	0	22	24
24	1	10	114.178604	23	0	25
25	1	23	126.546982	24	0	26
26	1	9	147.230499	25	0	27
27	1	11	170.859756	26	0	0

Dendrogram using Centroid Method

```
                 Rescaled Distance Cluster Combine

 C A S E     0         5         10        15        20        25
 Label  Seq  +---------+---------+---------+---------+---------+

        3    -+
        4    -+
        7    -+-+
        6    -+ I
        2    ---+-+
        5    ---+ I
       27    -----+-+
       12    -----+ I
       21    -------+---+
       18    -------+   I
       24    -----------+
        8    -----------+-+
       28    -----------+ I
       25    -------------+
       26    -------------+
       20    -------------+
       19    -------------+-----+
       22    -------------+     +-+
       14    -------------------+ +-+
       17    ---------------------+ I
       16    -----------------------+
       15    -----------------------+---+
       13    -----------------------+   +-+
        1    ---------------------------+ +---+
       10    -----------------------------+   +-------+
       23    ---------------------------------+       +-------+
        9    -----------------------------------------+       I
       11    -------------------------------------------------+
```

Parameters

1... Timbre
2... Interval Size
3... Texture
4... Tempo/meter
5... Attack Density
6... Key/mode
7.... Dynamic Level
8.... Melodic Presentation
9 - 28...Subjects

APPENDIX P

PERMISSION LETTERS

Sharon F. Lehmann
3821 Redstone
Denton, Tx. 76201
(817) 382-8258

May 22, 1987

To the Parents of ______________________________:

As an enrichment activity in music, several classes have participated in a music listening and graphing project. In conjunction with this and as part of the data gathering for a Ph.D. dissertation, several children were individually video taped as they graphed the music to which they were listening. These tapes will be analyzed in an attempt to determine the specific aspects of the music to which the child is attending.

The video taped sequences show only the child's hand as the graphing is being done, and in no way is the child identified except by age/grade and gender.

The purpose of this letter is to ask your permission to use the video tape of your child as part of my study of children's perceptual listening patterns. A self-addressed, stamped envelope is enclosed; your prompt response will be greatly appreciated. If you have any questions, please do not hesitate to contact me.

Cordially,

Sharon F. Lehmann, Music Teacher

Ray Lea, Principal

Sharon F. Lehmann has my permission to use the video tape of my child as data for music perception study.
Signature______________________________
Parent/Legal Guardian

Sharon Fincher Lehmann
3821 Redstone
Denton, Tx 76201
(817) 382-8258

February 23, 1992

To the Parents of ______________________________:

As part of the data gathering for a Ph.D. dissertation, several children from both second and fourth grades are being individually videotaped as they graph the music to which they are listening. These tapes will be analyzed in an attempt to determine the specific aspects of the music to which the child is attending.

The videotaped sequences show only the child's hand as the graphing is being done, and in no way is the child identified except by age/grade and gender. The taping session, which will be conducted at school sometime within the next two weeks, requires approximately fifteen minutes for each child.

The purpose of this letter is to ask your permission to use videotape of your child as part of my study of children's perceptual listening patterns. An addressed, stamped envelope is enclosed; your prompt response will be greatly appreciated. If you have any questions, please do not hesitate to contact me.

Cordially,

Sharon Fincher Lehmann
Music Teacher

Sharon F. Lehmann has my permission to use the video tape of my child, ______________________________, as data for music
(Name)
perception study.

Signature______________________________ ____________________
(Parent/Legal Guardian) (Date)

APPENDIX Q

HUMAN SUBJECTS RELEASE

University of North Texas
Office of Research and Academic Grants

June 26, 1989

Sharon Fincher Lehmann
3821 Redstone
Denton, Texas 76201

Dear Ms. Lehmann:

Your project entitled "An Investigation of Changes in Subjects' Graphing Response Pattern to Selected, Aurally-Presented Musical Compositions" has been approved by the Institutional Review Board under Exemption Category #3, and is exempt from further review under 45 CFR 46.101.

If you have any questions, please contact me at (817) 565-3946.

Good luck on your project.

Sincerely,

Peter Witt

Peter Witt, Chair
Institutional Review Board

PW/jh

P.O. Box 5396 • Denton, Texas 76203-5396
817/565-3940

BIBLIOGRAPHY

Abel-Struth, S. (1982). Experiment on music recognition. Psychology of Music [Special Issue], 7-10.

Abel-Struth, S. (1981) Frankfurt studies on musical audiation of five to seven year old children. Bulletin of the Council for Research in Music Education 66-67, [Special Issue], 1-7.

Aldenderfer, M. & Blashfield, R. (1984). "Cluster analysis". Sage University Paper series on Quantitative Applications in the Social Sciences, series no. 07-044. Beverly Hills & London: Sage Pubns.

Andress, B. (1986). Toward an integrated developmental theory for early childhood music education. Bulletin of the Council for Research in Music Education 86, 10-17.

Anstis, S. & Saida, S. (1985). Adaption to auditory streaming of frequency-modulated tones. Journal of Experimental Psychology: Human Perception and Performance, 11, 257-271.

Austin, L. & Clark, T. (1989). Learning to compose: modes, materials and models of musical invention Dubuque, Iowa: Wm. C. Brown Co.

Bamberger, J. S. (1974). The luxury of necessity. Unpublished Artificial Intelligence Memo 312, MIT. (Available from Microreproduction Laboratory, Massachusetts Institute of Technology, Room 14-0551, Cambridge, MA, 02139.)

Bamberger, J. S. (1975). The development of musical intelligence I: Strategies for representing simple rhythms. Unpublished Artificial Intelligence Memo 342, MIT. (Available from Microreproduction Laboratory, Massachusetts Institute of Technology, Room 14-0551, Cambridge, MA, 02139.)

Bamberger, J. S. (1977). Intuitive and formal musical knowing: Parables of cognitive dissonance. In S. S. Madeja (Ed.), The arts, cognition, and basic skills (pp. 173-209). St. Louis, MO: CEMREL, Inc.

Berry, W. (1989). Musical structure and performance New Haven: Yale University Press.

Bennett, P. (1981/1982). An exploratory study of children's multi-sensory responses to symbolizing musical sound through speech rhythm patterns (Doctoral dissertation, North Texas State University, 1981). Dissertation Abstracts International, 42, 4755A.

Billingsley, R. & Rotenberg, J. (1982). Children's interval processing in music. Psychomusicology, 2(1), 38-43.

Boisen, R. (1981). The effect of melodic context on students' aural perception of rhythm. Journal of Research in Music Education 29(3), 165-172.

Bregman, A. S. (1978). Auditory streaming is cumulative. Journal of Experimental Psychology: Human Perception and Performance, 4(3), 380-387.

Bregman, A. S. & Campbell, J. (1971). Primary auditory stream segregation and perception of order in rapid sequences of tones. Journal of Experimental Psychology 89(2), 244-249

Bregman, A. S. & Dannenbring, G. L. (1973). The effect of continuity on auditory stream segregation. Perception and Psychophysics, 13(2), 308-312.

Bregman, A. S. & Rudnicky, A. I. (1975). Auditory segregation: stream or streams? Journal of Experimental Psychology: Human Perception and Performance, 1, 263-267.

Clark, T. (1981). [Rhythm and pitch information, mathmatical expressions for analytical comparisons]. Unpublished raw data.

Colwell, R. (1970). The evaluation of music teaching and learning. Englewood Cliffs, NJ: Prentice-Hall.

Cogan, R. & Escot, P. (1976). Sonic design. Englewood Cliffs, NJ: Prentice-Hall.

Cratty, B. J. (1986). Perceptual and motor development in infants and children. Englewood Cliffs, NJ: Prentice-Hall.

Crowther, B. & Durkin, K. (1982) Towards an applied psycholinguistic study of musical concept development. Psychology of Music [Special Issue], 26-29.

Demorest, S. (1989). An information integration approach to modeling developmental differences in musical cognition (Doctoral dissertation, University of Wisconson - Madison, 1989). Dissertation Abstracts International

Demorest, S. (1992). Examining the "real world" validity of perceptual measurement in music Manuscript submitted for publication.

Deutsch, D. (1972). Octave generalization and tune recognition. Perception and Psychophysics 11(6), 411-412.

Deutsch, D. (1982). Grouping mechanisms in music. In D. Deutsch (Ed.), Psychology of music (pp. 99-130).

Dowling, W. J. (1981). The importance of interval information in long-term memory for melodies. Psychomusicology, 1(1), 30-49.

Downey, J. (). Texture as psycho-rhythmics. Perspectives of New Music, 20(2), 640-648.

Fay, T. (1971). Perceived hierarchic structure in language and music. Journal of Music Theory, 15, 112-137.

Fiske, H. E. (1990). Music and mind. Lewiston, NY: Edwin Mellen Press, Ltd.

Fiske, H. E. (1984). Music cognition: Serial process or parallel process? Bulletin of the Council for Research in Music Education, 80, 13-25.

Fiske, H. E. (1982). The application of stage reduction theory to music listening. Psychology of Music, [Special Issue], 31-35.

Frances, R. (1988). The perception of music (W. J. Dowling, Trans.).Hillsdale, NJ: Lawrence Erlbaum Associates.

Fyk, J. (1982). Perception of mistuned intervals in melodic context. Psychology of Music, [Special Issue], 36-41.

Garner, W. R., & Gottwald, R. L. (1968). The perception and learning of temporal patterns. The Quarterly Journal of Experimental Psychology, 20, 1968.

Greenberg, M. (1976). Research in music in early childhood education: a survey with recommendations. Bulletin of the Council for Research in Music Education, 45, 1-20.

Handel, S. (1973). Temporal segmentation of repeating auditory patterns. Journal of Experimental Psychology, 10 (1), 46-54.

Handel, S. & Yoder,D. (1975). The effects of intensity and interval rhythms on the perception of auditory and visual temporal patterns. Quarterly Journal of Experimental Psychology, 27, 111-122.

Hargreaves, D. J. (1986). The developmental psychology of music. Cambridge: Press Syndicate, University of Cambridge.

Heise, G. A. & Miller, G. A. (1951). An experimental study of auditory patterns. American Journal of Psychology 64, 68-77.

Heller, J. & Campbell, W. (1981). A theoretical model of music perception and talent. Bulletin of the Council for Research in Music Education [Special Issue, Summer], 20-24.

Heller, J. & Campbell, W. (1982). Music communication and cognition. Council for Research in Music Education 72, 1-15.

Heller, J., Campbell, W., & Gibson, B. (1982). The development of music listening skills in children. Psychology of Music, [Special Issue], 55-58.

Hofstetter, F. T. (1981). Computer-based recognition of perceptional patterns and learning styles in rhythmic dictation exercises. Journal of Research in Music Education, 29(4), 265-277.

Hufstader, R. A. (1976). A learning sequence of selected music listening skills for grades one through seven. (Doctoral dissertation, University of Iowa, 1976). Dissertation Abstracts International 77, 3741A.

Katz, L. G. (1986). Current perspectives on child development. Bulletin of the Council for Research in Music Education, 86, 1-9.

Kauffman, W. H. & Carlsen, J. C. (1989). Memory for intact music works: The importance of music expertise and retention interval. Psychomusicology, 8(1), 3-19.

Kidd, G., Boltz, M. & Jones, M. R. (1984). Some effects of rhythmic context on melody recognition. American Journal of Psychology, 97(2), 153-173.

Krumhansl, C. L. (1983). Perceptual structures for tonal music. Music Perception, 1, 28-62.

McMahon, O. (1982). A comparison of language development and verbalization in response to auditory stimuli in pre-school age children. Psychology of Music, [Special Issue], 82-85

May, W. (1985). Musical style preferences and aural discrimination skills of primary grade school children. Journal of Research in Music Education 32(1), 7-22.

Petzold, R. G. (1969). Auditory perception by children. Journal of Research in Music Education, 17, 82-87.

Petzold, R. G. (1963). The development of auditory perception of musical sounds by children in the first six grades. Journal of Research in Music Education, 11, 21-43.

Rainbow, E. L. (1981). A final report on a three-year investigation of the rhythmic abilities of preschool aged children. Bulletin of the Council for Research in Music Education, 66-67, 69-73.

Ramsey, J. (1983). The effects of age, singing ability, and instrumental experiences on preschool children's melodic perception. Journal of Research in Music Education, 31(2), 133-145.

Roederer, J.G. (1975). Introduction to the Physics and Psychophysics of Music (3rd ed.). New York: Springer-Verlag. (Heidelberg science library: v. 16)

Sergeant, D. (1983). The octave - percept or concept. Psychology of Music, 11, 3-18.

Sergeant, D. & Roche, S. (1973). Perceptual shifts in the auditory information processing of young children. Bulletin of the Council for Research in Music Education, 1(1), 39-48.

Serafine, M. L. (1983). Cognitive processes in music: Discoveries vs definitions. Bulletin of the Council for Research in Music Education 73(4), 1-14.

Serafine, M. S. (1988). Music as cognition. New York: Columbia University Press.

Shuter, R. (1968). The psychology of musical ability London: Methuen.

Sink, P. E. (1983). Effects of rhythmic and melodic alterations on rhythmic perception Journal of Research in Music Education, 31(2), 101-113.

Sink, P. E. (1984). The multidimensionality of rhythm in music-effects on musical learning. Paper presented to the Perception SRIG Session, MENC National Convention, Chicago, IL.

Sloboda, J. A. (1985). The musical mind: The cognitive psychology of music. Oxford Psychology Series 5, Oxford: Clarendon Press, 151-238

Wapnick, J., Bourassa,G. & Sampson, J. (1982). The perception of tonal intervals in isolation and in melodic context. Psychomusicology, 2, 21-37.

Warren, R. M., Obusek, C. J., Farmer, R. M., & Warren, R. P. (1969). Auditory sequence: Confusion of patterns other than speech or music. Science, 164, 586-587.

Webster, P. R. & Schlentrich, K. (1982). Discrimination of pitch direction by preschool children with verbal and nonverbal tasks. Journal of Research in Music Education, 30(3), 151-161.

Webster, P. R. & Zimmerman, M. P. (1981, April). Conservation of rhythmic and tonal patterns in second through sixth grade children. Paper presented at the Music Educators National Conference, Minneapolis, MN.

Wuthruch, C. & Tunks, T. (1989). The influence of presentation time asynchrony on music interval perception. Psychomusicology, 8 (1), 31-46.

Zimmerman, M. P. (1986). Music development in middle childhood: A summary of selected research studies.

Bulletin of the Council for Research in Music Education, 86, 118-131.