

MUSICAL TEXTURE: TOWARD A VISUAL MODEL

by

Terry Lee Zipay

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SIGNED:

Terry L. Zipay

APPROVAL BY THESIS DIRECTOR

This thesis has been approved on the date shown below:

Robert J. Werner
ROBERT J. WERNER
Professor of Music

August 27, 1975
Date

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ABSTRACT

Musical texture is the result of various sound components such as pitch contour, register, timbre, envelope, loudness, spacing, and density, identifiably interrelated in time. In any given work some or all of these component parts are structurally critical. This structural significance, a work's essential texture, can be abstracted from the score as a visual model.

Depending upon its inherent values, a work's essential texture is best represented in one of three ways: (1) functions of time and space, (2) functions of time and depth, and (3) functions of time, space, and depth. Representation in the time-space frame can include components of pitch level and duration, linear relationships, vertical density, melodic contour, spacing, and registration, while components in the time-depth frame include all properties of tone other than pitch: loudness, envelope and timbre. The third means of representation is used when the essential texture of a given work is the result of interrelationships of time, space, and depth.

A wide variety of works are presented as visual analogues to provide specific examples of textural types. This collection of small scale works also constitutes a broad sampling of textural relationships suitable for use as teaching aids.

CHAPTER 1

INTRODUCTION

Texture as a musical concept derives its original meaning from the Latin verb textura, to weave. This textile analogy is apparent in the Harvard Dictionary definition (Apel 1972, p. 842): "Much like woven fabric, music consists of horizontal ("woof") and vertical ("warp") elements. The former are the successive sounds forming harmonies. It is these elements that make up the texture."

Yet the function of texture goes beyond consideration of horizontal and vertical elements alone. Webster's New World Dictionary (Guralnik and Friend 1962, p. 1508) gives greater emphasis to the overall shape so that texture becomes "the structural quality of a work of art, resulting from the artist's method of using his medium." This structural role is qualified in musical terms by Paul Lansky (1974, p. 741):

The term is used here to refer to the quality of a sound or series of sounds that are generally, but not necessarily, from a musical composition. The texture of a sound is a product of the sound's component parts: (pitch(es), timbre, and loudness. The texture of a succession of sounds also describes the way in which these elements are connected in time. Thus in a musical composition texture describes certain relations between voices (e.g., contrapuntal and homophonic textures) and the quality of the sound produced by a given combination of instruments in terms of their instrumental color and the way in which they produce pitches together.

In the above definition, texture emerges as an inescapable component of the musical experience. Any comprehensive view of a given work should consequently develop a significant understanding of its structural role.

In order to qualify as a necessary structural component and not as a fortuitous by-product of the interaction of other elements, texture must be an isolatable phenomenon in the same way that harmony, for example, survives separation from other aspects. Harmonic events, however, can be identified, simplified, abstracted, and functionally related using only the notation of pitch, whereas textural abstractions should take into account not only pitch but also register, timbre, attack and decay factors (envelope), loudness levels, linear direction, spacing, and density as well as rhythmic articulations.

Keeping in mind the fact that theory usually follows practice, musical notation is essentially the result of performance demands. It was not specifically designed for convenience of analysis. Nevertheless, the process of abstracting a harmonic model from a given score is much more easily attainable than a corresponding textural abstract. Although textural analysis also relies on the score, the variety and variability of textural components are not conducive to the same type of abstraction and reproduction processes employed in harmonic analysis. For example, a harmonic abstraction of a Beethoven or Webern orchestral work could be accurately represented at the piano. The aural perception of harmonic function would be the same regardless of the change in the sound medium. Yet textural reproduction of these works at the keyboard would be significantly incomplete. Also, because orchestral works by Webern rely more heavily on register, timbre and envelope as structural factors, a Webern

piece would yield even less of its structurally essential texture in piano reduction than a Beethoven work.

One way in which the unique qualities of musical texture can effectively be rendered is through the formulation of a graphic symbolism that will more readily allow for clarification and emphasis of textural relationships. Developing and applying such a system accounts for the main thrust of this paper. Through the creation and refinement of this visual model approach the author has developed a perceptual notation for musical texture.

The resultant visual analogues are designed to supplement the comprehension of texture within the larger context of the total musical meaning. The intent is not to replace the printed score but rather to emphasize specific aspects of a work which normally require a great deal of time and specialized training to apprehend. In an educational setting, these models could provide an immediate, specific focus of attention with no intermediary interpretation of the printed score. Musical memory reinforcement would be brought about by the ability to see the entire work at a glance and relate parts to the whole with the time element graphically frozen.

The visual models presented eliminate or de-emphasize all aspects of a given work which do not bear directly upon an apprehension of its essential texture. As a result of this unique quality, the following objectives will serve as the focus for this paper: (1) to create models of compositions or complete sections of compositions that are visually analogous to the aural perception of musical texture, (2) to systematize these visual constructs in such a way that they provide a

basis for the development of a more complete conception of musical texture, and (3) to develop a convenient and logical means of exploring the role of texture in an educational setting.

CHAPTER 2

A VISUAL CONCEPT OF MUSICAL TEXTURE

The concept of musical texture is an abstraction derived from many individual components of sound and time functioning in a perceivable unified fashion. The frequent use of the term to describe a variety of different events implies a broad and complex nature. Consider the categories of polyphonic texture and woodwind texture, for example. Do these classifications have enough in common to justify the use of the word texture in each case, or is this simply a semantic problem requiring a different label for one term or the other?

A recent book on style analysis advocates the latter point of view in advising that (La Rue 1970, p. 27) ". . . it is a good plan to restrict the meaning of texture to refer to particular, momentary combinations of sound; then pursuing the analogy with textiles, we can use fabric to refer to the whole continuous web or combined textures and dynamic labels." As a result of this restricted conception of the term, texture is subsumed under the overall category of "Sound" which (La Rue 1970, p. 23)

. . . includes all aspects of sound considered in itself rather than as raw material for melody, rhythm, or harmony. Observations of Sound group naturally under three headings: (1) Timbre: the vocal, instrumental, and other colors chosen by the composer. (2) Dynamics: the intensity of the sound, both as indicated by markings and as implied by the disposition of forces employed for the piece. (3) Texture and Fabric: the arrangement of timbres both at particular moments and in the continuing unfolding of the piece.

This last category, Texture and Fabric, is later expanded to include (La Rue 1970, pp. 27 - 28): "Homophonic, homorhythmic, chordal . . . Polyphonic, contrapuntal, fugal . . . Melody/bass polarity . . . Melody plus accompaniment . . ." and finally "Sectionally specialized textures . . ."

This semantic reshuffling of the deck, although intended for greater clarity, occurs so frequently in critical and theoretical writings that references to texture may very well confuse rather than clarify the concept. Regardless of the terminology employed, what is ultimately important is the insight gained by application of conceptual information.

Paul Lansky suggests that texture can be described in two ways (1974, pp. 741 - 742): ". . . those aspects of texture that result from the pitch and rhythmic structure of a composition" and ". . . those textures that are products of the orchestration of a piece or are related to a description of its sound apart from harmonic textures." The former category is called "harmonic texture" and the latter, "sound texture." Lansky postulates the relationships between these two divisions in terms of relative value and function (1974, p. 742):

An important aspect of the textural problem is the extent to which these categories can be considered separable and the extent to which their identities are blurred by interaction and interdependence. The degree of separability between the two dimensions is a function of the difference in their importance. In piece A, for instance, if a change in the harmonic texture affected the values of the piece more than a commensurable change in the sound texture, the harmonic texture would be considered more important. The extent to which the commensurable changes affect the values of the piece would determine their separability (the greater the difference in affect, the greater the separability). In piece B, if the inverse were true, the sound textures would be more important. In piece C, if the two

dimensions were equal in importance, their affect on the values of the piece being of equal weight, they would in effect be inseparable.

In the creation of visual models as analogues, only the essential textural values are represented. Thus, emphasis of harmonic texture, as in Piece A, is accomplished visually by representation in a time-space context only, while that of Piece B, with its inverse importance, is represented in a time-depth frame exclusively, and the third possibility, Piece C, where equal importance is placed on both harmonic and sound textures, is visualized as a combination of time, space, and depth.

Three hypothetical visual models will serve to demonstrate how textural components are transposed into visual analogues and how these visual perceptions represent the essential texture of a given work. In order to produce an analogue more conducive to visual analysis, textural information derived from the original performance notation has been simplified so that the interaction and function of essential textural components can be emphasized.

Two visual frames, time-space and time-depth, provide specific points of reference for each textural property of a given piece. When these two planes are projected in combination, a three-dimensional model results. This geometrically solid form is a projection and correlation of all textural components. Although any musical work can be represented by such a three-dimensional model, only components which produce structural relationships -- the essential texture -- will be considered critical to visual representation.

The structural essentials of texture and all other musical parameters are dependent upon the peculiarities of time. As Rudolf Arnheim states (1974, p. 374):

Evidently in order to create or to understand the structure of a film or a symphony, one has to grasp it as a whole, exactly as one would the composition of a painting. It must be apprehended as a sequence, but this sequence cannot be temporal in the sense that one phase disappears as the next occupies our consciousness. The whole work must be simultaneously present in the mind if we are to understand its development, its coherence, the interrelations among its parts. We are tempted to call the object of this synopsis a spatial structure. In any case it requires simultaneity and therefore is hardly temporal.

Retention of the whole work aurally is significantly reinforced through the ability to perceive it visually in its entirety. Such is the advantage of the "spacial structures" presented in this paper.

Functions of Time and Space

Figure 1, page 9, is a sample visual model of relationships in time and space. This two-dimensional frame is a result of a given work's total time span and complete pitch register. Textural components within this frame are exclusively related to the ordering of pitch and include such considerations as: pitch level, pitch duration, linear relationships, vertical density, melodic contour, spacing, and registration.

Pitch and Duration

Individual pitch durations are represented by thick horizontal lines which, when connected by thin vertical lines, indicate linear motion. Rearticulation of the same pitch in the same voice is signified by short vertical segments through the pitch-duration line. (The lower

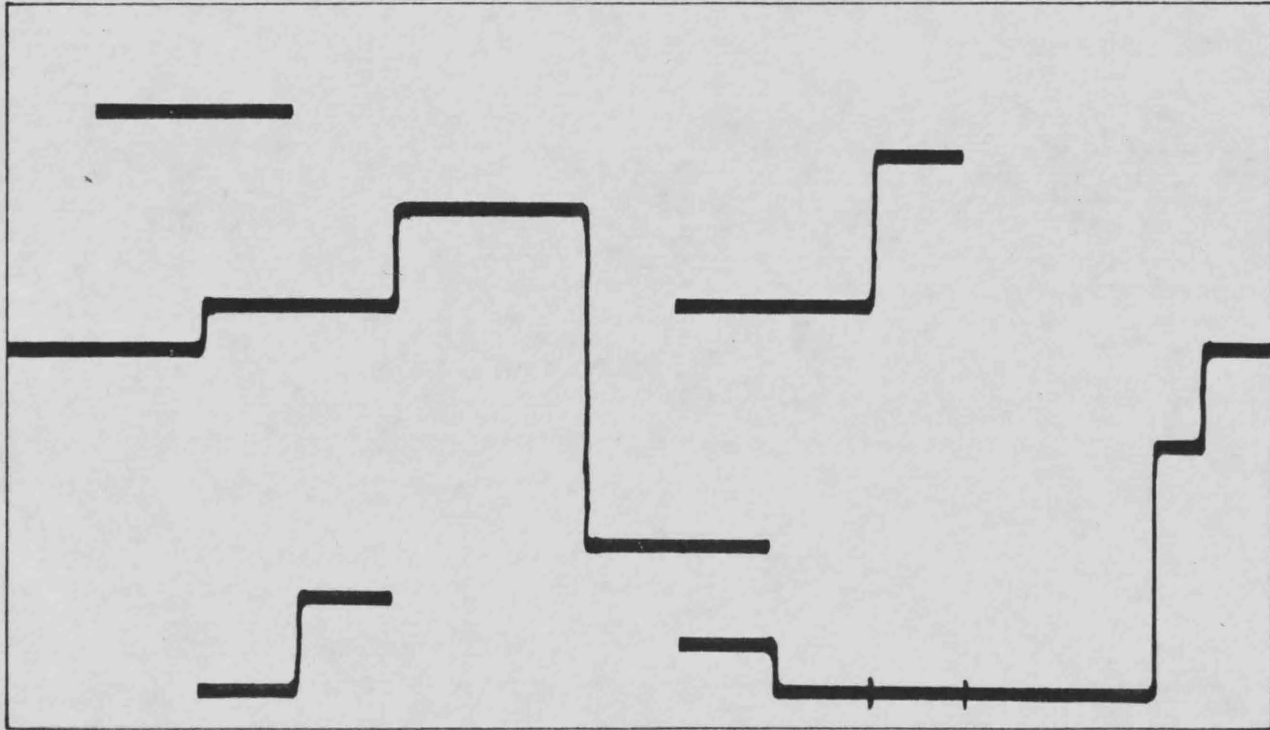


Figure 1. Sample Visual Model of Time-Space Relationships

right-hand section of Figure 1 provides an example.) Just as in a printed score, events in time are read from left to right.

Vertical Density

The stacking of pitches in space produces vertical density. This factor can be expressed as a numerical sum of the total pitches represented at any given moment. This concept is not to be confused with harmonic density -- the number of pitch classes sounding together -- nor is it exactly the same as the number of voices employed. For example, if soprano, alto, tenor, and bass voices produce an harmonic octave with the tenor and bass on the bottom note and the alto and soprano on the top, the harmonic density would be one, the number of voices four, and the vertical density -- as represented in a visual analogue -- two. This spacial function assumes textural significance when used as a means of growth or for contrast in sectional delineation.

As a sample application, the analysis of vertical density in Figure 1 is given. In the beginning, a relatively rapid increase in density from the opening single pitch through the addition of the upper pitch to the maximum density of three covers the entire density range of this imaginary piece. The central one density returns briefly to three then thins out to two and finally concludes on one.

Pitch Register

When the highest and lowest pitches or pitch regions of an entire work contribute to the large scale structure, they become more than boundary lines (Oster 1961, p. 71): "We have seen that in some works, particularly in piano works, register assumes a significance as great

as that of harmonic and contrapuntal texture or the unfoldment of thematic-motivic relationships." A simple example of pitch register as an essential textural component would be a situation in which the extreme pitch areas occur simultaneously or in close proximity to create or contribute to a dramatic climax. Juxtaposition of internally established pitch registers or carefully controlled overall expansion and contraction within the work are other possible structural functions of this component on medium and small scales. When pitch register becomes an aspect of the essential texture, visual emphasis is inherent in the graphic methods utilized.

Motion

As a function of time-space, motion is the sum of three individual directional possibilities: rise of pitch in space, fall of pitch in space, and durational movement in time. Visually, these forces are represented as up, down, and left-to-right respectively. When two or more voices are shown simultaneously, relative degrees of linear independence are easily grasped through comparisons of rhythmic duration and melodic direction from voice to voice. Directional associations in space (contrapuntal motion, for example) and directional relationships in time (rhythmic associations) are thereby visually emphasized.

Comparatively greater or lesser motion is relative to the number of individual directional factors active per time unit. This sort of visual reference allows for simplified identification of voice roles as active or passive relative to the overall context of the piece. For

example, the three voice lines of Figure 1 show three individual levels of motion for the entire work. Arranged in order from active to passive, the sequence is bottom, middle, top. The rearticulations of the same pitch in the bottom voice combined with changes in vertical direction and articulation of each new pitch in time result in its greater motion than the other two voices.

Methods of Construction

The following methods have been developed for the creation of a visual analogue in the time-space frame. Pitch and interval are shown on a vertical grid of equal half steps, while time units (usually the value of the shortest note) are plotted on a horizontal grid. Since the pitch grid is a fixed property while the time units are relative, coordination of length and height of the visual model for optimum perceptual correlation is a key consideration.

The generalized time-space frame of Figure 1 is further qualified in all the models from literature in Chapter 3. Vertical and horizontal brackets (not provided in Figure 1) relate specific information about time-space divisions: pitch register location on the great staff, total pitch interval encompassed, an approximation of total performance time, metric divisions, and measure numbers corresponding to the printed score.

During initial development, models in the time-space frame were produced on clear acetate sheets placed over a graph paper grid for orientation of pitch and time units. Washable overhead projector pens in various colors allowed for coding of voices and convenient correction

of mistakes or improvement of visual effect without the entire figure being redrawn. After satisfactory results were obtained, the image was then permanently fixed to the acetate by tracing over all lines with permanent colors on the opposite side of the sheet. After washing off the front colors and mounting on white cardboard, the figures were complete.

Several advantages to this method of presentation were realized, among them: specific aspects of the models could be highlighted during class discussion by drawing on the front surface with a washable marker which later could be removed without damage to the original figure and, specialized emphasis of aspects other than voice lines could also be color coded. An example of this second technique is described in relationship to Figure 7 in Chapter 3.

As a result of attempts to develop a form of presentation appropriate to a thesis format, the use of plastic materials and color coding systems was abandoned in favor of the means employed in this paper. The new technique involved developing the model directly on the original grid with washable markers, overlaying with No. 1000 Clearprint paper, and tracing the complete figure with Pelikan drawing ink or simply drawing the original in pencil directly onto the relatively transparent Clearprint and overdrawing again with ink. The resultant figures were then reduced to more convenient dimensions for reproduction.

Functions of Time and Depth

The components of textural depth include all properties of tone other than pitch: loudness, envelope, and timbre. Since time is common to both space and depth dimensions, its horizontal visual representation remains the same in the time-depth frame.

Figure 2, page 15, shows a sample visual model of all components and their relationships in the time-depth frame. The overall shapes outlined indicate relative loudness contours for each pitch as well as attack and release points. Specific timbres are indicated through various line patterns, and tone color combinations are shown as the more complex results of the component hatching patterns.

Timbre

Although timbre alone cannot produce a directional force, it can generate vast qualitative distinctions from relatively few resources. Consider the three sound sources of Figure 2. Timbre A, represented by the vertical line pattern, timbre B, represented by the diagonal pattern, and timbre C, represented by the horizontal pattern are combined in various ways to produce six different sound qualities. The total potential possibilities from these three discrete timbres would be seven: A, B, C, A plus B, A plus C, B plus C, and A plus B plus C. The only timbral permutation not utilized in Figure 2 is the quality B alone.

Loudness

The quality of a sound's intensity is registered on the vertical plane. With zero intensity along the bottom of the plane, peak loudness

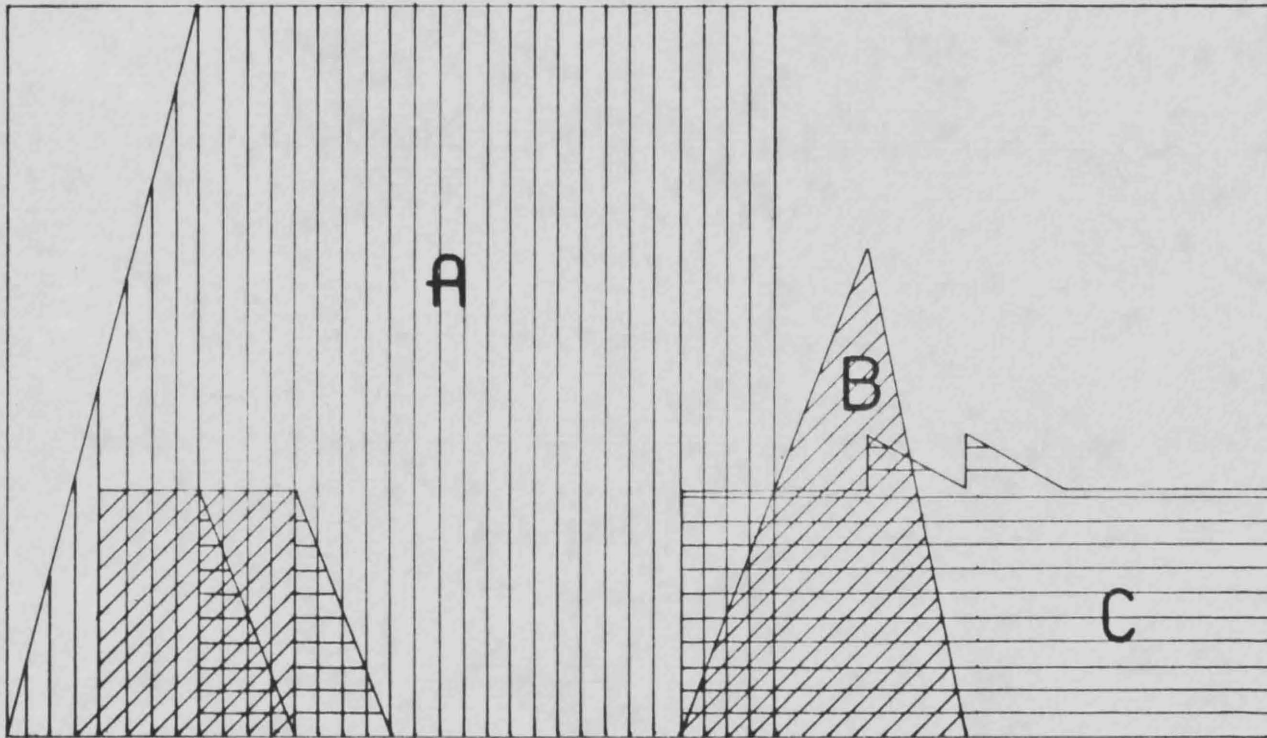


Figure 2. Sample Visual Model of Time-Depth Relationships

provides the top boundary. In Figure 2 note that sound source A provides the highest loudness level after an initial crescendo from silence, and the first appearance of sounds B and C are very soft in relationship to A. Although they do not appear in Figure 2, specific loudness levels from the score are indicated by vertical brackets in works from literature in Chapter 3.

Envelope

The characteristics of attack and decay that constitute the envelope are complex qualities showing subtle variations over a wide range of possibilities. For purposes of simplification, however, attack and decay are represented visually only when they contribute to the essential texture and then only as sharp increases and decreases in volume. If, for example, a work is for piano alone, indication of this instrument's relatively rapid decay factor is superfluous because all aspects of decay for the entire piece are constant and uncontrollable; therefore, they cannot qualify as essential texture. If, however, a score includes instruments having controllable or different decay factors than the piano, the composer may manipulate these decay components in such a way that they become critical to the textural values. In such a case, the visual model would indicate differences of decay.

Attack characteristics follow the same rationale.

Methods of Construction

In order to produce an accurate visual analogue in this frame, a time unit grid, as in the time-space frame, is used to establish the

point where each sound will begin and end. The loudness scale is based on the highest printed or otherwise implied level as the top boundary. Horizontal contours follow increases, decreases, or stability in loudness levels for each note including significant attacks or rapid decay factors. The outlined shapes created by loudness and envelope are then identified as to their timbre. Each timbral source is coded by a specific visual pattern which will remain recognizable when overlaid with other patterns. Although this system clearly shows facts of combination, it does not reveal the various resultant qualities -- the new totality of blending and reinforcement or separation and cancellation -- which occur. As Henry Brant states (1974, p. 541): "It must not be assumed that all instrumental timbres will mix or fuse, either at the unison or in harmony. For example, a violin and an unmuted trumpet will not fuse at the unison; both timbres will be heard separately."

Developing a more accurate visual model than that given above poses a unique problem. For example (Cogan 1970, p. 75): "Timbre, of all the parameters of music, is the one least considered. It lacks not only an adequate theory, but even an inadequate one. Its obscurity is in part notational, in part analytical -- and in each respect historical." Even though the overtone series supplies an explanation of how timbre is produced, acoustically accurate visual representations of different sound sources are impractical because (Backus 1969, p. 101):

. . . the harmonic structure of a given tone on an instrument depends on a number of factors. It changes with loudness, for example; soft tones will have many more harmonies covering a greater frequency range. The harmonies in the sound radiate differently in different directions from the instrument due to interference and diffraction effects, so the harmonic structure

of a tone will depend on where it is heard. The spectrum of a tone will also depend on how the player produces it.

Initial visual representation of timbre employed different transparent colors appropriately shaped and coded for each sound so that when overlaid, sound combinations produced new colors. Although very effective, reproduction of color within this paper proved to be impractical. Color coding was thus replaced by the patterning system employed in Figure 2.

Color coding of timbre presents more than reproduction limitations however, (Arnheim 1974, p. 333)

The number of colors we can recognize reliably and with ease hardly exceeds six, namely the three primaries plus the secondaries connecting them . . . We are quite sensitive in distinguishing subtly different shades from one another, but when it comes to identifying a particular color by memory, or at some spatial distance from another, our power of discrimination is severely limited.

There currently seems to be no accurate and simple way of representing complex relationships of timbre. Perhaps continued acoustical research will some day reveal new insights into this phenomenon. Until that time, it is hoped that the methods of representation employed in this paper can serve as a workable visual generalization of timbral perception.

Interaction of Time, Space, and Depth

Figure 3, page 19, is a sample model of a texture that relies on functions of time, space, and depth in combination. This particular figure is a correlation of aspects depicted in Figures 1 and 2. It is important to remember that although any musical work can be represented

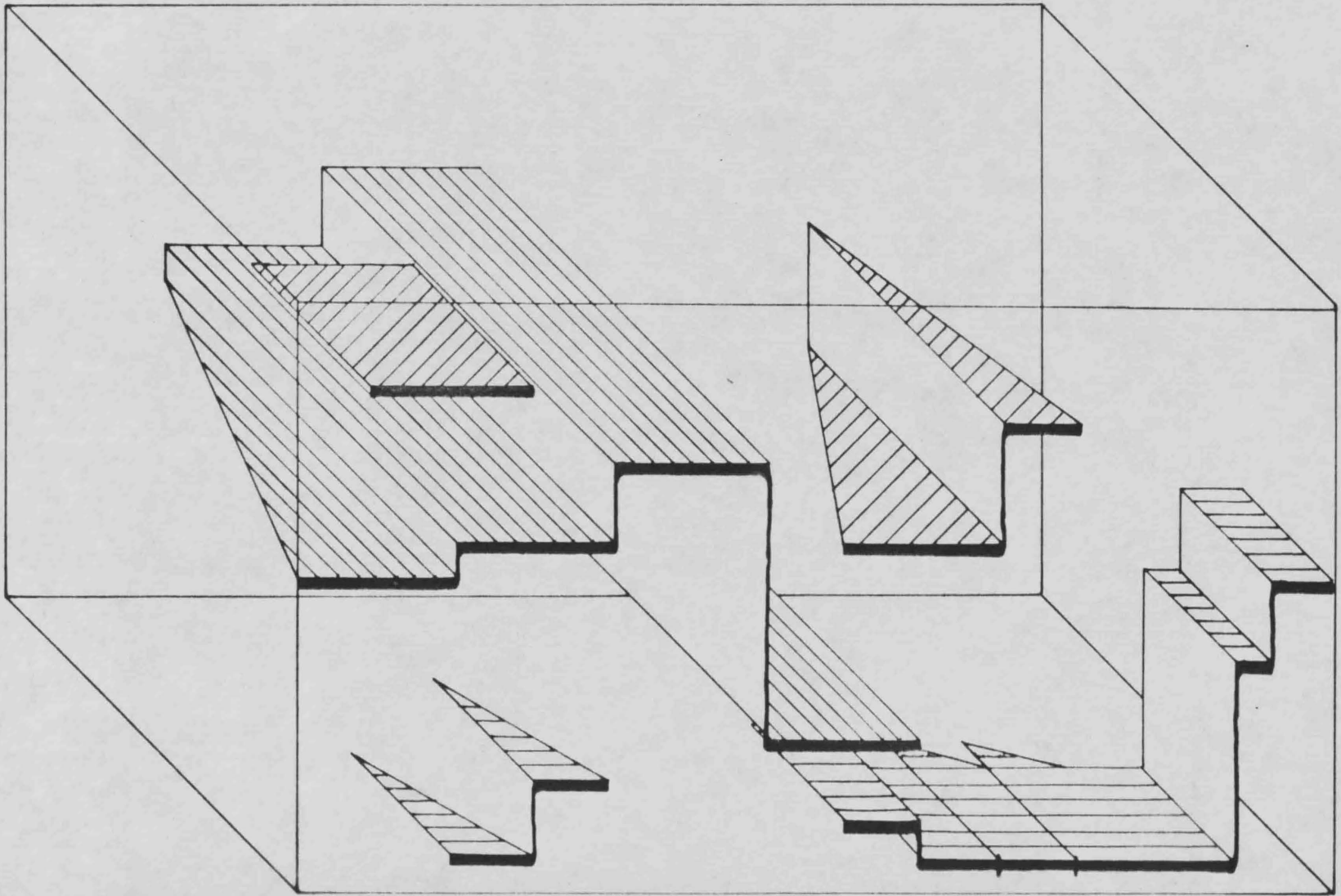


Figure 3. Sample Visual Model of Time, Space and Depth Interrelationships

as an interaction of time, space, and depth, only certain works which display a balance between musical values of pitch, rhythm, and sound components require this mode of visual representation to reveal their essential textural aspects. If textural importance is best summarized by a three-dimensional model, then representation in either time-space or time-depth alone would not be considered adequate. In other words, any work should have its essential texture represented in either of three ways, as illustrated by Figures 1, 2, and 3. Thus the textural value of various components in a given work must be weighed to determine which type of model will best emphasize the critical textural aspects of that particular work.

Methods of Representation

When a given work necessitates representation in three-dimensional space, three possibilities exist: (1) a flat model on paper showing the time-depth frame directly above and in line with the time-space frame (Figure 2 placed directly above Figure 1), (2) a flat model on paper showing a more direct correlation of time-space and time-depth as a perspective drawing (as in Figure 3), or (3) a physical three-dimensional model.

In this paper, due to obvious limitations, the three-dimensional representations take the form of the first and second possibilities as outlined above. However, the author has developed a method of presenting time, space, and depth in actual three-dimensional space. This model was developed as follows.

A time-space image was first drawn on to clear acetate. Then clear plastic rectangles the thickness of one half step (one tenth of an inch) were stacked "sandwich" fashion so that each pitch in the time-space image was matched to a corresponding plastic sheet. A color-coded sound shape was drawn on to the flat side of the plastic so that it touched the appropriate pitch of the acetate sheet. The finished model allowed several ways of viewing the interaction of textural components. One of these viewpoints provided a perspective similar to that of Figure 3.

Figures 1, 2, and 3 were designed to illustrate in a generalized way the many components of musical texture as related to visual representation. Emphasis in the following chapter will be on the unique textural qualities of specific compositions by applying the concepts and methods discussed in this chapter.

CHAPTER 3

MUSICAL EXAMPLES IN THE FORM OF VISUAL ANALOGUES

The following fourteen figures are visual analogues of essential textural aspects in complete works or complete sections of works. Each figure is introduced along with a brief discussion of its visual texture to demonstrate the effectiveness of this means of representation. Works represented have been carefully selected for optimum utilization based on specific criteria.

The most important consideration has been the representation of a wide variety of textural values from polyphony through Klangfarbenmelodie via miniature scale works that allow for representation in one unbroken flow without page turns or other disruptions of the total view. In this way, initial visual emphasis corresponds to a conceptual unity of the work. This initial unified view is critical to an appreciation of parts and their relationships to the whole. (La Rue 1970, p. 5)

"The first axiom for the analyst seeking completeness is to begin by looking at the piece as a whole, not as parts, not even as a collection of parts" so that "once we comprehend the wholeness, the parts fall into a proper perspective."

Since the visual models are designed for practical classroom applications, works were selected on the basis of availability in score form. It was decided that selection from standard anthologies used in

theory and history or literature classes would be most expedient. Thus, all of the musical works cited, with one exception, may be found in the following collections: Masterpieces of Music Before 1750, edited by Carl Parrish and John F. Ohl; Historical Anthology of Music, edited by Archibald T. Davison and Willi Apel; and the Anthology for Musical Analysis, second edition, edited by Charles Burkhart. The only work not found in the above anthologies is the Webern Five Pieces, Op. 10 which is available in miniature score from Philharmonia Scores. The Selected Bibliography lists sources of musical scores for each work used.

As a supplement to a comprehensive analysis of these scores, the models allow for presentation in two formats: as a large chart visible to the entire class, or conveniently reduced in size, as individual hand-outs. In either case, it is suggested that a live or recorded performance precede or accompany initial reference to the visual analogues. In this way aural-visual correlation is quickly established.

Another consideration in the selection of works has been their contribution to the development of an historic cross section. This small sampling from about the second half of the fifteenth century to the mid-twentieth century draws from a time span of approximately five hundred years and, with the exception of the Webern Five Pieces, Op. 10, is arranged in a chronological sequence so that factors of stylistic textural identity may be more easily considered. This arrangement not only demonstrates the ability of the visual analogue techniques to cope with a wide range of textural profiles accurately, but also provides a dramatic perspective for the consideration of the unique role that texture plays in twentieth century music. This profound change in textural

identity seems to have been a result of the following circumstances (Vinton 1974, p. 307):

Composers began to show an interest in sound (as opposed to a particular classification of sounds) as soon as they began taking liberties with the metrical-tonal system. This is not revealed in the use of new sound-sources but in the way composers used the sources at hand, and in particular by the increased attention they gave to timbre; to novel solo and ensemble effects; to density, chord spacing, register and other details of texture; and to subtleties of dynamics and articulations.

The following discussions of each figure are not intended to be exhaustive but merely attempt to direct attention to the unique possibilities inherent in visual representation of musical texture. The fourteen examples that follow represent a comprehensive set of textural types which can serve as a broad yet concise basis for continued study of textural relevance to musical perception.

Figure 4 Ockeghem: Sanctus (first part)
from Missa Prolationum

This fifteenth century example from Ockeghem's Prolation Mass, page 25, is a contrapuntal texture generated by a double canon at the sixth above. Its essential texture, as represented in the time-space frame, functions within a mid-range span (great A to two line c) of little more than two octaves (exactly two and three-twelfths octaves). The four all male voice qualities, the relatively limited range, and the frequent voice crossing all contribute to the overall unity.

The canonic technique employed results in a symmetrical division of time into two equal and overlapping sections: section one from measure one through thirteen, and section two from measure thirteen through twenty-five. The first of these sections is characterized by the



Figure 4. Ockeghem: Sanctus (first part) from Missae Prolationum

contratenor and bass voices in a contrapuntal association of vertical direction and rhythmic duration that establishes the contratenor as the more active of the two voices. Details of pitch register for this first section reveal a dramatic contrast in range from the unison of measure six to the largest span only one measure later which, when ascertained by ear from a performance or read from the printed score, is recognized as a major tenth. Another significant interval relative to pitch register is the octave. Heard as the initial interval at the beginning, it establishes a relative spacial identity for the entire work and, aurally confirms the vertical distance at measure thirteen as a cadence point and beginning of the second section.

The two octave span at measure thirteen, introducing the tenor and superius voices, is momentarily doubled in the middle by both the tenor and contratenor before the contratenor moves up -- as shown by the dotted vertical line -- between the canonic superius and tenor voices. (One way of directly comparing these canonic voices with the original contours in the first section is by subtracting twelve from any measure number in the second section to quickly locate its corresponding contour in the first section.) This type of visual analysis not only shows the transposed canonic voices to be tonal but also reveals the extensive interweaving of superius, contratenor, and tenor voices, the bass maintaining a relatively defined spacial identity.

Small scale imitation occurs in the first section in two measures only: a rapid, descending figure introduced in the upper voice in the latter half of measure ten is echoed by the lower voice at the beginning of measure eleven. This descending contour is tossed about

between the upper three voices in measure twenty-two and three. A similar contour in longer durational values breaks the polarity between superius and bass voices in measures nineteen and twenty-one where this figure is stated in parallel motion between voices. As a result of frequent changes in vertical density and pitch direction, linear clarity is maintained in the second section in spite of the restrictive range.

Figure 5 Lassus: No. 11 "Fulgebunt justi"
from Cantiones Duarum Vocum

Eleventh of the twelve motets from Cantiones Duarum Vocum, Lassus' "Fulgebunt justi," page 28, is a series of ten different phrases in canonic imitation. Its tenor and bass voices encompass a range one semitone short of two octaves (one and eleven-twelfths) in a medium-low register (great F to one-line e). In comparison with Figure 4, the overall pitch registers of these two works are rather close even though the Lassus uses only two voices.

The diagonal relationship between voices is consistent throughout with the bass comes always entering one measure after the tenor dux. The entrance of the dux always overlaps with the end of the previous comes to produce a constant sense of flow and forward momentum.

Just past the mid-point of the work (measure eighteen), a pair of phrases can be seen which show new variations in the comes pattern. The comes of measure nineteen begins in exact imitation of its dux but, after the first two pitches, inverts the remainder of the phrase. In the following phrase the comes is a complete and exact inversion (measure twenty-one). In addition to this common use of inversion, the

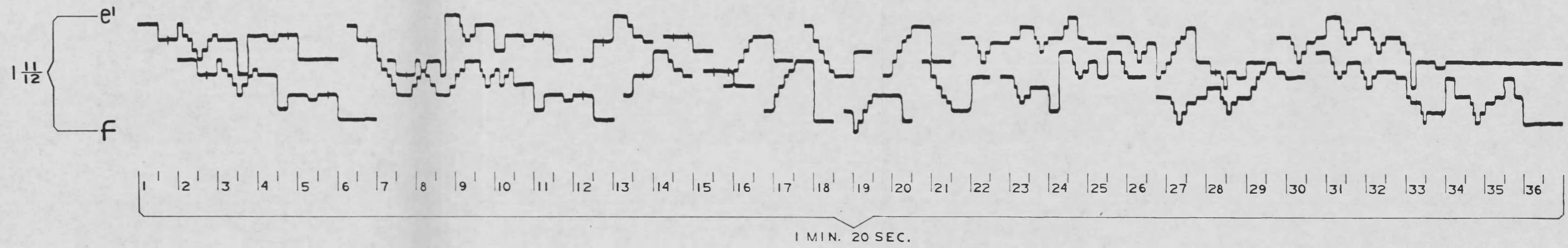


Figure 5. Lassus: No. 11 "Fulgens justus" from Cantiones Duarum Vocum

comes of these two adjacent phrases show a contoural duplication of the dux of measure eighteen in the comes of measure twenty-one.

Figure 6, page 30 is an example of a visual approach to the isolation of specific components for detailed analysis. In this instance, the emphasis is on small scale motion levels from the Lassus example of Figure 5. Enclosed in heavy lines are arrows representing vertical motion in terms of distance and direction for each phrase. The phrases are numbered and coded with a circle for the dux or a square for the comes. The pitch register for each voice can be easily compared phrase by phrase as well as the internal details of direction which form the rectangular groupings.

Figure 7 Comparison of Two Madrigals

A textural comparison (see Figure 7 in pocket) is the focus of the next two works: "Alla riva del Tebro" by Palestrina (Figure 7A) and Marenzio's "s'io parto, i'moro" (Figure 7B). These two madrigals, published only eight years apart, offer interesting textural similarities and differences.

Although the Marenzio adds a fifth voice, its overall range is only one half step greater than that of the Palestrina. Pitch register in the Marenzio, however, is a fourth lower. Both pieces are close to the same length in performance time (one minute, fifty-eight seconds versus one minute, thirty-nine seconds).

In terms of relationships between voices, the Palestrina reveals a highly polyphonic character with each section beginning in imitation. The Marenzio is relatively homophonic in comparison. Its voices show

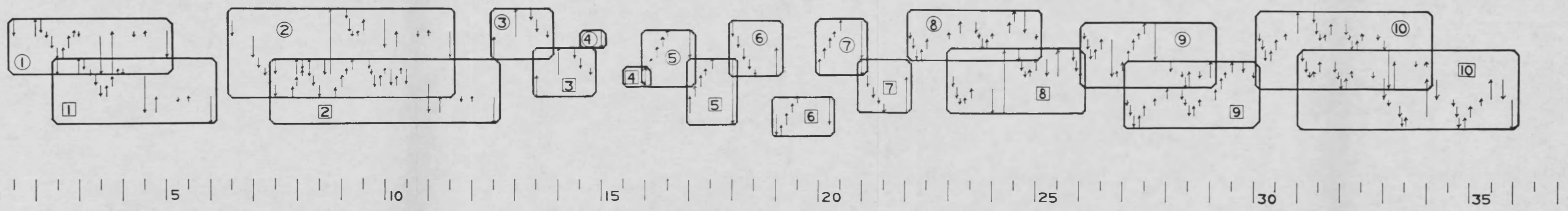


Figure 6. Composite Motion Graph

much less rhythmic differentiation and imitation is used very sparingly. However, both works utilize frequent fluctuations in vertical density to contribute to a sense of continuous flow.

Another factor which influences the overall texture is the frequent change in pitch register. Figures 7C and 7D are pitch register profiles which show the vertical space outlined by the highest and lowest voices at any given moment. Figure 7C, the Palestrina, and Figure 7D, the Marenzio, both demonstrate the juxtaposition of musical space as expressive gestures. Radical changes in vertical distance most often correspond to sectional divisions; for example, measures six, eighteen/nineteen, and twenty-three in Figure 7C and measures seven, nine and twelve in Figure 7D mark new sections.

Frequently in vocal works the setting of the text reflects structural outlines. Such is the case with the two madrigals under discussion. A visual representation of the relationships of word-phrase to pitch-phrase was produced by color coding pitch-phrases to correspond with the appropriate word-phrase being set. Due to the impracticality of color reproduction, however, this illustration has been omitted. In textures where there is a great deal of voice crossing and unisons, as in these madrigals, color coding of individual vocal lines clarifies linear relationships.

Figure 8 J. S. Bach: Invention
No. 4 in D minor

This visual analogue, page 32, was utilized in three University of Arizona freshman theory classes studying the work. Drawn on a large

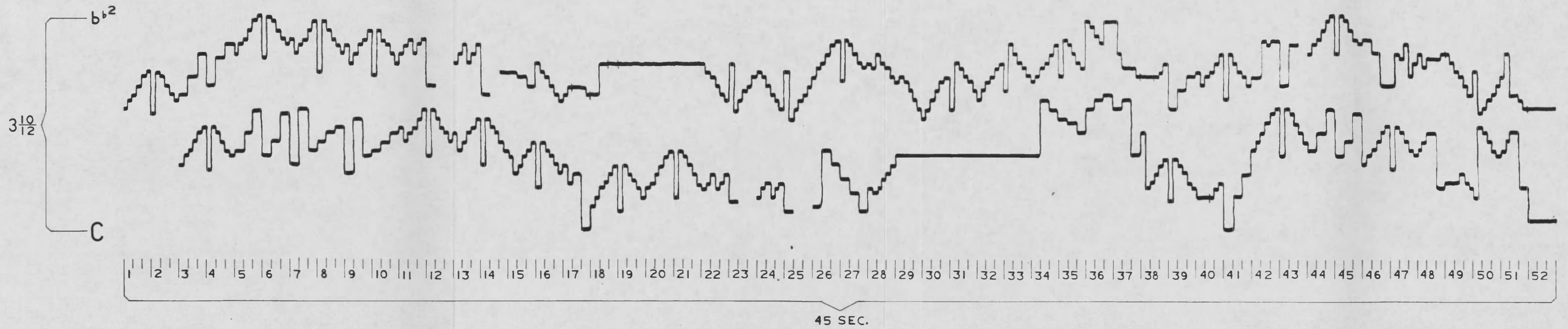


Figure 8. J. S. Bach: Invention No. 4 in D minor

scale visible to the entire class, this model was used to demonstrate the economy of means with which Bach composed the D minor Invention.

In addition to the large visual model each student had a copy of the printed score. A recording of the work was played while the students followed the visual model. Then the following discussion sequence ensued. The generating motive was isolated and described as to its characteristics. The visual location of this subject throughout the entire work was then identified and circled. Sequential, inverted, and fragmented patterns were discussed relative to the opening subject contour and surrounding events. These considerations led to discussion of textural inversion. The active versus passive quality of voices on a small scale and the large scale textural comparison of measures eighteen to twenty-two with measures twenty-nine through thirty-three were seen as unifying qualities.

Major cadences (measures seventeen/eighteen, thirty-seven/thirty-eight, and fifty-one/fifty-two) were examined in terms of textural reinforcement. For example, the parallel motion at measure sixteen and the large skip in the lower voice down to the lowest note of the piece (great C) draw attention to the first cadence. The second major cadence, measures thirty-seven/thirty-eight, is also characterized by large skips in the bass, but here both voices approach the cadence in long durational values so that the previous active-passive pattern, measures fifty through fifty-two, is announced by contrary motion of rhythmically identical voices followed by the cadence itself which makes use of sudden expansion of vertical space and long durational values.

In summarizing textural influences with the class before proceeding to harmonic considerations, it was also pointed out that within the almost four octave range (three and ten-twelfths) each voice defines its own territory so that the vertical space utilized by both voices only amounts to a perfect fourth (one-line c to one-line f). In this way the linear identity of each voice is reinforced.

Figure 9 J. S. Bach: Fugue No. 2 in C minor
from The Well-Tempered Clavier, Book I

As in the previous Bach example, the subject contour is easily traced throughout this fugue (page 35). In addition, textural units made up of distinct combinations of contoural components are easily identified and related to other events within the total visual context. For example, the brief episode (measures five and six) before the entrance of the third voice shows its contoural relationships to fragments of the subject and countersubject. The top voice is a sequence of the subject's opening five note shape followed by a contour from the last six notes of the subject. The lower voice is an inversion of the initial descending line from the countersubject sequenced to a statement of the first three notes of the subject which anticipate the entrance of the third voice in measure seven. The counterpoint set off from this third voice is essentially the original countersubject now in the top voice reinforced in parallel and then contrary motion by the third voice.

A textural distinction is made at the end of the exposition (measure nine). The following episode (measures nine to eleven) is

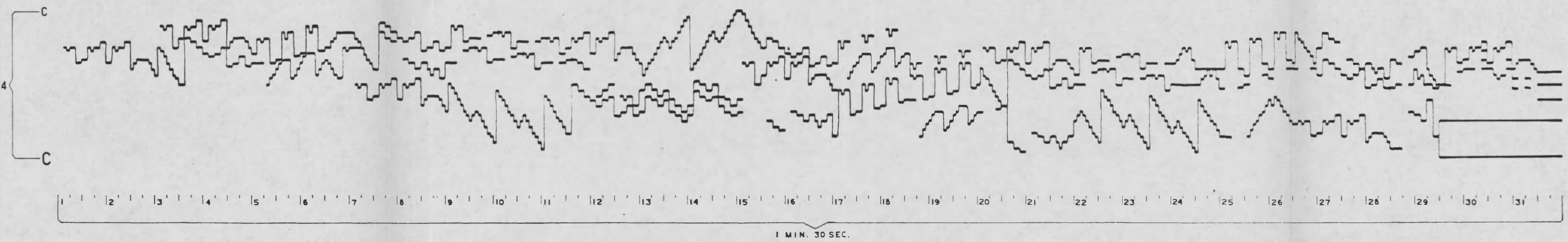


Figure 9. J. S. Bach: Fugue No. 2 in C minor from The Well-Tempered Clavier, Book I

characterized by the lower voice line as a sequential derivative of the original descending line in the countersubject, extending down into the lower part of the overall pitch register, and imitation between the middle and top voices of the opening five note pattern of the subject.

At this point, measure eleven, the subject returns in the top voice. After the complete subject has been stated, this voice becomes an inversion of the bass line from measures nine and ten. The middle voice takes up the subject at measure fifteen within a surrounding counterpoint which essentially is a rearrangement of previous background material from measure eleven.

The episode beginning in measure seventeen is a textural reordering of the contour elements in measures five and six. Toward the end of measure eighteen, another reorganization of the same components continues up to the return of the subject in the top voice at measure twenty. Here the lower voices are dramatically separated in space.

The episode which begins in measure twenty-two corresponds to the episode initiated in measure nine, only here it is sequentially extended up to another subject statement in the bass voice beginning in the second half of measure twenty-six. The counterpoint at this spot shows some correspondence to that at measure seven and eight.

The final textural unit is set off by the only complete break of rhythmic flow in the entire piece (measure twenty-eight). In addition to the final statement of the subject, this section is characterized by a double pedal and an increase in vertical density of up to six lines.

Figure 10 J. S. Bach: Canon a 2 "Quaerendo
invenietis" from The Musical Offering

This last Bach example, page 38, is a two voice canon which cleverly employs an exact inversion of the top voice as the comes. The solution to this riddle canon, realized visually, clearly shows this unique relationship between voices. In order to correlate each part with the score, measure numbers are given for both the top original voice and the bottom derived voice whose entrance is delayed until the second half of the third measure.

Because of the perfectly symmetrical disposition of voices, the pitch register divides exactly in half (one and five-twelfths octaves) to reveal the one-line g axis of the entire work which functions as the dominant of the key. The time component, however, is divided unevenly. Notice that measure one is not a part of the repeated section because its two pick-up notes are incorporated into the end of measure sixteen. Also, the work ends on the second note of measure nine in the dux and the second note of measure six in the comes.

As a teaching aid, this particular work can serve as a point of departure for the study of retrograde and inversion. By tracing the top voice on to a piece of clear plastic, the original melodic form can demonstrate inversion by turning the plastic sheet upside down, retrograde by exchanging ends, and retrograde inversion by combining both operations. Because the retrograde and retrograde inversion forms are not utilized in this piece, further discussion could extend to other appropriate works. A connection with twelve tone works that use these devices is one possibility.

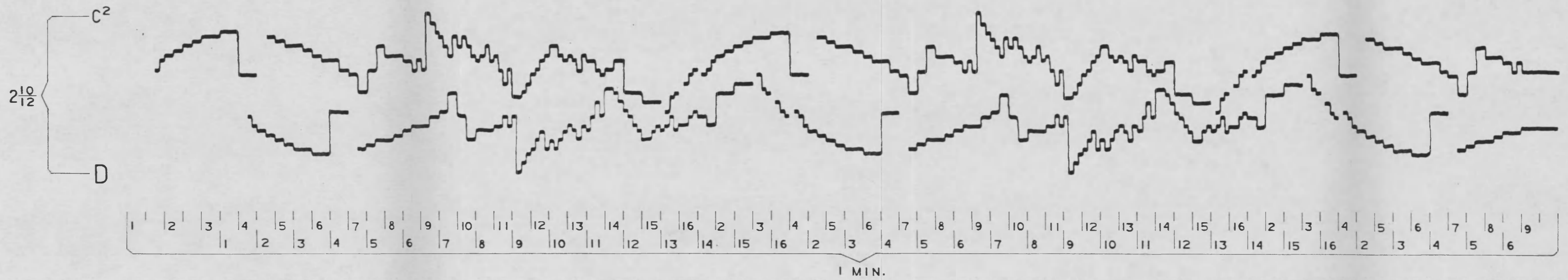


Figure 10. J. S. Bach: Canon a 2 "Querendo invenietis" from The Musical Offering

Figure 11 Comparison of Theme and Variations

The third movement of Mozart's Piano Sonata in D major, K. 284 consists of an original theme and twelve variations. Figure 11 (in pocket) represents the theme (Figure 11A) and variations one (Figure 11B), six (Figure 11C), and nine (Figure 11D). In order to save space, the repeats are not written out but indicated above the measure numbers. Metric length is exactly the same for each section and, the performance time is almost identical. Because the variations are all derived from the same harmonic and melodic source, textural variety becomes a focal point.

Figure 11A illustrates the simplicity of the original theme. After two pick-up notes, the melody and characteristic Alberti bass accompaniment continue until the clearly defined phrase ending, emphasized by a temporary increase in vertical density, is reached at the beginning of measure four. This same pattern continues in the consequent phrase. The second section, beginning after the double bar, is initiated by four pick-up notes, and in general, shows a greater vertical density than previous sections. The two voice parallel descending run in measure ten is also a significant characteristic of this section. A long silence of almost a measure delays the anticipated return of the last phrase.

Figure 11B, by comparison, displays a continuous melodic line in even durational values interrupted only by phrase endings. The lower accompaniment figure is basically dyadic throughout with the exception of the final phrase (measure fourteen) where the lower parts sound triadic structures. The silent space of the theme is partially filled

in by a fragment derived from the pick-up notes to the second section (measure eight). The overall range has been reduced with the lowest pitch a perfect fourth above the theme's bottom range. Other than that, the pitch registers are the same.

The next variation, Figure 11C, can be generally characterized by a simple melodic line fragmented between extreme high and low ranges with doubling most often occurring in the bass. The only other contour component is the mid-range three note shape that is repeated throughout this variation. The pitch register has been expanded an eleventh from that of the theme's as a result of the octave doublings in the low range.

Variation number nine, Figure 11D, has the widest range as well as the consistently highest vertical density. The first phrase opens with a mock imitation in the second voice. The second phrase overlaps with the conclusion of the first, is imitated exactly in double octaves above, and concludes with a chordal syncopation figure. The second section begins on pick-up notes in a high range, increases in vertical density and descends in register. The last phrase, measure twelve, is similar to the second phrase (measure four) except that the doubled upper voice is inverted.

Figure 12 Chopin: Prelude No. 4 in E minor

This Romantic miniature, page 41, utilizes a radical fluctuation in pitch register and vertical density for dramatic effect. Structural identity is revealed as a result of textural change. A gravitational



2 MIN. 28 SEC.

Figure 12. Chopin: Prelude No. 4 in E minor

pull toward the final cadence is a critical shaping force on the entire profile of the work.

Although a major third lower, the total range of this work is exactly the same as that of Figure 11D, four and eight-twelfths octaves. Vertical density levels, however, cover a much broader range. The first section beginning in the upper middle range establishes fixed linear relationships of a melodic line in long durations moving in an overall downward direction and a harmonic accompaniment in even, short values descending more rapidly than the melody via staggered, downward motion. Aside from the two pick-up notes, the vertical density of this section is consistently four.

In measure twelve, the three harmonic voices drop out while the melodic line leads to a return of the opening register and spacing at measure thirteen. Gravitational motion is interrupted in measure sixteen, however, and, the climactic downbeat of measure seventeen grows into a vertical density of seven and a momentarily expanded pitch register which nearly matches the vertical dimension of the entire work. Following this climax, the texture returns to its normal state (measure nineteen) except for a lower pitch register and the brief exclusion of a voice line at measure twenty-one (a deceptive cadence).

This concluding phrase is characterized by a high vertical density (six and seven), long durational values, and a pitch register encompassing approximately half the overall range and incorporating the lowest pitch in the work. Its lower pitch register is a resolution of the overall gravitational pull.

Figure 13 Webern: Variations for Piano
Op. 27, second movement

This extremely short movement displays a high degree of organization in all parameters. Its textural components are therefore carefully controlled. This visual model, page 44, shows the time-depth frame above the corresponding time-space frame. All repeats are reproduced visually.

Because of the relatively quick tempo (the quarter note equals approximately 160), short note values (the quarter note is the longest duration used), and rapid decay factors of the piano, changes in articulation function not only in time-space but also in time-depth. Articulation becomes (Westergaard 1963, p. 108) "the closest the composer can get to control of piano timbre." The five articulation-timbres employed and their corresponding visual patterns in time-depth are: (1) two successive legato eight notes -- vertical hatching, (2) two successive staccato eight notes -- horizontal hatching, (3) two overlapping quarter notes with attacks an eight note apart -- diagonal hatching from upper right to lower left, (4) two successive staccato eight notes with a grace note before each -- check hatching, and (5) two successive accented eight notes always related to a vertical density of three in the time-space frame. Each articulation group is also represented in the time-depth frame on a specific dynamic level: (1) piano -- shortest height, (2) forte -- medium height and (3) fortissimo -- greatest height.

The time-space frame shows the serialized pitch sequence. Dotted lines connect articulation groups and help emphasize the overall

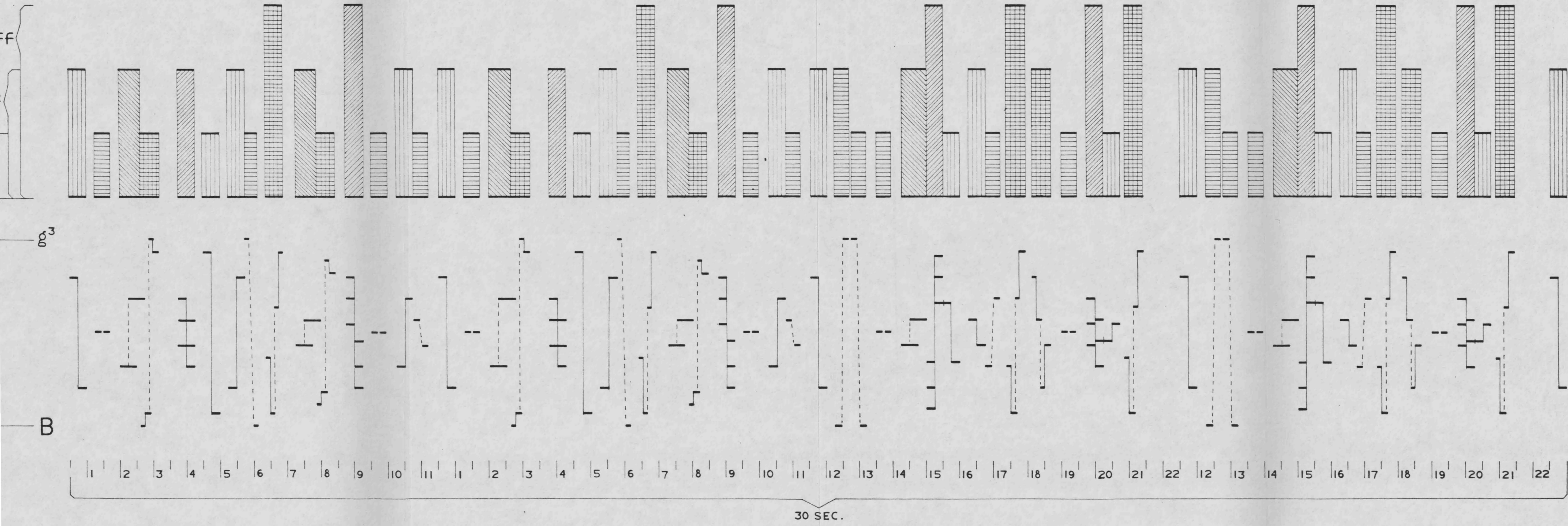


Figure 13. Webern: Variations for Piano, Op. 27, second movement

symmetry of this work focusing on a central axis which is always represented by two successive articulations of the same pitch (one-line a).

The rapid fluctuation between extremes of range combined with the small scale control of other components produces a carefully balanced, integrated texture with a limited sense of forward motion. As Peter Westergaard summarizes (1963, p. 115), "Despite its highly energetic texture (the large intervals, the way the rhythmic detail works against the meter, the constant rapid changes of dynamics and articulation) the movement sounds highly static."

Figure 14 Sessions: From My Dairy, third movement

The most striking feature of this analogue, page 46, is the parallel line configuration which runs through most of the work. This upper pedal (a minor ninth) is constantly rearticulated to: provide a sense of motion, overcome the relatively rapid decay characteristics of the piano, and simply contribute to the total unity of the work.

Another unifying element is the bass contour which grows in an additive fashion from its initial shape in measures one and two to a more complete version, measures three through the first half of five. It is then fragmented, measures six and seven, and finally returns in an abbreviated form toward the end, measure nine.

Disruption of the static parallel lines toward the end of measure five signals a changing pattern. The bass contour expands downward while the three voices move toward the high point of measure seven. The large vertical space encompassed, the rhythmically active upper voices

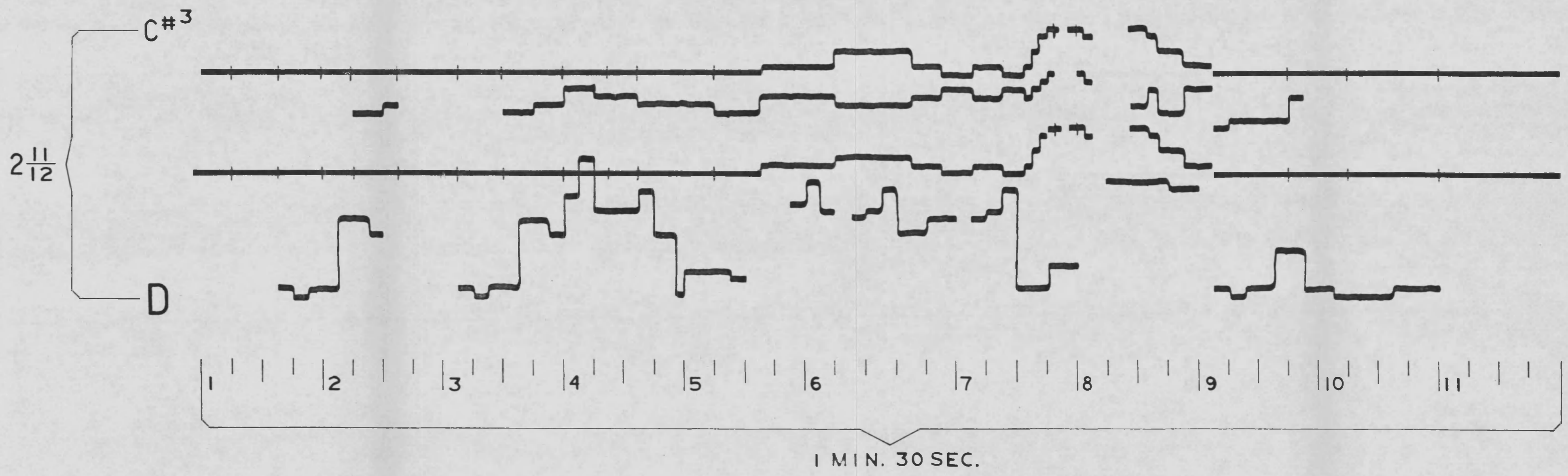


Figure 14. Sessions: From My Diary, third movement

moving in parallel motion, and the following brief silence all contribute to the climax before measure eight.

The concluding section (measure nine to the end) echoes the opening texture with its return to the minor ninth pedal and melodic bass contour. Thus, the overall pattern of motion in this piece can be identified as statement, growth, climax, and return.

Figure 15 Schuman: *Three-Score Set*, second movement

This short work for piano produces a unique visual pattern (page 48). The strict homorhythmic regularity focuses attention on vertical direction and spacing. Large textural segments are clearly defined by clean breaks in linear patterns and vertical densities are symmetrically grouped in space.

An examination of vertical density alone is structurally revealing. The peak density of the work is represented in the initial six line component which is not relieved until a complete break occurs at the end of measure four. The following events from measures five up to eleven successively progress in density from one through five. Measure eleven restores and maintains the initial maximum density to the end of the work with only brief interruptions of silence.

The mirrored contracting pattern of measures one and two is easily traced through measures three and four, eleven and twelve, as well as thirteen and fourteen. It also displays a relationship to measure sixteen and twenty through the vertical element of measure two. The contrasting pattern of measures five through ten represents not only a

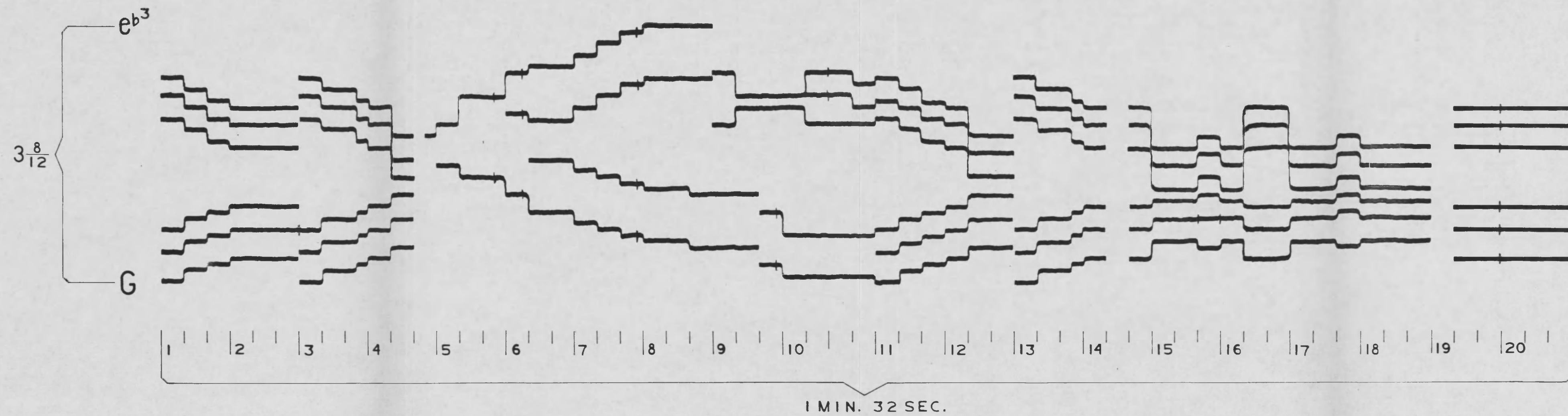


Figure 15. Schuman: Three-Score Set, second movement

change in vertical density but also a shift in pitch register profile via expansion rather than contraction and a higher registral location.

The pattern from measures fifteen through eighteen displays the only homorhythmic combining of both expansion and contraction in one textural unit. It thus summarizes all previous directional patterns and has a neutralizing effect on the vertical rhythm so that the final chord is texturally more conclusive.

Figure 16 Carter: Etude No. 7

Produced entirely on only one pitch, one-line g, Elliot Carter's seventh etude from Eight Etudes and a Fantasy for Woodwind Quartet is an extreme example of structural emphasis occurring in the time-depth frame. Changes in timbre, attack, and decay as well as overall loudness levels constitute the essential texture. Figure 16 (in pocket) shows not only the composite texture but also isolates each instrument's role in producing this Klangfarbenmelodie.

Along the left-hand edge of the model is a loudness scale. The piano marking is parenthetical because it does not occur in the score and, the space above the fortissimo mark is used to distinguish accents above this level. Wedge shapes indicate relative crescendo and decrescendo values and, patterns which represent specific timbres can be related to the appropriate instrument as given along the right-hand border.

By comparing the individual parts to the composite, various structural identities of specific instruments are revealed. For example, the clarinet begins and ends the study. This choice was probably

based upon this instrument's superior ability in controlling low level dynamics. Compare the oboe in measure nineteen with the bassoon in measure three. Both instruments use the same articulation shape in similar textural circumstances. Also notice the absence of the oboe in measures fourteen through eighteen. The subtraction of this particular sound quality is all the more effective because the oboe quality blends the least of all the instruments used.

In the composite model measures one through seven return as a condensed recapitulation beginning toward the end of measure seventeen through measure twenty-two. Between these two events are two sections characterized by crescendo shapes. The first section, measures eight through twelve, is relatively densely articulated by all four instruments. Loudness direction is from a pianissimo to a mezzo forte level. The second section crescendos up to forte and omits the oboe color. From the recapitulation to the end, measures twenty-three to thirty-one, all articulations are either decrescendo shapes or maintain constant volume levels.

From four sound sources -- flute, oboe, clarinet, and bassoon -- fifteen different color possibilities are developed. This variety of colors combined with highly controlled envelope and loudness factors produces a musical structure exclusively shaped by textural components.

Figure 17 Webern: Five Pieces, Op. 10, No. 4

The final work is presented out of its proper historical sequence so as to conclude the list of examples with a work that necessitates representation in time, space, and depth. Figure 17 (in pocket)

presents three different views of the fourth of Webern's Five Pieces for Orchestra.

Figure 17A is the time-depth representation. Each instrumental timbre is coded by a specific pattern: mandolin -- horizontal hatching, harp -- diagonal lower left to upper right hatching, muted viola -- circles, muted violin -- wavy vertical lines, snare drum -- individual thick lines, celesta -- upper left to lower right diagonal hatching, muted trombone -- squares, muted trumpet -- vertical hatching, and clarinet -- dots.

Only three dynamic levels are printed in the score but, given crescendo marks imply a fourth level. Instruments with a fixed decay factor -- mandolin, harp, and celesta -- are represented by a sharp drop in loudness following each attack. Individual snare drum articulations, having almost no duration, are represented (measure four) by bold lines only.

The time-space frame of Figure 17B shows the various relationships of pitch. Of special note are the three snare drum articulations of measure four. Because this instrument essentially produces non-pitched noise, it is represented as covering the entire pitch spectrum for a brief moment. Also of interest is the representation of the clarinet trill toward the bottom of measure five.

The combined relationships of time, space, and depth are represented in Figure 11C, although the textural identities have been omitted to avoid visual confusion. This last drawing is a representation of an actual three-dimensional model constructed by the author from clear

plastic and transparent colors as described in Chapter 2, Interaction of Time, Space, and Depth, page 53.

The textural values of this microstructure are such that color, envelope, and loudness identify pitch events. The melodic contour initiated by the mandolin (horizontal hatching) at the beginning is picked up in the muted trumpet (vertical hatching) in measure two, carried by the muted trombone (squares) to the lower register in measures three and four with a final statement in the violin (wavy lines) beginning in the last part of measure five. The accompaniment is static in pitch contour but very carefully shaped in terms of loudness factors.

The delicate balancing of events in both space and depth produces a clear perception of foreground and background relationships.

William Austin emphasizes this control as follows (1966, p. 347):

"There is no need for the markings of Hauptstimme and Nebenstimme . . . because . . . every note is made clear by the instrumentation, and the melodic motifs are brought out by continual sharp contrasts."

Figure 18 Comparison of Time Span and Pitch Register

One of the advantages in representing pieces as visual analogues is the ease with which direct comparisons can be made. By adjusting visual dimensions to conform to a common scale, Figure 18, page 53, summarizes all of the musical works cited in terms of their overall pitch registers and performance times. Comparisons of these two components are thereby greatly facilitated through visual emphasis. For example, the extreme contrasts in pitch register of Figure 12, the Chopin Prelude

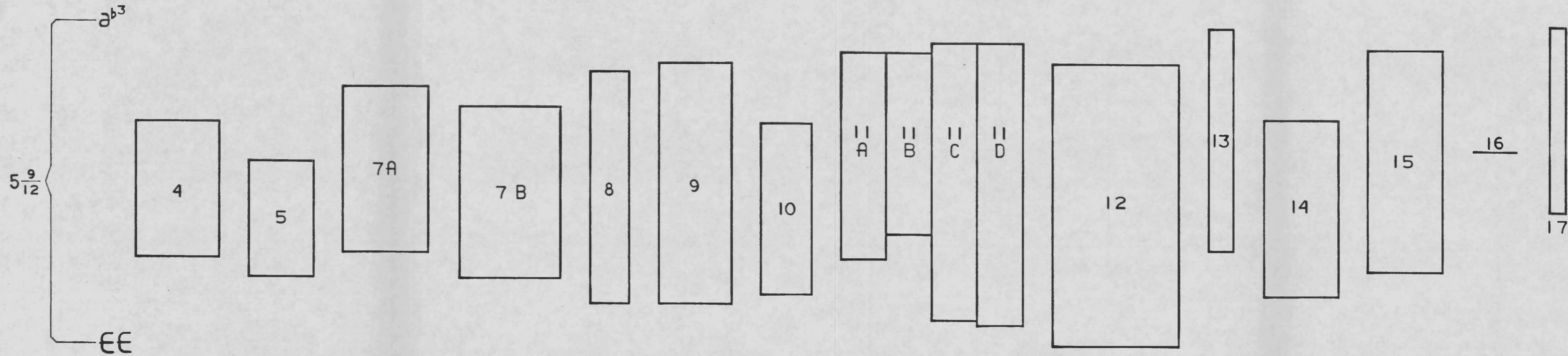


Figure 18. Comparison of Time Span and Pitch Register

and Figure 16, the Carter Etude are a reminder of the different textural components which shape each of these works.

Other individual or combined textural components such as loudness or vertical density could easily be presented in the same fashion. Through such comparisons of isolated aspects from work to work and their composite interactions, a conception of generalized textural types could be developed which would allow for classification of any work as to its specific textural values.

CHAPTER 4

OPPORTUNITIES AND LIMITATIONS

The visual analogues of texture presented in this paper have been developed to facilitate the conceptualization and teaching of this musical element. Because the works selected for inclusion were necessarily short in length, the method of presentation would seem to have inherent limitations. The textural relationships established maintain their validity, however, regardless of a composition's dimensions. Once the conception of a specific textural type is clearly formulated, sensitivity to the same or similar values in other works, large or small, is increased.

Because of the ability of visual representation to simplify complex interrelationships and selectively emphasize components, it is frequently a more economical means of communication than performance notation or discursive description. This unique quality makes the visual analogue an ideal educational tool. All of the models presented require a minimal orientation to perceived sound -- in most cases one performance -- to use effectively. Although a musician with a well-developed sense of aural imagery does not require a visual interpretation of sound events to hear the score, analyzing and conceptualizing textural types can be significantly assisted with the aid of visual models. For the developing music student, the supplementing of score interpretation by emphasizing textural events and relationships via a

visual model can be of significant value. And, for the nonmusician interested in the inner workings of compositions, the visual analogue method provides an easily apprehended sequence of events and relationships frozen in time.

The possibility of computer assisted construction and manipulation of models could eliminate the inconvenience of mechanical production as well as expand the availability and scope of visual representation. Current limitations such as the representation of timbre or the modeling of large-scale works might be overcome with adequate equipment and technology.

The complexity and variety of components which make up the texture of music command our attention as part of the total musical meaning. Through appropriate visual representation, a portion of this meaning can be preserved.

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- J. S. Bach: Canon a 2 "Quaerendo invenietis" from The Musical Offering
- Mozart: Theme with Variations from Piano Sonata in D major, K. 284
- Chopin: Prelude No. 4 in E minor
- Webern: Variations for Piano, Op. 27, second movement
- Sessions: From My Diary, third movement
- Schuman: Three-Score Set, second movement

Carter: Etude No. 7 from Eight Etudes and a Fantasy for Woodwind Quartet

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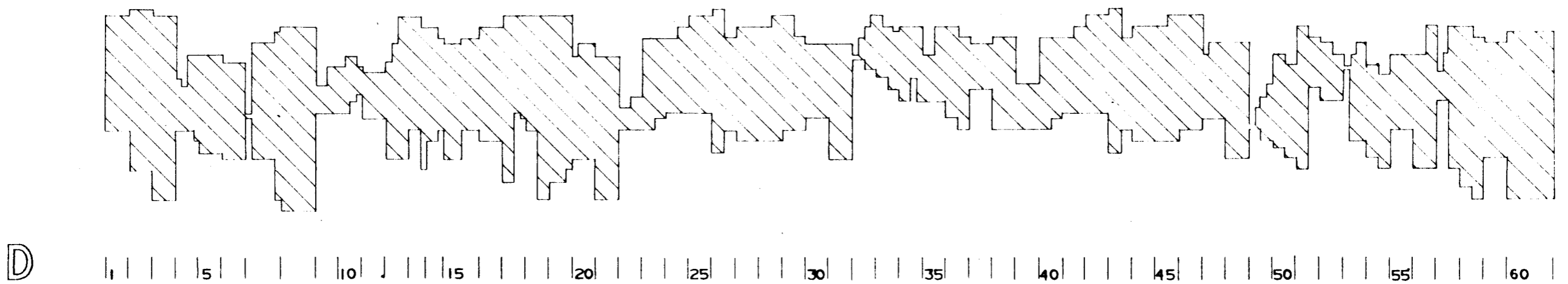
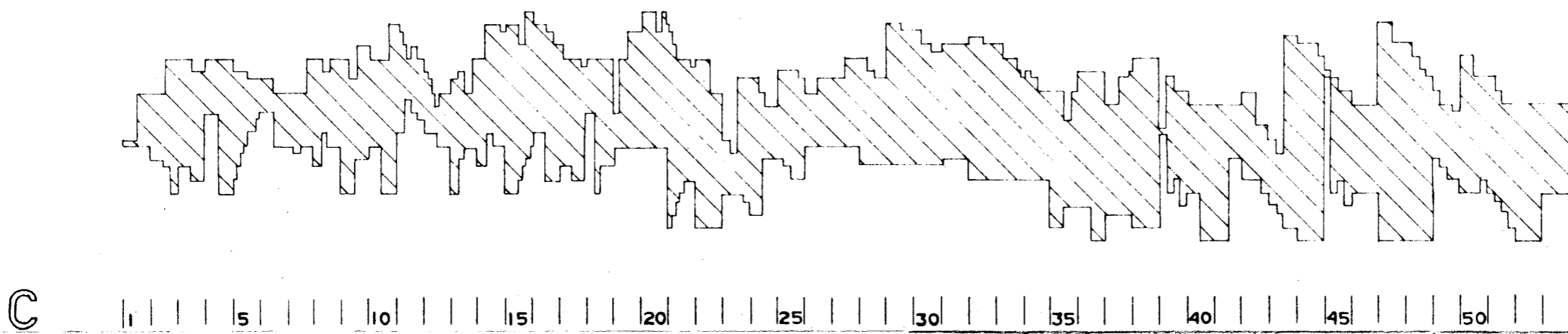
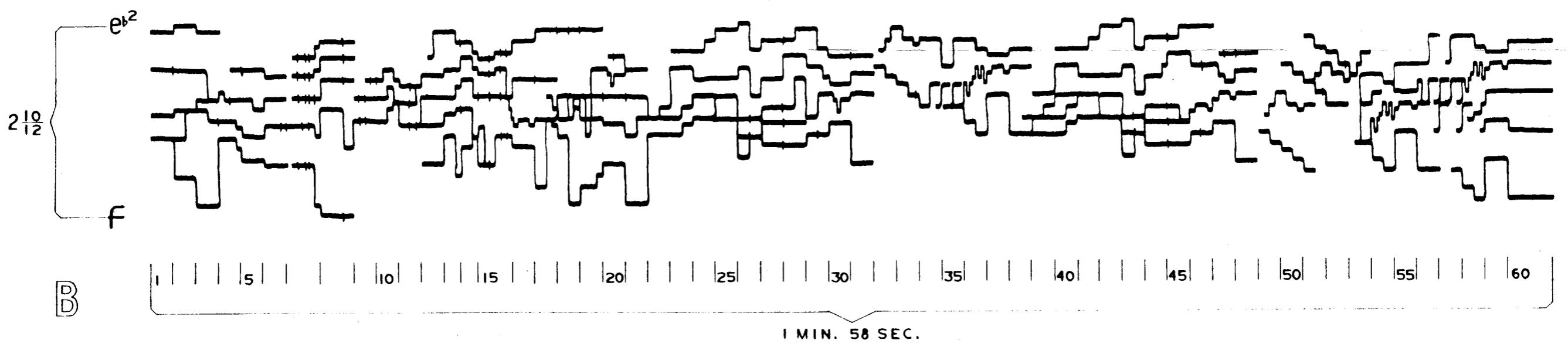
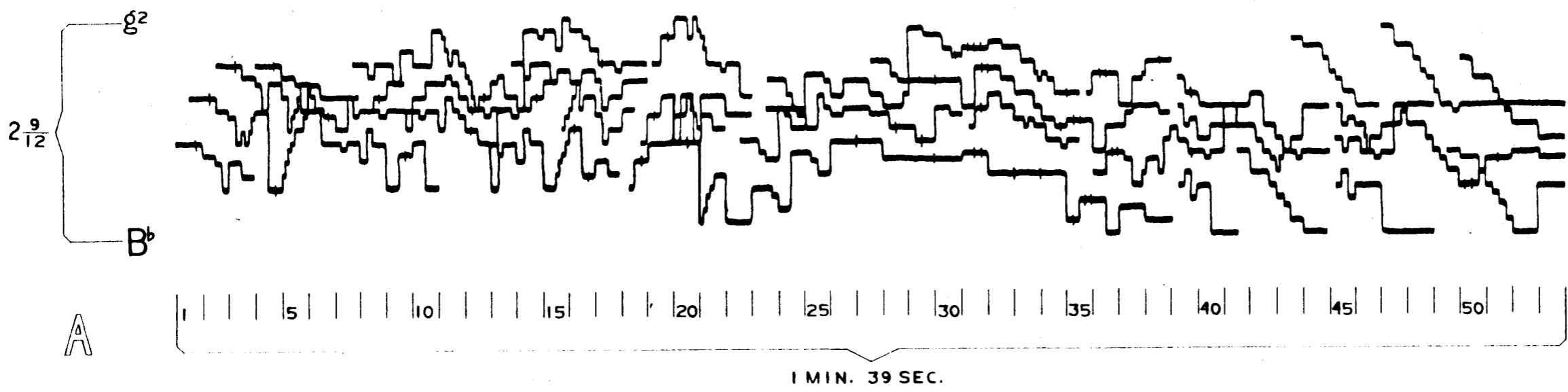


FIG. 7 COMPARISON OF TWO MADRIGALS

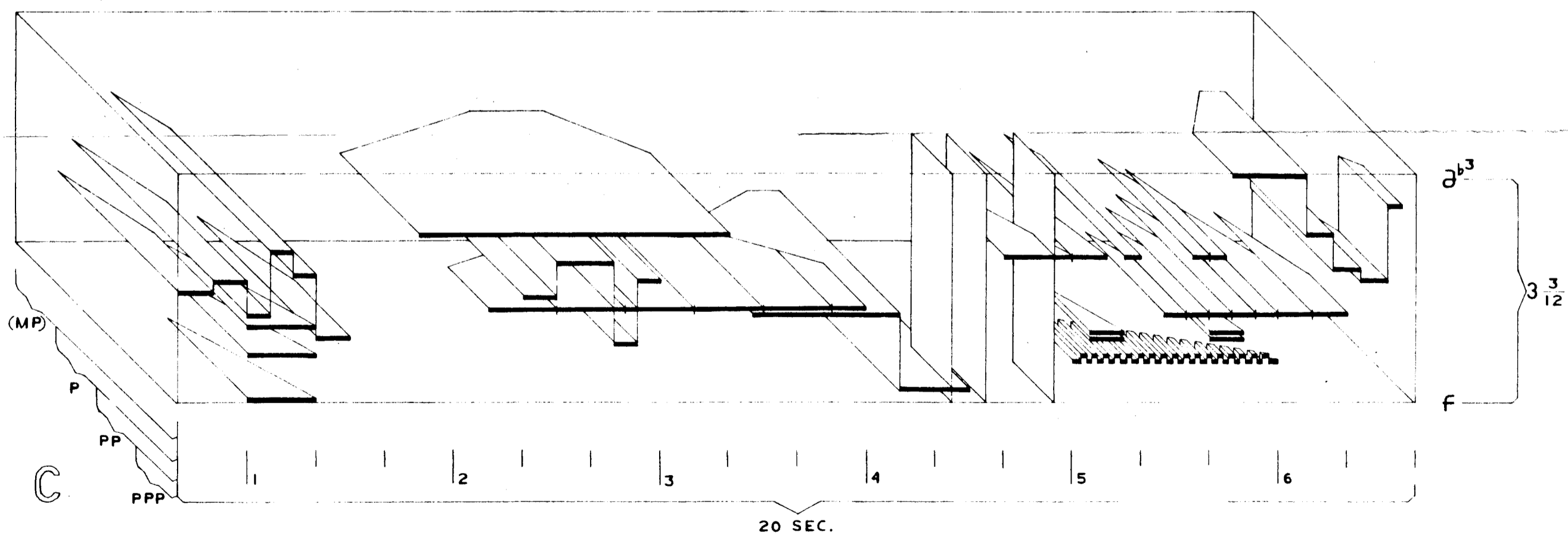
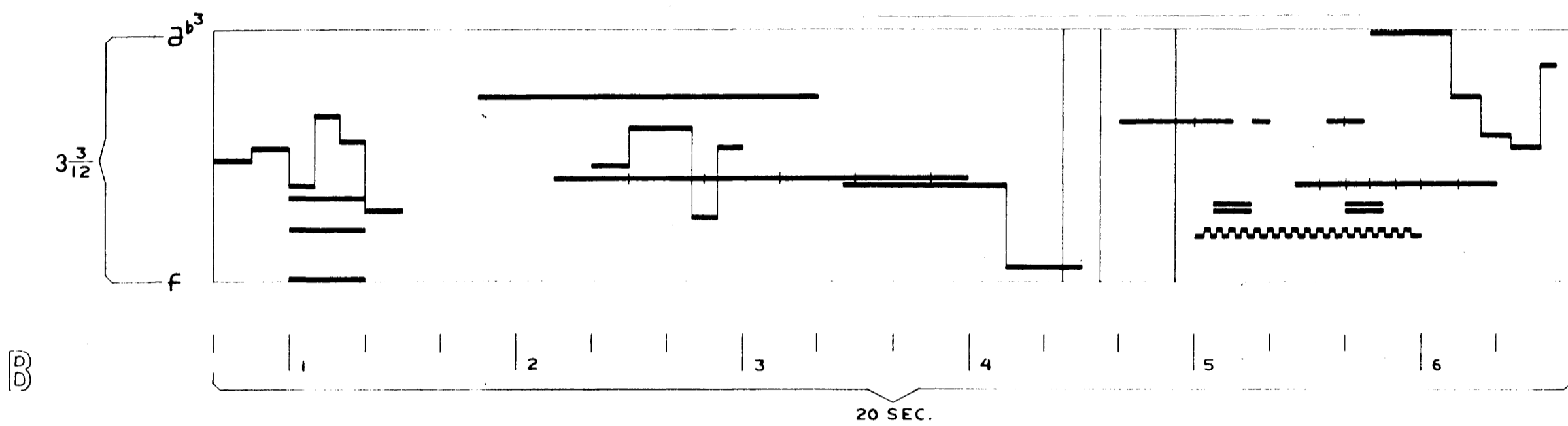
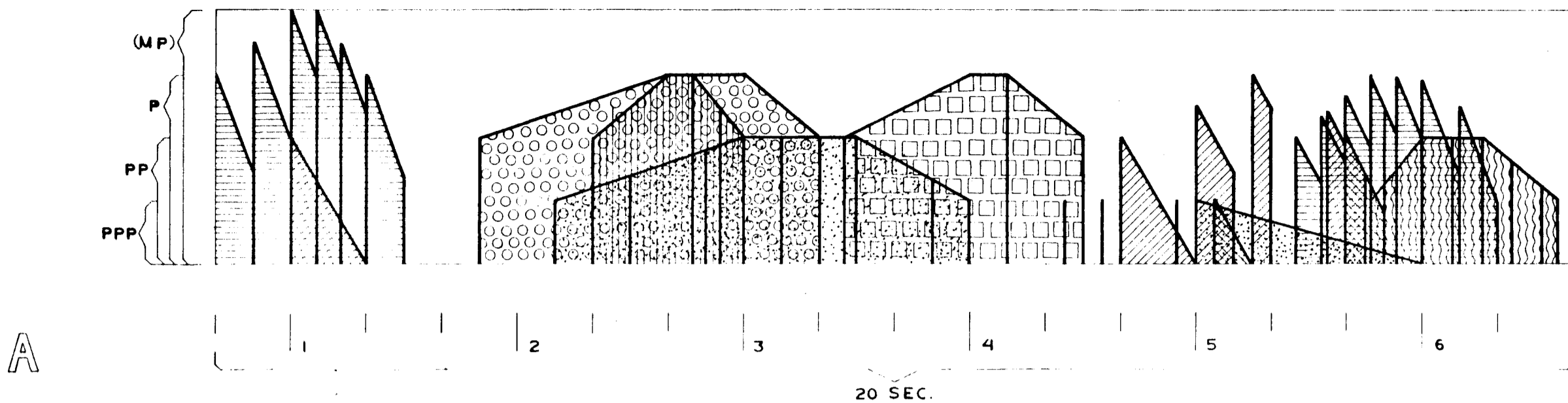


FIG. 17 WEBER: FIVE PIECES, OP. 10, NO. 4

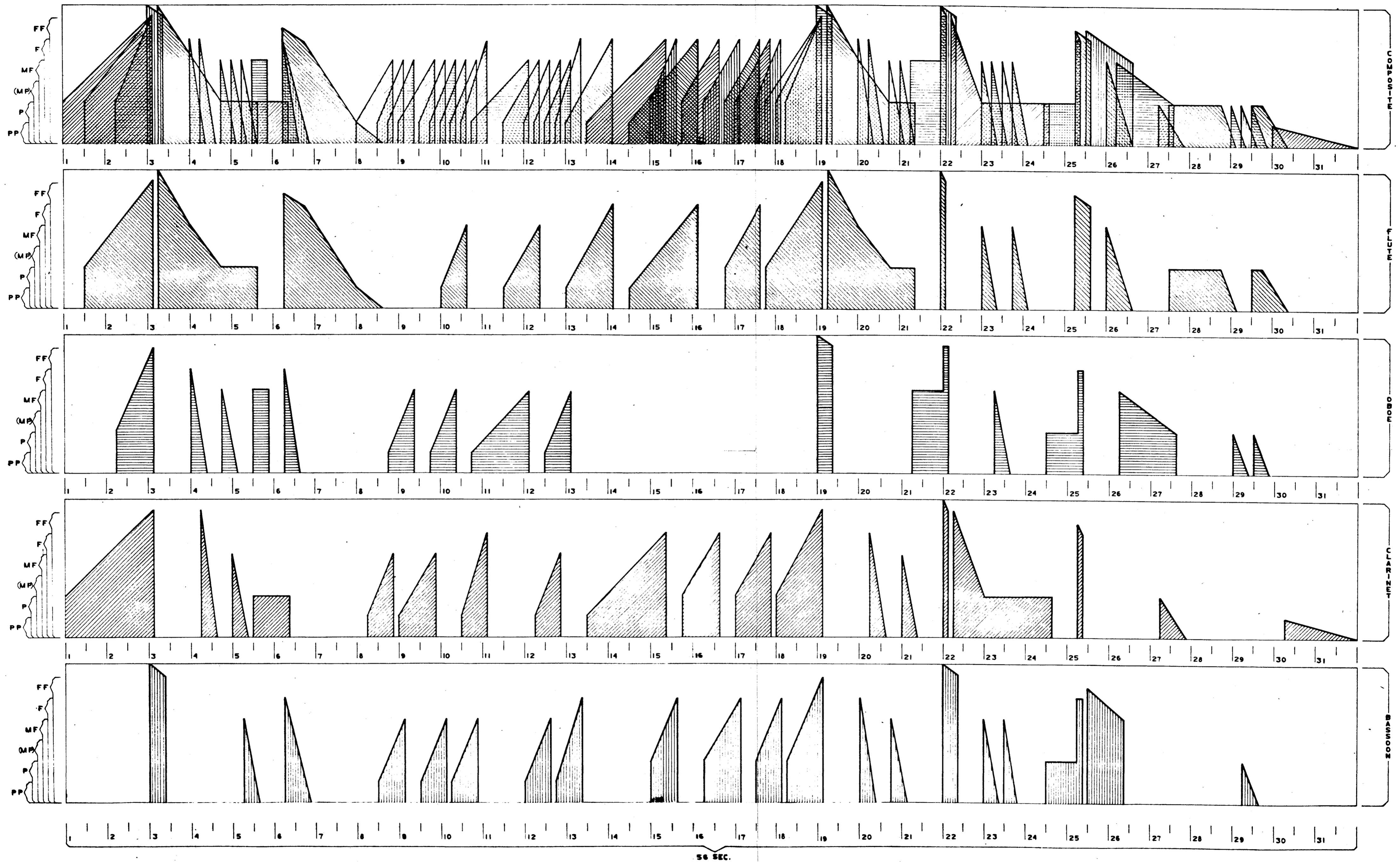


FIG. 16 CARTER: ETUDE NO. 7

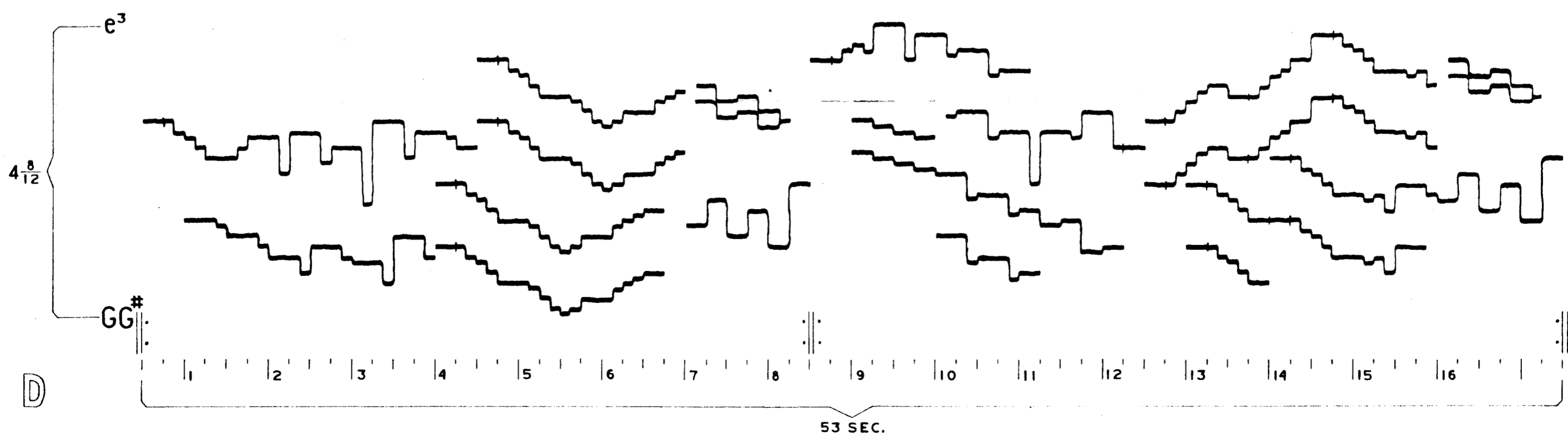
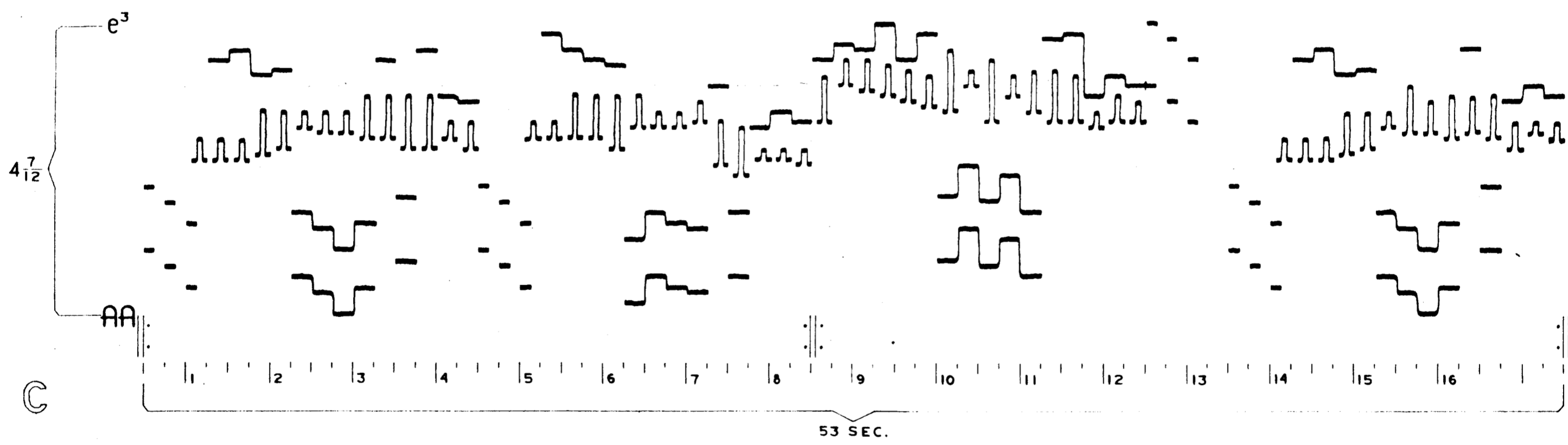
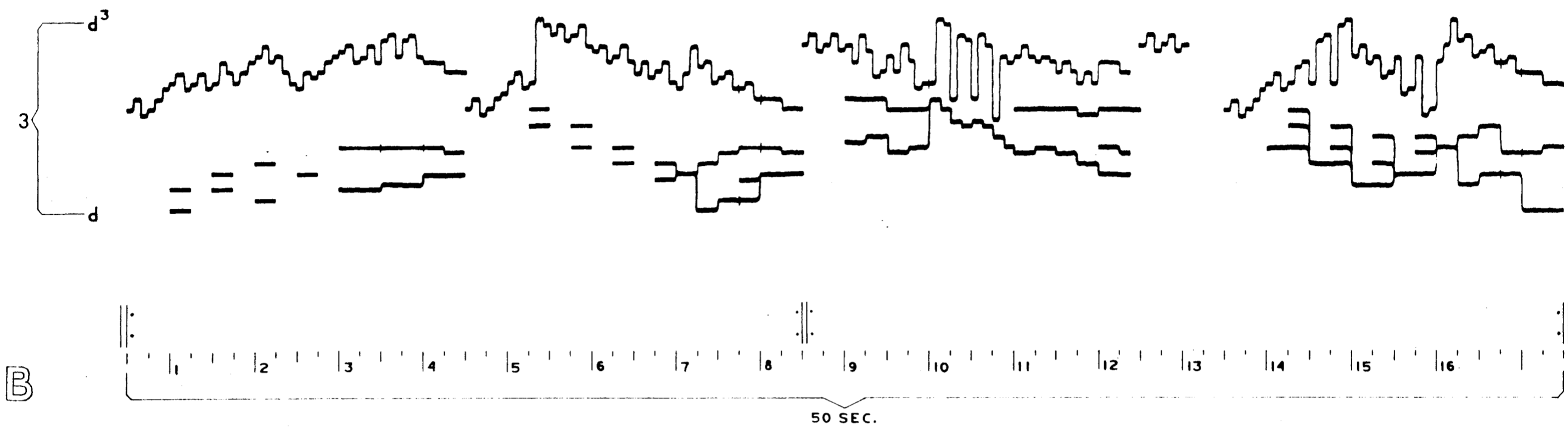
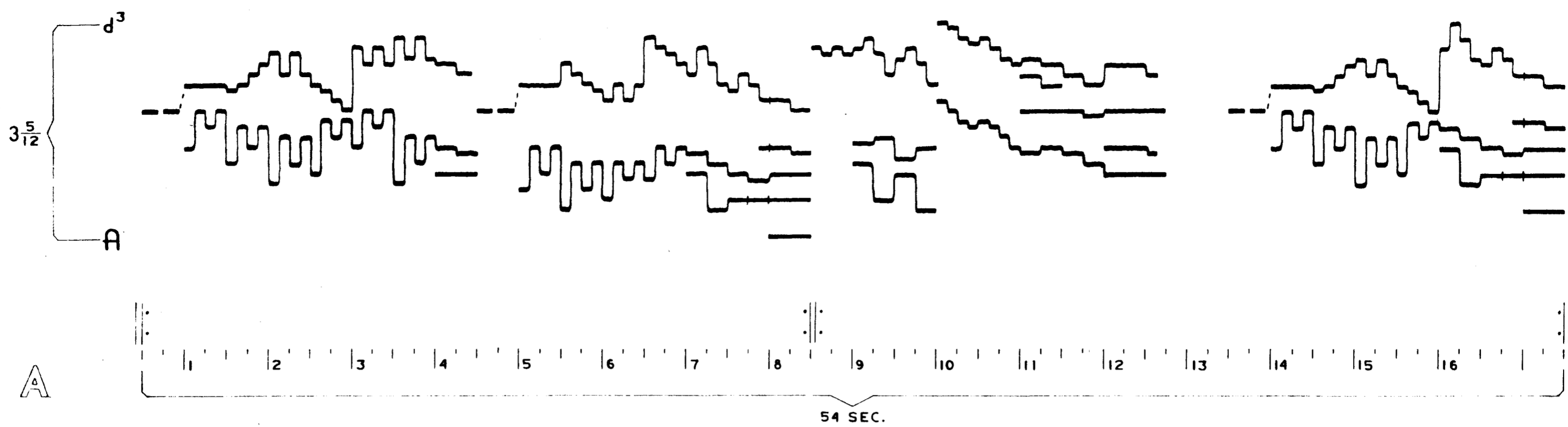


FIG. 11 COMPARISON OF THEME AND VARIATIONS