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Post-Pitch World: Timbre as the Primary Element of Form

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by

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ABSTRACT OF THE DISSERTATION

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While pitch has been the primary element of form for many centuries, this dissertation considers the possibility of using timbre as the primary element of form in a musical composition. It explores the different mindsets, structural procedures, and techniques which contribute to the construction of form in the absence of pitch. As its primary case study, this dissertation analyzes *Crama* by Panayiotis Kokoras (b.1974) to discover the practical applications of a piece formally organized by timbre, including over one hundred figures that analyze *Crama* in smaller sections. These figures express the timbre of each instrument, and then compare the timbre of each instrument to all other instruments before discussing the results. Most of the figures include a short conclusion that explains how timbre supports the form in this piece. The conclusion chapter draws from the case study chapters and suggests even more options to create a sound-based composition.

The dissertation of Arash Majd is approved.

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Glossary:

To make this work comprehensible to the reader, I define all terminology used in this dissertation in this glossary. To support my analysis of Crama by Panayiotis Kokoras (b.1974), I read Kokoras's writings and was influenced by the bibliography he used. I also developed my own terminology to describe and clarify different events in this paper.

Terms of STASIS

Elements / Contributing elements of form: Different components or aspects that contribute to the creation of form.

Elements of sound: Seven different elements (table one) that contribute to the quality of sound.

Timbre: The quality of sound. Table one indicates seven elements that define timbre or the quality of sound in this paper.

Table.1 contributing elements to the quality of sound.

Seven contributing elements to timbre or the quality of sound.
1. Number of partials = **P#** (1 = fewer, 9 = more)
2. Thinness or thickness of sound = **Th/Tk** (1 = thin, 9 = rich)
3. Range of strongest partials = **PR** (1 = low, 9 = high) or, better: (1 = bottom, 9 = top)
4. Irregularity of sound = **I** (1 = irregular, 9 = regular)
5. Amount of noise = **N** (1 = clean, pure, 9 = noisy)
6. Sharpness of attack = **AS** (1 = gentle, 9 = sharp)
7. Noisiness of attack = **AN** (1 = non-noisy attack, 9 = noisy attack)

Anatomy of timbre: The components in table 1 that contribute to timbre. Imagine the anatomy of the human body, consisting of the heart, kidney, lungs, and so on. The seven contributing elements in table one can be considered the components or the anatomy of timbre.

Minimum and maximum values: These values derive from the subtraction of the absolute timbral values of each instrument. The minimum value indicates smaller timbral values, and the maximum values indicate larger timbral values.

Timbral space: Derived from the subtraction of minimum from maximum values. For example, if the maximum value is 20 and the minimum value is 15, the timbral space between the two instruments is 5.

Noise: The absence of pitch.

<u>Terms of SEPARATION</u>

Section: A specific range of measure numbers that express more than one musical idea.

Subsection: A specific range of measure numbers that express only one musical idea.

Phrase: A musical sentence that suggests a beginning, a possible climax, and an ending.

Shape: A phrase that suggests an arc-like shape.

Form: An organized and meaningful presentation of different sections that create logic concerning the overall structure in a musical composition.

Structure: The overall procedure to organize the form in a musical composition. Also, the logical process of creating a section.

Module: A small motivic idea, usually consisting of fewer than eight cells, which usually but not always repeats itself either solely or as part of a texture.

Figure: A chart line that shows a timbral progression of one or more instruments. It can exhibit different shapes as a result of activity from the contributing elements of the quality of sound.

Sound unit: Similar to module except that it should be pitch-less.

Sound-based composition: According to Kokoras, "In sound-based composition, sound replaces the musical note as the fundamental structural unit."[1]

<u>Terms of CHANGE</u>

Timbral State: The appearance of a particular timbre.

Start: The beginning of a phrase.

Return: Any identical repetition of an idea, module, or sound unit.

Transformation: When an idea, in a section, module, or sound unit, undergoes a process and changes to a variation of that idea but retains an essence of the old idea.

Continuity of sound: The consistent appearance of a timbral state via repetition or transformation.

Forward Motion: Motion that is driven by the transformation or repetition of similar or identical timbral values.

Process: A series of procedures that contribute to the transformation of timbral state A to timbral state B.

Progression: The progress of an idea or a timbral state.

Progression of timbres or timbral progression: The progress of changing the absolute timbral value, or timbre, from point A to point B.

Force: Energy

[1] Panayiotis Kokoras, "Sound Composition," Panayiotis KOKORAS – Projects, August, 2016, http://www.panayiotiskokoras.com/en/projects.html.

Evolving: Change or progression.

Growth: A process which contributes to the creation of shape, form, section, and musical meaning to a timbral state, module, or sound unit.

Decay: Fading away from a timbral state.

Repetition: The consistent appearance of identical absolute timbral values, modules, or sound units.

Periodicity: The consistent repetition of identical absolute timbral values, modules, or sound units within a specific interval of time.

Structuring: The process of organizing or creating a phrase, subsection, section, and form in a musical composition.

Variation: A different version of the same timbral state.

Contribution: Compositional tools to support or create the appearance of shape, phrase, subsection, section, and timbral state in a sound-based composition.

Terms of RELATIONSHIP

Parallelism: The relationship between two parallel lines that each express a particular value and never cross each other. These values are the result of either comparison between the absolute timbral value of two instruments or an absolute timbral value that is derived from the sum of seven contributing elements to the quality of sound (table one).

Deviation: When two lines move away from each other without a parallel relationship. To move away from or not meet a particular number.

Contrast: Two lines that move away or deviate from each other, and do not display a parallel relationship. Two shapes, phrases, subsections, sections, or timbral states that have almost nothing in common.

Similarity: When two timbral states, shapes, phrases, subsections, or sections are alike.

Imitation: The repetition of identical or similar absolute timbral values in different contributing elements of sound, instruments, or modules.

Interrelation or interactivity: The numerically fluctuating relationship between the seven contributing elements of the quality of sound.

Dissonant relationship: The disagreement between different modules or partials.

<u>Terms of QUALITY</u>

Granularity: The level of density.

Density: The dissonant or disagreeing relationship between different layers, modules, and the contributing elements of the quality of sound.

Texture: The consonant or dissonant relationship between different layers, modules, and the contributing elements of the quality of sound. Texture is analogous to density.

Active bars: The appearance of music within a bar or range of bars. Rests are non-active bars.

Saturation: The level of activity that contributes to a musical texture. If the level of activity in different layers, modules, or the contributing elements of the quality of sound is high, the level of saturation is high, and vice versa.

Biographical Sketch:

Arash Majd's music is inspired by timbre, noise, and pitch. He uses timbre as the primary element of form in his works. His latest works employ noise as the main component, and pitch as the secondary component, of timber. His early work has been described by Stephan Smoliar of the San Francisco Examiner as "highly expressive, showing great respect for both traditional forms and contrapuntal techniques, as significant to the serial style as they were to the emergence of sophisticated counterpoint during the Renaissance."

Arash has collaborated with Yarn|wire ENSEMBLE, Lyris Quartet, Ensemble TM+, Winsor Trio, Moscow Contemporary Music Ensemble, Friction Quartet, Elements of Nimbus Ensemble, Tina Guo, Ball State University Saxophone Quartet, Choreographers Batina Essaka & Stefan Poetzsch, and Peter Yates. He was the Alternate Winner of the ASCAP/SCI Commission Composition Competition, in Region VII in 2013. He was also the semi-finalist and finalist for the American Prize in 2013 and 2014, respectively. Arash's principal teachers are David S. Lefkowitz, Ian Krouse, and Richard Danielpour.

Introduction

The Importance of pitch:

For many centuries, pitch has been the most prominent element of musical composition. Pitch makes up harmonies and contributes to timbre and many other elements in music. A well-designed pitch structure creates a listening map for the listener and plays a crucial role in understanding the overall structure of a composition. A clear advantage of using pitch structures is that, in a tonal hierarchical context, good voice-leading creates musical "sentences" or phrases.

Synergy:

We take this powerful phenomenon for granted, but how does good voice-leading create musical sentences? Well-designed phrases have a beginning, a cadence, and typically a focal point (climax). Phrases create meaning and a sense of organization on a small scale, which gradually contributes to a sense of large-scale meaning. This synergy between the small and large scale creates a form that feels logical and natural, and, ultimately, builds a sense of meaning for the listener. Therefore, one can claim that pitch is an essential element in defining a form.

The Suppression of pitch:

Let us imagine, however, a musical context or expression in which pitch is not the most crucial element, no longer contributing to texture, phrase, or form. Would it be possible to convey musical meaning if pitch were the least-prominent element in a composition? What type of structural procedure might contribute to conceiving of a musical composition in which pitch is suppressed?

Replacements for pitch:

What musical elements can replace pitch and also contribute to sonorities, harmonies, and perhaps all of the other elements in a composition? How would its replacement(s) generate musical meaning? How could a composer create even modest-length "forms" under these conditions, not to mention larger-scale forms akin to sonatas and symphonies?

If pitch is not the primary element of form in a musical composition, how would the listener engage in such a post-pitch world? What are the elements that the listener could follow to engage in the musical process and form in a post-pitch composition?

Clarifications:

Of course, one can claim that a composition for percussion family can be considered a pitch-less composition. The percussion family, such as "talking" drums, middle Eastern Dombek, Indian tabla, Western drum set, Irish bodhran, African drums, and non-pitched percussion ensemble, has been involved with pitch-less compositions for thousands of years. However, the point of this dissertation is to explore efficient processes to create a sound-based composition in an all-instrumental family. Furthermore, while rhythm is the undeniable ally of pitch or pitch-less materials, the focus of this dissertation is to discuss timbre as the primary contributor to musical structure and meaning in a sound-based composition.

Post-pitch world:

I propose a world in which pitch, whether it exists or not, is subservient to all of the other musical elements. In this world, color, timbre, or noise, which always accompanies the production of pitch (though not necessarily the other way around), would be more important than pitch. One might see, for example, an E in the score but not “hear” it. This might be because the normal sound associated with E on a given instrument has been subjected to an acoustically altering process, perhaps an extended technique. This would result in the suppression of pitch E to the point where its identity has been replaced by a new one that we would describe by its color or timbre, rather than its pitch. As a result, timbre could be the building block of process and the primary element of form. Let us imagine combinations of timbre replacing combinations of pitch (that is, harmony)!

Variety:

Unlike in the pitch-oriented world, in which each pitch has a specific name and frequency, and often a specific function to perform in a hierarchy of pitches, in the post-pitch world, every note could have one name but multiple characters and colors. Therefore, over the course of a composition, differing meanings are independent from or regardless of a specific frequency. For example, every note on a string instrument can have different colors depending on where the bow is placed. Imagine a sound world that can be created only by the way that each note operates in different characters and colors.

Possibilities:

Such acknowledgment of the gradations of colors gives rise to the possibility of creating or “orchestrating” composite colors of immense subtlety and nuance. It is almost self-evident that pitch must be severely de-emphasized to allow our senses to focus on and appreciate the pure colors of the sounds, emancipated from their subservience to pitch as merely expressive elements.

The Role of composer:

As intriguing as the preceding may appear, it raises the question, can a composer stimulate and capture the interest of an audience in this way? How can a composer create a road map for the listener to follow, so that the listener does not get confused or lost? After all, we are used to music that has, over centuries, accomplished this largely through pitch, harmony, melody, and so on. How will listeners be able to follow and be sensitive to musical structures in our post-pitch world? How will their emotions be stirred?

My "credo":

In the Medieval and Renaissance eras, melodies were simple — "primitive" by modern standards—and musical interest was centered on the elegance and shape of the individual lines, both as stand-alone melodies and as elements in a contrapuntal environment. This is what Profesor Ian Krouse calls a "melo-centric" style.

In the Baroque era, vertical sonorities become much more complex; the approach to dissonance more liberal, and musical structures and development become much more invested in harmonic content and syntax. As this happens, melodic lines lose their independence, lines become hierarchical, and the meaning often becomes wrapped up in the rhythm and harmony.

A further simplification occurs in the early Classical era, where harmony (and rhythm) become dominant, which yielded throughout two or three generations the first great large abstract musical forms ever: the symphonies, sonatas, and concertos of the Viennese era.

Eventually, the Romantic composers, such as Wagner, Brahms, Strauss, and Mahler, reinvigorated music by rediscovering the counterpoint of earlier music, enabling them to create complex, multi-layered, and liberally dissonant textures, often to express extra-musical meanings. Schoenberg and others took these trends to logical extremes and led us into a world of atonality, at times intuitive, and at times systematic. However, what unites all of these eras is that pitch and harmony were the primary elements in creating and sustaining musical meaning.

The value and potential of pitch, as the predominant element of form, texture, sonority, harmony, and phrase, through the past nine or ten centuries, at least in Western music, has been exhausted. Perhaps it is time to turn the tables, and, taking a line from Schoenberg, to emancipate timbre and color! Perhaps it is time to find new ways to express musical ideas. Pitch can be present but will be devalued. I seek to analyze, learn from, and, in turn, compose my own music that stems from this value system.

The Point of view in this dissertation:

This dissertation will explore the possibilities and answers to the questions above. What are the possible solutions to create textures? Are the old “harmonic” forms salvageable, and are there new forms and structures to be discovered that can engage an audience? What will replace cadences in post-pitch composition? Is there any relation between rhythm and texture(s)? How can explorations and experiments with density and saturation of pitch play a role in the suppression of pitch?

The post-pitch world I envision offers a new set of guidelines to engage the audience. It offers new forms that may be the successors to older forms. These explorations might, in time, lead to a new set of micro rules that contribute to the overall organization of the post-pitch world.

Chapter 1: Attempt

In December 2017, I randomly stumbled upon Crama by Panayiotis Kokoras (b. 1974). This work was written for the flute, Clarinet, Piano, Violin, Viola, and Cello. What struck me was Crama's minimal use of pitch; performers had to make sounds instead of playing pitches. In other words, one would see a pitch on the score but hear something totally unrelated to that pitch. Crama is a sound-based composition, in which sound replaces pitch as a functional unit. As a result, there is no melody, harmony, or voice-leading in a traditional sense. Instead, timbre is the primary element of formal design in Crama. I found Crama very intriguing and decided to study the form of the piece.

First Attempt:

My first attempt was to map Crama[2] to sonata form, just as a starting point. Since this piece is a sound-based composition and pitch does not function in a traditional sense, I decided to relate the characteristics of each section of Crama to sections and subsections of the sonata form.

Bar 1-6 could be an introduction because there is a sense of space and there are introductory characteristics in the first 6 bars. In search of an exposition section, one needs to have a primary tonal group and secondary tonal group. Since Crama is a pitch-less composition, I decided to look for two contrasting themes, such as "masculine" and "feminine." Bars 7 – 20 was labeled masculine. There were two main problems with this section: 1) the motivic idea in the clarinet, bar 5, from the introduction, reappears in this section; 2) the motivic cell in the violin appears in

[2] Since the full score and recording of Crama is available at https://www.youtube.com/watch?v=h3toKwPr93I, I did not insert scores as part of this analysis.

bar 18 as part of a masculine theme. These two discoveries provided me evidence that Crama might not fall into the sonata form category.

I decided to continue and seek evidence that might link the form of Crama to sonata form. Bars 21 – 38 was labeled as a transition, but this section was too long to be a transition in an early classical sense of sonata form. Also, this section could not be labeled feminine because it did not sound thematic or provide any contrast with bars 7 – 20. Furthermore, the motivic idea in the clarinet in bar 5 returns in bar 33 as part of the "transition section." These three reasons were enough to show that bars 21 – 38 is not a transition.

At this point, though there were several pieces of evidence to suggest that Crama is not in sonata form, I decided to look further for more conclusive evidence. Bars 39 – 45 was labeled a feminine section. This section should offer a contrast with bars 7 – 20, but this was not the case. Instead, the sections had two main factors in common: 1) the rhythmic motion was a common characteristic of both sections; 2) the motivic idea in the cello, bar 7, from the masculine section reappears in bar 30 and develops in the viola. The same motive appears in cello and develops as well. To have exposition, one needs a masculine and feminine section, and since these two sections are missing, there is no exposition. Hence, Crama is not in the sonata form.

Second Attempt:

Since I found in Crama that there is a sense of continuity, transformation, and linkage between sections, I thought it might be possible to relate the form in this piece to developing variations. Although Brahms used it in many of his compositions, such as violoncello sonata op.99, he never explained how this technique functions in his compositions. It was Arnold Schoenberg who specifically mentioned the idea of developing variations in his essays.

In his 1950 essay "Bach" Schoenberg defined developing variations as "Music of the homophonic-melodic style of composition, that is, music with the main theme, accompanied by and based on harmony, produces its material by, as I call it, *developing variation.*"[3] This means that variations of the features of a basic unit produce all the thematic formulations which formulate and provide fluency, contrast, variety, logic, unity, character, mood, expression, and every needed differentiation, thus elaborating the idea of the piece. In another essay, "Criteria for the Evaluation of Music," Schoenberg mentions "repeated phrases, motives, and other structural ingredients of themes only in varied forms, if possible in the form of . . . *developing variations*" (p.209).

Let us apply the concept of developing variations to Crama and see what results. Does this piece fall under the developing variations category?

My first attempt was to find a sense of variation in the timbre of each instrument as an individual unit through each section. There are many reoccurences and varieties of the motivic ideas in Carma. While some instruments, like piano, show a subtle transformation of timbres, other instruments, like clarinet, transform into new timbres more quickly and obviously. For example, the "flop sound"[4] motive in the clarinet returns many times with exact rhythm but different pitch.

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[3] Arnold Schoenberg, *Bach*, 1950.

[4] "Flop sound: Play staccato every other note whilst you produce a double like slap tongue. It is not expected to be produced as a standard slap tongue sound. The diamond notehead indicates that the tone should not be clear and

The difference in pitch is not audible. On the other hand, the timbre transformation of the "flop sound," bars 21 – 26, is audible and apparent. The appearance of timbre transition in individual instruments is evident at almost all times. For example, the viola in bar 26 – 32 performs the short and sharp movement on the bow that becomes high-pitch pizzicato in bar 31. These two types of sound production are similar in color as well as in timbral variations.

The sense of transition between different timbres in individual instruments contributes to the holistic character of each section as a sound block. Sometimes transformation occurs via timbre dovetailing between the different instruments and eventually the sections. Crama can be heard as a series of metamorphoses. For example, the slow bow sound, bar 59, in viola dovetails, in terms of timbre, with piano performing a harp bridge sound. Also, there is a rhythmic and timbre dovetailing between the flute and piano in bar 62. Sometimes, two instruments are doubling the same timbre at the same time. For example, there is a timbre-like unison between harp bridge, piano, and angled bowing sound, cello, in bars 64 – 67.

The sense of transition between timbres, which happens via a series of variations in sound can be the reminiscence of the specifics in developing variation form. After all, *"composition begins with the 'gift' of a musical idea, which grows and expands of its own accord. Then, in a separate and fully conscious process, the composer draws all the implications and possibilities from the initial idea."*[5] Though Crama is a pitch-less composition, according to the examples discussed earlier, it employs the concept of developing variations to each individual or combination of

some high partials should appear along with the fundamental. Moreover, a glissando upward or downward movement should be produced where indicated." From page 2 of the preface in Crama.

[5] Walter Frisch, *Brahms and The Principle of Developing Variation,* University California Press, Berkeley and Los Angeles, California, 1984, 33.

instruments. The developing variation results in a series of transformations starting at the individual instrument level and, in turn, affecting the entire texture.

I believe that the concept of developing variation does not require a melody and variations of that melody via different intervals and rhythmic manipulation. The concept of developing variation can be applied to any substance or event. Therefore, even though there is no melody or intervals in Crama, the concept of developing variations contributes to the idea of continuity of sound in the piece. According to the examples above, the concept of developing variations applies to Crama. Thus, the form of Crama is built out of the developing variations.

Third Attempt:

In another attempt, I decided to take an analytical approach to discover the form of Crama via motivic ideas. In this approach, I noticed that Crama consists of a series of motivic blocks. These motivic blocks are exchanged between different instruments, which creates a correlation between the different combinations of instruments. For example, the motive in the clarinet in bar 5, the "flop sound," appears in the the flute and the piano as a closing motive in bar 31. Another example is the "duck sound"[6] motive, bar 7 in the cello, which reappears in bar 14 as col legno battuto in the violin and recombines with other motives in other instruments. The same percussive the "duck sound" motive, bar 5 in cello, reappears in the flute in bar 18 as "breathy

[6] "Duck bowing sound: Place the bow hairs flat against the string, pressing down into the string. Make short and very sharp movements of the bow close to the frog point. Two L.H. fingers should touch the string lightly on the indicated note. By touching the string with two fingers (slightly angled), most of the harmonic content of the sound is muffled. The sound produced is noisy with a blurred sense of pitch content. [b.7]." From page 5 of the preface in Crama.

sound,"[7] and "tap sound."[8] The form of Crama might be interpreted as a wall that consists of smaller walls that transform one other via a series of color-coded bricks. Analyzing Crama by considering motivic blocks could produce new results that might compare to developing variations.

As one can see, there are many instances in Crama in which a motivic block, such as "flop sound" in clarinet, is repeated. This means repetition is one of the ingredients that contribute to the overall form in this piece. Motivic blocks create a modular character in all sections in Crama. In other words, this piece employs different combinations of modules to generate different sections. In this type of procedure, if modules ABC are placed on top of one another and repeat in different orders, they can create ABC, BAC, and CAB, but also AABAC, BBACC, and CCCAABBB. Therefore, the lengths of phrases are unpredictable, and, as a result, variable length of phrase and section is another distinguishing characteristic of block form.

A closer look at Crama shows the unpredictability of length in different sections and the asymmetrical relationship between these sections. For example, rehearsals A, B, C, and D consist of 16 bars, whereas rehearsal E, which uses almost the same modules as the above rehearsals, has roughly 13 bars. The asymmetrical relationship between different sections that employ the same motivic blocks are further evidence that Crama is in block form. Since Crama is a sound-

[7] "BREATHY SOUNDS: The square noteheads indicate the production of a rich sound mixture of tone and air together regardless of pitch range and dynamic. Direct the air flow in different angles and lip tensions to the embouchure in order to produce expressive variations of this type of sound. Blowing above and below the edges of the hole produces a rich mixture of sound and noise with which varied harmonics can be produced. The accurate and stable pitch intonation is not desired. [b.1]" From page 1 of the preface in Crama.

[8] "TAP SOUNDS: The crossed noteheads indicate the production of a percussive sound by tapping the written key. The square notehead indicates a Breathy sound that should be holding down continuously (example left, note F). The finger at the crossed notehead (G key at the example) should just create the tap sound of the key while the F note continuous, which might interrupt instantly the air flow of F note. [b.2]" From page 1 of the preface in Crama.

based composition that employs motivic blocks to form sections and continuity of sound, discovering the form of Crama via motivic blocks might be an appropriate choice. Note: the majority of the time, the modules occur on the strong beats.

Through trial and error, the form of Crama was discovered to be that of developing variations. The repetition of the motivic blocks and their transformation are the principal aspects behind the shaping each section. Also, since it seems repetition and transformation contribute to the piece's forward motion, it follows that repetition contributes to the growth, transformation, and form in Crama.

The motivic blocks are the main components generating the form in Crama. What distinguishes one motivic block from another or links them to one another, however, are the sounds and sound qualities. Therefore, the form of Crama is based upon the sounds and sound qualities. As Edgar Varese mentions, *"Form and content are one. If there is no form, there is no content, and if there is no content, there is only a rearrangement of musical patterns, but no form."*[9] Varese suggests an idea about development that might involve variations of a musical idea. As part of this process, variation can lead an idea, color, sound palate, and rhythm, to a new idea that has the essence of the old idea but has transformed to a new idea, color, sound palate, and rhythm. This process is referred to as "transformational variation,"[10] by Panayiotis Kokoras.

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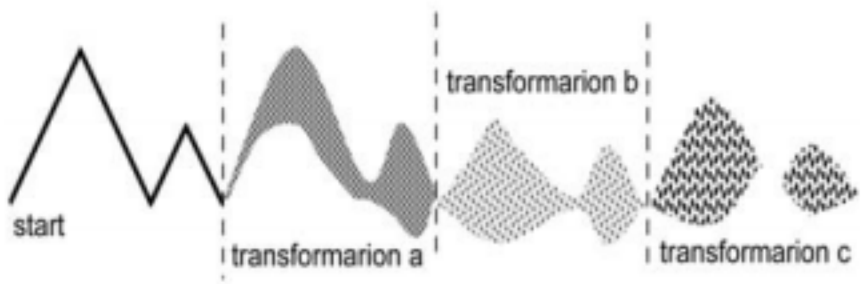
[9] Edgar Varese, "The liberation of sound," *Perspectives on New Instruments and New Music,* 1936.

[10] Panayiotis Kokoras, *Morphopoiesis: An Analytical Model for Electronic Music*, 2005.
Morphopoiesis is a mindset which contributes to the creation of form. A musical composition must display four steps in order to achieve Morphopoiesis. Thease stages are prioritized in asending order. In other words, the 4th stage has priority over the other stages.

As mentioned above, in my second attempt, developing variations is one of the concepts behind the structural procedure in Crama. I suggested that each motive or timbre transitioned to another. Therefore, transition and transformation begins with a single or combination of instruments and transforms in the flux of time. This can lead to the gradual change of the entire section.

Furthermore, the composer proposed a new concept in terms of structural process. Since Crama is a sound-based composition and timbre appears to be an essential form-bearing dimension, structuring form in this piece must be different from structuring form in a pitch-based composition. Whereas earlier music employed pitch-based structures or structural processes, timbre-based music must use timbral structures or structural processes, such as transformational variations.



"Figure 1. the stages separated by dotted lines are not intended to represent a 'natural' musical flow but rather to show an example of some further steps in the process."[11]

"Figure 1 represents graphically the structural procedures by giving a simple example in three stages. The starting point represented by the black thick line is transformed to an even thicker texture in 'transformation a', although it keeps most of the melodic profile [Chion 1983] of the starting point. In the next stage, the spectral elements and the mass profile [Chion 1983] of the sound change more and the overall shape goes a step further away from the

[11] Panayiotis Kokoras, *Morphopoiesis: An Analytical Model for Electronic Music*, 2005.

previous stage. Finally, in 'transformation c', the two parts of the initial idea are separated by silence and the whole morphology and spectral components of the two sounds now become even more different from the previous stages."[12]

In the evolution of the above structural processes, Kokoras has added a concept of *transformational variations* as one of the stages for the evolution of the structural process. Transformational variations might be considered an extension of developmental variations. As the names implies, it refers to a series of transformations. These transformations might be binary transformation; AB, in which the idea A undergoes a process and transforms to idea B; ternary transformation, ABA; arc transformation, ABCBA; or perhaps another type of transformation such as transitional chain. *"As a result of this process, for a binary A to B transformation extra steps can be added in between the start point and the end point to create a transitional chain."*[13] These transformations can be accelerated or decelerated according to the textual evolution and density of music.

Based on my observations in Crama, every section transforms into a new section via different types of transformational variations. This is due to the fact that every single instrument transforms as a single unit, which results in the holistic transformation of the entire section to a new one. "*The sound units themselves can undergo a general sound process which characterizes the whole transformation."*[14] However, these transformations might occur between multiple sound units that transform, synchronized, or unsynchronized with other sound units, with similar timbres or un-similar timbre. This contributes to the unpredictable and natural quality of holistic

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[12] Panayiotis Kokoras, *Morphopoiesis: An Analytical Model for Electronic Music*, 2005.
[13] *Ibid*.
[14] *Ibid*.

transformation from one section to next. This can be understood as one of the common practices in the transformational variations stage of "morphopoiesis."[15]

According to Kokoras, there are four stages of morphopoiesis. The first stage, as indicated above, is transformational variation. As an example, a single-unit sound-block level of transformational variations could be bar 46, the "flop sound,"[16] in clarinet, which switches to multiphonic trill, bar 55, then to natural multiphonic tremolo, bar 57. The fact that within 12 bars, there are three techniques that share almost the same rhythm and have similar colors creates a small sense of transition between colors in clarinet, which contributes to the holistic transformation of rehearsal I to J to K. Another example, a multiple-unit sound-block level of the transformational variations can be bar 88, clarinet, that transforms from "natural multiphonic sound,"[17] to ordinario, bar 89, and transforms back to natural multiphonic sound in bar 90. In contrast, piano switches from ordinario in bar 89, to harp bridge, bar 90, which shows unsynchronized transformation timbres in a multiple-unit sound level.

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[15] The etymology of the word is simple: Morphopoiesis is a composite word consisting of the prefix morpho- which means structure, shape, form (from the Greek *Morphe*), and the suffix -poiesis which means creation, formation, production (from the Greek poiesis, which is formed from the verb *poiein* "to make") [Microsoft Encarta 2003].

[16] "Flop Sound: The production of this sound is characterized by a fast movement of the tongue outwards that stops the airflow while wedges to the lips. At the example right, the Flop sound is combined with tap sound and followed by legato breathy sounds.
The tap sound is the sound of the keys, in order to produce the tap sound at every x notehead you should release and hit down the key. The same time the key is down you should produce the flop sound. This is produced by a fast movement of the tongue outwards that stops the airflow while wedges to the lips. Blow continuously air with the lips shaped like you pronounce 'oo', the tongue stops for a moment the air flow and then gets back again. This procedure is repeated four times per quarter. A rather blurry and energetic sound amalgam will be produced with certain timbral characteristics. [b.71]" From page 2 of the preface in Crama.

[17] "Natural Multiphonic Sound: First-Type harmonics. Play the harmonics of the fundamental as blocks. The sound is produced by greater pressure of the lips. This type of multiphonic is more effective and rich in tones in the lowest register of the instrument. It can also be effective when it is combined with trills." From page 3 of the preface in Crama.

All of the examples above create content and form as a result of transformation. As Edgar Varèse states, “form and content are one.”[18] In other words, there has to be a relationship between content and form. This relationship can be created via the transitional variation which contributes to the structural process. Transformations naturally avoids creating rearrangements of the same musical idea. These transformations generate phrases, sections, and eventually form.

The second level of morphopoeisis suggests the organization of sounds units and the relationship between them in terms of note attack. In other words, in this step, almost all the sounds in the transformation usually fall into the same category, in terms of the attack of the note. Pierre Schaeffer’s “In search of concrete music,” suggests the organization of sound based on the attack of each sound type:

A) “Plectrum-or *plucked*- attack, in which a string was displaced from its initial position, then abruptly released. This is the steepest attack that can be found: the sound comes in immediately at its maximum level.
B) *Percussive attack* (piano): here a hammer hits a string, which vibrates after the time taken for the impulse to spread along the whole string. This attack is less violent that the preceding one, and it is also different from it mainly because the timbre produced is modified.
C) Aeolian attack (reed or violin bow), in which a string is made to vibrate very gradually, without any sort of discontinuity, for example by blowing a current of air across telegraph wire, or gradually making a violin string vibrate with rosined bow.

[18] Edgar Varese, “The liberation of sound,” *Perspectives on New Music New Instruments and New Music,* 1936.

> This is the same type of attack, even more gradual, as is made by the reeds of the woodwind instrument (organ, harmonium)."[19]

In order to analyze Crama, a sound-based composition, perhaps there are other categories or sub-categories that can be added to Schaeffer's note attack categorization. I propose to add scratch tone as a subcategory of the aeolian category. Scratch tone is a result of an immediate and extreme bow pressure of an attack that can be sustained or not sustained. This extreme pressure results in a distorted noise that can be understood as scratch tone. The sustain might be agitated, as in the 64th, 32nd, and 16th notes in bars 152 – 160 in violin and viola, or might be sustained, as in bar 160 in the viola.

Forward Motion:

The third level of morphopoiesis refers to motion which is conceived via transitional variations. As mentioned earlier, in my third attempt, Crama is a motivic-block-driven composition, which consists of modules that create forward motion. According to Kokoras, motion in these transitional variations can be defined in six different categories: *"bi-directional, uni-directional, linear, curved linear, reciprocal/cyclic) proposed by Smalley is a comprehensive guide that characterizes both small units and whole phrases or sections."*[20] In this level of morphopoiesis, the main concern should not be the textural construction of sound, because if this is the case there would not be a sense of forward motion. Instead, forward motion should be the result of

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[19] Pierre Schaeffer, *In search of Concrete Music* (A la recherche d'une musique concrete), 202.
[20] Panayiotis Kokoras, *Morphopoiesis: An Analytical Model for Electronic Music*, 2005, referencing Denis Smalley, "Defining Timbre – Refining Timbre." *Contemporary Music Review,* 1994, Vol. 10, part 2,"(Hardwood Academic Publishers), 35–48.

gestures and postures. Kokoras explains, *"All degrees of combinations between texture and gesture can appear within a single composition."*[21]

Finally, the last—and the most important—level of morphopoiesis correlates to the perception of a sound-based composition by the brain. This level refers to cognition and interpretation of sound units, their relationship with one another, and their perception by the listener. In other words, it refers to the listener's engagement with the form, interpretation of the sound-based composition, and the perception of form, if any, as a large-scale work. Kokoras notes this level is *"to understand the balance between units, or to connect the primary with the secondary part of the music."*[22] This means that morphopoiesis is not fully completed if the listener cannot engage.

This final level creates a very important relationship between music and the listener.
It defines the composer as the creator of form in a sound-based composition.
Therefore, compositions which employ structural-process techniques, total serialism or aleatoric, but are not able to engage the listener through their content have not satisfied all levels of morphopoiesis. As Kokoras confirms, *"it is necessary if a listener is to become aware of the new content while distrusting preconceived ideas and relying first and foremost upon what is heard."*[23]

Conclusion:

The form of Crama was discovered through the attempts I describe in this chapter. I discovered that the structural process in a composition, in which sound is the main form-bearing element,

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[21] Panayiotis Kokoras, *Morphopoiesis: An Analytical Model for Electronic Music*, 2005.
[22] *Ibid*.
[23] *Ibid*.

must create a functional relationship between content and form. In other words, content should construct the form in a sound-based composition but not the other way around. I also determined that the content can be constructed via morphopoiesis approach. Therefore, morphopoiesis is an analytical tool which can be employed for the construction of the content. Furthermore, morphopoiesis creates intrinsic relationships among the sound units, which should result in an extrinsic connection with the listener and, as a result, the listener's involvement with the form of the sound-based composition on a perception and cognition level. Put another way, morphopoiesis creates a symbiotic and functional relationship between the sound units within a composition, as well as connecting the listener with the sound-based composition.

Chapter 2: Preparation for Case Study

Definition of timbre:

Timbre can be defined as the quality of sound. There are various factors which contribute to the quality of sound. The contribution of different acoustical properties which can define the quality of sound in a particular instrument. The acoustical property of each instrument can be modified according, but not limited, to many factors, as follow:

1) The number of harmonic partials: Usually, regular sound waves contribute to the overall acoustical property of a note, whereas irregular sound waves mostly contribute to generating noise. Therefore, a vast number of partials with regular sound waves results in a rich sound spectrum. Pierre Schaeffer refers to this kind of sound as 'rich sound,' "for a sound that has a significant number of harmonics with significant amplitude."[24] In contrast, a smaller number of regular sound waves or a vast number of partials with irregular sound waves contribute to forming noise or a sound which contains a large portion of noise. Pierre Schaeffer refers to this kind of sound as 'poor sound,' "for a sound made up of only one or a very small number of components of significant amplitude."[25]

2) Thinness or thickness of sound: There is always a direct relationship between register and thinness or thickness of sound. Sounds in the lower register are thicker, whereas sounds in the upper register are thinner. The thick sound is the resultant of sinewaves in the lower register, which fluctuate slower. On the other hand, sinewaves with fast fluctuations form thin sounds in

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[24] Pierre Schaeffer, *In search of Concrete Music* (A la recherche d'une musique concrete), 209.
[25] *Ibid*., 208.

the upper register. Furthermore, thinness or thickness of sound can be the resultant of the dissonant relationship between a package of partials which are focused on the lower register or upper register.

3) Range of the strongest partials: The placement of the regular or irregular sound waves in the higher portion of the sound spectrum, which results in high pitch or noise, or their contribution to the lower part of the spectrum, which contributes to lower and richer pitch or noise.

4) Irregularity of sound: Since pitch ceases to be important in Crama, the inharmonicity of sound is substituted by the *irregularity of* (or: *disturbances to*) sound. Such disturbances or irregularities may refer to the deviation of partials from the original (pure) integers—as is the standard definition of "inharmonicity"—but may also refer to the presence of partials from multiple overtone series that result in beating. (Some might describe such beating as "noise," although it is not technically noise.) Such techniques as multiphonics may result in a high degree of irregularity of sound.

5) Amount of noise: The amount of noise as part of the pitch. This proportionality varies from one instrument to another. For example, the proportion of noise to sound in the flute is much higher than in a clarinet. This is due to the difference in the mechanics of sound production in the flute, as well as the different relationship between fundamental and partials in the flute than in the clarinet.

6) Sharpness of attack: The amount and manner of force employed to produce a pitch. For example, whether the attack is soft, aggressive, or harsh.

7) Noisiness of attack: The amount of energy to produce a pitch in different instruments, and the mechanics of sound production in various instruments. For example, the mechanics of a string instrument's sound production is based upon the repetition of pull and release: the string is pulled by the bow and snaps back. Therefore, sharp attacks create more noise and less pitch. An example of a noisy attack is reh.13, in strings, in Igor Stravinsky's (1882-1971) Rite of Spring. The repeated down-bow motion of the bow, pull, and a very sharp attack will result in a proportionally high-noised and less-pitched attack.

Case study:

The primary purpose of this case study is to discover essential tools which contribute to the creation and organization of form in a sound-based composition. In my case study, I ask the following questions: Do timbres contribute to the creation of the form? Does timbre function as the primary element of form? Which compositional ingredients contribute to the form in a sound-based composition? Were timbres chosen randomly or not?

Why I decided to use numerical values:

My analytic approach is as follows: for each measure of music, the seven different parameters of timbre for each individual instrument were determined "by ear" (upon close and careful listening). Those numeric values were tallied within a seven-place "timbral vector."[26] For

[26] "I am indebted to Lefkowitz, Chapter 13, for this analytic approach."

example, the flute in m.1, breathy sound, is represented by the following numerical values for each contributing element of sound: Number of harmonic partials =1, thinness and thickness of sound = 3, Range of strongest partials = 3, irregularity of sound = 6, Amount of noise = 9, Sharpness of attack = 2, Noisiness of attack = 2. Collecting those numbers within their respective timbral vectors makes direct comparisons between different sounds (whether in the same instrument or in different instruments) possible. The comparison of the numeric values of individual parameters should be quite obvious — such as the number of harmonic partials in one sound vs. another. But it is also possible to compare the totality of one sound with the totality of another. The reason for this is that each of the parameters, ranked on a scale from 1 to 9, represents increasing "*saturation,"*[27] of the relevant parameter**.**As detailed in Chapter 10, the totality — the total timbral saturation — of each sound is determined by adding all of the numbers in the timbral vector**.** Therefore, the total timbre value of the breathy sound in the flute in bar one of Crama is twenty-six. Furthermore, if the timbre value of the second bar of the flute is determined, then the absolute value difference between these two bars and, as a result, the progression of timbre can be identified. This sum is termed the "absolute value,"[28] of the sound. Different aspects of the timbral vectors are used to analyze the sounds in different ways, including line charts that can provide the reader clear visual progression of elements contributing to the timbre, as detailed in subsequent chapters 3 – 9.

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[27] "With the exception of the range of the strongest partials. As this exceptional parameter is the only one not measuring saturation, it was determined that including it in the totality of the sound would not have an adverse effect on the measure of the totality of sound."

[28] "It is arguably the case that measuring the *magnitude* of the timbral vector (determined by the formula <square root of the sum of the squares>) is a more accurate measure of the total saturation of a timbral vector, but as this magnitude is, perhaps, somewhat less intuitive (and since it does not typically result in integer numbers), the less accurate but easy-to-understand <sum of the values in the timbral vector> formula is used instead."

How the value of each sound was calculated:

Granting the premise that the seven elements listed above define the quality of sound, I assign a numerical value, 1 – 9, to each element of sound, table 3. In this way, the total of the absolute value of each timbre can be expressed numerically in each bar. For example, the flute in m.1, breathy sound, is represented in the following numerical values for each contributing element of sound: Number of harmonic partials =1, thinness and thickness of sound = 3, Range of strongest partials = 3, irregularity of sound = 6, Amount of noise = 9, Sharpness of attack = 2, Noisiness of attack = 2. Therefore, the total timbre value of the breathy sound in the flute in bar one of Crama is twenty-six. Furthermore, if the timbre value of the second bar of the flute is determined, then the absolute value difference between these two bars and, as a result, the progression of timbre can be identified.

As part of the process, the numerical value of bar 1 was compared itself then to bars 2, 3, 4…170, then bar 2 to 1 then to itself, then to bars3, 4, 5…170, up until bar 169 was compared to bar 170. This same process was applied to the clarinet, violin, piano, and eventually all thirty-six instruments. This process created a massive database, which enabled me to generate line charts to find information related to the contribution of timbre in creating form. The resulting information led me to discover occurrence, recurrence, relationships, and return, of each value, and then relate their function to the elements which contribute to the creation of form. In this way, one can observe bar to bar progression of timbre and discover the importance and contribution of timbre to form in Crama.

Table.1 shows seven different contributing elements to the quality of sound.

	Seven contributing elements to timbre or the quality of sound.
1.	Number of partials = **P#** (1 = fewer, 9 = more)
2.	Thinness or thickness of sound = **Th/Tk** (1 = thin, 9 = rich)
3.	Range of strongest partials = **PR** (1 = low, 9 = high) or, better: (1 = bottom, 9 = top)
4.	Irregularity of sound = **I** (1 = regular, 9 = irregular)
5.	Amount of noise = **N** (1 = clean, pure, 9 = noisy)
6.	Sharpness of attack = **AS** (1 = gentle, 9 = sharp)
7.	Noisiness of attack = **AN** (1 = non-noisy attack, 9 = noisy attack)

Disclaimers:

1) The rating of "1" for the first parameter does *not* mean that there is *one* harmonic partial, but that there are *few* harmonic partials. Similarly, a rating of "9" does *not* mean that there are *nine* harmonic partials, but that there are *many* harmonic partials. This rating system is applied to all seven aspects of the contributing elements to sound.

2) This paper is not about orchestration, instrumentation, or timbre. It is about discovering practical techniques, structural procedures, and mindset to create form from timbre.

3) Since the full score and recording of Crama is available on https://www.youtube.com/watch?v=h3toKwPr93I, I did not insert scores as part of the analysis.

4) The contributing elements to the quality of sound were chosen randomly for each instrument to achieve different results, in the course of the case study. For example, the irregularity of sound is not part of the case study in flute, whereas it is part of the case study in clarinet.

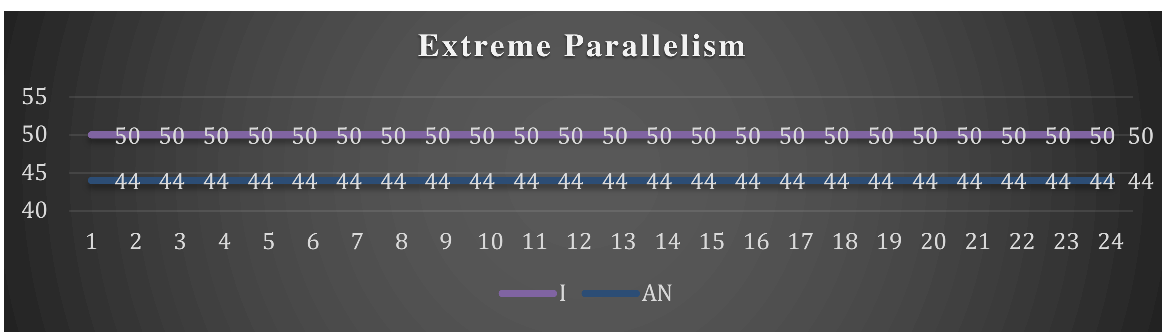
5) The main database to all of the line charts in this dissertation will be available on my website by the end of 2020.

6) This dissertation includes a work for guitar quartet titled Metamorphosis on a Holophonic Texture, which uses timbre as the primary element of form.

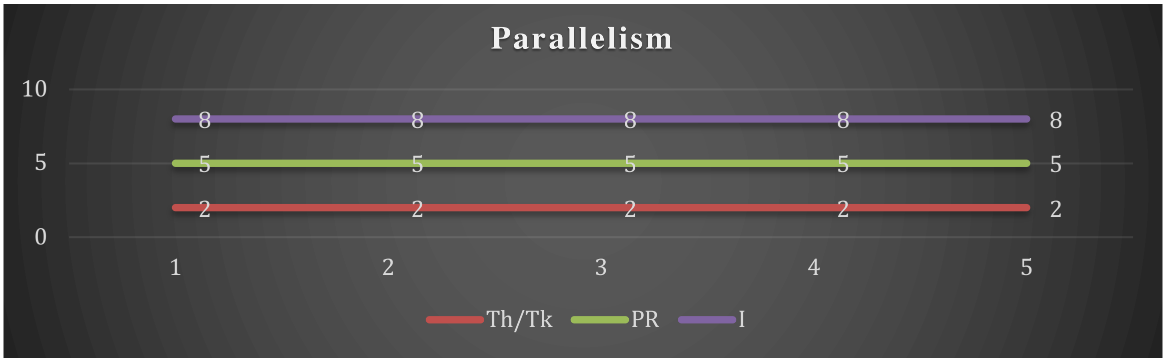
Different motions:

Below are examples of different types of motion that will be discussed in the case study.

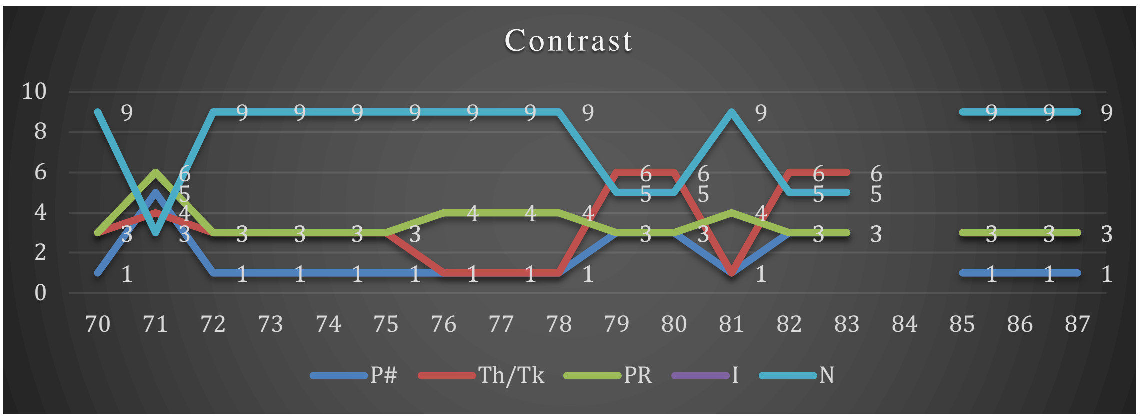
Extreme parallelism: Stagnant motion for significant number of measures.



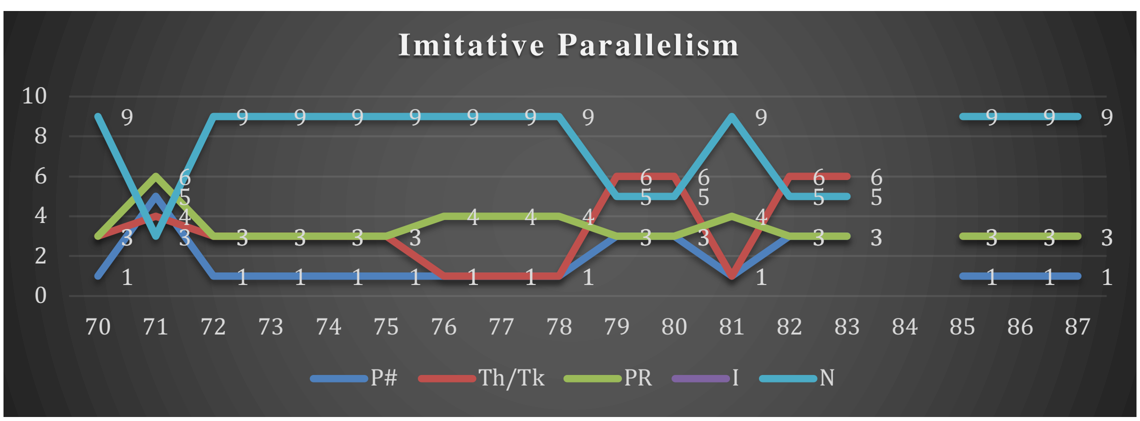
Parallelism: Stagnant motion for 4 bars or more.



Contrast: Opposite motion between different series. The motion between irregularity of sound category and the amount of noise category, bars 79 – 81.



Imitative parallelism: The timbral values move in parallel upward or downward motion without coinciding with one another, number of partials, and range of partials in bars 70 – 72.



The Structure of analysis:

In order to analyze the function of timbre and the process of its contribution to the form, I divided Crama into smaller sections. These uneven sections were chosen based on the progression, evolution, and transformation of motif and timbre, and how they contributed to the form in Crama.

Chapter 3: Anatomy of Timbre

In this chapter, I make six comparisons between different combinations, such as the number of partials, thinness or thickness of sound, range of strongest partials, amount of noise, sharpness of attack, and noisiness of attack, to discover the outcomes. Notice, irregularity of sound is not included.

The progression of number of partials in the flute:

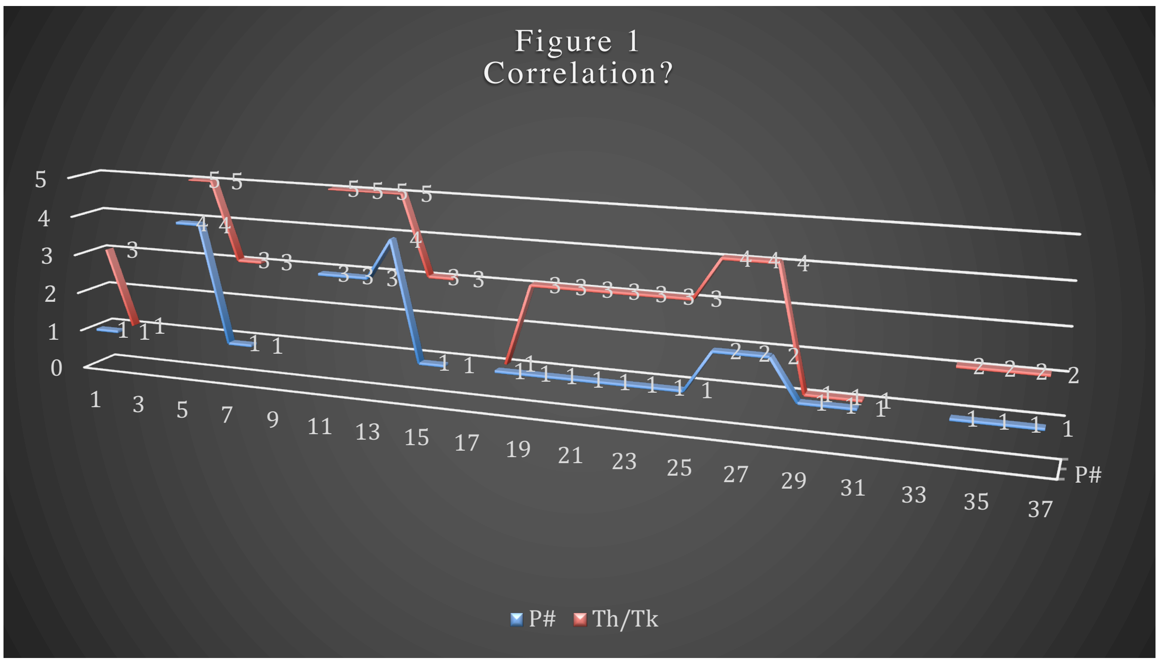


Figure 1 demonstrates the progression of the number of harmonic partials, blue, as well as the thinness or thickness of sound, red, from bar 1 – 37. There is a strong sense of imitation between these two contributing elements of sound. The imitation between these two elements suggests a sense of correlation, which leads to a strong sense of parallelism between the number of harmonic partials and thinness and thickness of sound. The parallelism creates a consonant, agreeable, relation between the above elements and suggests a sense of correlation to the quality of timbre in Figure 1. The agreeable relationship between the number of partials and thinness and thickness of sound contributes to the creation of phrase and supports the relationship between timbre and form.

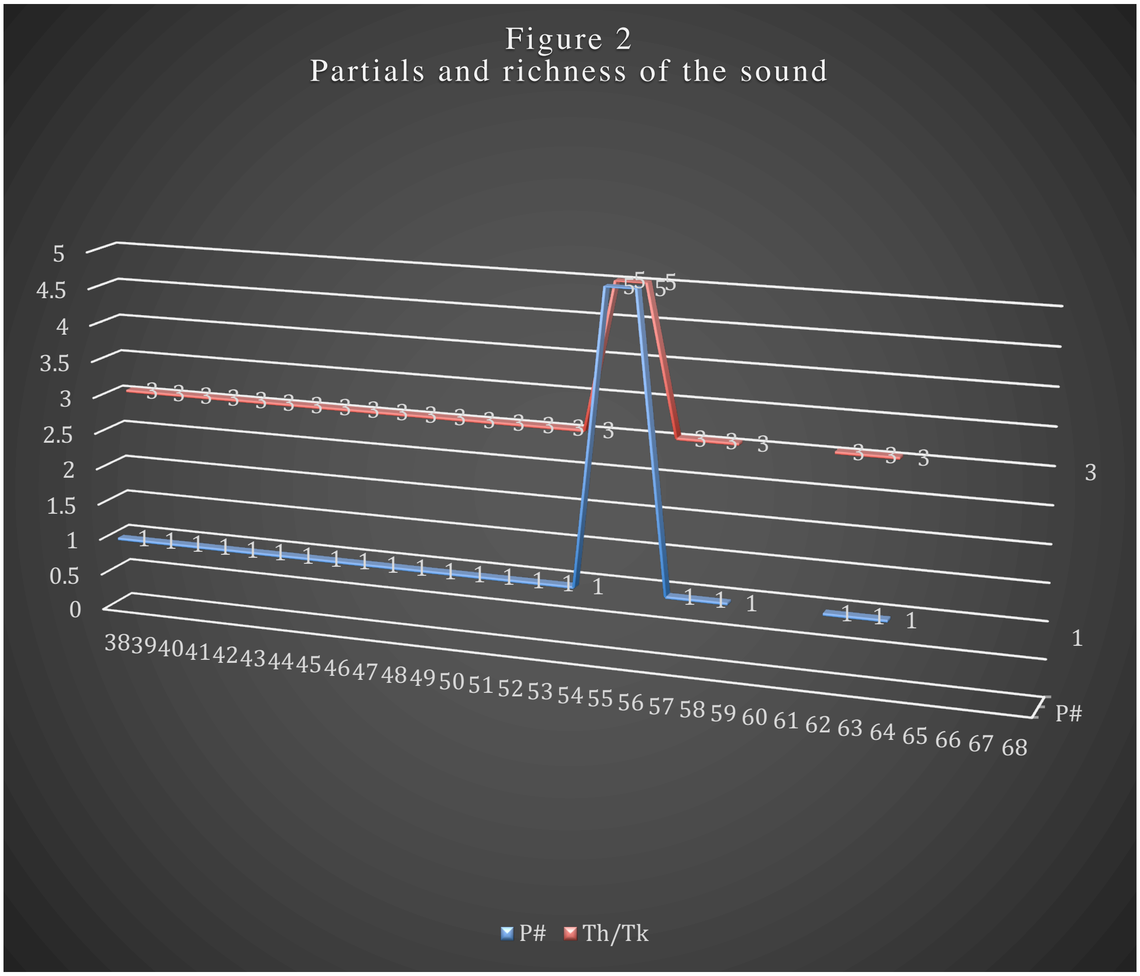
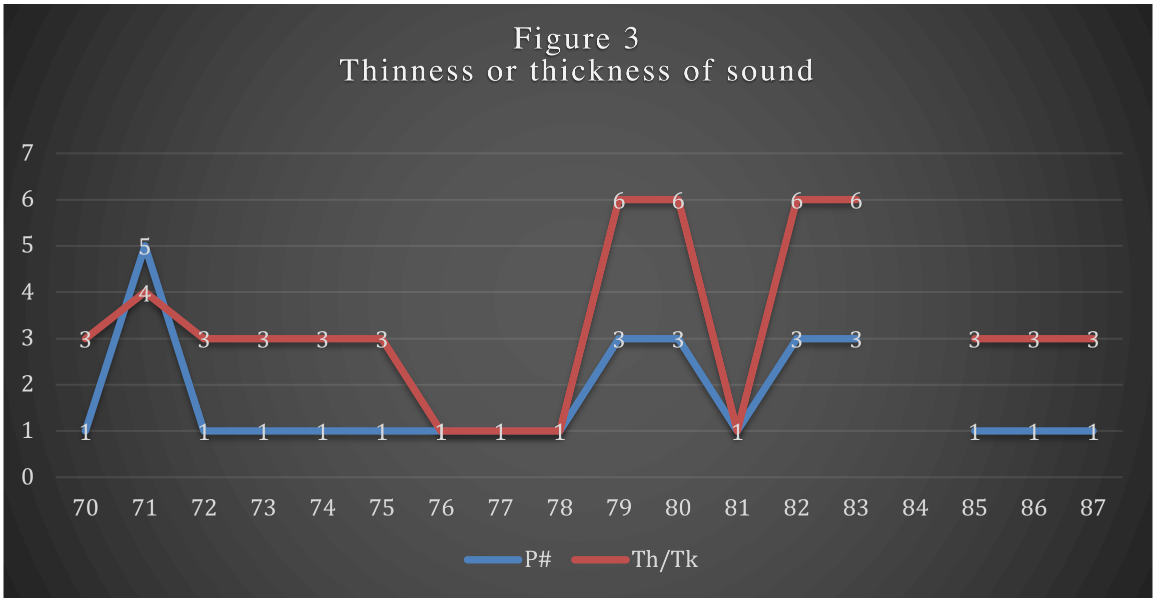


Figure 2 shows the continuation of the correlation between the number of partials and the thinness or thickness of sound in the flute in bar 38 – 69. There direct relationship between these two elements of sounds in Crama. In other words, when the number of harmonic partials increases, the thinness or thickness of sound increases as well.



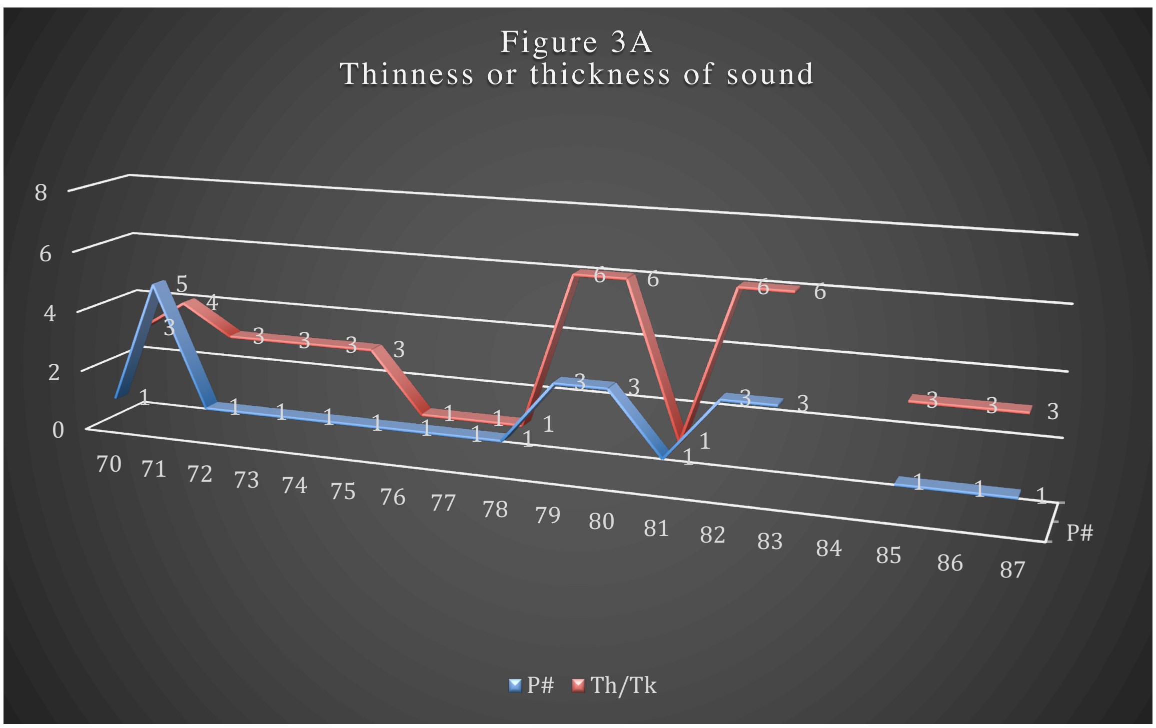
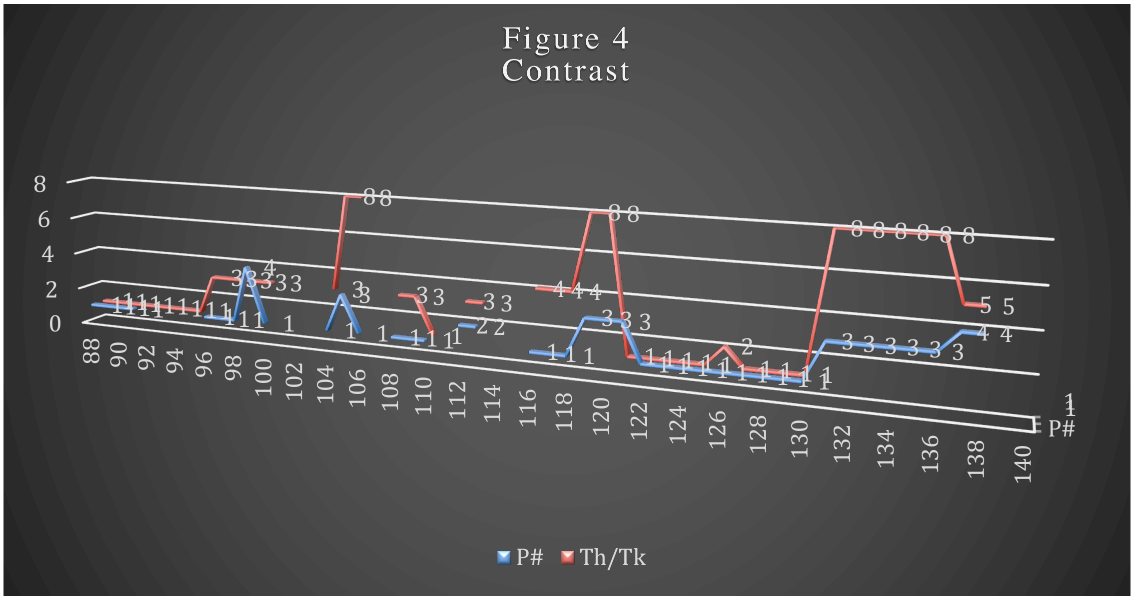
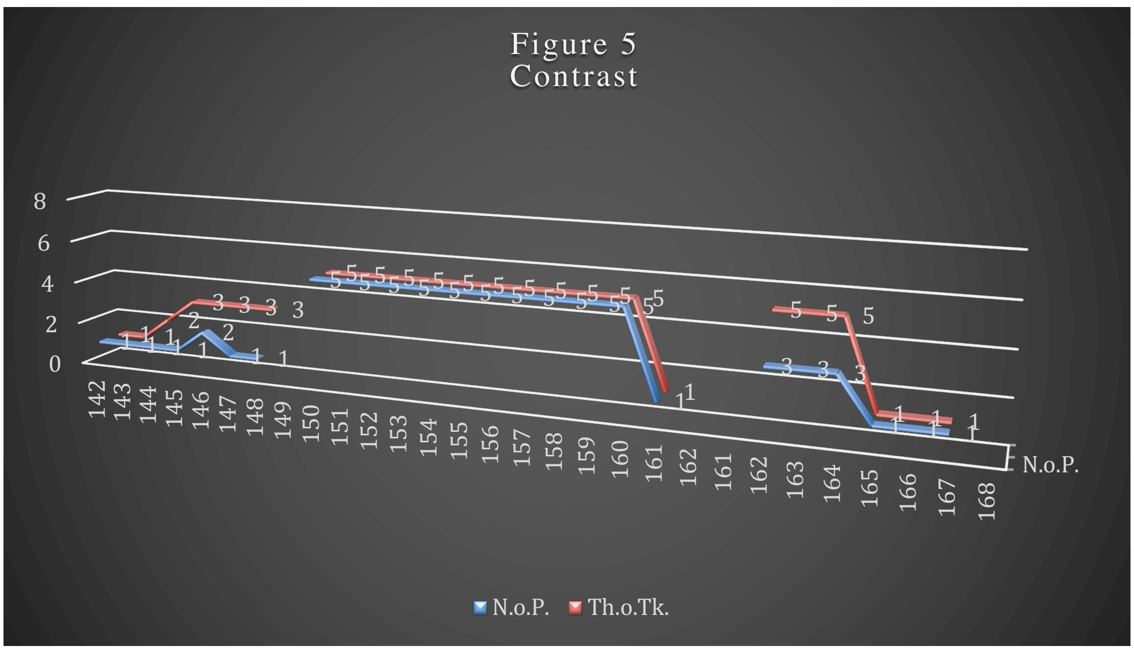
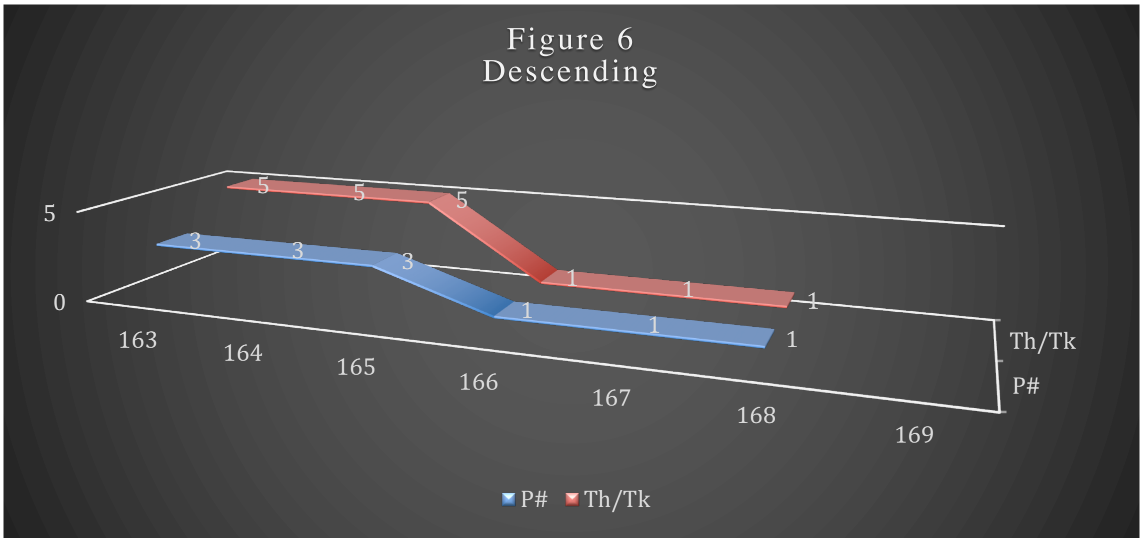


Figure 3 suggests a continued of correlation between the number of patrials and the thinness or thickness of sound in bars 70 – 87 in Crama. This sense of correlation between the two elements of sound has been consistent from bar 1 – 87. This correlation also resonates with the creation of shapes, which have contributed to forming phrases in Crama thus far.

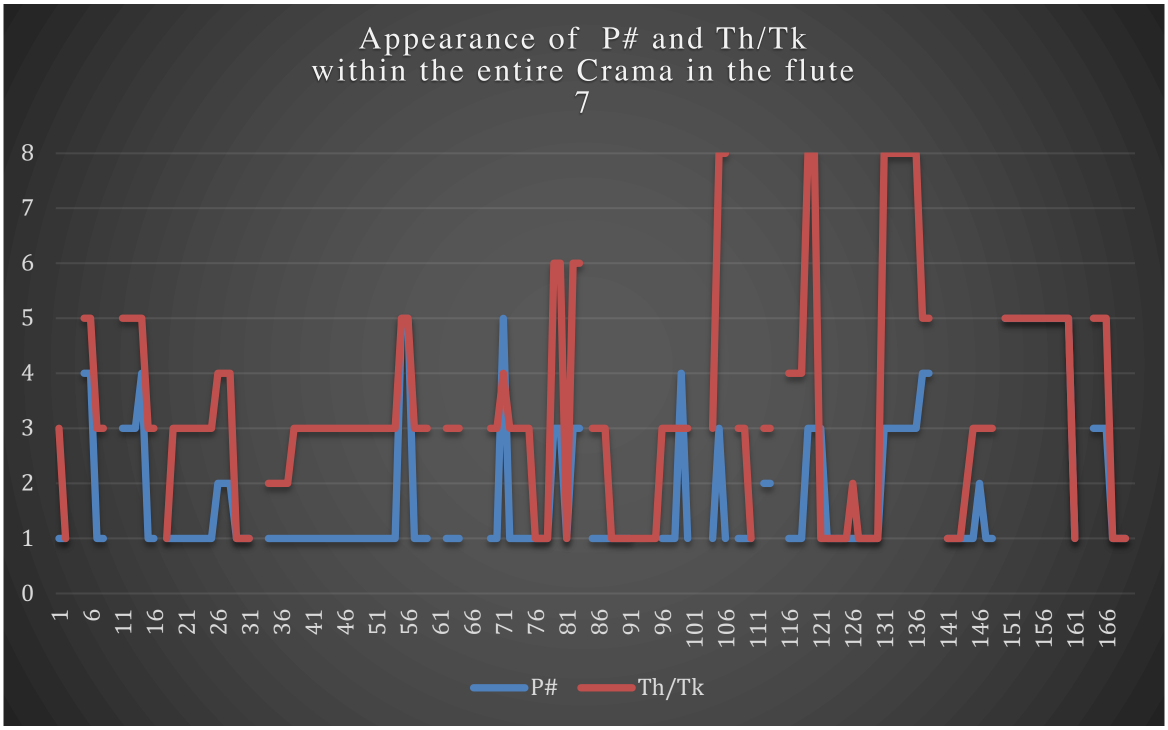




Correlation, imitation, and parallelism continue between the number of partials category and thinness or thickness of sound in Figures 4 and 5. The parallelism is consistent between the number of partials category and thinness or thickness of sound within bars 1 – 169. I expect some amount of unparallelism to create contrast between different sections, but this was not the case. Therefore, we can conclude there is a direct relationship between the number of partials category and thinness or thickness of sound in Crama. Whenever the number of partials decreases or increases, the thinness or thickness of sound will decrease or increase as well.



The reappearance of values one, three, and five in the last seven bars, as well as the sense of descending between values, is similar to the number of partials category in Figure 1. This justifies the idea of the correlation between the number of partials category and thinness or thickness of sound as part of the quality of sound in Crama.


Appearance of P# and Th/Tk
within the entire Crama in the flute
7
8
7
6
5
4
3
2
1
0
1
6
11
16
21
26
31
36
41
46
51
56
61
66
71
76
81
86
91
96
101
106
111
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121
126
131
136
141
146
151
156
161
166
P#
Th/Tk

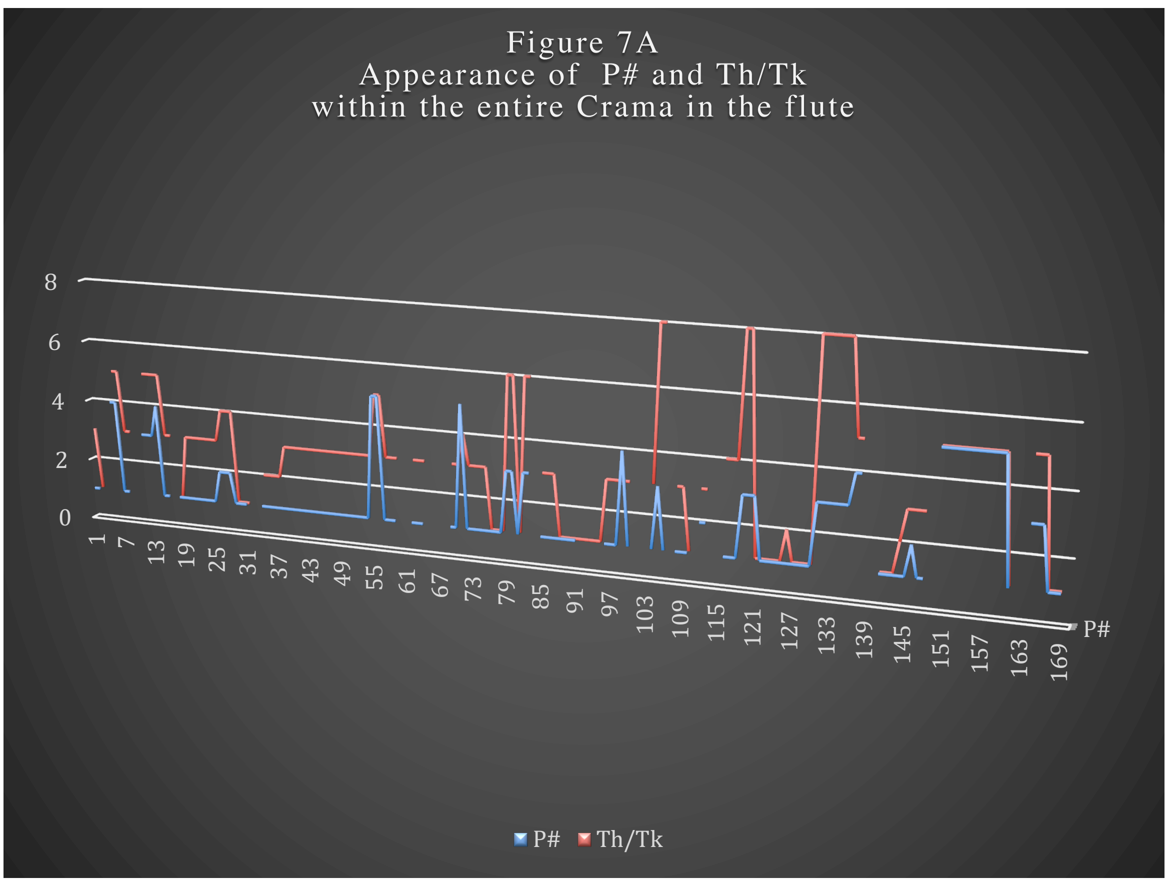


Figure 7A
Appearance of P# and Th/Tk
within the entire Crama in the flute
8
6
4
2
0
1
7
13
19
25
31
37
43
49
55
61
67
73
79
85
91
97
103
109
115
121
127
133
139
145
151
157
163
169
P#
P#
Th/Tk

The progression of range of partials (1 = low, 9 = high) in the flute:

Introduction:

The range of partials in the flute is the third dimension of the sound quality in Crama. So far, I have discovered that, the majority of the time, the flute leans towards a lower number in partials and low to average values in the thinness or thickness of sound. Next, I will focus exclusively on the range of partial category, before studying its relation to its number of partials and the thinness or thickness of sound category.

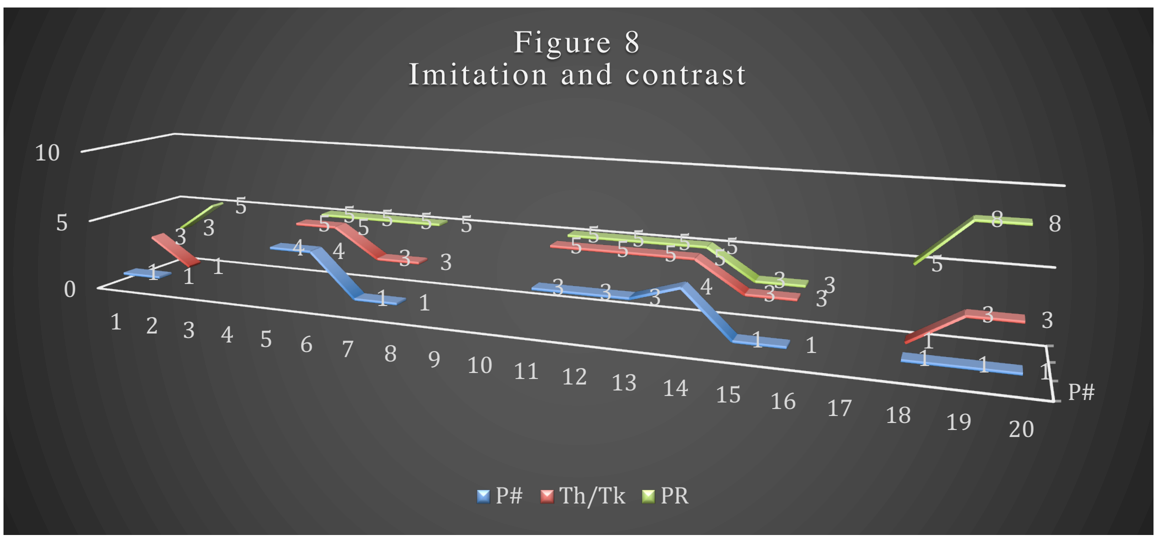
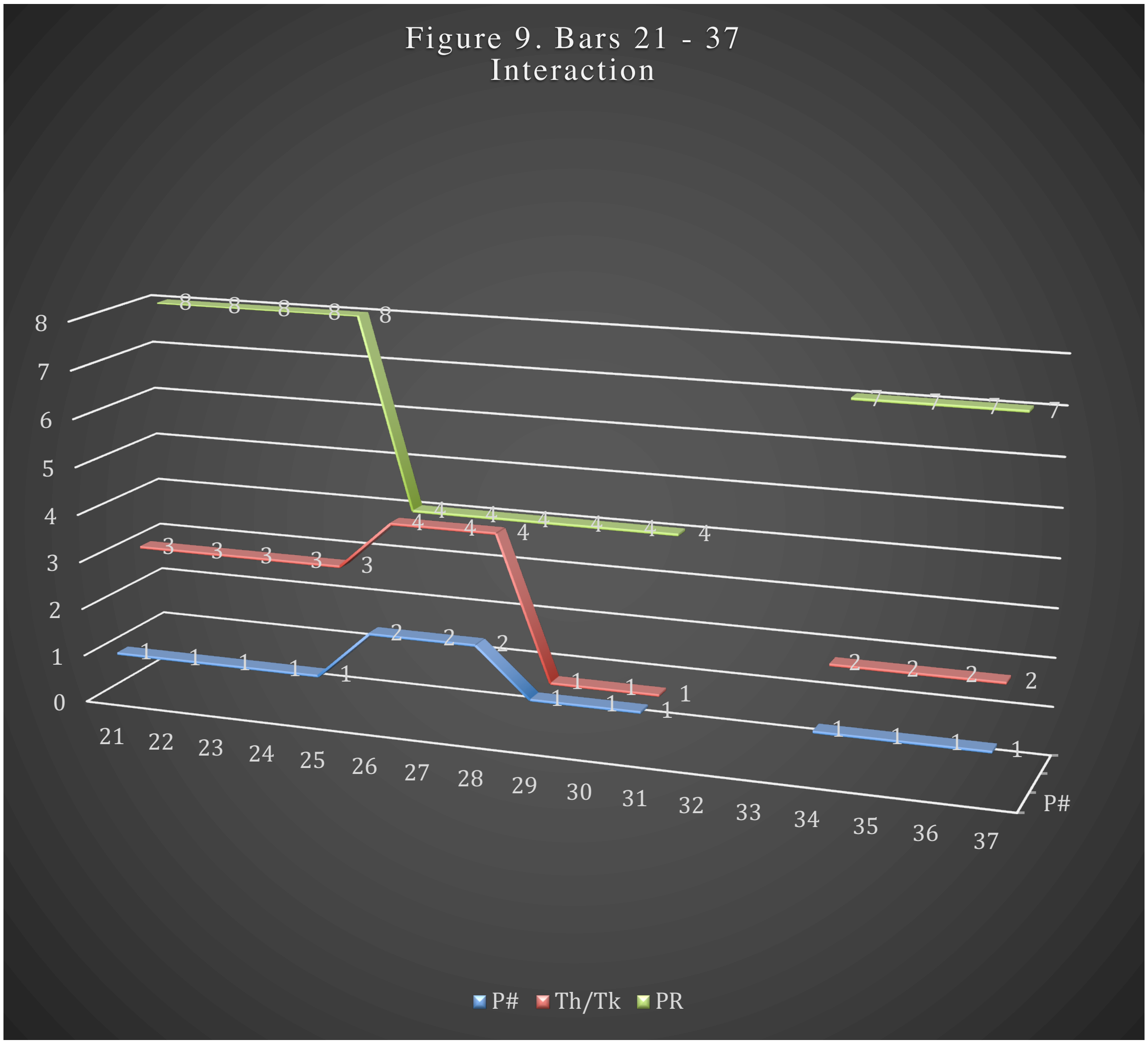
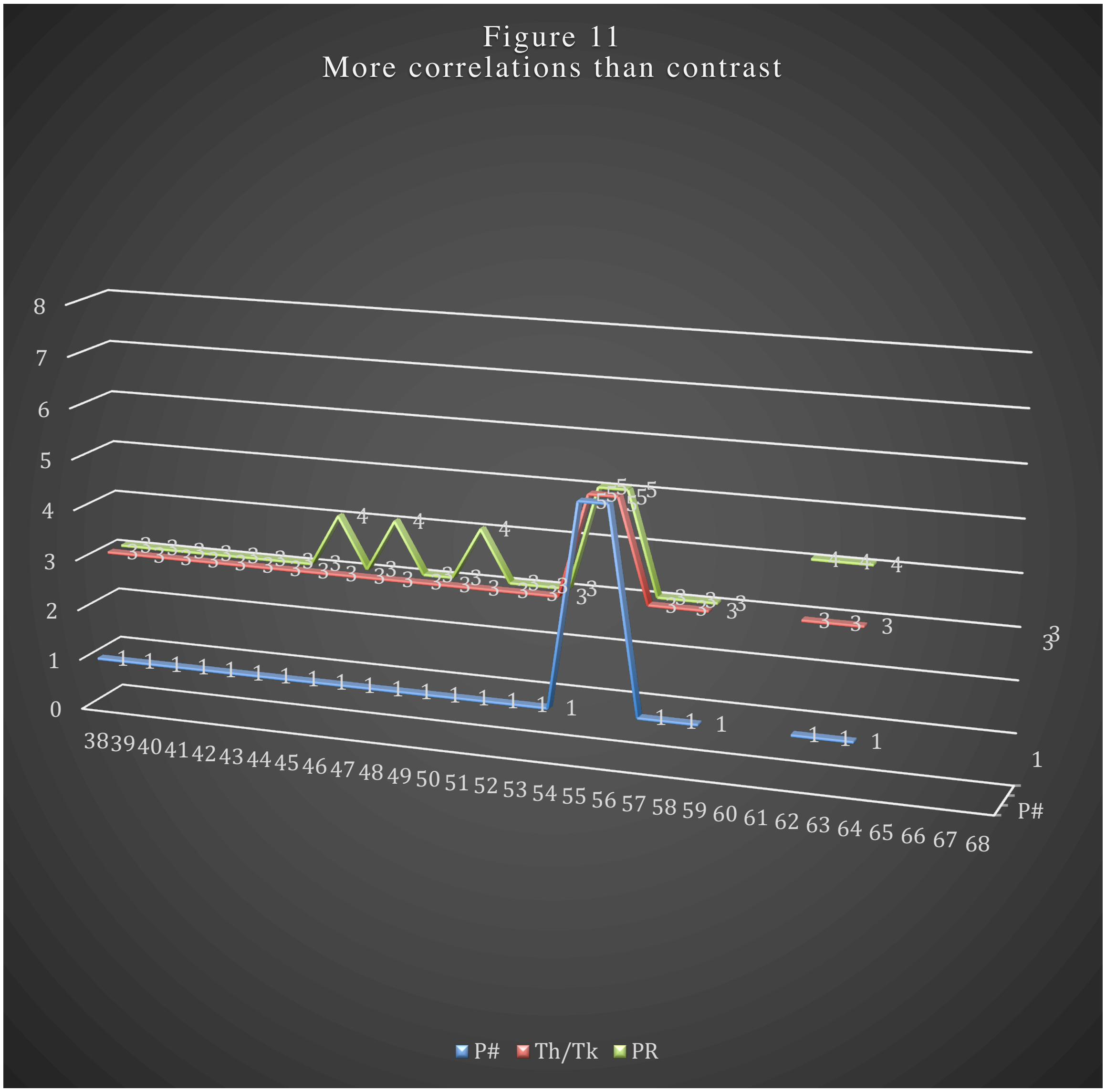


Figure 8 shows the parallelism and contrast between the range of the strongest partials and the other two elements. There is parallelism between the number of partials and the range of partial in bars 11 – 13 and 14 – 16. There is a contrast between the number of partials and the other two categories in bars 18 – 19. In addition, there are a few other instances of contrast between the number of partials category, thinness and thickness of sound, and range of partials. Greater instances of parallelism and fewer of contrast are the primary components in forming this section.



There is parallelism between all three elements of sound in bars 21 – 25. There is also parallelism between the number of partials and the range of partials in bars 26 – 28. Furthermore, there are correlations between the thinness and thickness of sound category and range of partials in 29 – 31. This section begins with parallelism between 3 elements of sound, bars 21 – 25, and ends with correlations between three elements, bars 34 – 37. Bars 25 – 29 do not demonstrate the same parallelism as bars 21 – 25 and 34 – 37. The interaction between different elements of sound in bars 25 – 29 shows this section to have an ABA' structure.



There is parallelism between all three elements from bars 38 – 45 and 57 – 64. There is also parallelism, 54 – 60, between the number of partials, blue, and the range of partials, green. Furthermore, the appearance of value four creates a non-parallelism relationship between the thinness or thickness of sound, red, and the range of partials. This, however, eventually becomes parallel with the range of partials 52 – 54 and creates a parallel relationship with the number of harmonic partials, blue. The above parallel and non-parallel connections contribute to the quality of the sound. As a result, the structure of sound in bars 38 – 64 produces a sense of clarity.

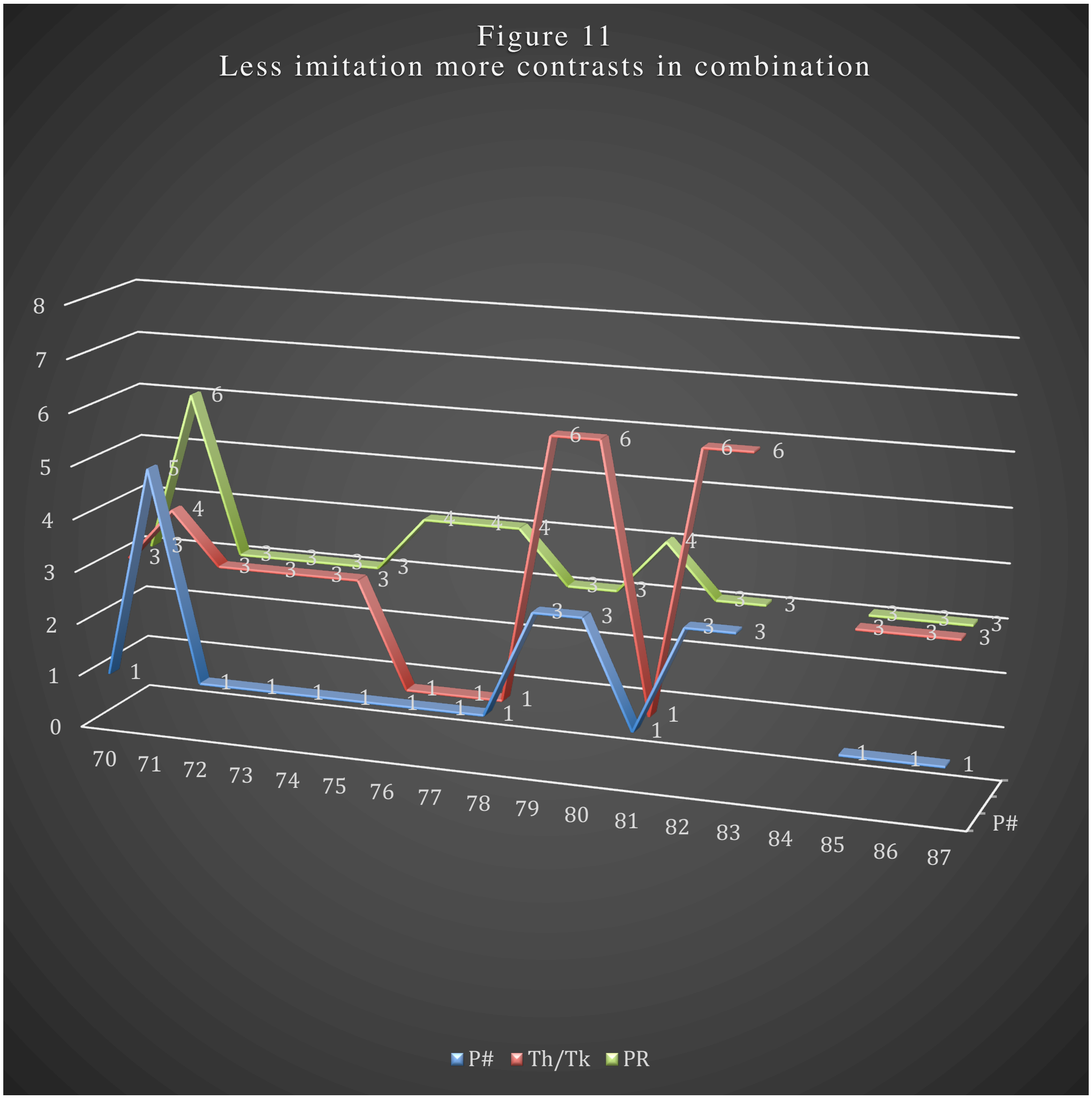


Figure 11
Less imitation more contrasts in combination

There is only one case of parallelism between all three elements, in bars 70 – 72. The remaining cases are either parallelism between two elements or a combination of contrast and parallelism between several combinations. This is the first occurrence of this type of contrast between different combinations and parallelism between three sound elements. This type of contrast contributes to the overall structure of this section and its contrast with other sections. Additionally, it adds to the complexity and the overall richness of sound in Figure 11.

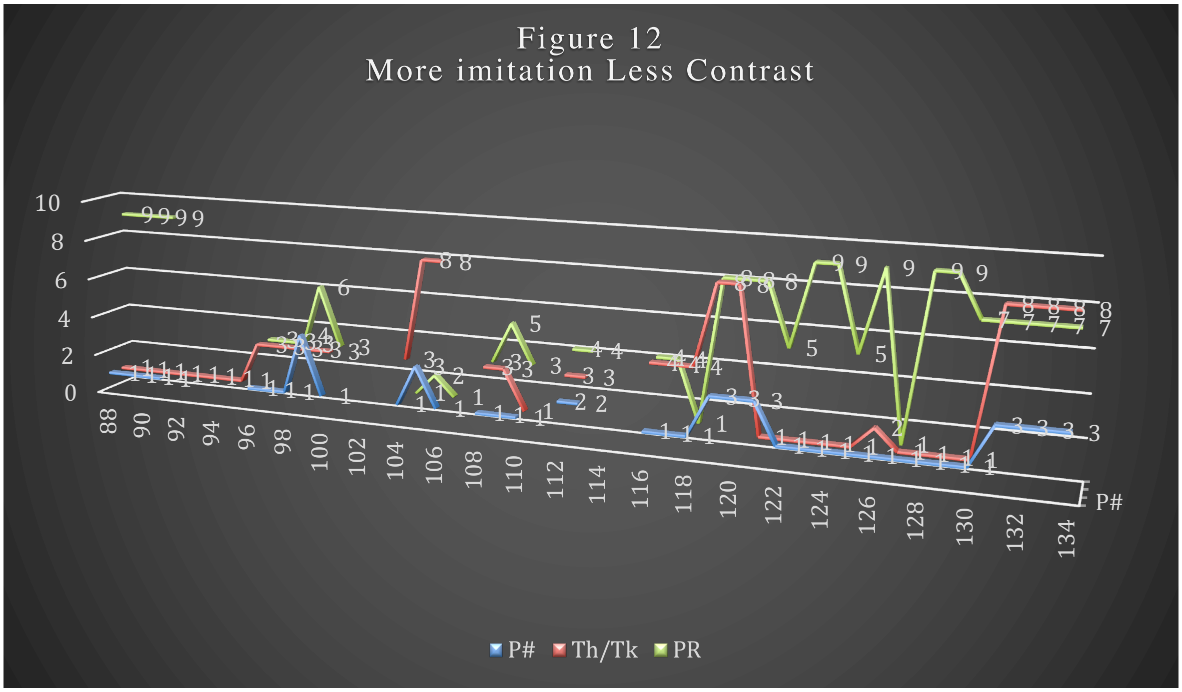


Figure 12
More imitation Less Contrast

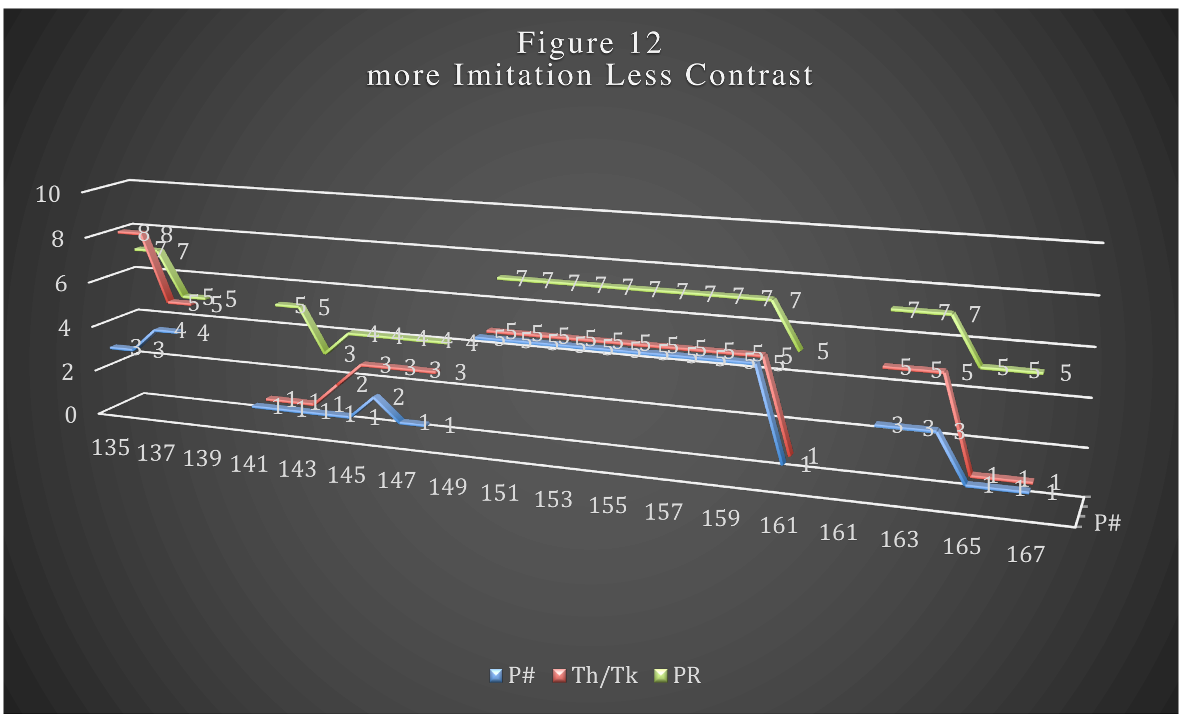


Figure 12
more Imitation Less Contrast

Unlike Figure 11, Figure 12 exhibits the independence of the range of partials from the other parameters. This independence sometimes will result in parallelism (for example 98–100), but other times they just seem to be independent – not contrast, not parallel.

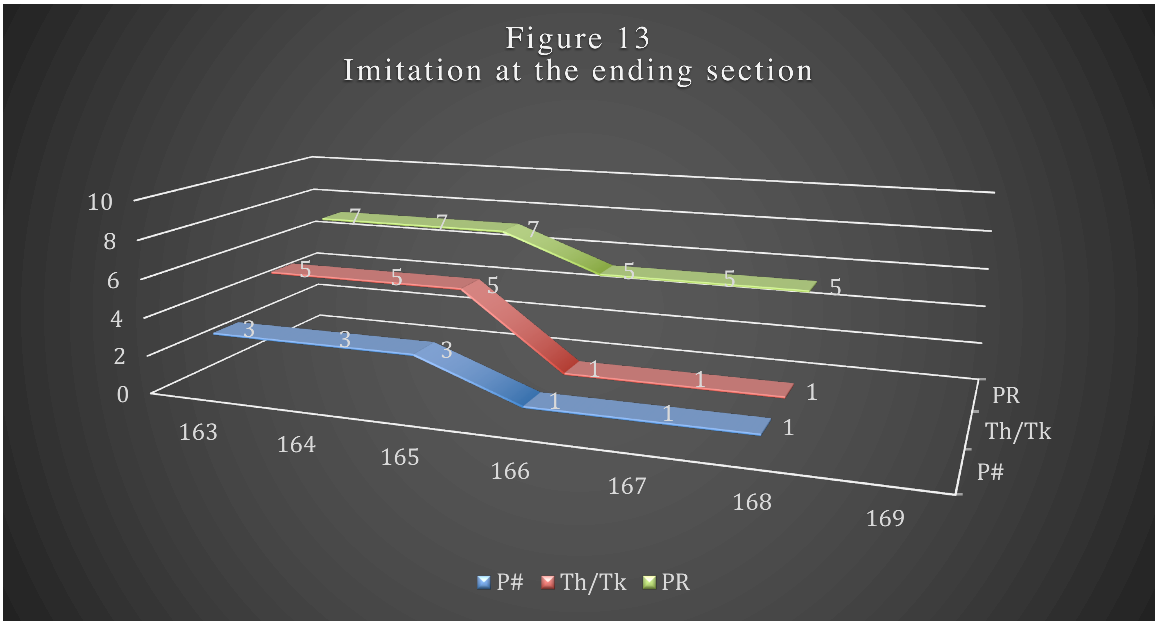
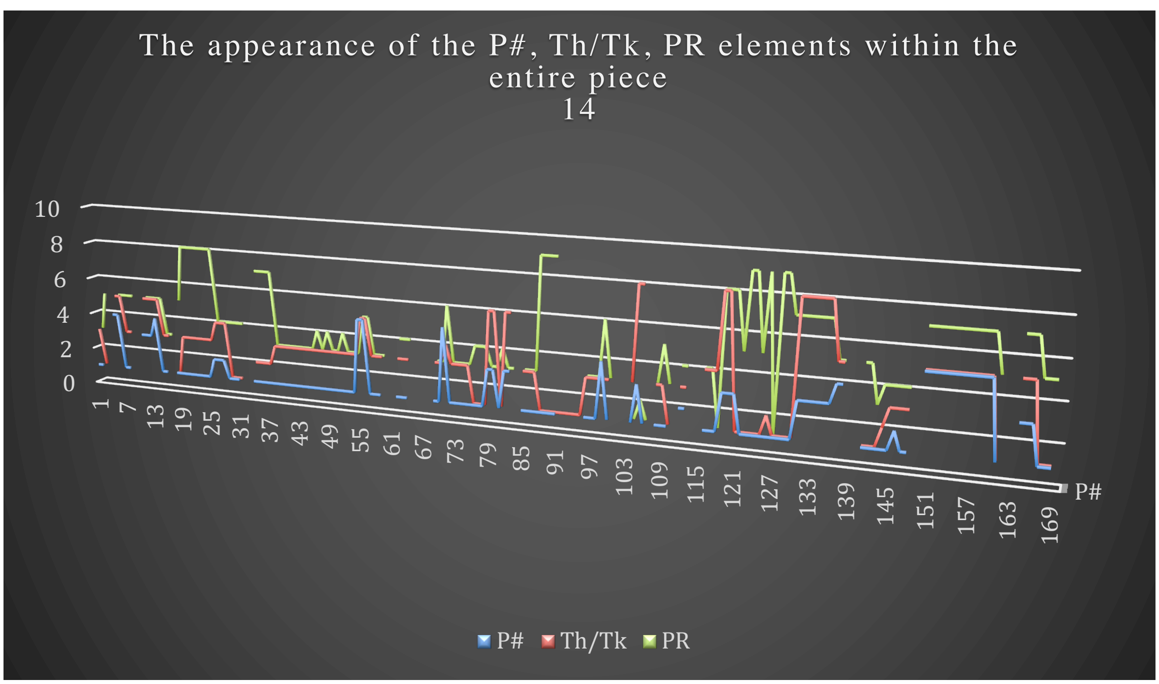


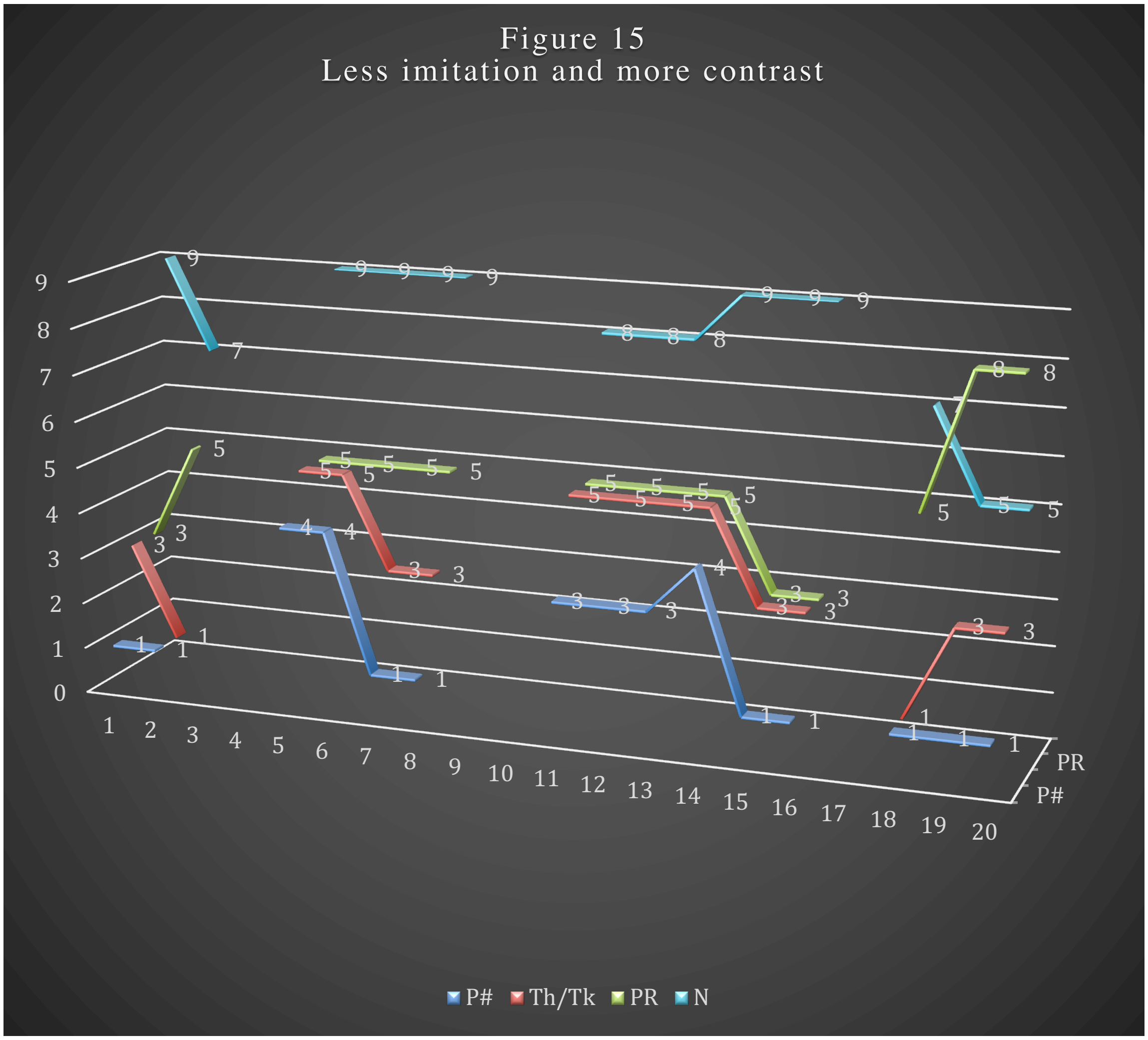
Figure 13
Imitation at the ending section

The ending section exhibits the sense of falling in all three quality of sound categories. Also, it proves the consistent reappearance of the same values from the opening section in all categories. This is a piece of evidence which refers to the importance of consistency between the opening and ending sections. As a result, this contributes to the overall form in Crama.

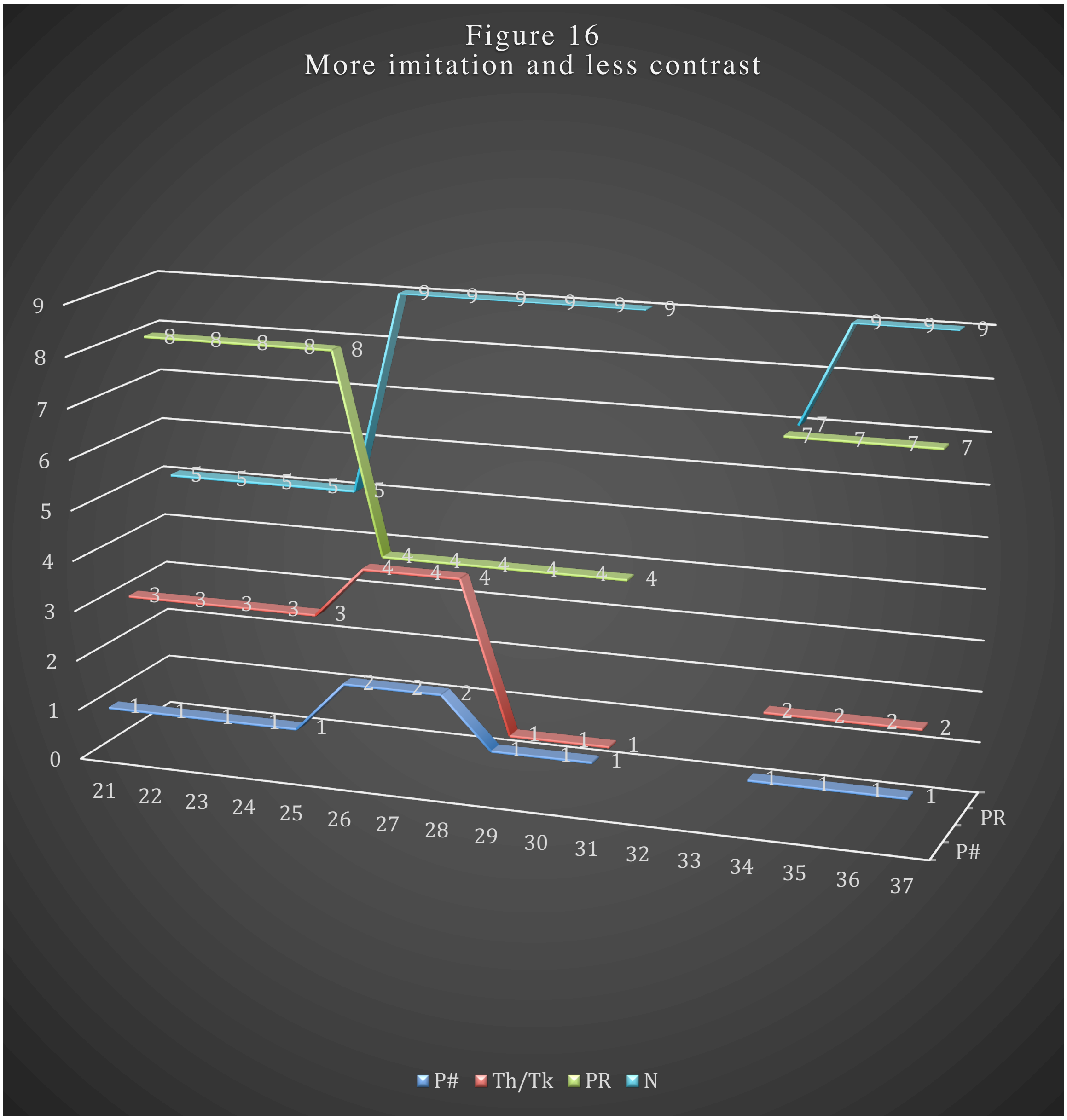


The appearance of the P#, Th/Tk, PR elements within the entire piece
14

The progression of amount of noise (1 = clean, pure, 9 = noisy) in the flute:



There are about 6 bars, out of 11 active bars, not counting the rests, that have parallel imitation between all four elements of the quality of sound. These are bars 5 – 6, 7 – 8, 11 – 13, 15 – 16, and 19 – 20. The remaining 5 bars, 1 – 2, 6 – 7, 13 – 15, and 18 – 19 are non-imitative. This non-imitative relationship creates a contrast with the other elements of sound, and the relationship between imitative and non-imitative contributes to the quality and overall richness of sound. As a result, these relationships contribute to the overall construction of sound within the entire section in Figure 15.



There are 10 out of 16 bars that offer parallel motion between all of the contributing elements of the sound. Those bars are 21 – 25, 29 – 31, and 31 – 37. Conversely, three bars contribute to the non-parallel relationship between all the elements of sound. Those are bars 25 – 26, 28 – 29, and 34 – 35. Compared with Figure 15, the level of parallelism is increased by four bars, and the level of non-parallel motion is decreased by 2 bars. As a result, the increase and decrease across different elements of sound contribute to the growth and balance of sound from Figures 15 to 16.

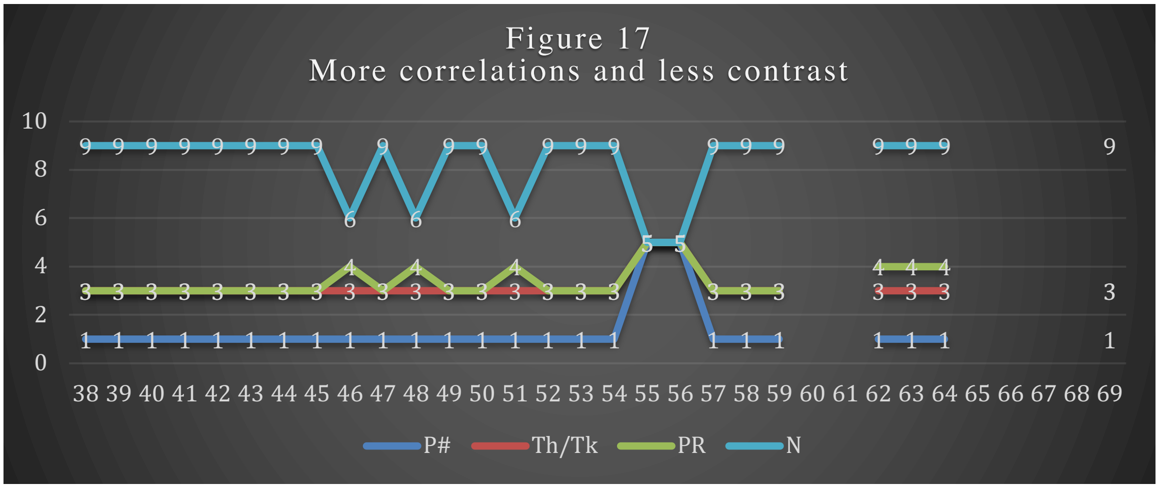


Figure 17
More correlations and less contrast

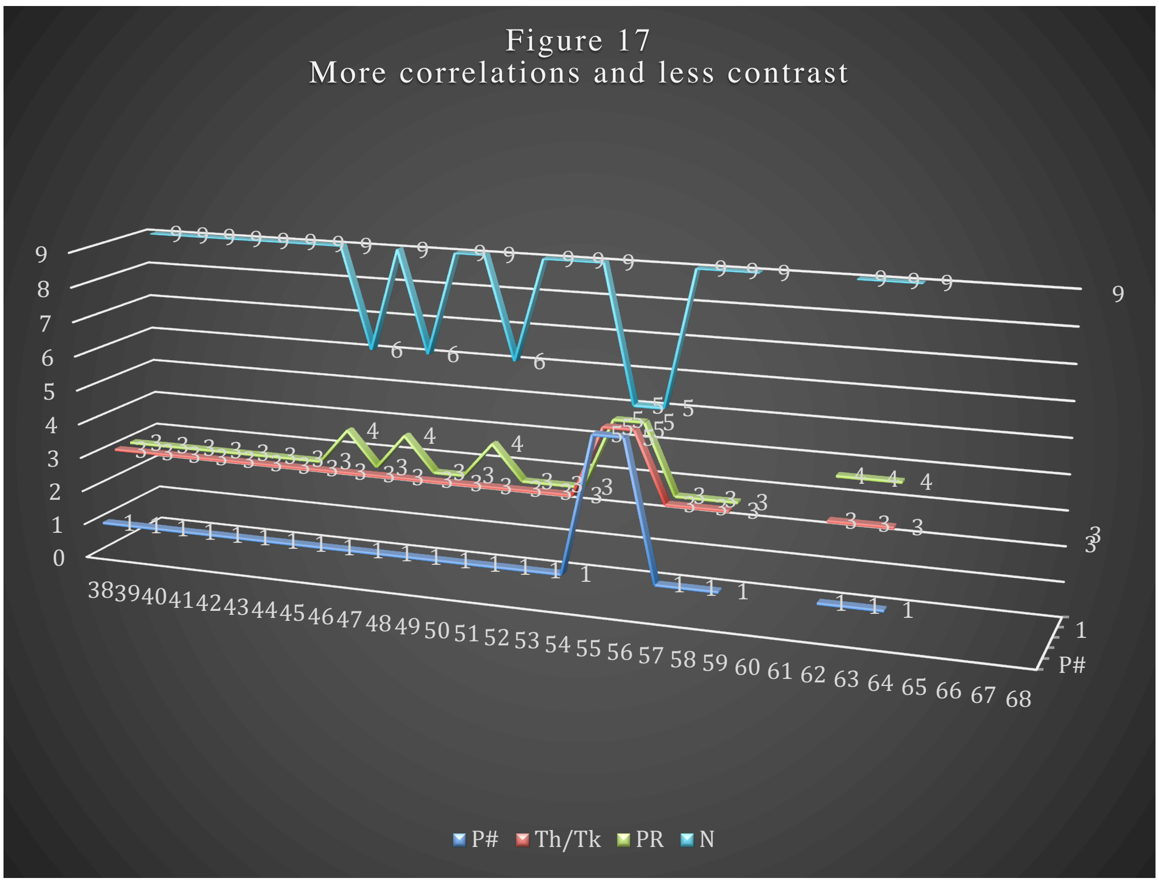
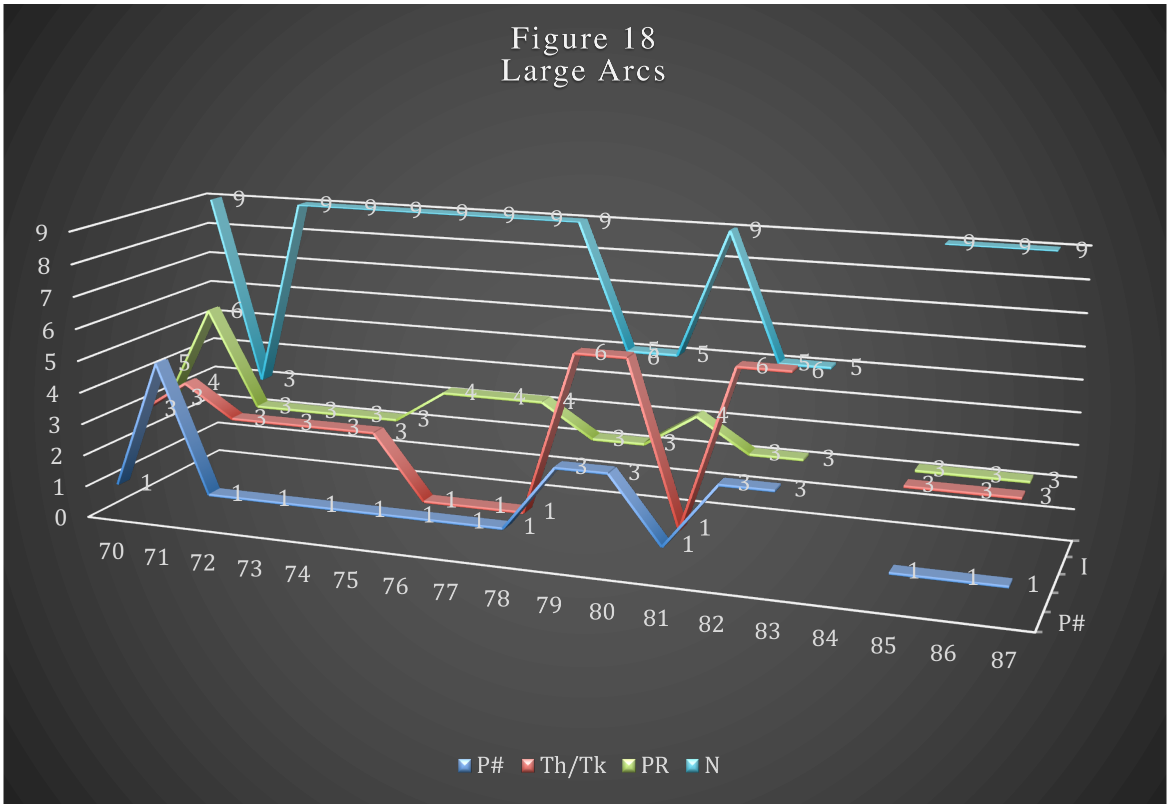


Figure 17
More correlations and less contrast

There are 12 bars of parallelism between all four elements within all 21 active bars of this section. These are bars 38 – 45, 55, 57 – 59, and 62 – 64. Therefore, as previously mentioned, the increase and decrease between different elements of sound contribute to the growth and balance of sound between different sections in Crama.



There are 9 bars, out of the active 16 bars, which suggest parallelism between all four elements of sound. Those are bars 72 – 76, 76 – 78, 79 – 80, 82, 83, and 85 – 87, which show the heightened level of contrast in the correlation between Figures 18 and 17.

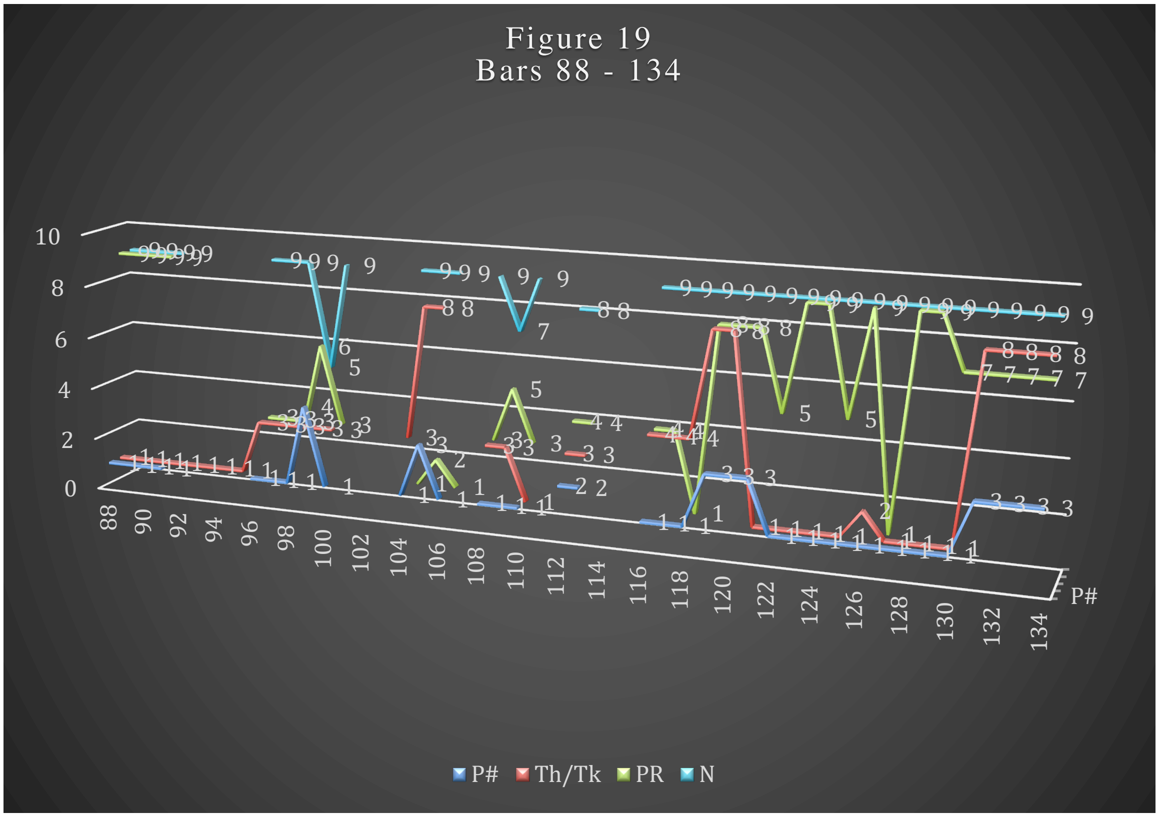


Figure 19
Bars 88 - 134
P#
Th/Tk
PR
N

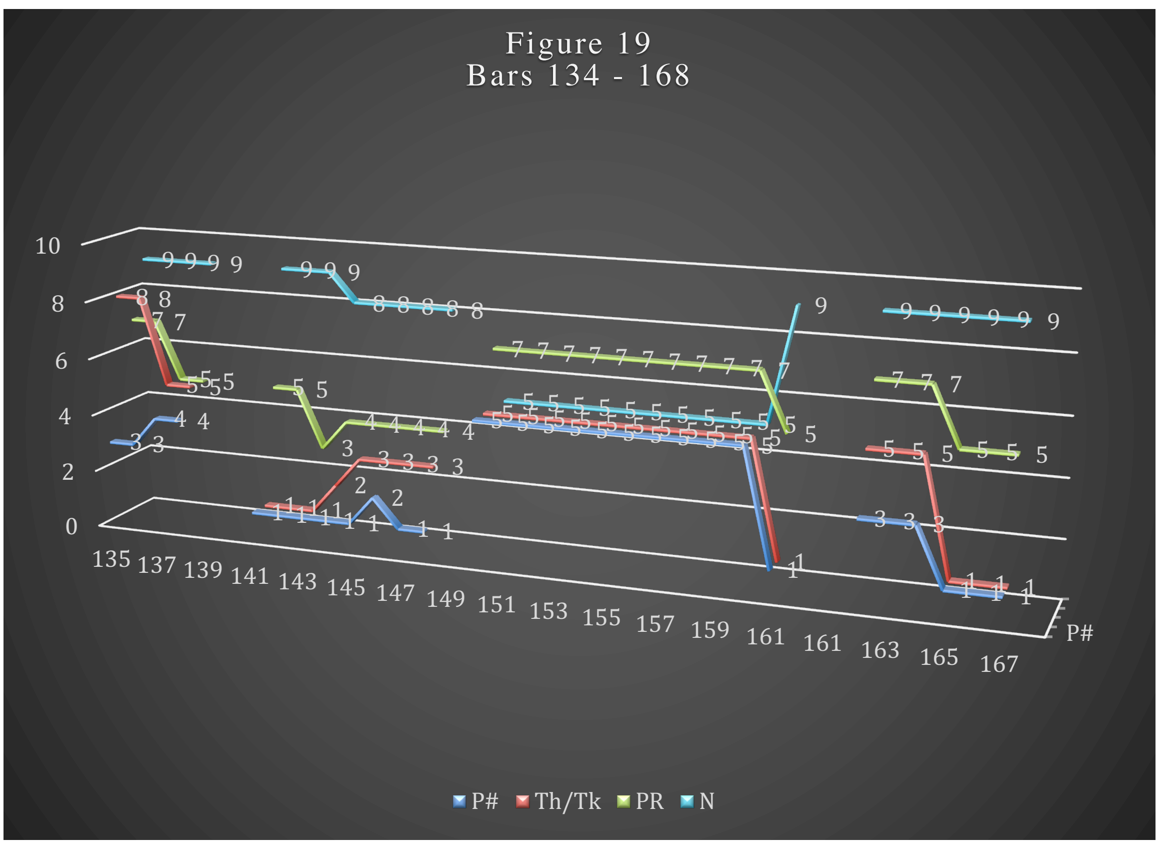
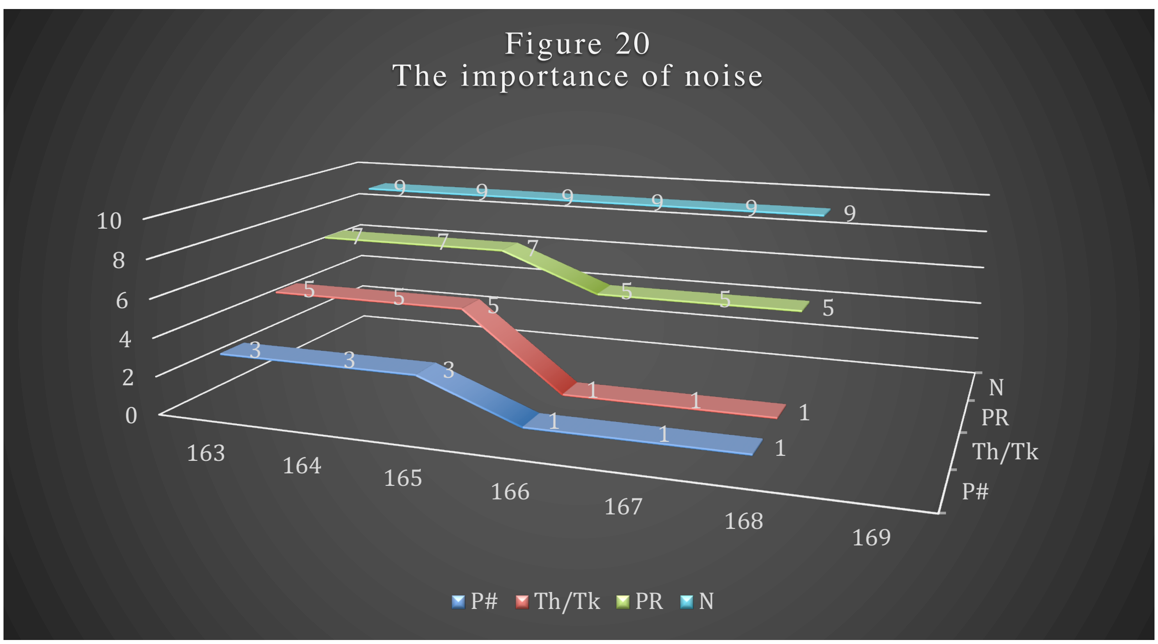
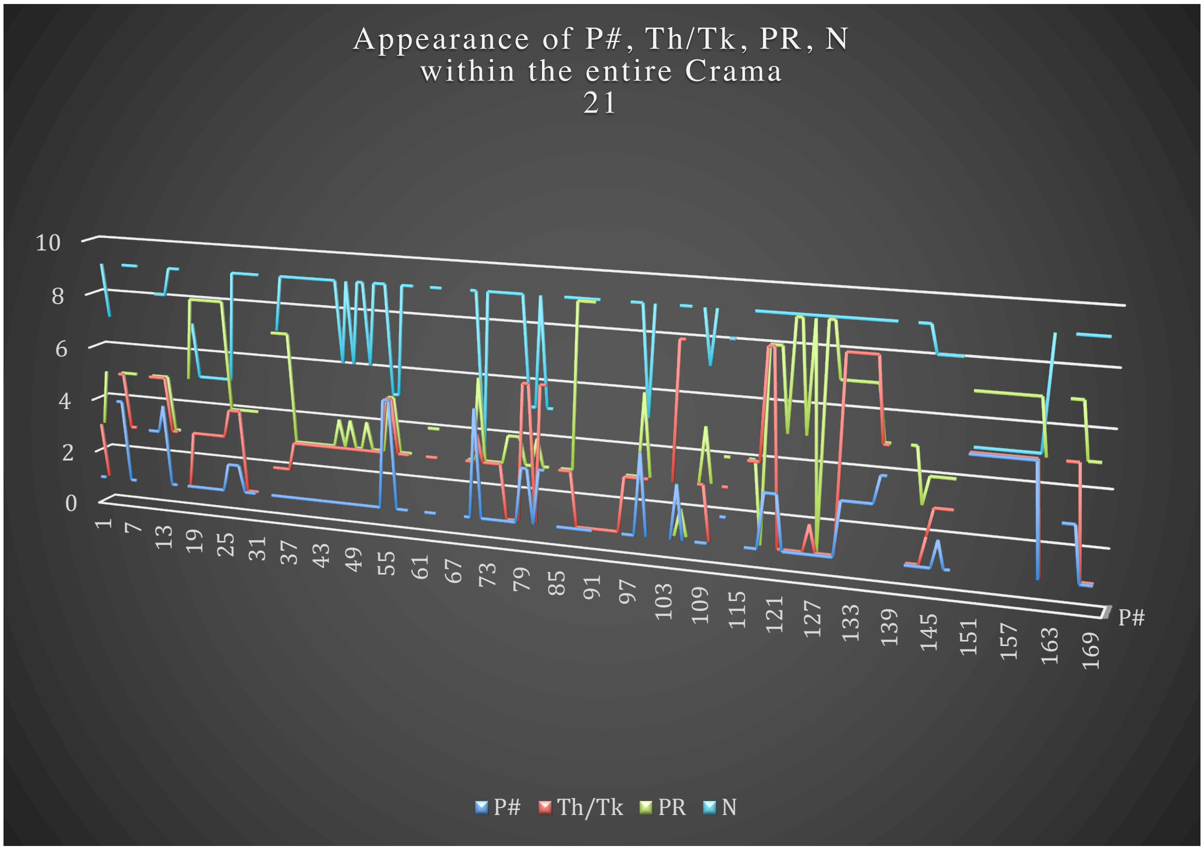


Figure 19
Bars 134 - 168
P#
Th/Tk
PR
N

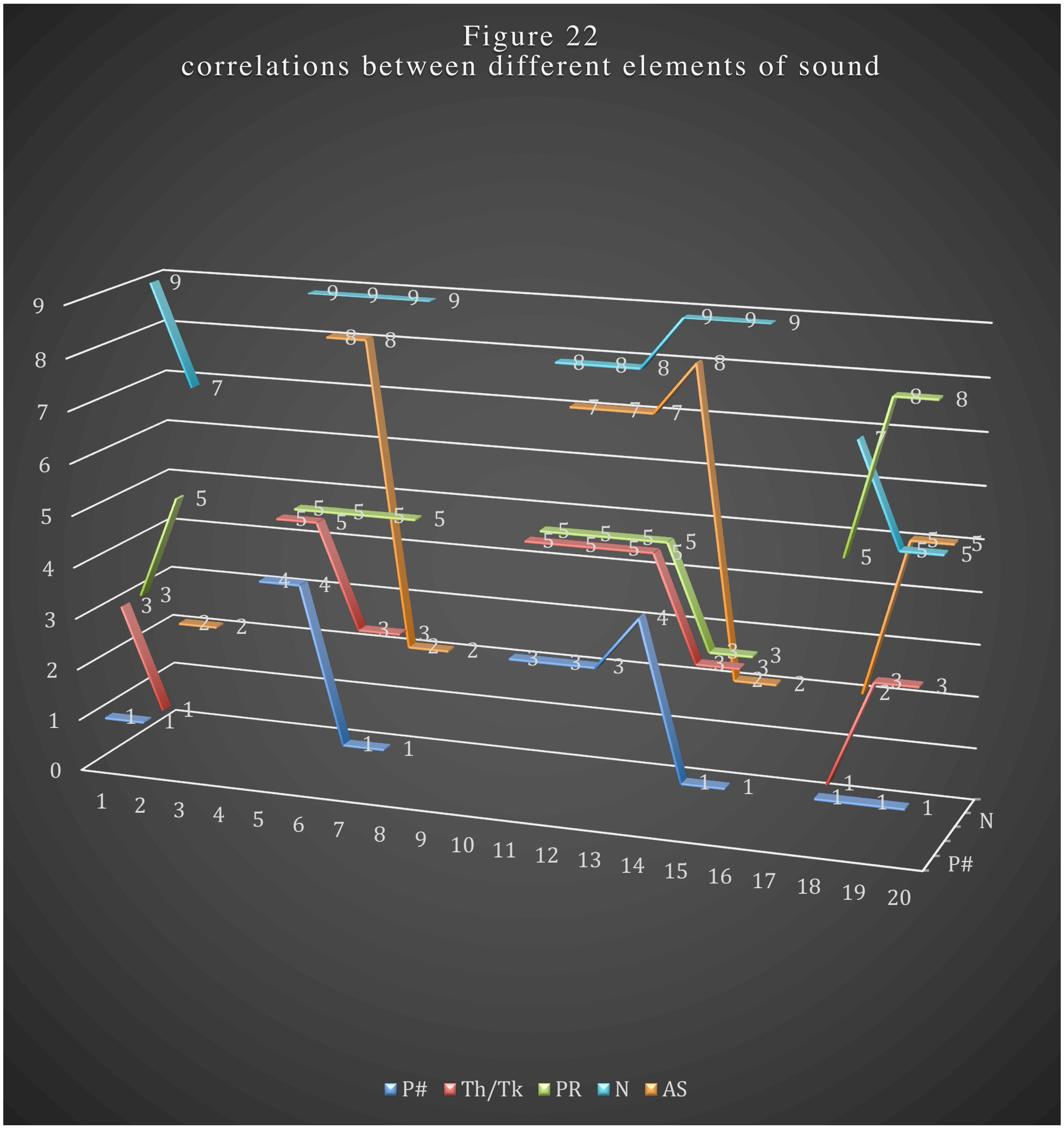
Figure 19 begins and ends with the same values, one and nine. Note the simultaneous appearance of these values through the discourse of this section. Due to their consistent occurrence, one and nine are the most critical values in Figure 19. The regular appearance of these two values relates to two observations about Figure 19: 1) The number of partials is almost always one, meaning the disappearance of harmonic partials is essential to the existence of this section. 2) The amount of noise category, series five, is almost always at nine, showing the presence of noise to be crucial in this section. A closer look reveals the consistent appearance of either very high values, seven, eight, and nine in all categories, or very low values, one and three. This consistency proves the importance of the disappearance of harmonic partials, the density, and the level of noise in a sound-based composition such as Crama. In addition, the repetition of one and nine proves that repetition is a crucial element to form in a sound-based composition.



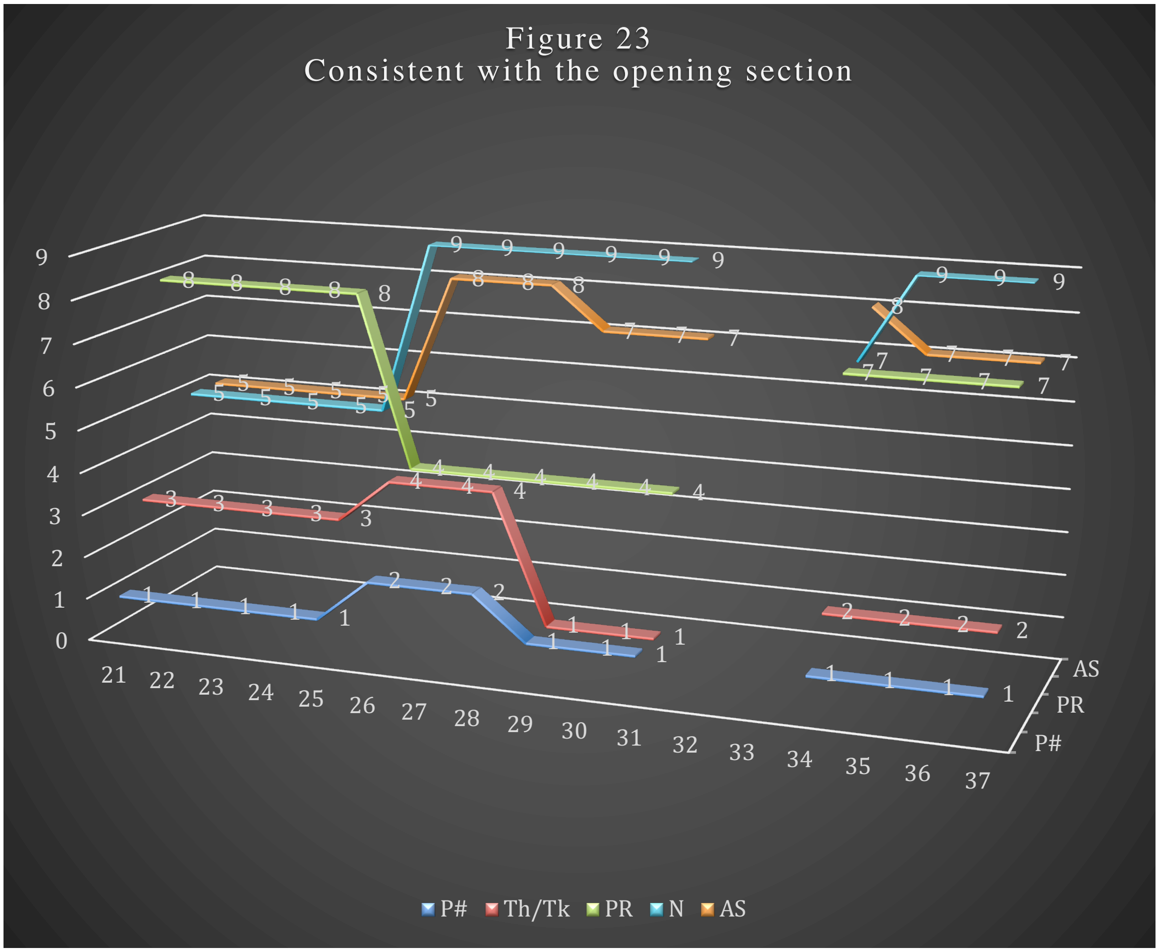
Unlike the other elements of sound in Crama, the noisiness of the flute stays at number nine, as high as possible. Also, unlike the other elements in Figure 20, the level of noisiness does not drop. Kokoras's choice not to drop the level of noise at the end of Crama is evidence that noise is an essential aspect of the piece. Because Crama is a sound-based composition, timbre or noise functions as the primary element of form.



The progression of sharpness of attack (1 = gentle, 9 = sharp) in the flute

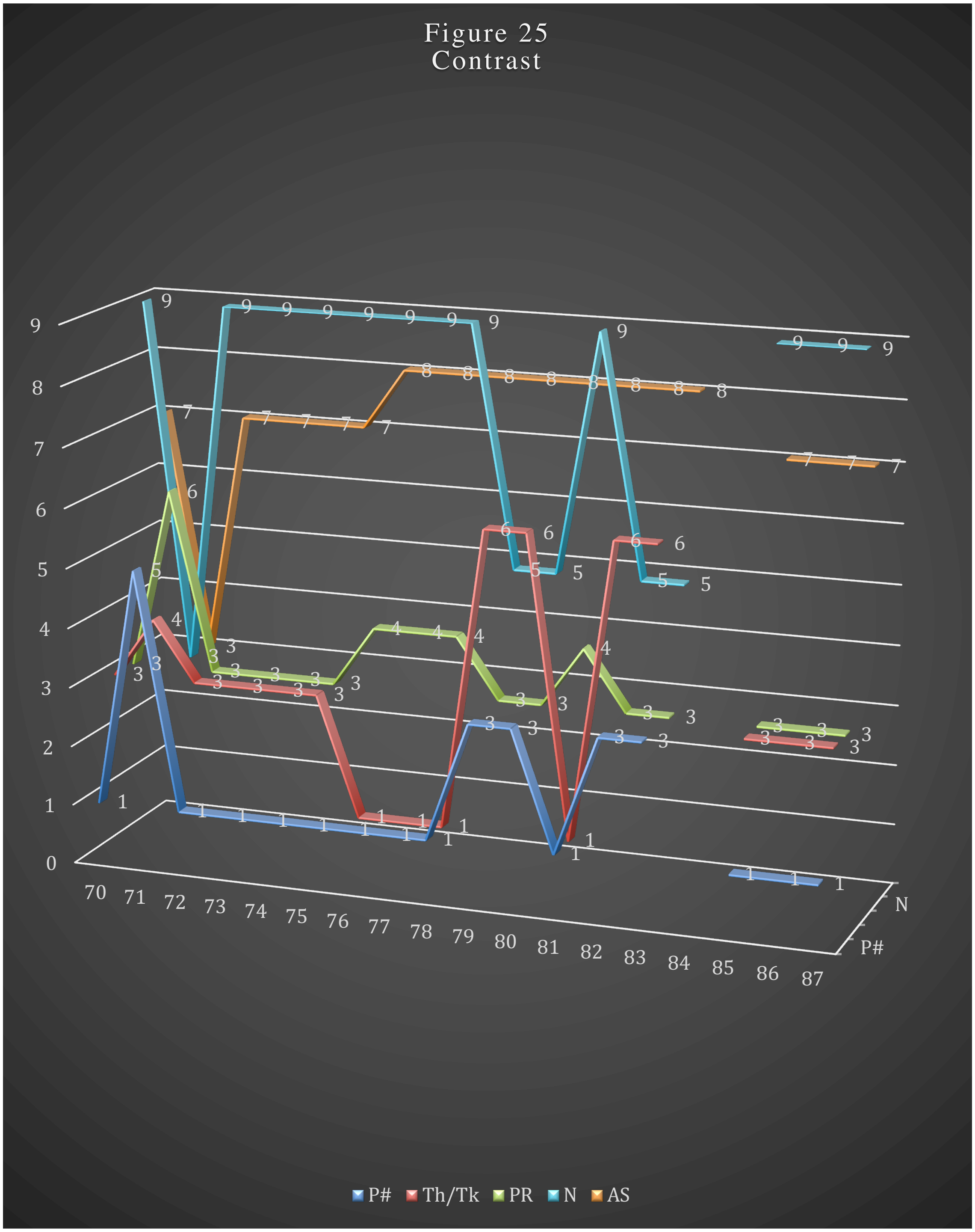


The new element, the sharpness of attack, orange, imitates the movement of some of the other elements. This new element has parallelism and contrasts with others, resulting in a sense of correlations between different aspects of sound. Thus, the complex relationship between different elements of sound adds to the quality of the sound in the flute. Notice the proximity between the number of partials and thinness and thickness of sound in bars 11 – 16, as thinness and thickness of sound category disappears.

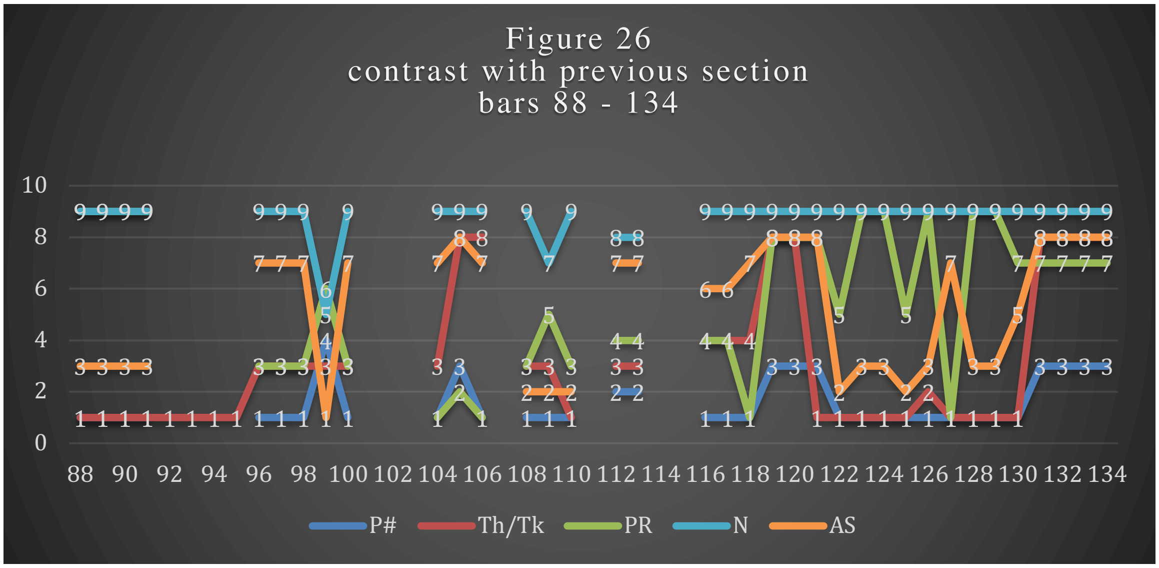


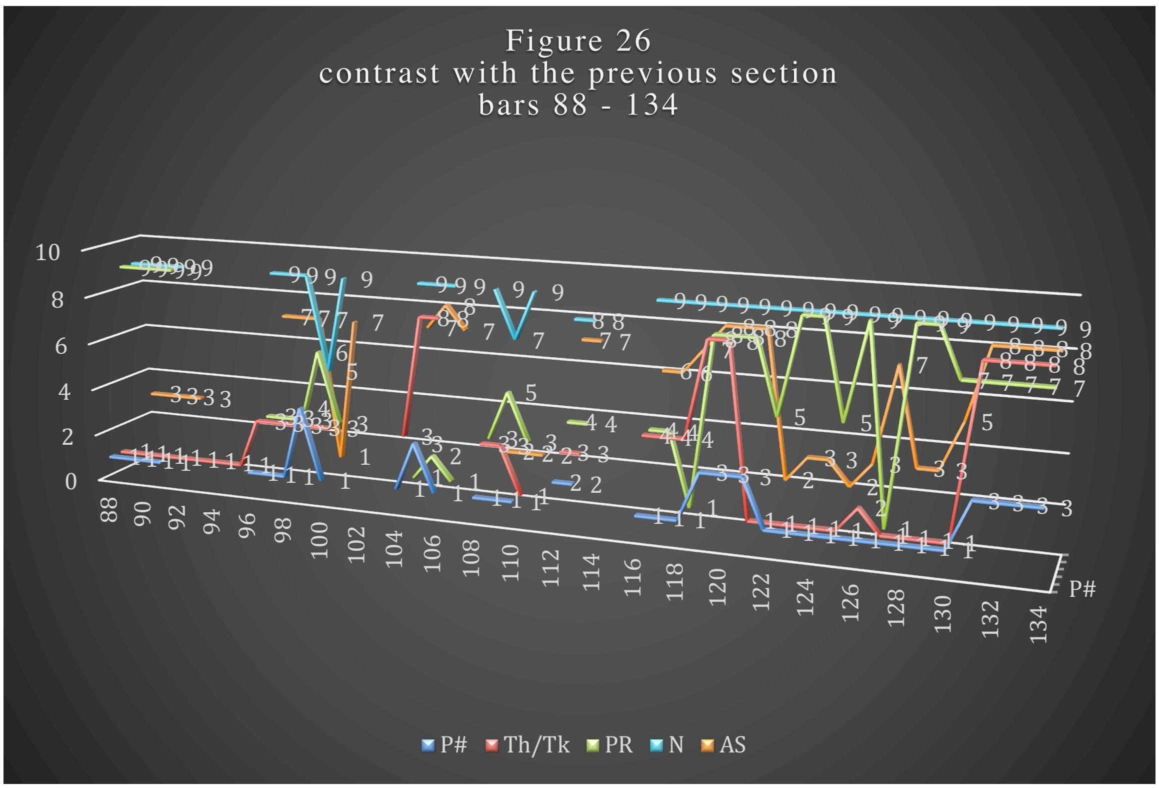
Similar to Figure 22, the correlations between different elements of sound reappears in Figure 23. There is consist creation of sound across these two sections. The unity of sound production in Figures 22 and 23 contributes to the importance of timbre as a form-bearing element in sound-based composition Crama.

The imitation, correlation, and contrast between all five elements of the sound continues. This continuity contributes to the construction of sound in the flute. Thus far, all sections suggest consistency in terms of the correlation between different elements of sound, promoting the idea that the choices were not random in the construction of sound, which is true not only within each element but also correct when comparing different elements.

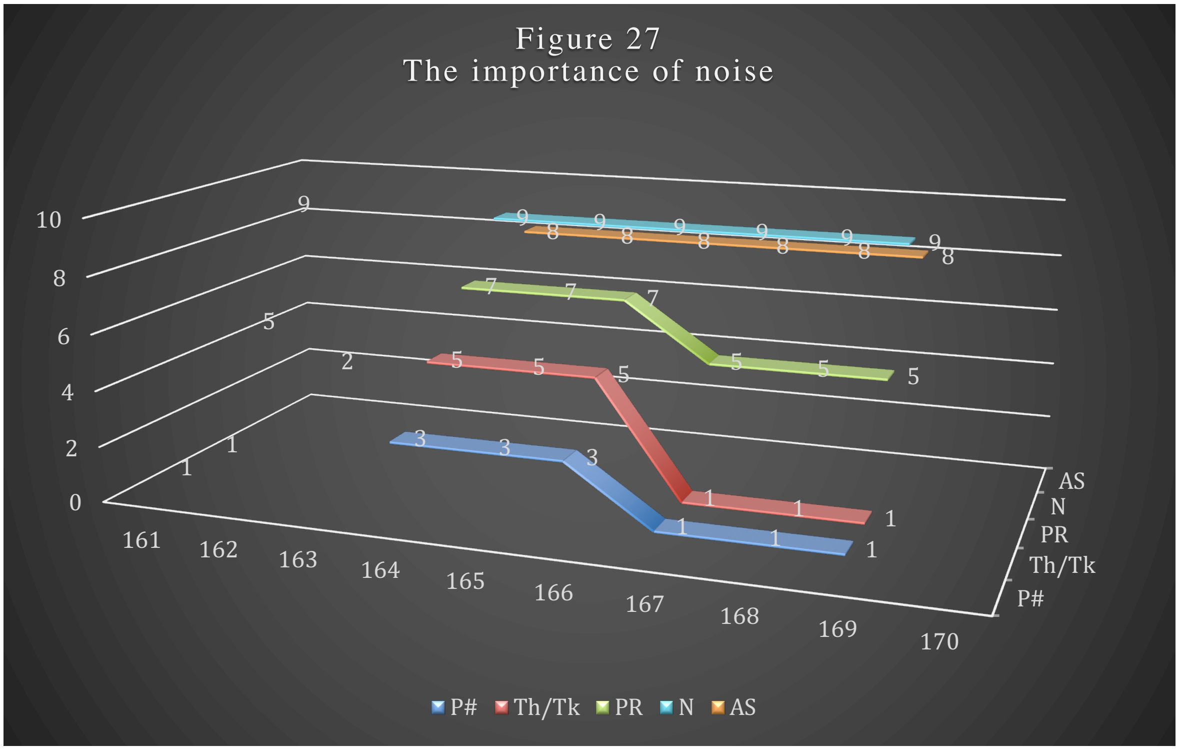


In Figure 25, the level of parallelism and contrast is almost a variation of Figure 24. The notion of change from one section to another resonates with transformational variation as a fundamental process in this piece. Additionally, the variation between Figures 24 and 25 contributes to the continuity of sound, which supports structuring form in Crama.





There are more parallelism and less contrast between the contributing elements of sound in this section. This contrasts with Figure 25, which presented more contrast and less parallelism between the contributing elements to the sound. In other words, there is a contrast between the timbre in Figures 26 and 25, and thus, the contrast contributes to the creation of the form in Crama.



The sharpness of attack category stays stagnant in bars 164 – 170. We have observed the lack of spikes and drops numerous times in the flute in this category. This can bring two points to the fore: 1) The importance of the nature of the attack and its contribution to creating noise as part of timbre. 2) The contrast in activity between this category and others helps create the construction of timbre in the flute. These points suggest, therefore, that the sharpness of attack is an essential element in the creation of noise in the flute in Crama.

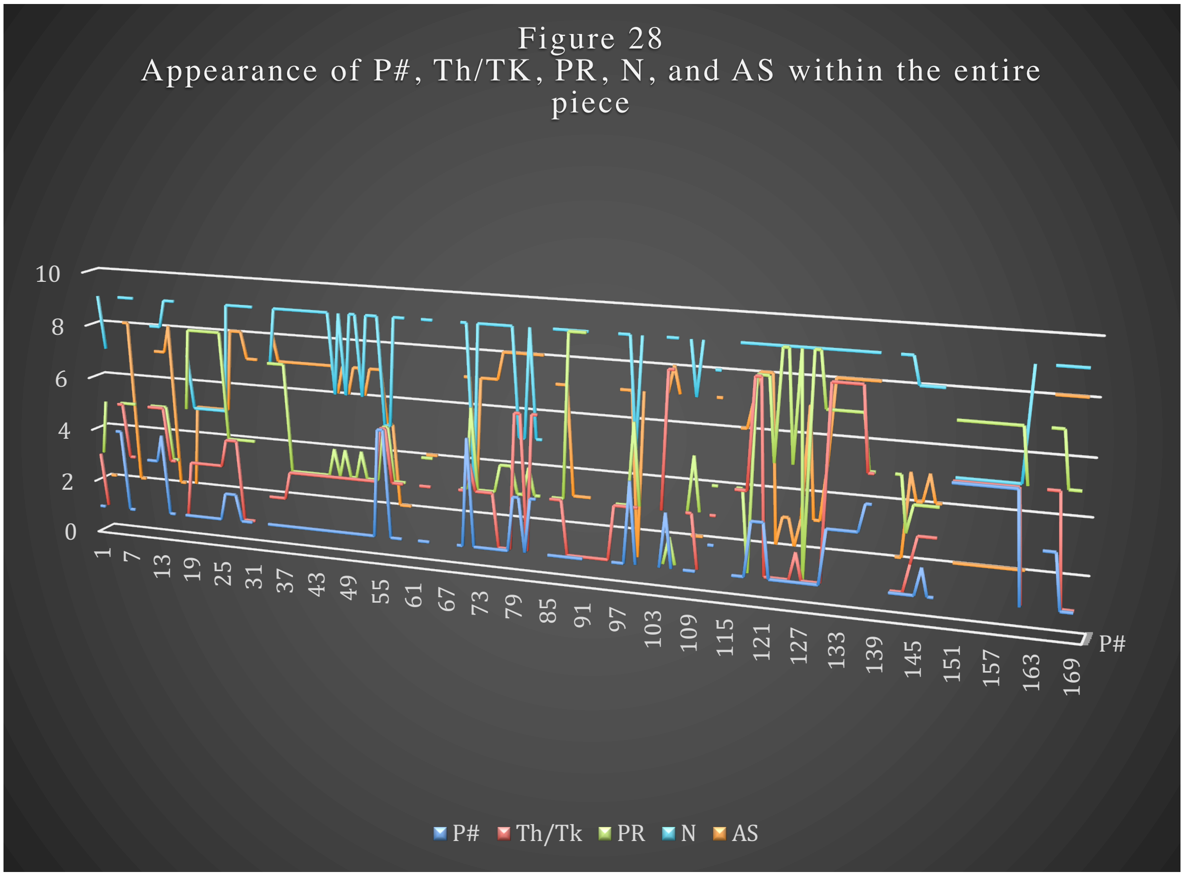
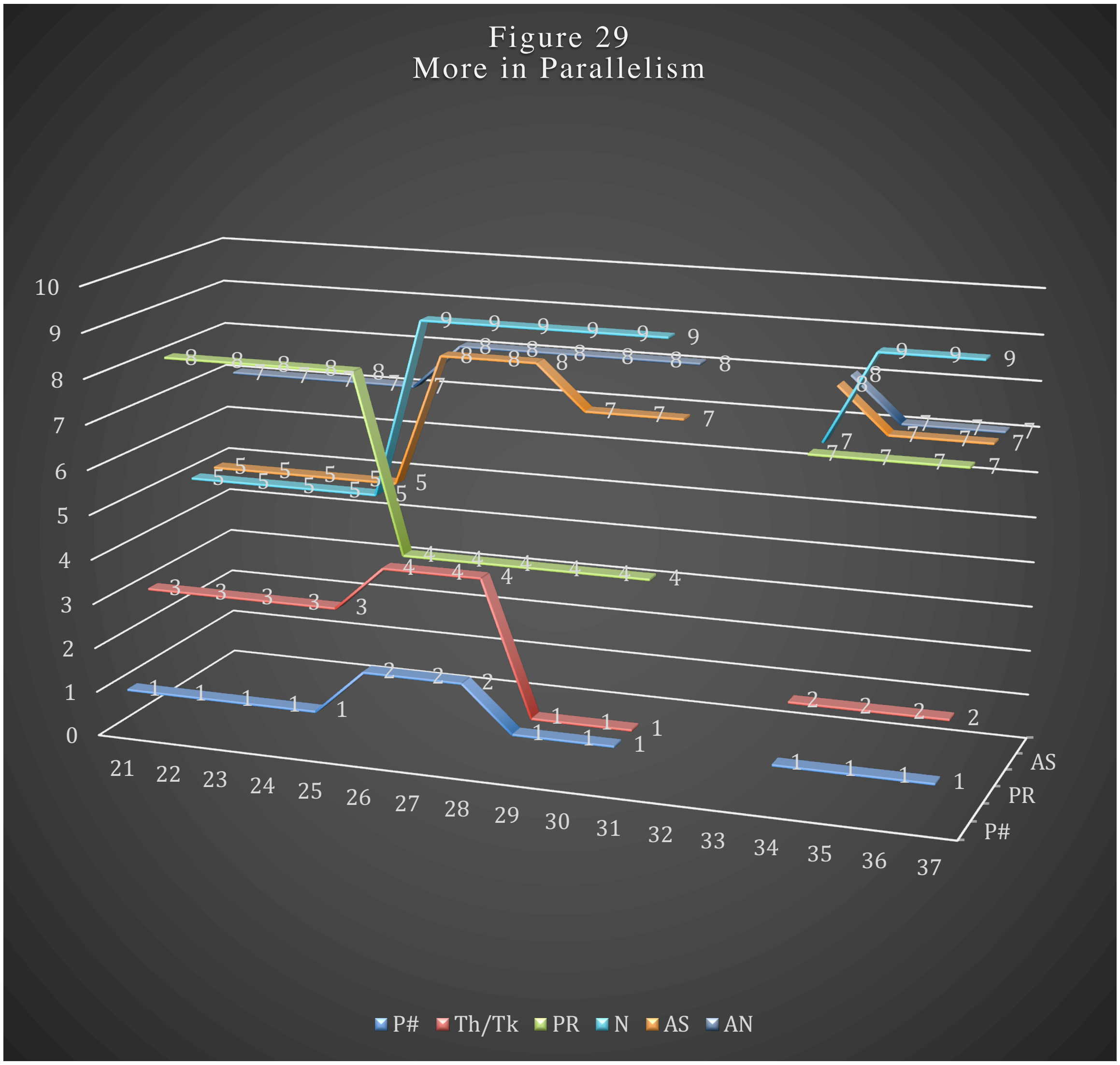


Figure 28
Appearance of P#, Th/TK, PR, N, and AS within the entire piece
10
8
6
4
2
0
1
7
13
19
25
31
37
43
49
55
61
67
73
79
85
91
97
103
109
115
121
127
133
139
145
151
157
163
169
P#
P#
Th/Tk
PR
N
AS

The progression of noisiness of attack in the flute (1 = non-noisy attack, 9 = noisy attack):



The amount of parallelism and imitation is greater than the amount of contrast in Figure 29. Moreover, the amount of parallelism and imitation in Figure 29 is more than in Figure 22. This shows consistency in parallelism between bars 1 – 20 and 21 – 37. The repetition of a low ratio of parallelism to contrast from Figure 22 to 29 supports the importance of parallelism and imitation in these two sections. This repetition also helps the continuity of noisiness of attack in the sound of the flute.

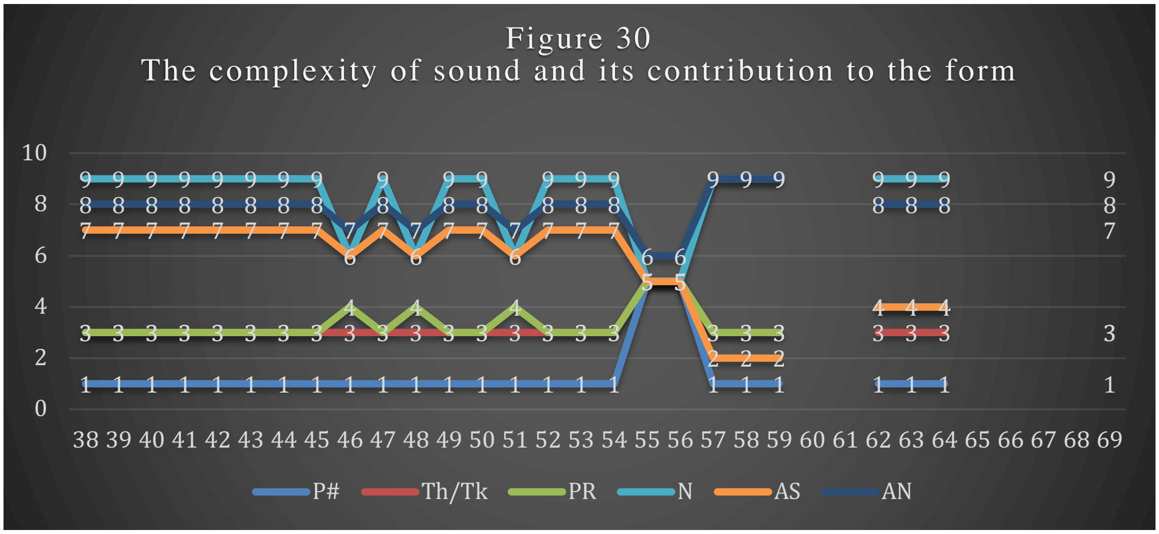


Figure 30
The complexity of sound and its contribution to the form

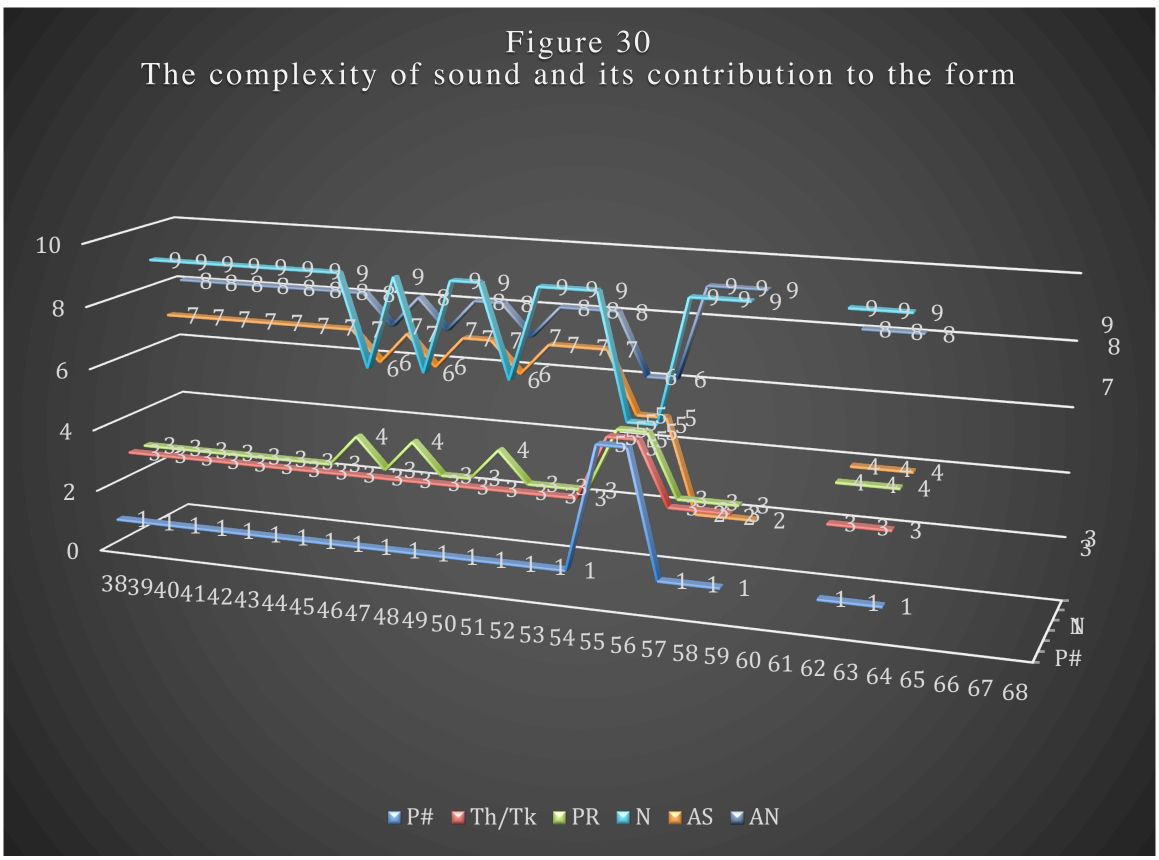


Figure 30
The complexity of sound and its contribution to the form

The levels of parallelism and contrast between different elements of sound continue to evolve in this section. There are many different relationships between different elements of sound in Figure 30. For example, whenever the number of partials is at its lowest, the level of noise is at its highest, nine. As the number of partials increases, the level of noise decreases, showing an inverse relationship. However, this relationship does not follow in all sections. The direct and indirect relationships between different elements of sound contribute to the modification of timbre. These relationships create similarities and contrast between different sections in Crama.

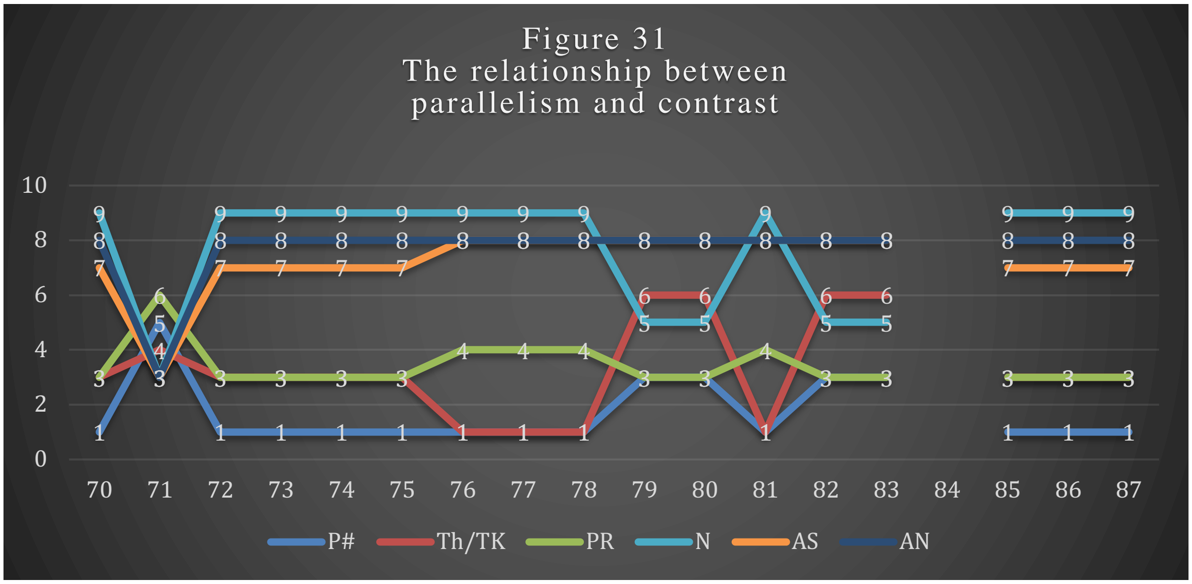


Figure 31
The relationship between parallelism and contrast

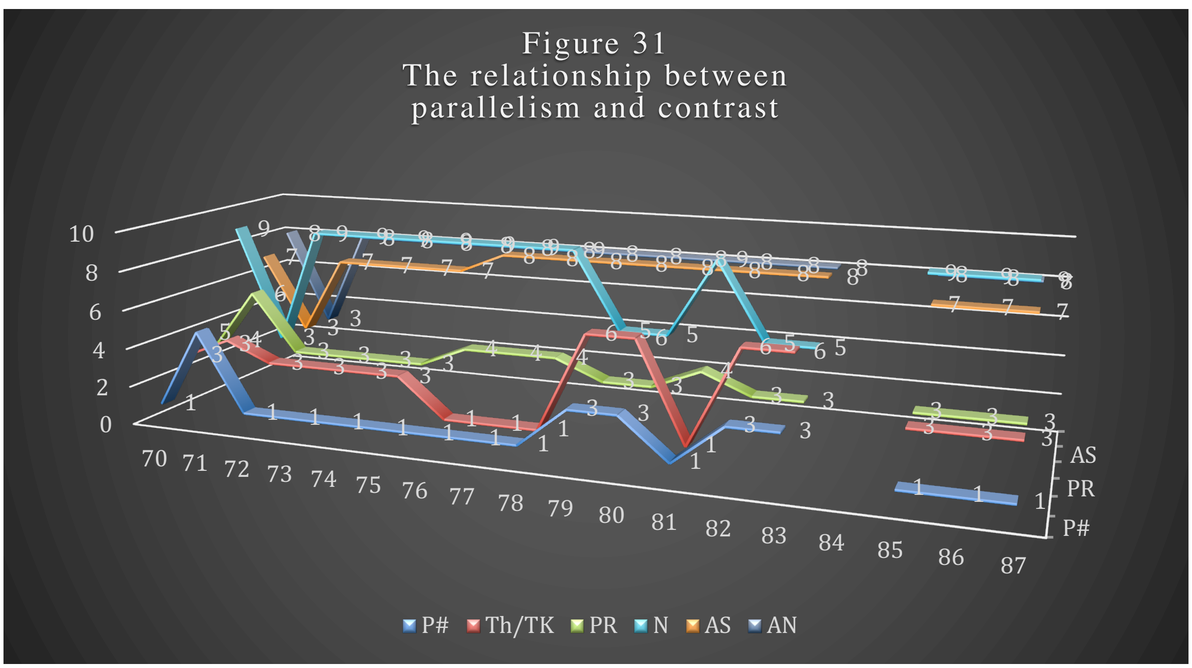


Figure 31
The relationship between parallelism and contrast

The level of parallelism remains highly active between the contributing elements to the quality of sound in Figure 31. The level of contrast balances the parallelism in this section, as it does in almost all sections in Crama. There are 9 bars of parallelism, bars 72 – 75, 76 – 78, 79 – 80, 82 – 83, and 85 – 87, and six bars of contrast, 70 – 72, 75 – 76, 78 – 79, 80 – 82 between the contributing structural sound elements in Figure 31.

The balanced relationship between parallelism and contrast contributes to the anatomy of timbre in all sections. This evolving relationship creates shapes, phrases, sections, and form in Crama. Therefore, in a sound-based composition, the relationship between parallelism and contrasts can foundationally contribute to shaping form.

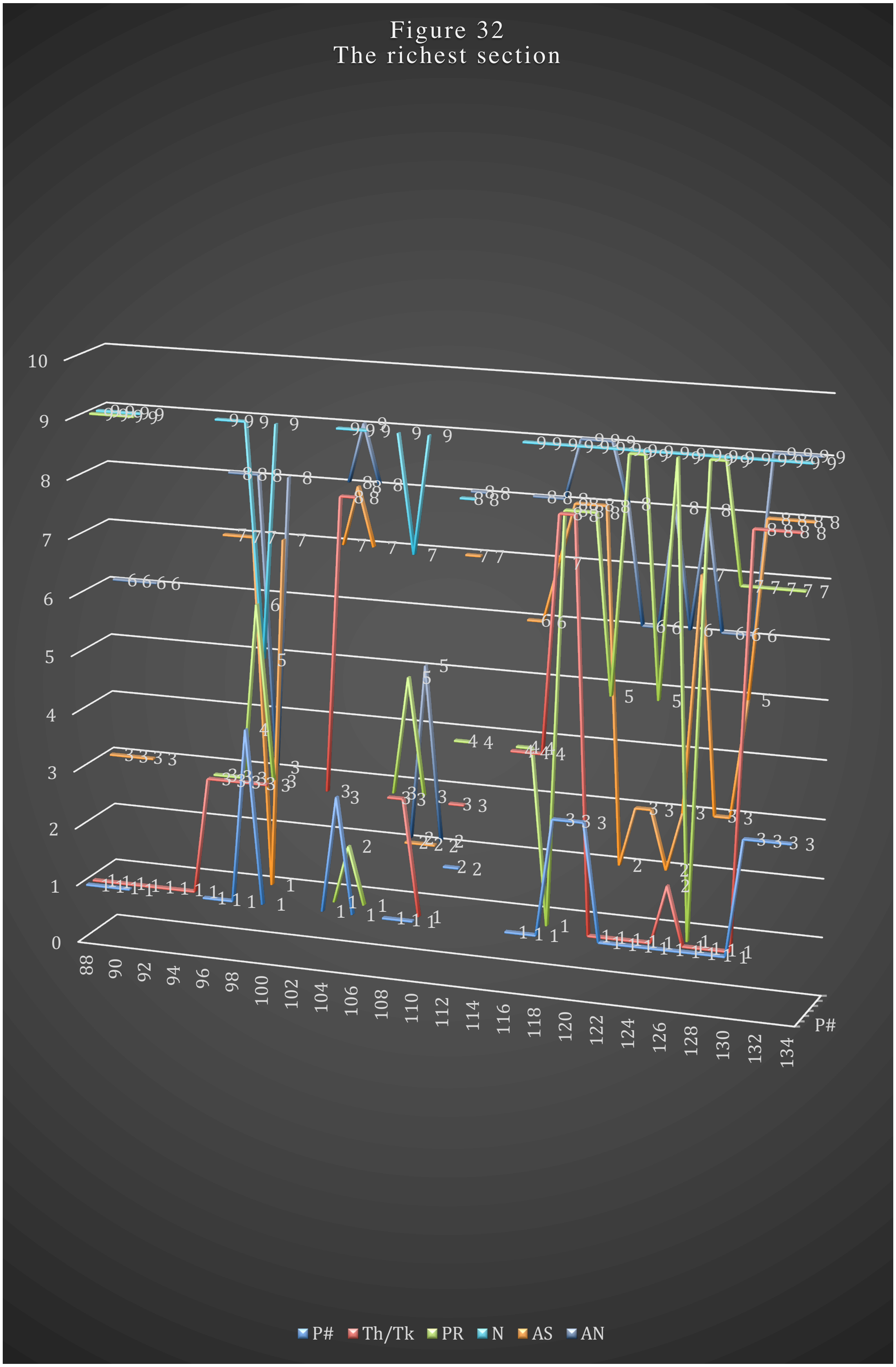
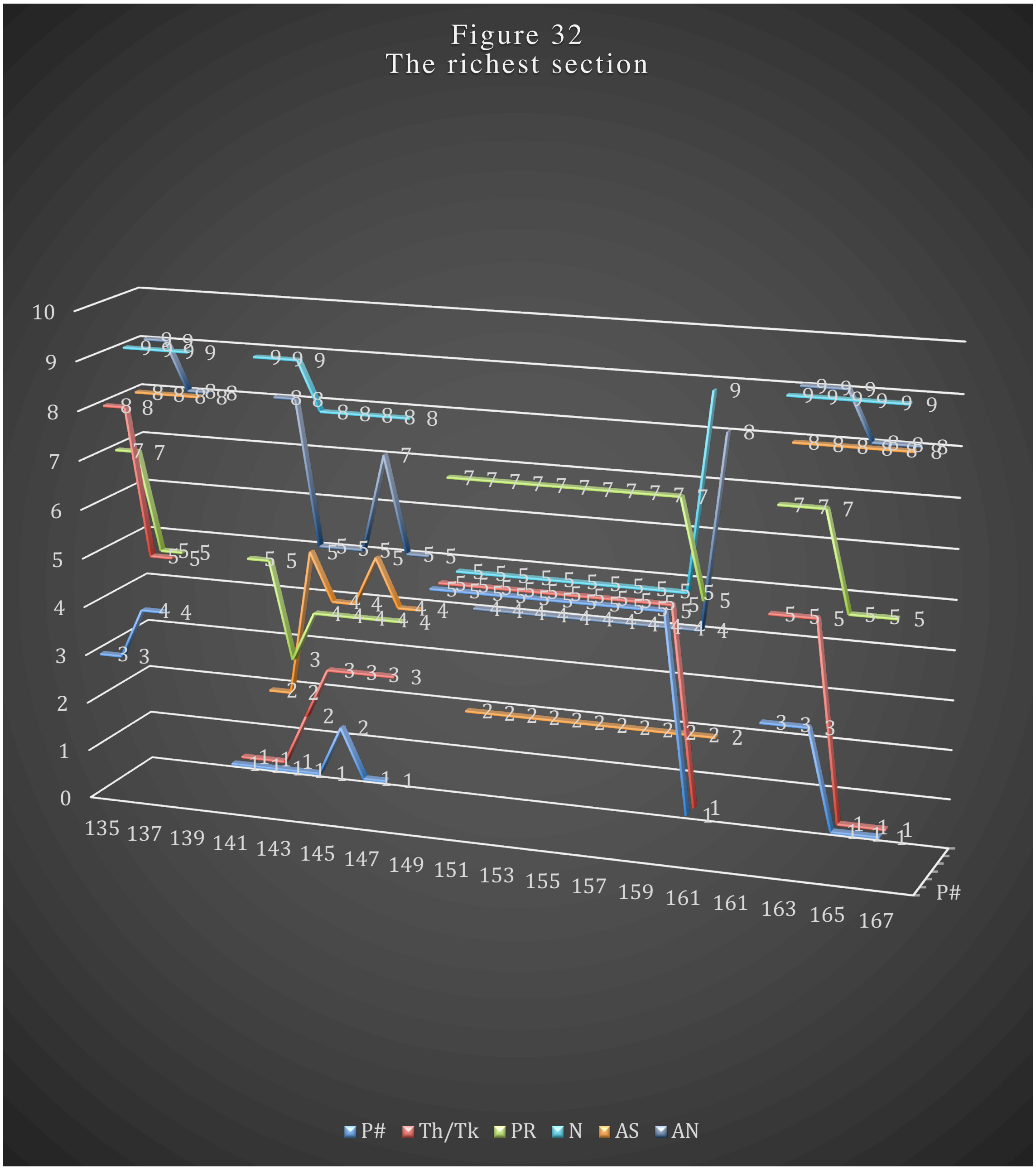


Figure 32
The richest section



As previously mentioned, Figures 32 is the richest sections in terms of arc variety. This variety is the result of an evolving relationship between the parallelism and contrast of different contributing elements of sound. Thus, the relationship between parallelism and contrast is not only one of the perquisites of shaping phrase—and timbre as the primary element of phrase—but it also contributes to the form of sound as well. In this way, parallelism and contrast are among the tools essential to creating sounds as well as forms.

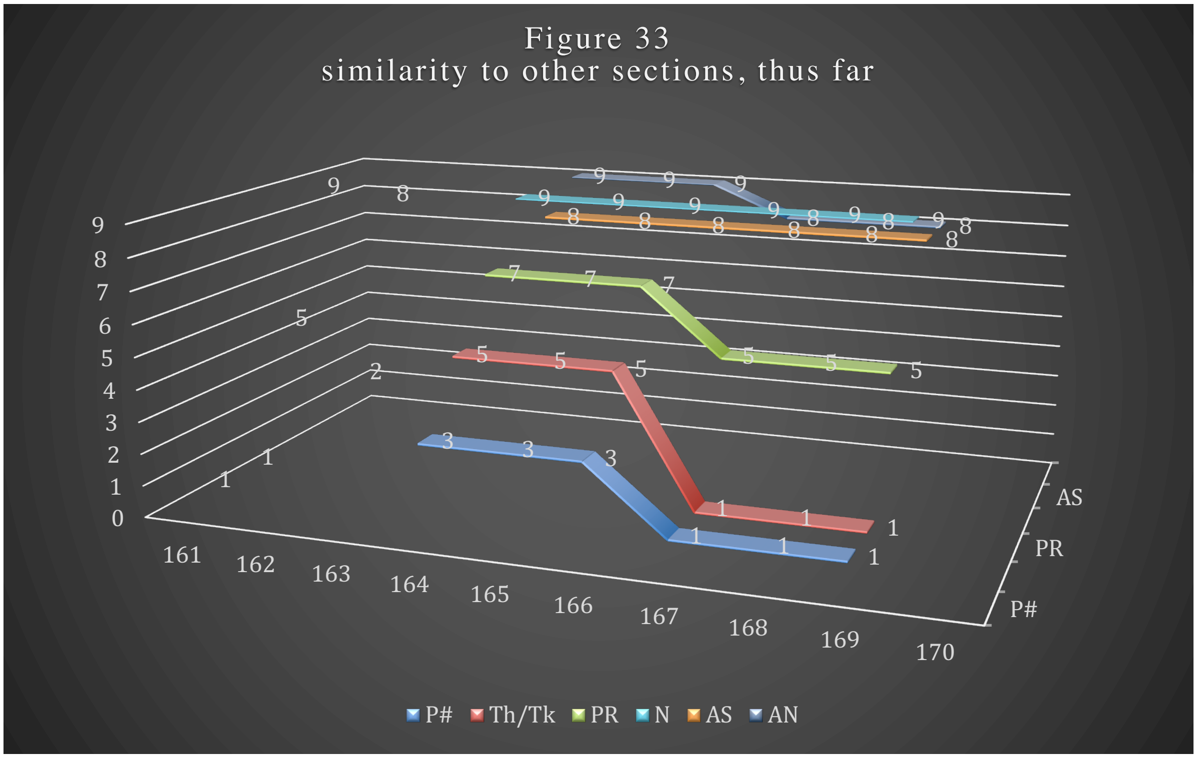
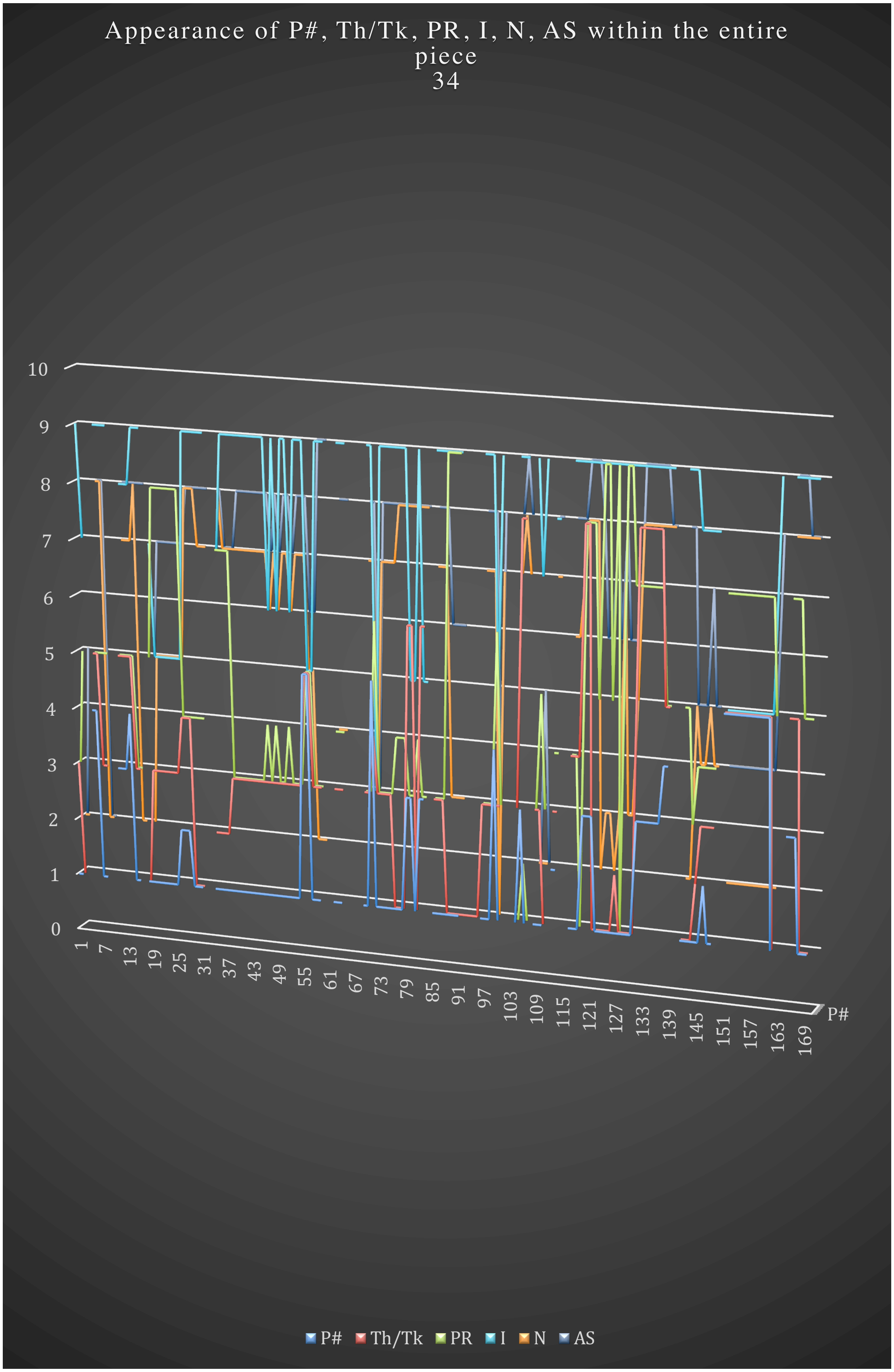
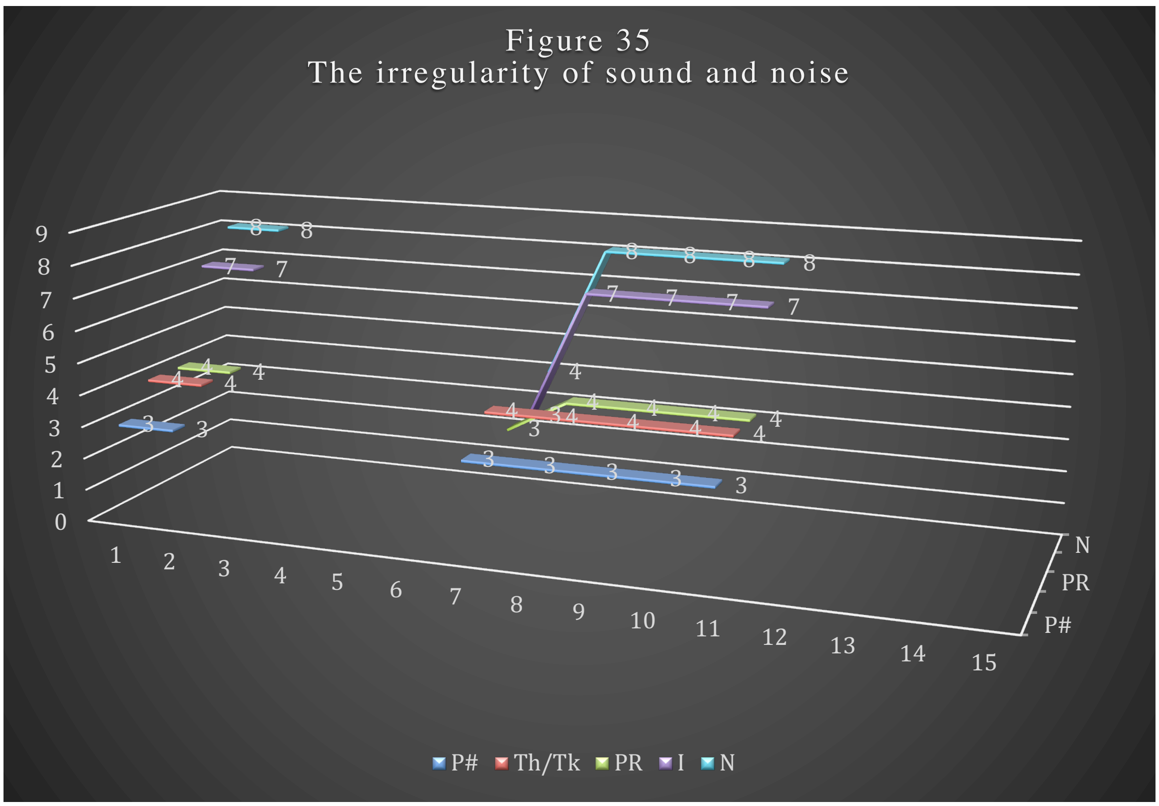


Figure 33 demonstrates a decrease, from nine to eight, in the noisiness of attack category and the sharpness of attack category. However, this is a mild drop when compared with number of partials, thinness and thickness of sound category and range of partials category. As the number of partials, thinness and thickness of sound, and range of harmonic partials drop, the amount of noise, sharpness, and noisiness stays essentially stagnant. This relationship is similar to ones in Figures 19 and 11. The similar and consistent behavior in the ending section relates to the consistent importance of noise through a sound-based composition like Crama. A closer look reveals that number eight is the most repeated value in Figure 26, the opening section. Figure 29 also ends with value eight. The way in which the number eight bookends the section argues for a logic behind this consistency, and how it is essential to form. The repetition connecting the beginning and ending relates to timbre as a critical element of the form in Crama.

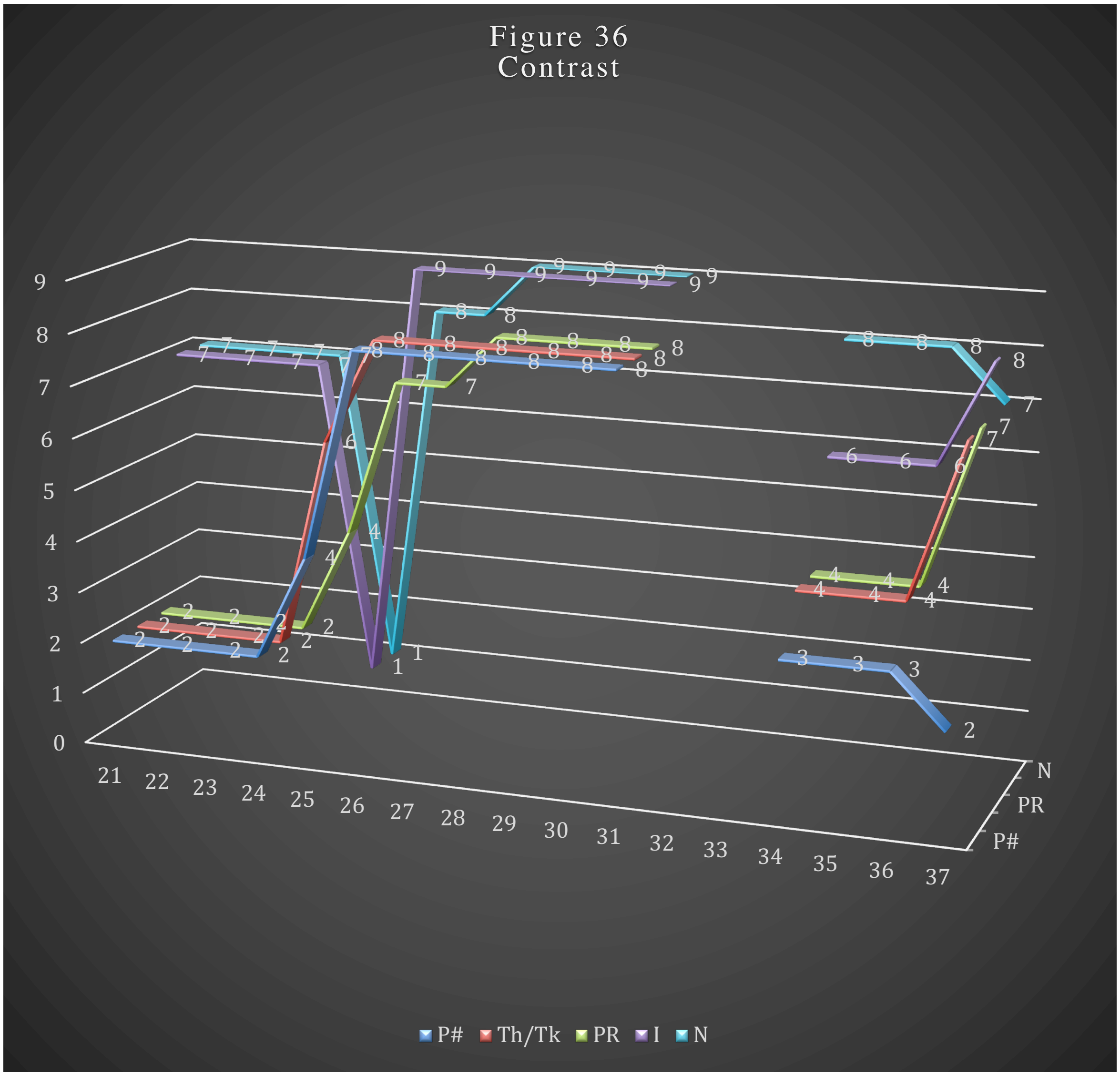

Appearance of P#, Th/Tk, PR, I, N, AS within the entire piece
34
10
9
8
7
6
5
4
3
2
1
0
1 7 13 19 25 31 37 43 49 55 61 67 73 79 85 91 97 103 109 115 121 127 133 139 145 151 157 163 169
P#
P# Th/Tk PR I N AS

Chapter 4: The Progression of the Five Contributing Elements of Sound and Form in the Clarinet

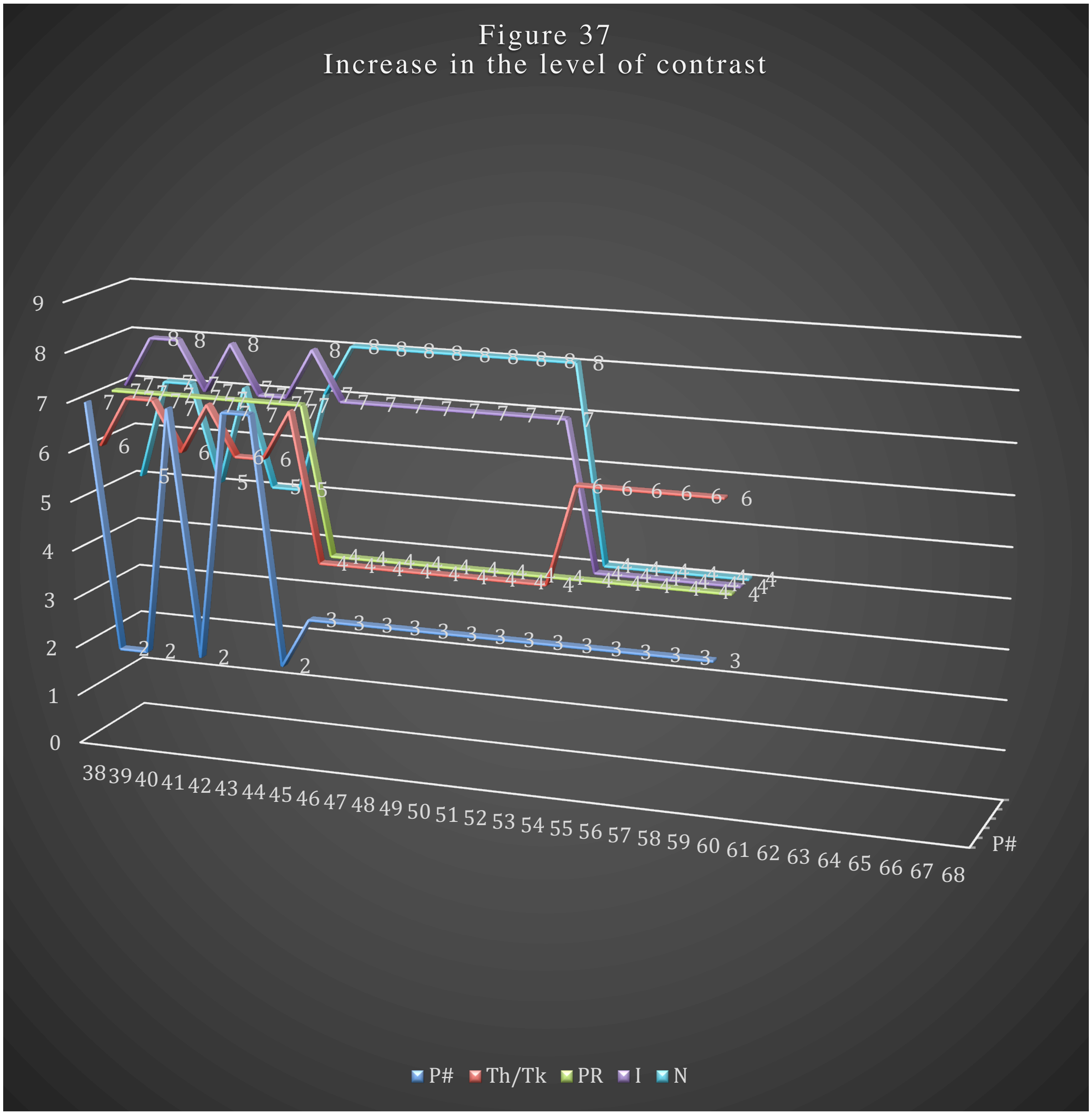
In this chapter, I compare the different combinations of five categories, including the number of harmonic partials, the thinness or thickness of sound, the range of strongest partials, the irregularity of sound, and the amount of noise.



The irregularity of sound is in parallel motion with the other elements of sound for most of this section. A closer look shows that, when there is an increase in the level of noise, there is an increase in the irregularity of sound. Therefore, there is a consistent direct relationship between the level of noise and irregularity of sound in Figure 35. Can there be a contrast or unparallel motion between the level of noise and irregularity of sound? The answer will be discussed in the course of this chapter.



The level of parallelisms between different contributing elements of sound is similar to Figure 35. The only points of contrast between these two sections are: 1) the drop and spike in the level of noise in bars 25 – 27, and 2) the rise and fall between different elements of sounds in bars 37 – 38. The contrasting bars above define Figure 36 as a section in contrast with Figure 35, and this contrast between these two Figures contributes to the form in Crama. Notice the unparallel motion between the irregularity of sound, and the amount of noise in bars 36 – 37.



Concerning parallelism and contrast, Figure 37 can be divided into two smaller sections. Those sections are bars 38 – 46 and 46 – 60. Bars 38 – 46 indicate a significant drop and spike in the number of harmonic partials category, which is in contrast to Figures 35 and 36. Also, there are smaller spikes and drops in the vicinity of bars 38 – 46 within other contributing elements of sound. The spike and drop in bars 38 – 46 is not present in bars 1 – 69, meaning that bars 38 – 69 play a contrasting role in this section and within bars 1 – 69. Notice the slight unparallel motion between the irregularity of sound, and the amount of noise, between bars 45 – 46.

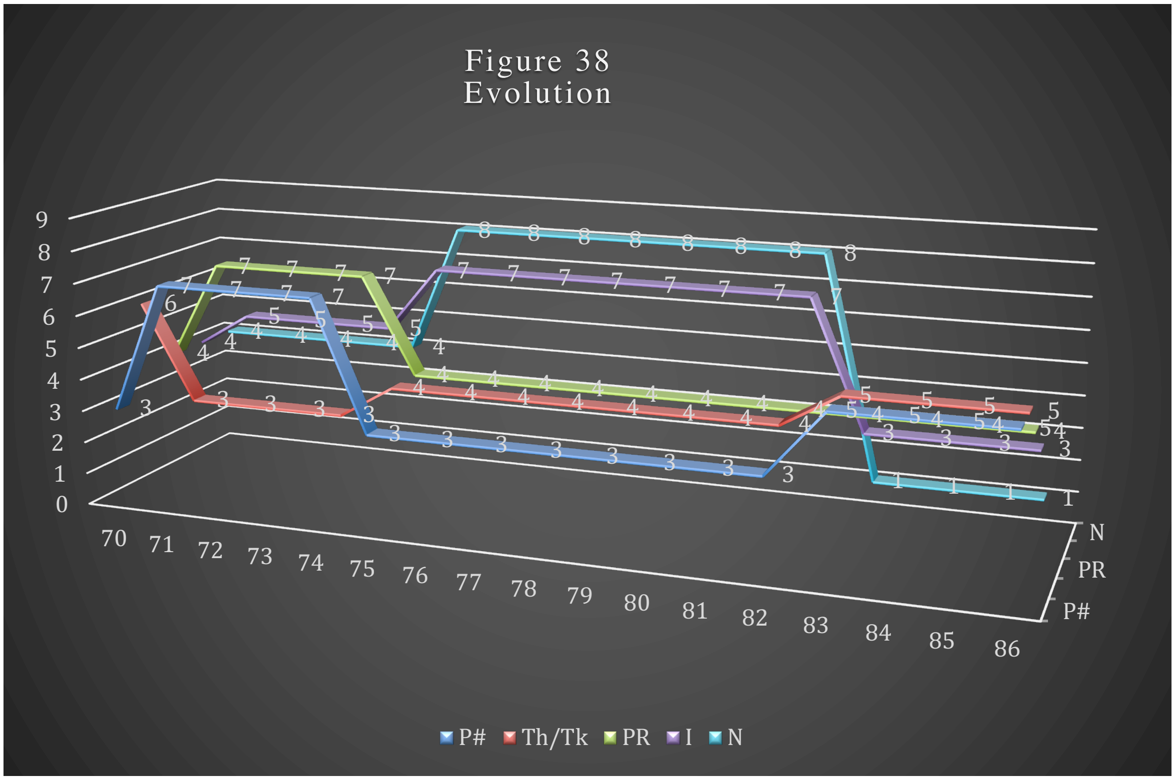


Figure 38 can be divided into three sections. Section 1: bars 70 – 74, showing short spikes, bars 70 – 71, bars 71 – 74, showing small-stagnant motion, and bars 74 – 75, showing short spikes and drops. Sections 2: bars 75 – 82, showing long-stagnant motions. Section 3: bars 82 – 83, showing big drops, and bars 83 – 86, which is short and stagnant.

Figure 38 suggests the first appearance of such a concise construction of spike, drops, and stagnation in Crama, and there is a clear sense of how these three elements are constructed. As Crama makes progress in the construction of its form, the relationship between constructing elements of sound and form becomes more clear. Notice there is no unparalleled motion between the irregularity of sound and noise, levels 4 and 5, in Figure 38.

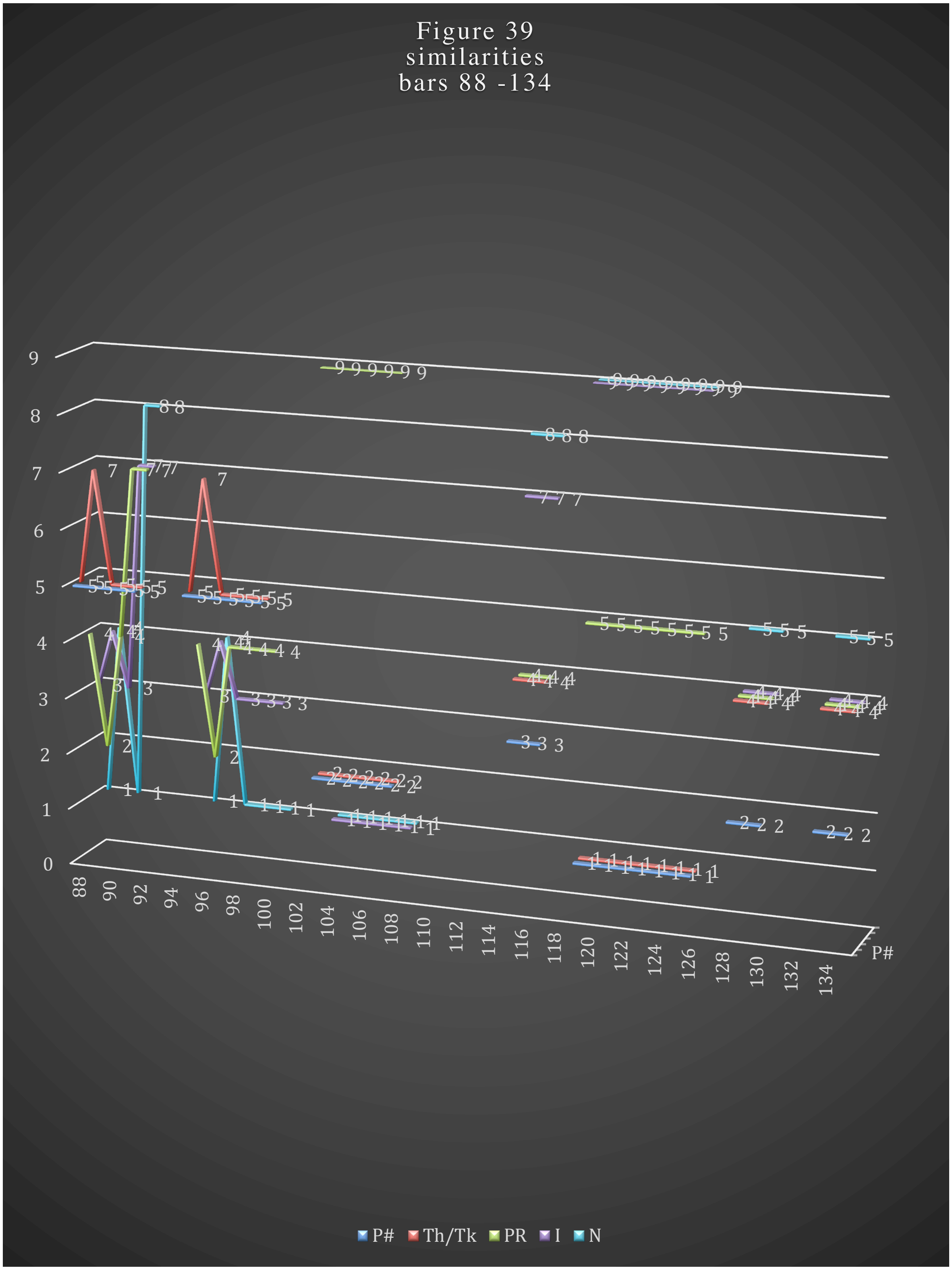


Figure 39
similarities
bars 88 -134
0
1
2
3
4
5
6
7
8
9
88
90
92
94
96
98
100
102
104
106
108
110
112
114
116
118
120
122
124
126
128
130
132
134
P#
P# Th/Tk PR I N

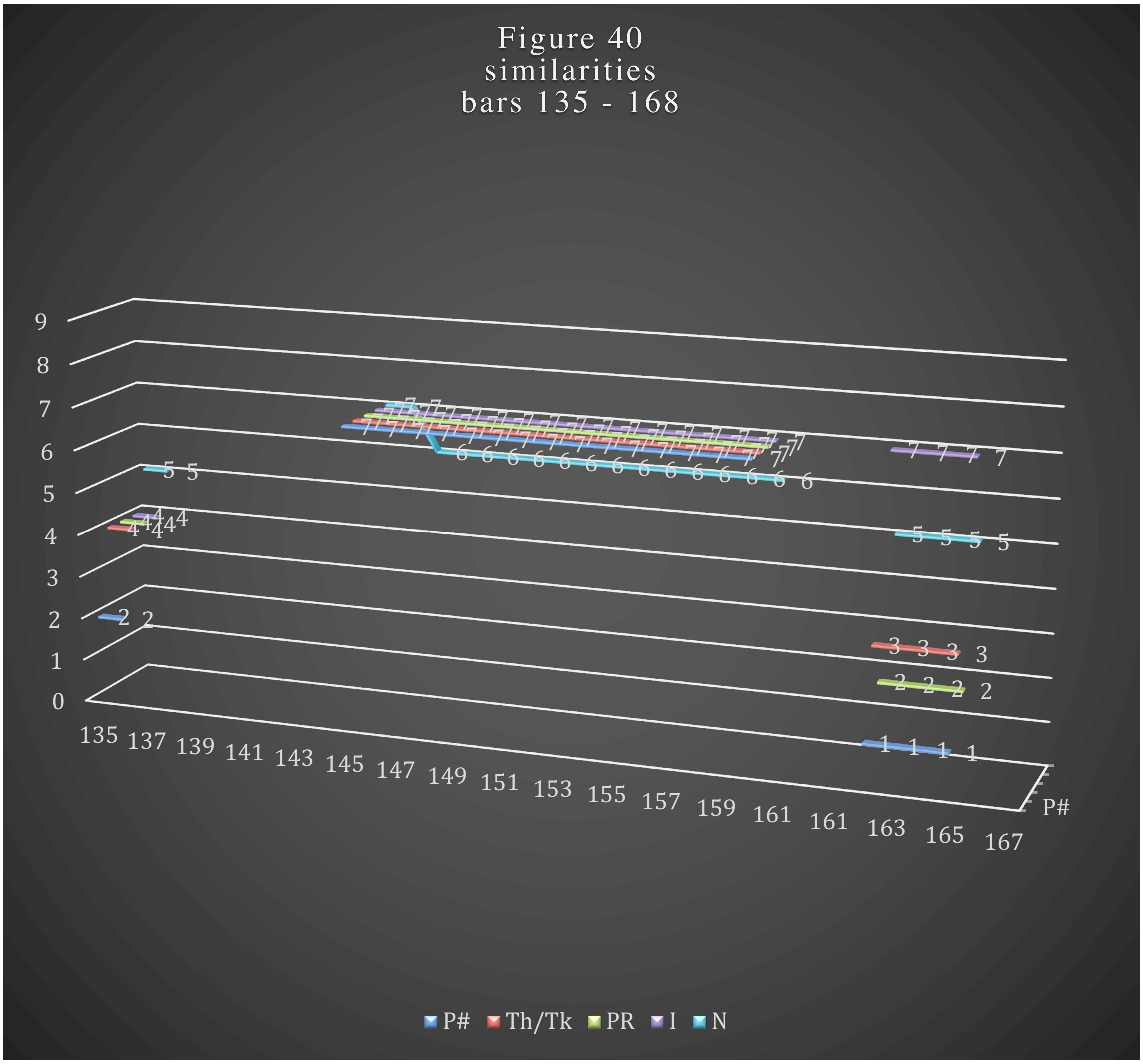


Figure 39 and 40 can be divided into two sections. Section 1: bars 88 – 99, showing large spikes and drops. Section 2: bars 98 to 162, showing long-stagnant parallelism motions. Figures 40 and 37 share the same construction in terms of the relationship between stagnant and spike sections.

Additionally, the spike in the amount of noise in bars 91 – 93, is similar to that in bars 24 – 27 in Figure 42. Thus, there is progress and return to the irregularity of sound. The progress occurred in Figures 37 and 39, and the return in Figure 40. Notice there is no unparalleled motion between the irregularity of sound and noise.

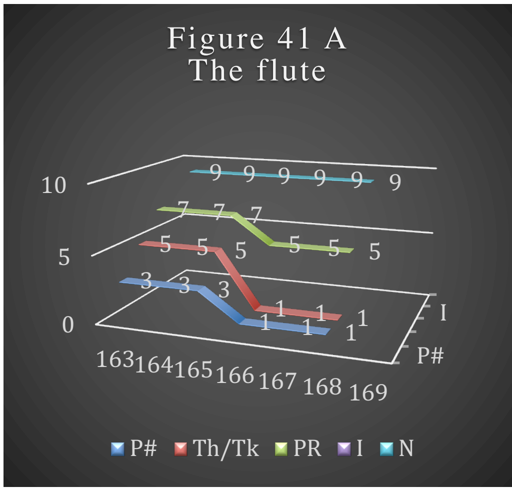


Figure 41 A
The flute

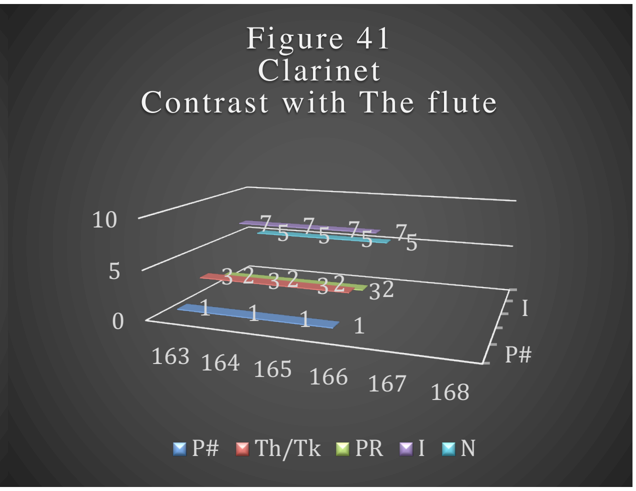


Figure 41
Clarinet
Contrast with The flute

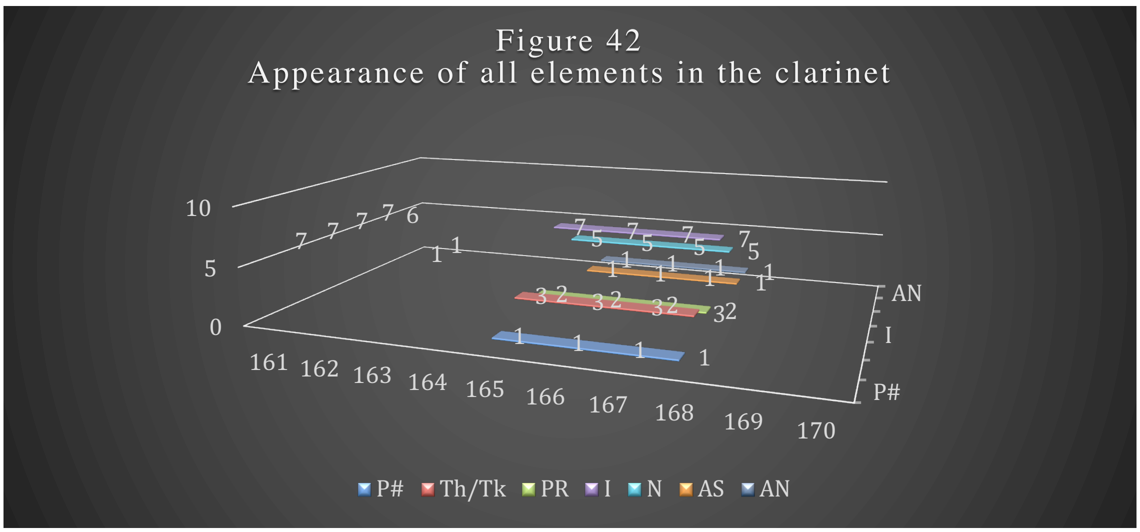
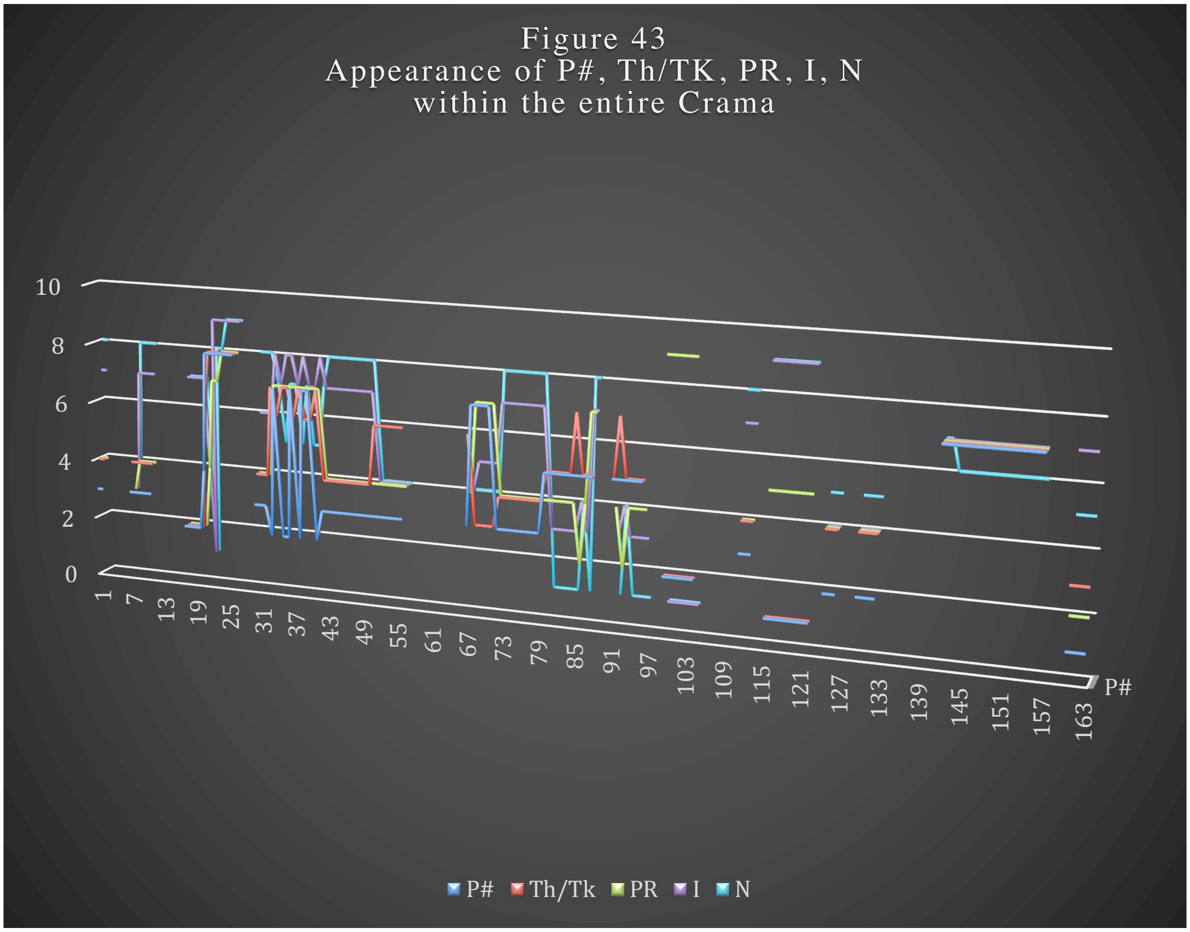


Figure 42
Appearance of all elements in the clarinet

In the discourse of timbre analysis in the flute, within the five contributing elements to the sound of the flute, I noted that all the elements of sound dropped except the level of noise. However, according to Figure 41, the five contributing elements to sound in clarinet stay stagnant. This difference means that the contrast in the timbre of the flute and the clarinet contributes to the anatomy of timbre in Figure 41.

Figure 35 raised a question: Can there be a contrast or unparallel motion between the level of noise and irregularity of sound? The answer to this question is now clear: The sound analysis of

Figures 35 – 41 reveals that a small portion of the sound, under 3%, suggests a contrasting motion between the irregularity of sound and level of noise.



Chapter 5: Transparent in the Flux of Time

Moving forward, I will make comparisons between different combinations of the elements contributing to the quality of sound, such as the number of partials, the thinness and thickness of sound, the range of partials, the irregularity of sound, and the amount of noise in the violin.

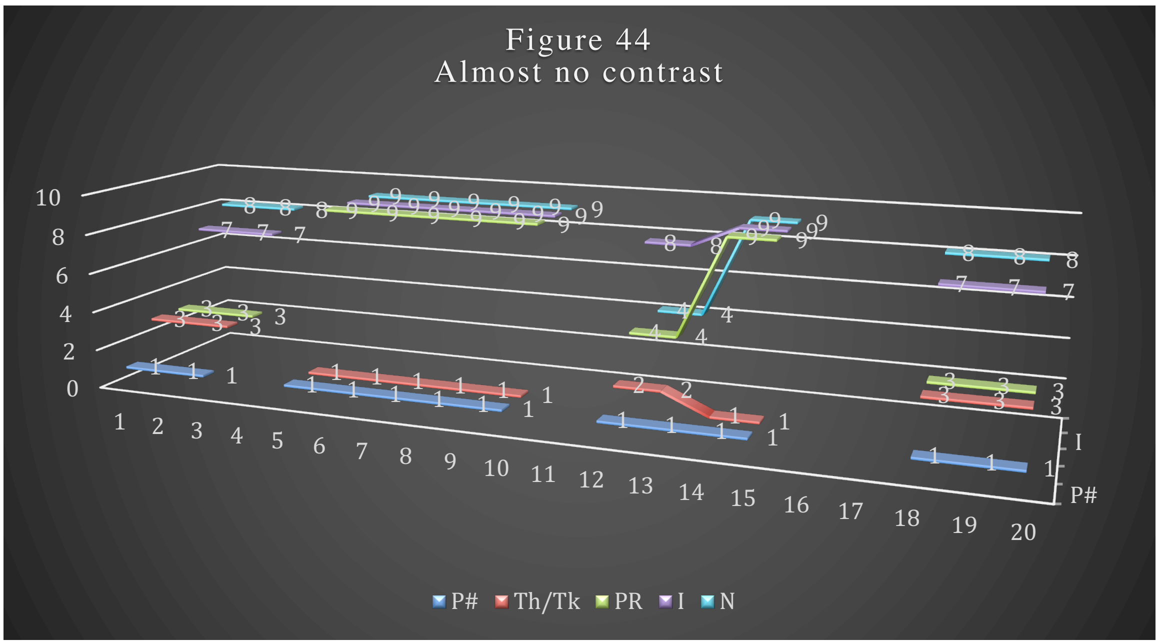
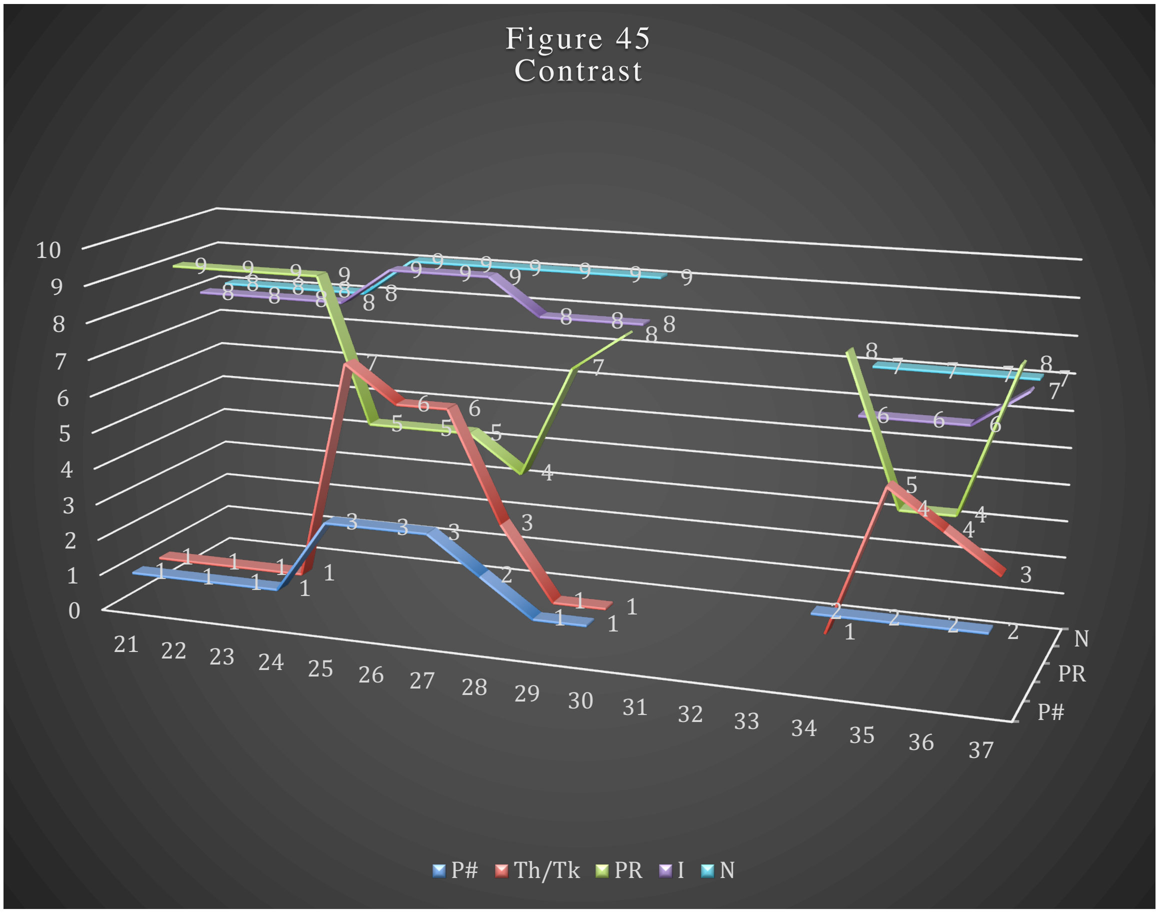


Figure 44
Almost no contrast

Figure 44 demonstrates a large amount of parallelism between different contributing elements to the quality of sound. The amount of noise increases, bar 13, as the sound becomes thinner in the same bar. The number of partials category drops to two or one, as compared to Figure 35, bars 1 – 20 of the clarinet, while the amount of noise suggests alignment with Figure 35. Similar to Figure 35, Figure 44 does not show any contrast, and thus, as an opening section, it does not have a definite form.

Repetition is the primary tool of this section. The opening section of a sound-based composition can be formed by repeating the same timbres without leading to any contrast. Hence, repetition with no sense of contrast, are the ingredients of the introduction section of a sound-based composition.



The sound becomes dramatically thicker in bars 24 – 25 while the amount of noise, does not change significantly. The dramatic increase is due to the change of technique from left-hand gliss, a thinner sound, to the "slow-bow sound,"[29] beat 4, in the violin. The slow-bow sound is a thick sound. This means there is a direct relationship between the level of noise and the thickness of sound in bar 24. As the amount of noise increase, sound is thicker. The level of contrast

[29] "SLOW BOW SOUND (Slash notehead): The left-hand fingers should touch the strings but should not hold them down firmly (like natural harmonic). It is necessary to bow at slower speed than normal at sul tasto area with light bow pressure. The sound produced is dark, muffled with noisy qualities without very clear pitch intonation. ATTENTION: the written note does not always correspond to the one that is sounded. In this case the performer should follow the written note regardless of the sounding result." Page 3 of the preface.

contributes to the complexity of timbre, and the interactive relationship between different elements contributes to the overall construction of sound in bar 24.

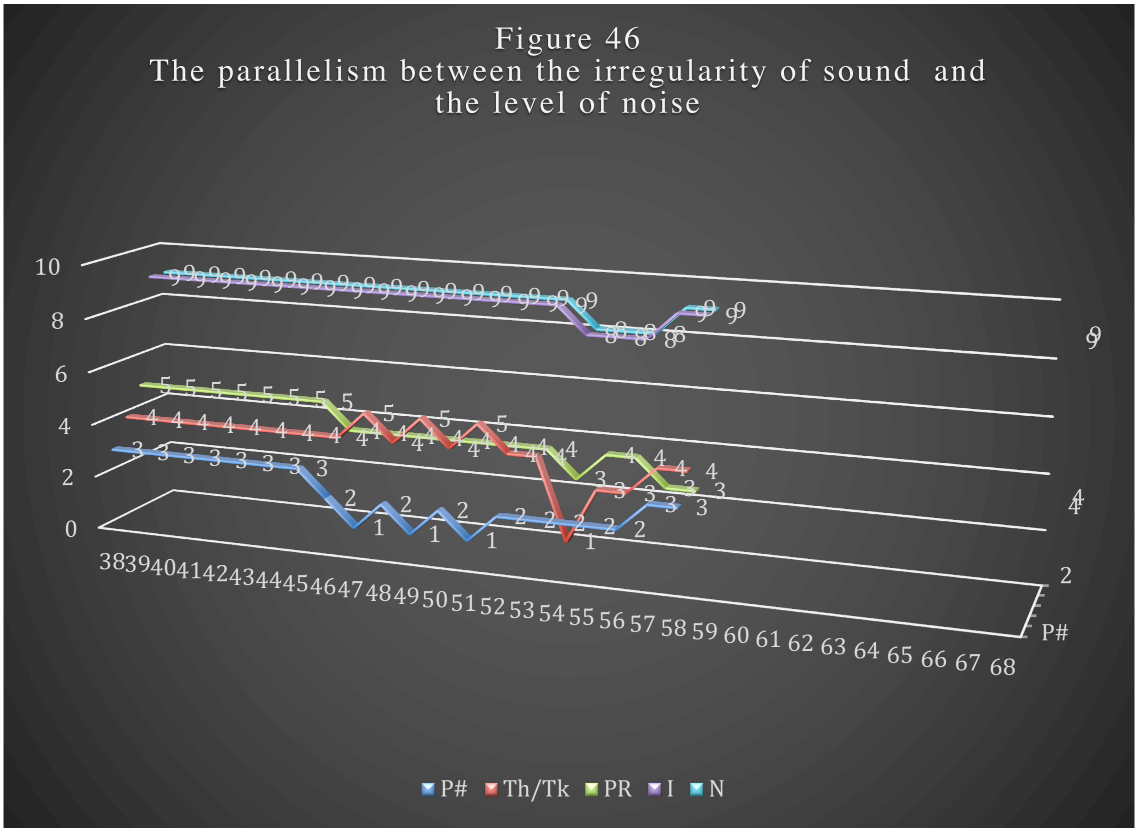


Figure 46
The parallelism between the irregularity of sound and the level of noise

Notice the parallelism between the irregularity of sound category and the amount of noise in Figure 46. Notice also the contrast motion in bars 45 – 54, between the number of partials, and the thinness or thickness of sound. Also significant is the return of parallelism between all of the above elements in bars 55 – 59.

Parallelism and contrast can divide Figure 46 into three sections: 1) bars 38 – 45, showing parallelism between all the contributing elements of sound, 2) bars 46 – 54, showing the contrast between the number of partials and the thickness of sound, and 3) bars 55 – 59, showing the return of parallelism between all the elements. In comparison with Figure 44, Figure 46 demonstrates a much more clear shape in terms of the ratio between contrast and parallelism and their correspondence to the overall shape of Crama. One can observe the evolution in form as Crama moves forward in the flux of time.

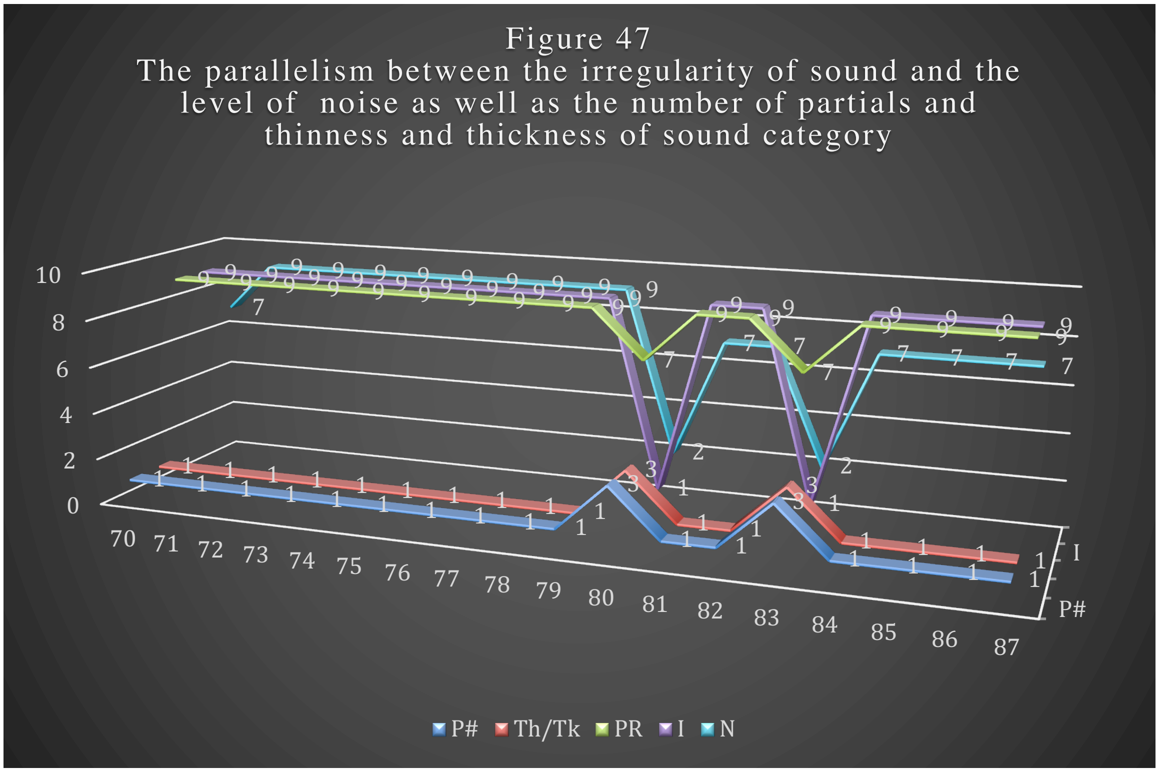
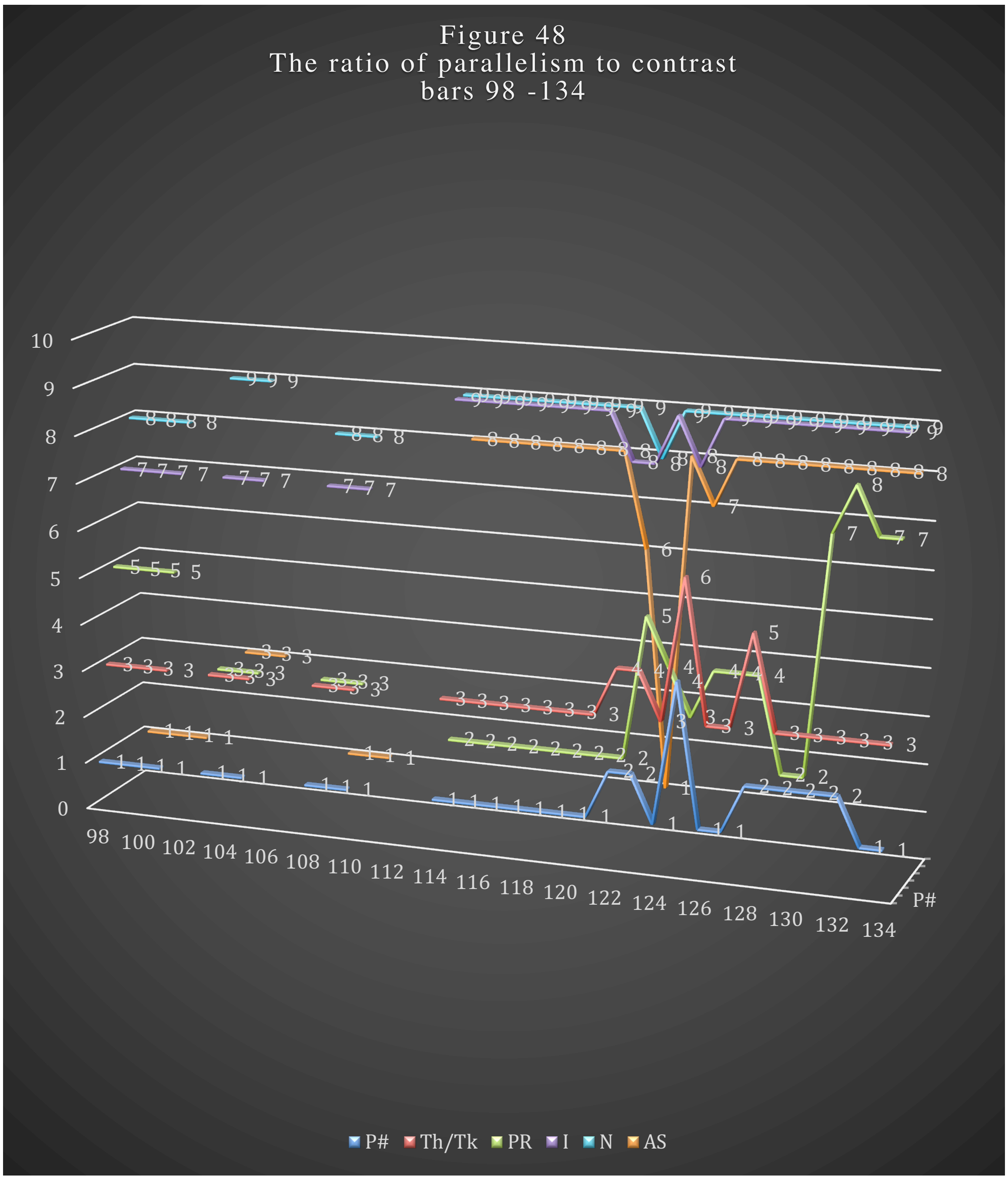


Figure 47 demonstrates two essential moments of parallelism, which do not exist in any other Figures: 1) There is parallelism between the number of partials, and the thinness and thickness of sound from bars 71 – 87, almost the entire section. 2) The parallelism between the irregularity of sound category and the amount of noise, between bars 70 – 81, also for almost the entire section.

Figure 47 reveals another moment that Figures 44, 45, and 46 do not display. Notice the drop in the irregularity of sound and noise, as the number of partials and density of partial spike in bars 79 – 81 and 82 – 84. The appearance of the open strings, as an ordinario, in bars 80, 81, and 83, is the main reason for this unusual change. The appearance of the ordinario in the violin is a unique moment, and it does not appear anywhere else in Crama. In a sound-based composition, therefore, pitch can be employed as a secondary element when timbre is the primary element of form.

Similar to Figure 46, the overall shapes of line in this section can be divided into three different sections: 1) bars 70 – 80; 2) bars 81 – 85, its drop and spike contrasting with bars 70 – 80; and 3) bars 85 – 87, a variation of bars 70 – 80.



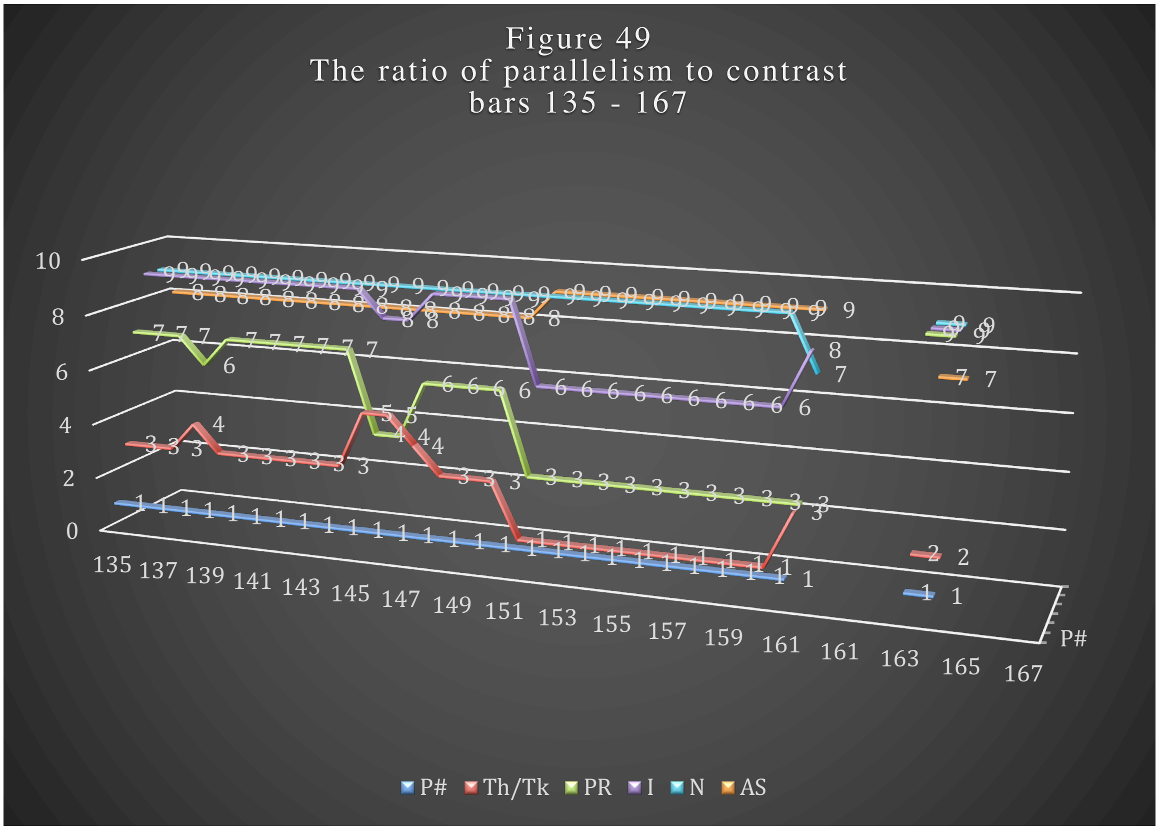


Figure 49
The ratio of parallelism to contrast
bars 135 - 167

There are sixty-eight bars in Figures 48 and 49. Bars 98 – 122 exhibit stagnant parallelism, whereas bars 123 – 164 demonstrate a combination of stagnant and imitative parallelism.

It seems bars 122 – 126 suggests a contrast between all the six contributing elements of sound. As a result, there is a large ratio of parallelism and imitation to contrast in Figure 48/49. A similar ratio appears between Figures 48 and 44 – 47. The unbalanced ratio between parallelism, imitation, and contrast, contributes to the construction of timbre in Crama.

The number of partials is always at its lowest when affecting the irregularity of sound and noise at their highest. The relationship between the number of partials and inharmonicity proves the importance of noise, as the result of the interaction between different contributing elements of sound in Crama.

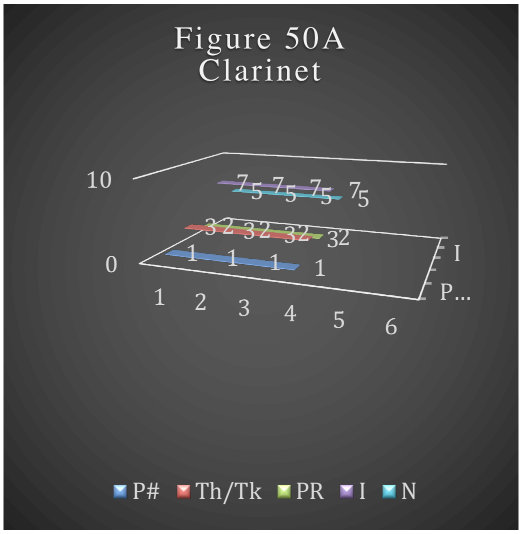


Figure 50A
Clarinet
10
0
1 2 3 4 5 6
I
P...
P# Th/Tk PR I N

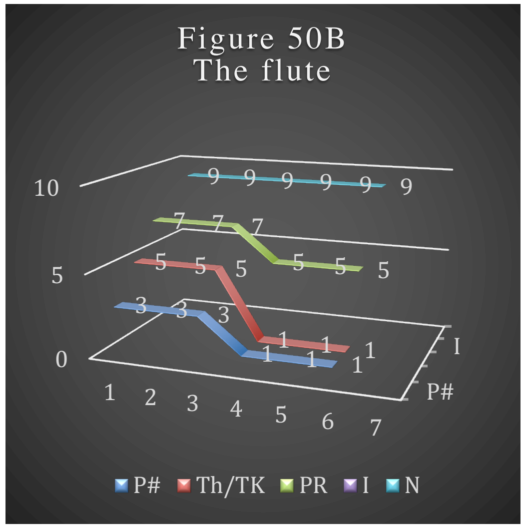


Figure 50B
The flute
10
5
0
1 2 3 4 5 6 7
I
P#
P# Th/TK PR I N

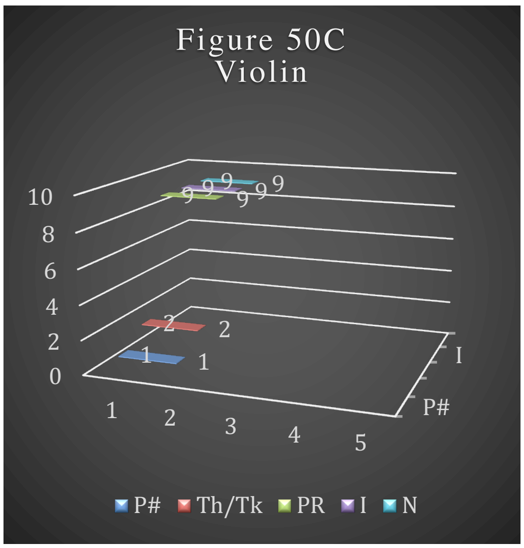


Figure 50C
Violin
10
8
6
4
2
0
1 2 3 4 5
I
P#
P# Th/Tk PR I N

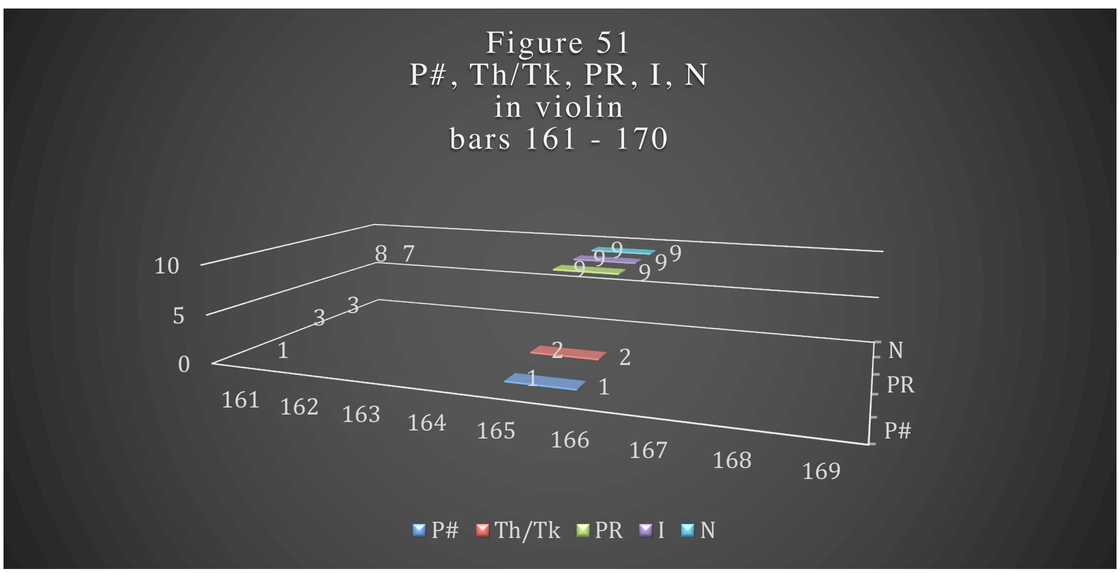


Figure 51
P#, Th/Tk, PR, I, N
in violin
bars 161 - 170
10
5
0
161 162 163 164 165 166 167 168 169
N
PR
P#
P# Th/Tk PR I N

The irregularity of sound and noise are parallel and equal in Figure 50C. There are similarities and differences between all the elements of sound in the flute, clarinet, and violin. All the elements of sound are stagnant in the violin. The interactive relationships between different elements of sound in each instrument, in addition to their interactions with other instruments, contribute to the overall complexity of sound in the ending section of Crama. The similarities between values of 1, 2, and 9, in the number of partials, thinness and thickness of sound, and the amount of noise in the introduction section in the violin, and the ending section proves the importance of timbre and its contribution to form in Crama.

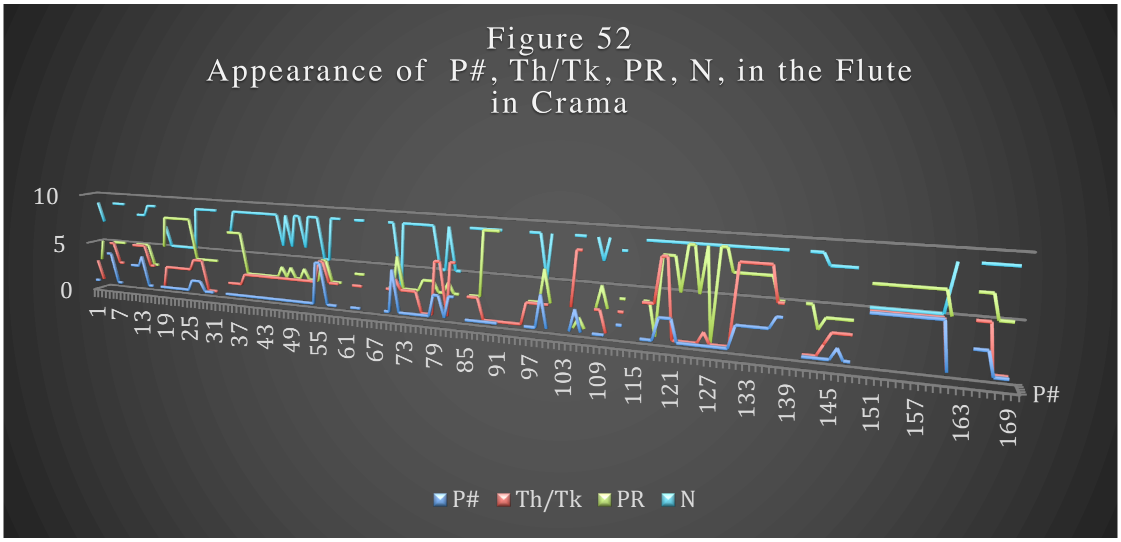


Figure 52
Appearance of P#, Th/Tk, PR, N, in the Flute
in Crama
10
5
0
1 7 13 19 25 31 37 43 49 55 61 67 73 79 85 91 97 103 109 115 121 127 133 139 145 151 157 163 169
P#
P# Th/Tk PR N

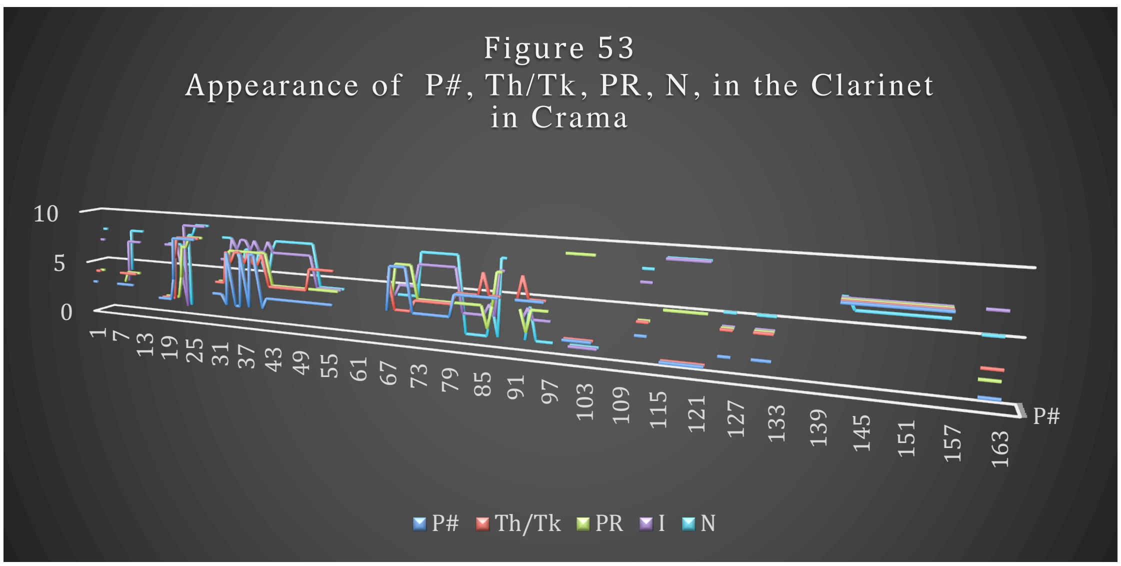


Figure 53
Appearance of P#, Th/Tk, PR, N, in the Clarinet
in Crama
10
5
0
1 7 13 19 25 31 37 43 49 55 61 67 73 79 85 91 97 103 109 115 121 127 133 139 145 151 157 163
P#
P# Th/Tk PR I N

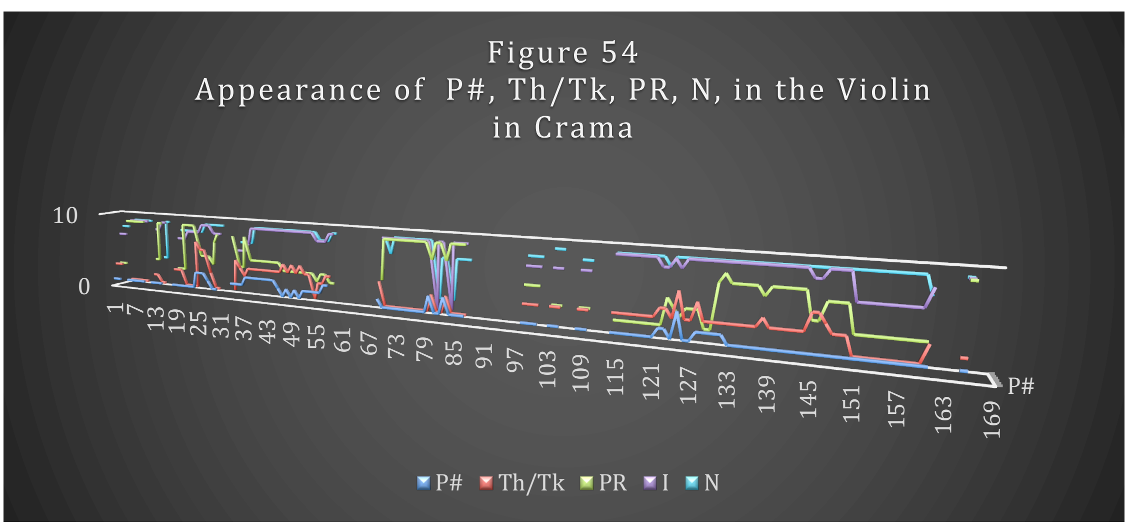


Figure 54
Appearance of P#, Th/Tk, PR, N, in the Violin
in Crama
10
0
1 7 13 19 25 31 37 43 49 55 61 67 73 79 85 91 97 103 109 115 121 127 133 139 145 151 157 163 169
P#
P# Th/Tk PR I N

Chapter 6: The Noisiest Instrument in Crama

Chapter six discusses the comparisons, in the viola, between different combinations of the contributing elements of sound. The elements are the number of partials, the thinness or thickness of sound, the range of partials, the irregularity of sound, the amount of noise, and the sharpness of attack.

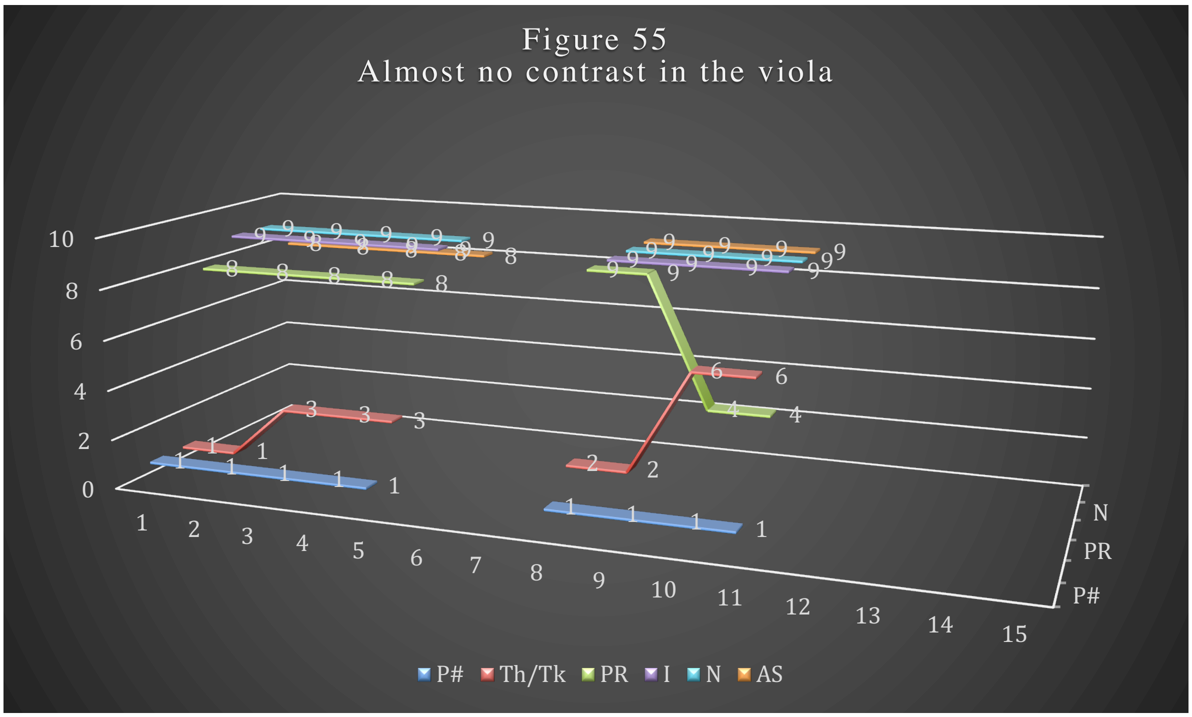


Figure 55
Almost no contrast in the viola

When compared with the others, the viola is almost the noisiest instrument in Crama. The irregularity of sound and the amount of noise are parallel in Figure 55, and bars 8 – 11 indicate the parallelism between the amount of noise, inharmonicity, and sharpness of attack. The parallelism between these elements proves that the sharpness of attack affects the levels of noise and inharmonicity. The number of partials is at its lowest since there is a higher level of noise. Also, the thinness or thickness of sound fluctuates between four and nine. This fluctuation creates a shape for the thinness and thickness of sound category, unlike the other stagnant elements in Figure 55.

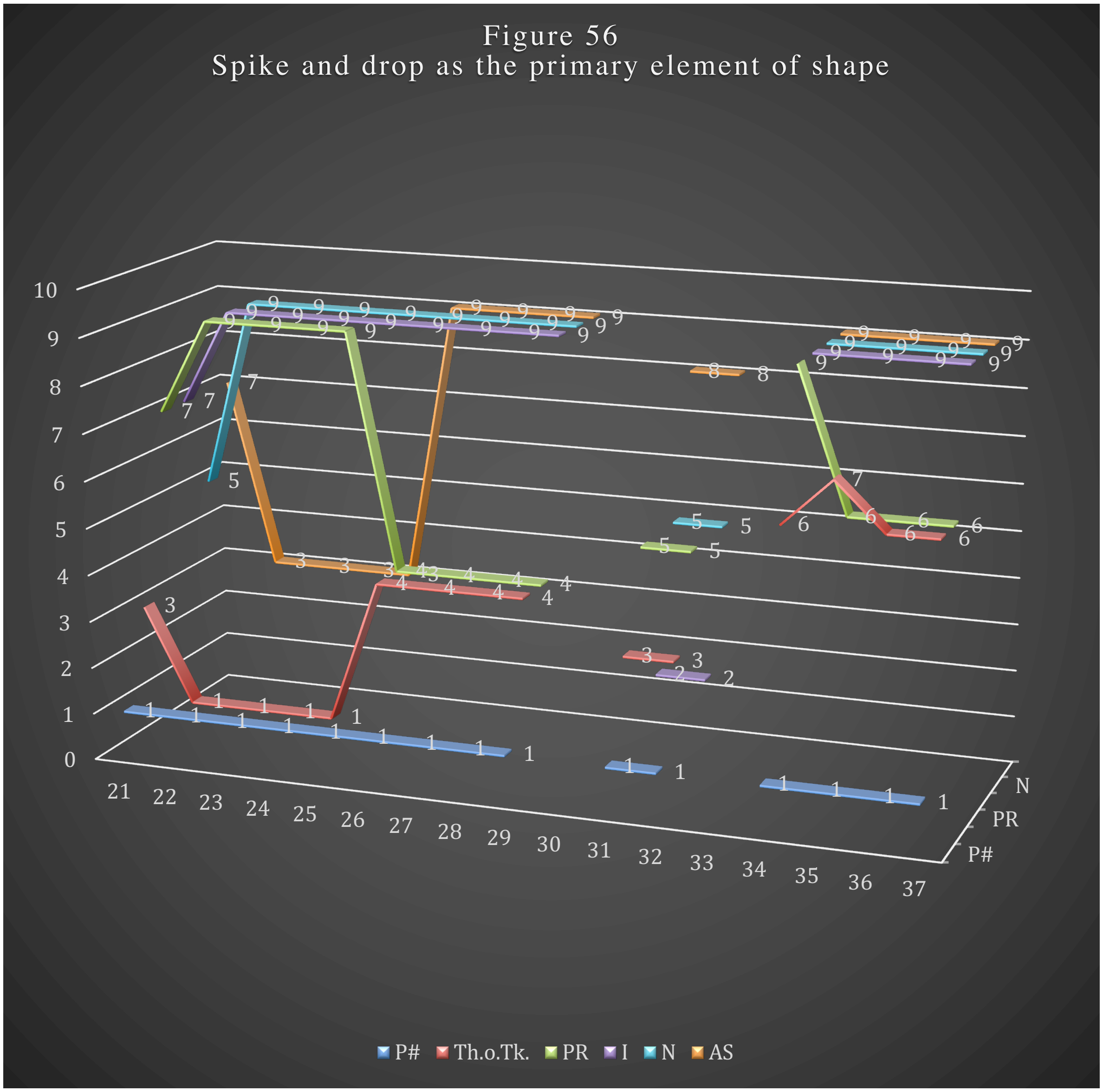


Figure 56
Spike and drop as the primary element of shape

Compared with Figure 55, Figure 56 suggests a clear sense of shape due to spikes and drops in the amount of noise and sharpness of attack. The presence of spikes and drops are due to the change of levels among the contributing elements of sound. Hence, peaks and drops always contribute to the evolution of timbre. The shape of a phrase is affected as quality-defining elements of sound are modified. This modification, among sections, bars, or within the section and phrases, can be considered one of the contributing factors to the transformation of timbres in a sound-based composition.

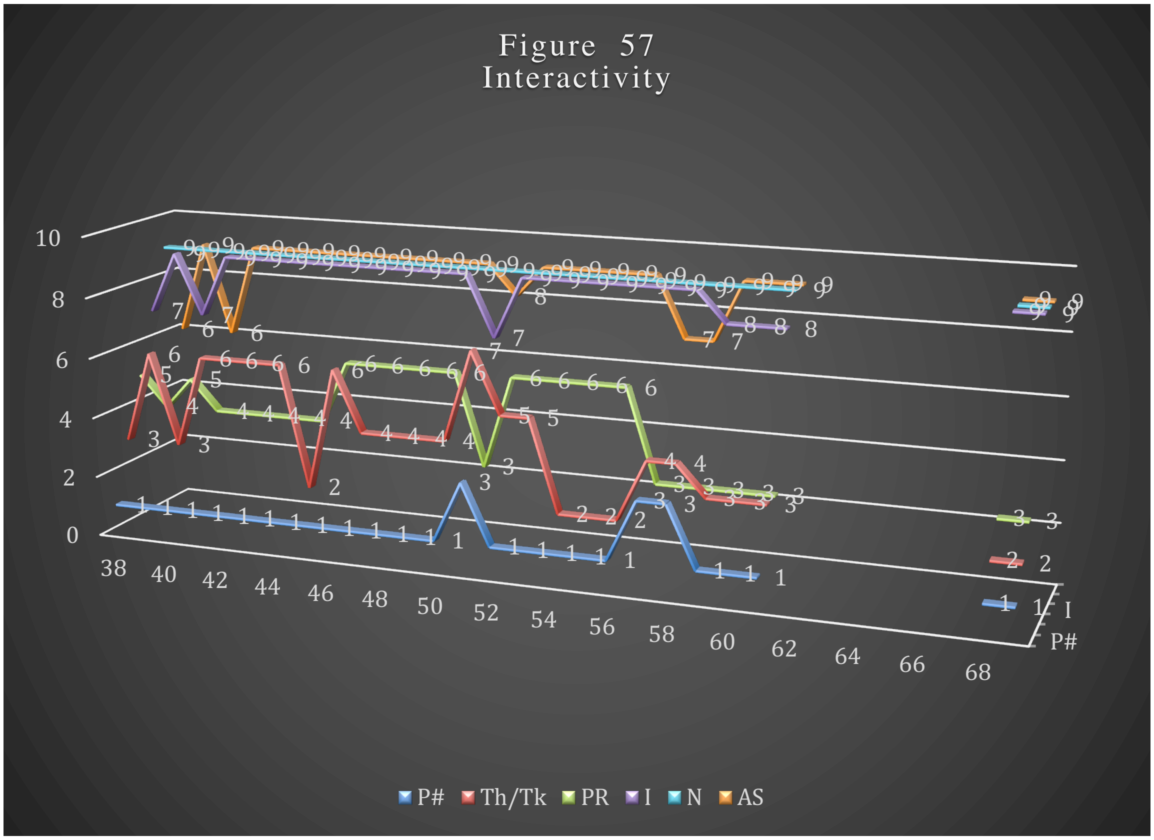


Figure 57
Interactivity

Similar to Figures 53C and 55, the sharpness of attack and the level of noise are parallel for the majority of the time in Figure 57. Also, like Figures 53C and 55, the number of partials here is always between 1 – 3. These similarities indicate the importance of noise in the viola as part of the construction of timbre, when considering viola as the noisiest instrument among the flute, clarinet, and the violin, thus far.

In Figure 57, the lower portion is occupied with the number of partials category. The upper portion is occupied by the interaction between irregularity of sound, the amount of noise, the irregularity of sound, amount of noise, and sharpness of attack. Furthermore, the introduction of new activity between thinness and thickness of sound, the range of strongest partials and range of harmonic partials, contributes to the anatomy and contrast of sound in Figure 57 and the contrast between Figures 57, 54, and 55.

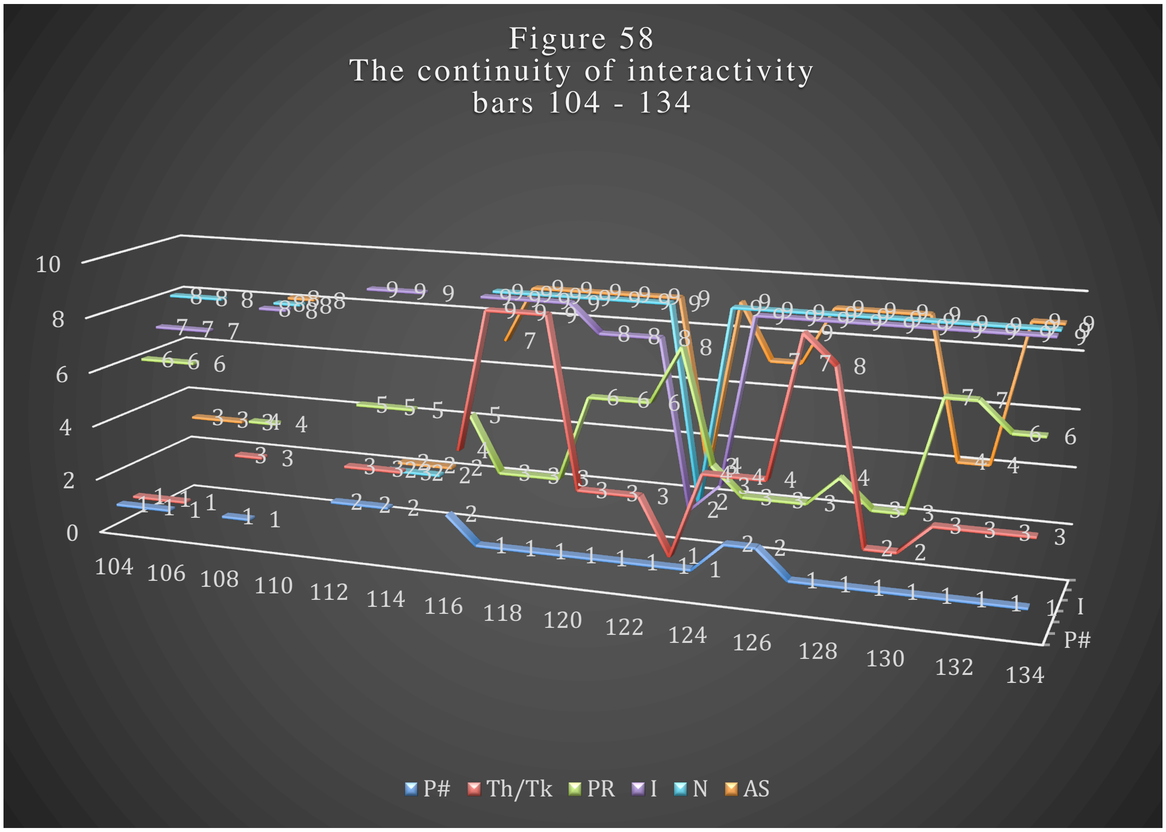


Figure 58
The continuity of interactivity
bars 104 - 134

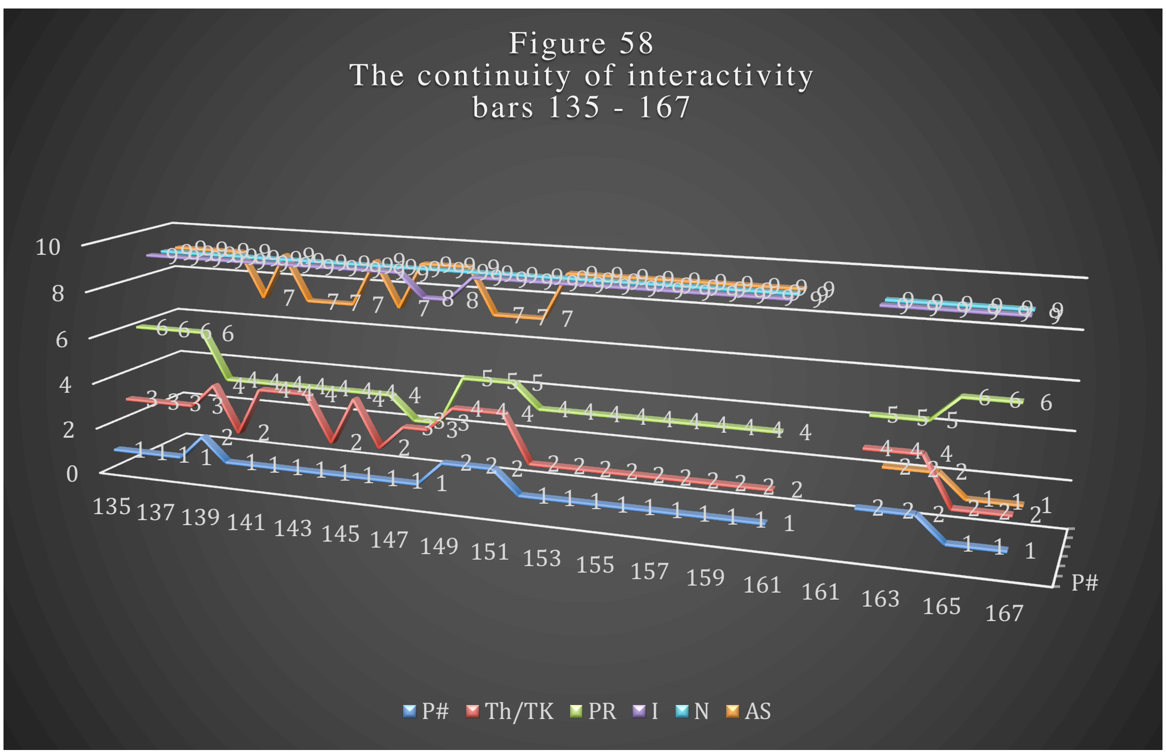


Figure 58
The continuity of interactivity
bars 135 - 167

There is an interactivity between the sharpness of attack category and the range of strongest partials and the thinness and thickness of the sound category, which creates contrast in timbres with Figures 56 and 57. There is an evolution in the interactivity between the elements of sound from Figures 56 – 58, which contributes to the transitional variation character of this section. The transformational character of the section above resonates with the idea that the structural process is the principal procedure to form in Crama.

Figure 58 can be divided into three sections: A) bars 104 – 114, showing stagnant parallelism; B) bars 116 – 134, showing spikes and drops; and A') bars 135 – 168, showing stagnant parallelism. There is a clear ABA' shape to this Figure 58, and the notion of organized form supports the idea that the contributing elements to sound are the primary elements of sections. The introduction of such an organized shape also shows the contrast between Figure 58 and Figures 56 and 55. As Crama evolves, form becomes more clear.

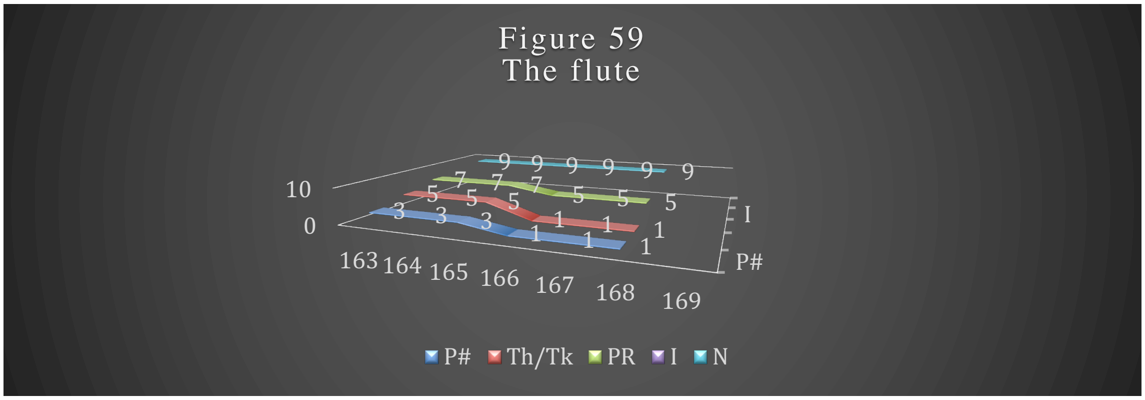


Figure 59
The flute
10
0
163 164 165 166 167 168 169
I
P#
P# Th/Tk PR I N

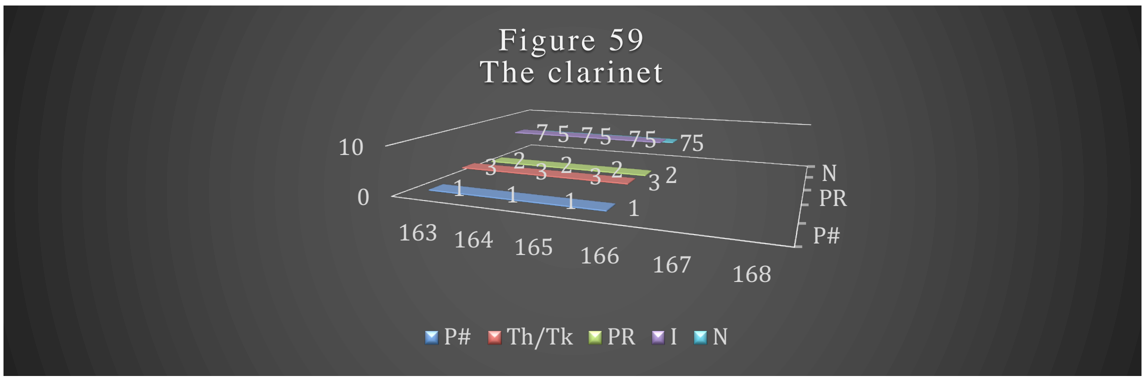


Figure 59
The clarinet
10
0
163 164 165 166 167 168
N
PR
P#
P# Th/Tk PR I N

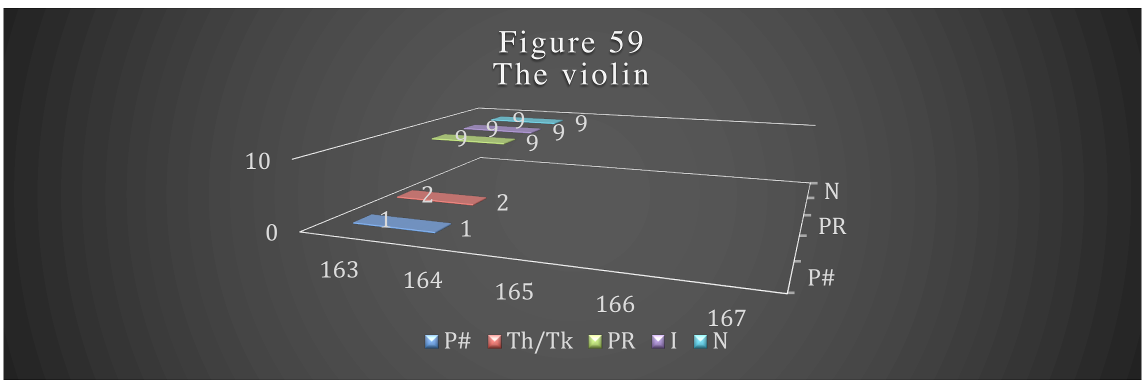


Figure 59
The violin
10
0
163 164 165 166 167
N
PR
P#
P# Th/Tk PR I N

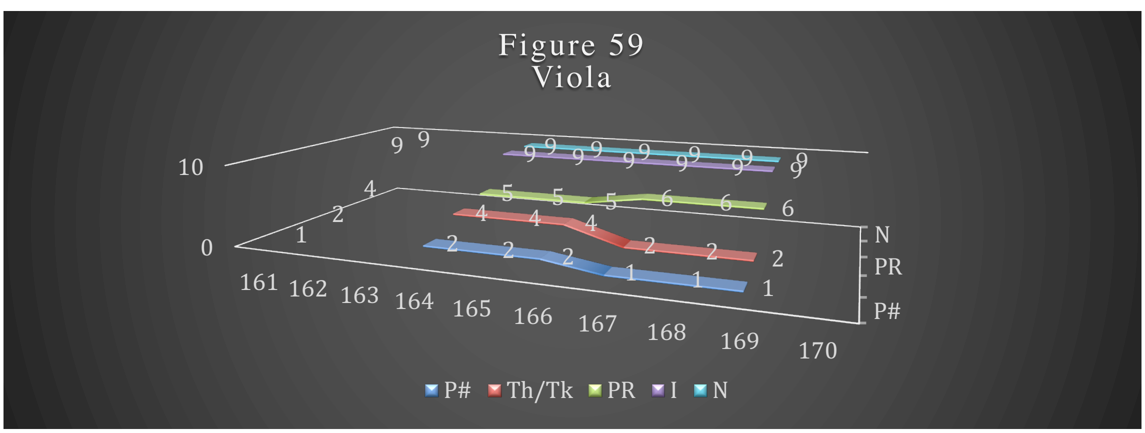


Figure 59
Viola
10
0
161 162 163 164 165 166 167 168 169 170
N
PR
P#
P# Th/Tk PR I N

The number of partials and the sharpness of attack are parallel in Figure 59, as does the irregularity of sound and amount of noise, which is similar to Figure 56, the beginning section. This means there are connection and return between the beginning and ending sections in the viola. The return can be considered as a tool to create form, as it is used in a sound-based composition such as Crama.

In this Figure, the range of partials, the irregularity of sound, and the amount of noise in the viola are all parallel. This is in contrast to the woodwind instruments, as those elements of sound do not display parallelism, which exaggerates the difference between woodwinds and the strings. Note the parallelism between the irregularity of sound and the amount of noise in this section.

Conclusion:

In the viola, the interactive relationships between different elements of sound contribute to the construction of the timbre and its evolution through various sections. As a result, this relationship affects the construction of shapes, phrases, sections, and form.

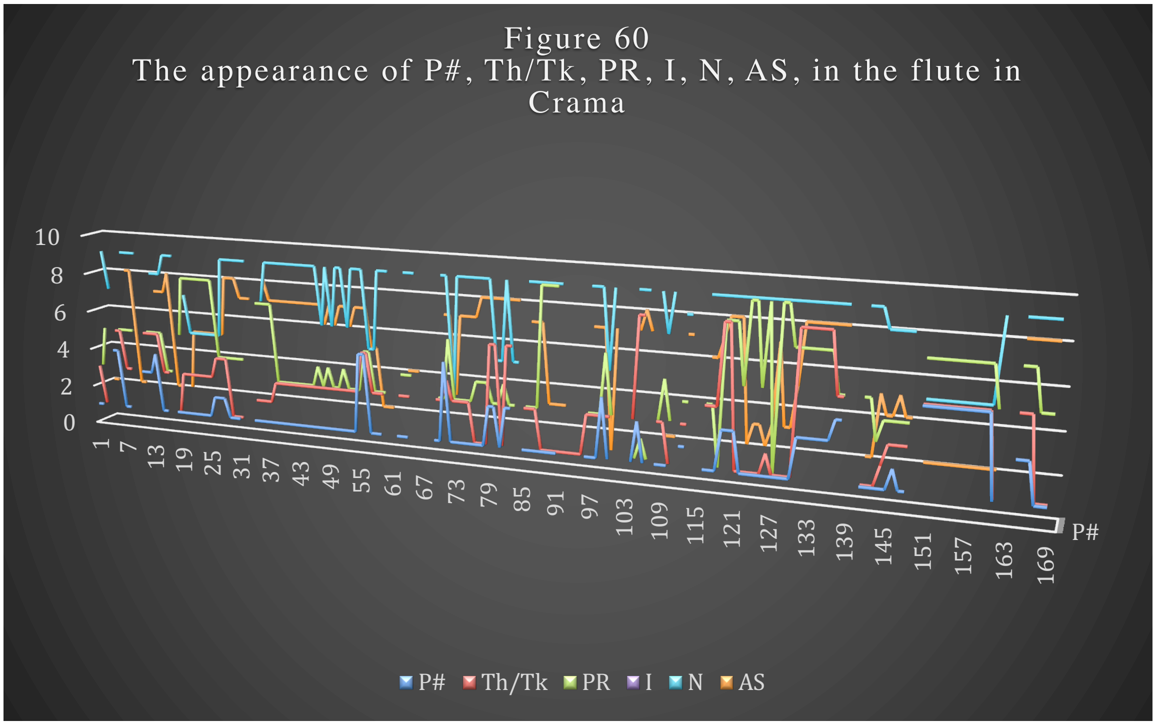


Figure 60
The appearance of P#, Th/Tk, PR, I, N, AS, in the flute in Crama
10
8
6
4
2
0
1
7
13
19
25
31
37
43
49
55
61
67
73
79
85
91
97
103
109
115
121
127
133
139
145
151
157
163
169
P#
P#
Th/Tk
PR
I
N
AS

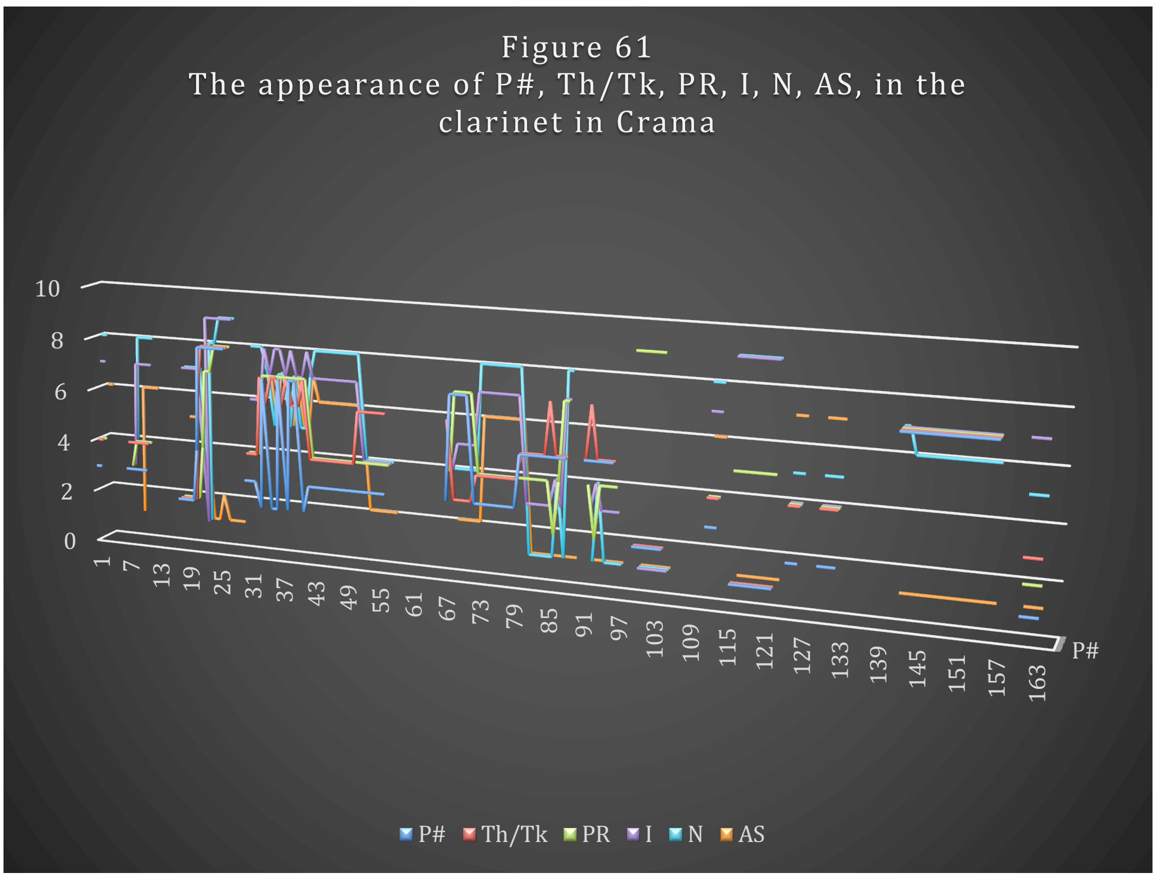


Figure 61
The appearance of P#, Th/Tk, PR, I, N, AS, in the clarinet in Crama
10
8
6
4
2
0
1
7
13
19
25
31
37
43
49
55
61
67
73
79
85
91
97
103
109
115
121
127
133
139
145
151
157
163
P#
P#
Th/Tk
PR
I
N
AS

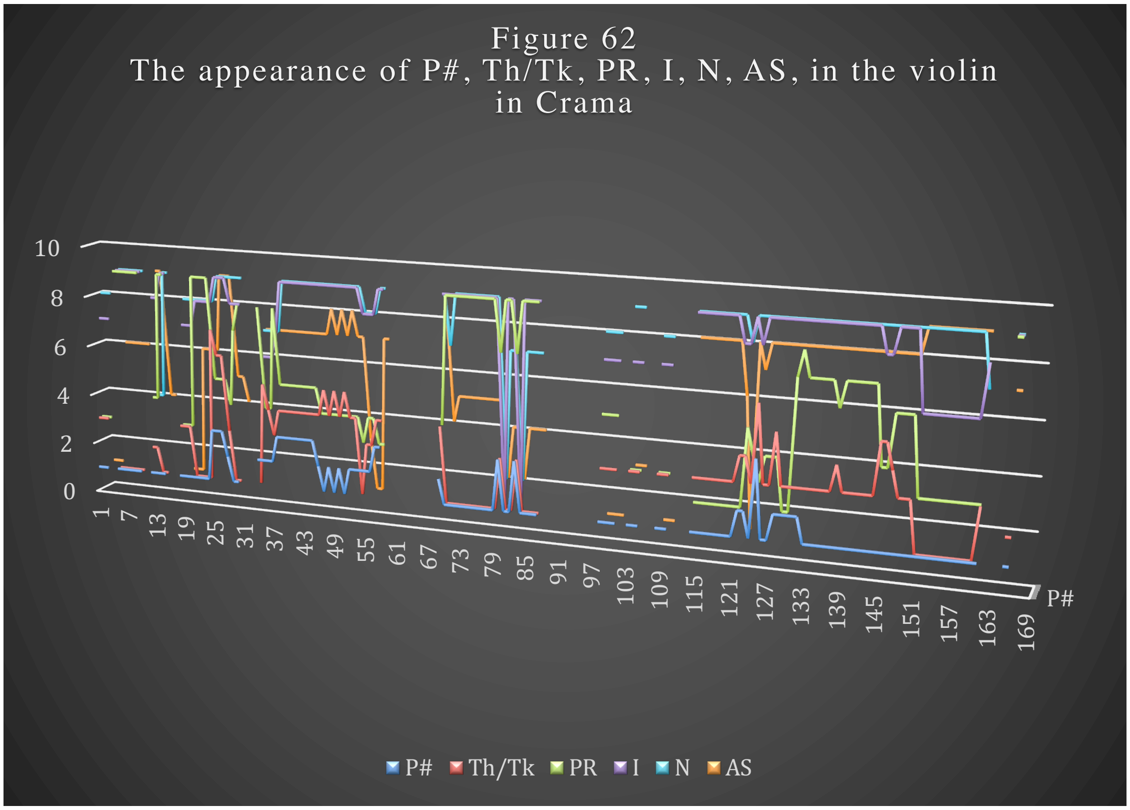


Figure 62
The appearance of P#, Th/Tk, PR, I, N, AS, in the violin
in Crama
10
8
6
4
2
0
1
7
13
19
25
31
37
43
49
55
61
67
73
79
85
91
97
103
109
115
121
127
133
139
145
151
157
163
169
P#
P# Th/Tk PR I N AS

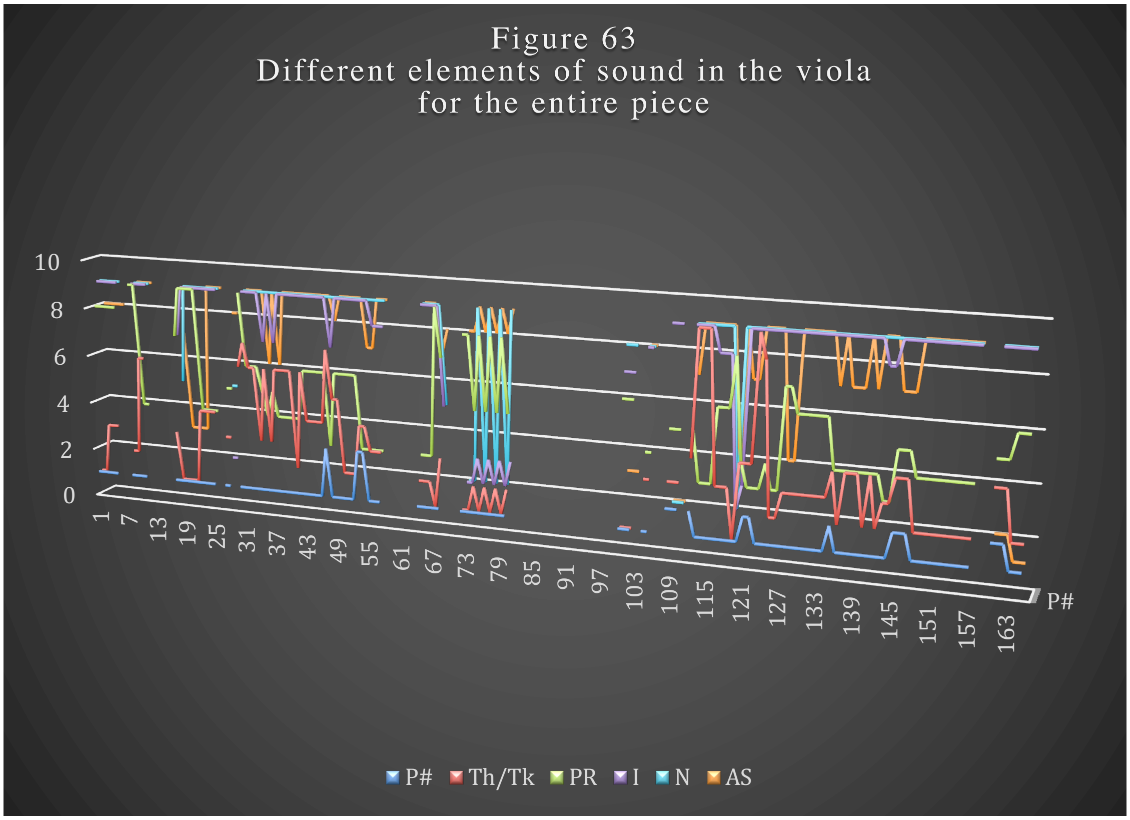


Figure 63
Different elements of sound in the viola
for the entire piece
10
8
6
4
2
0
1
7
13
19
25
31
37
43
49
55
61
67
73
79
85
91
97
103
109
115
121
127
133
139
145
151
157
163
P#
P# Th/Tk PR I N AS

Chapter 7: Cello as the Leader of the String Section

Chapter seven contains comparisons between all contributing elements of sound in the cello.

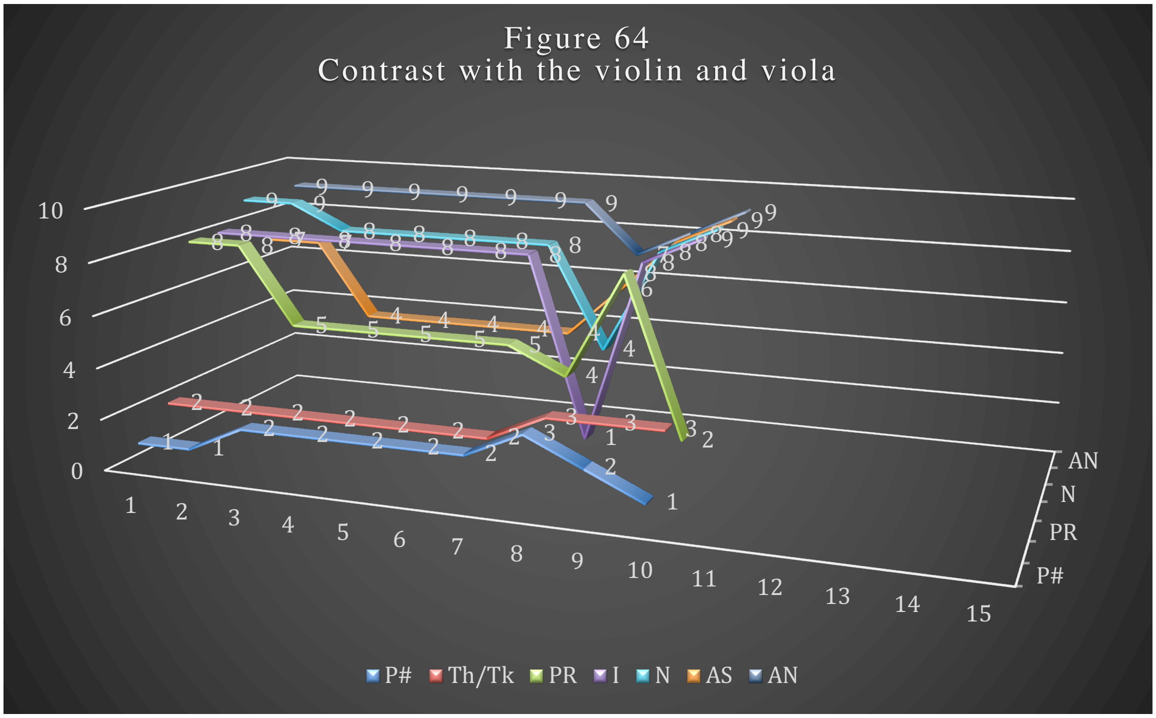


Figure 64
Contrast with the violin and viola

Figure 64 demonstrates a definite form that contrasts with the opening sections of the violin, Figure 52, and viola, Figure 55. The beginning section of cello consists of three smaller sections: the middle section, bars 3 – 7, showing stagnant parallelism, and the opening and closing sections, 1 – 3 and 7 – 10, showing spikes and drops. The contrast between these sections and the interactivity between different elements of sound contributes to the form in Figure 64. There is also a contrast between Figure 64 and the other string instruments in the beginning section. The contrast between string instruments in Crama contributes to the construction of timbre within the string section.

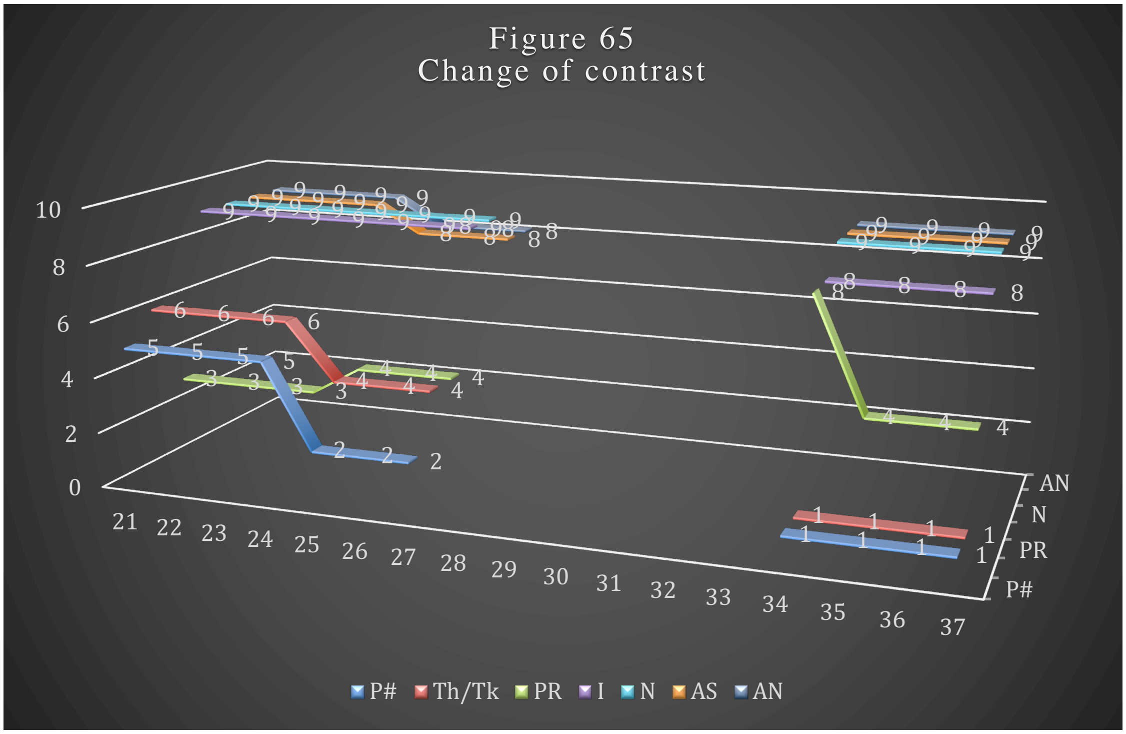


Figure 65 does not suggest a form as definite as Figure 64, and there is a change in the level of contrast. In other words, the disproportionality between the levels of parallelism and contrast transforms into a new level. More importantly, the parallelism among the contributing elements creates a contrast between Figures 64 and 65, due to the appearance of deviations and parallelisms in Figure 64. The parallelism contributes to the overall transformation of timbres from Figures 64 to 65, supporting a sense of transformation in the timbre, which begins in Figure 64 and continues to Figure 65. This transformation supports the continuity of sound.

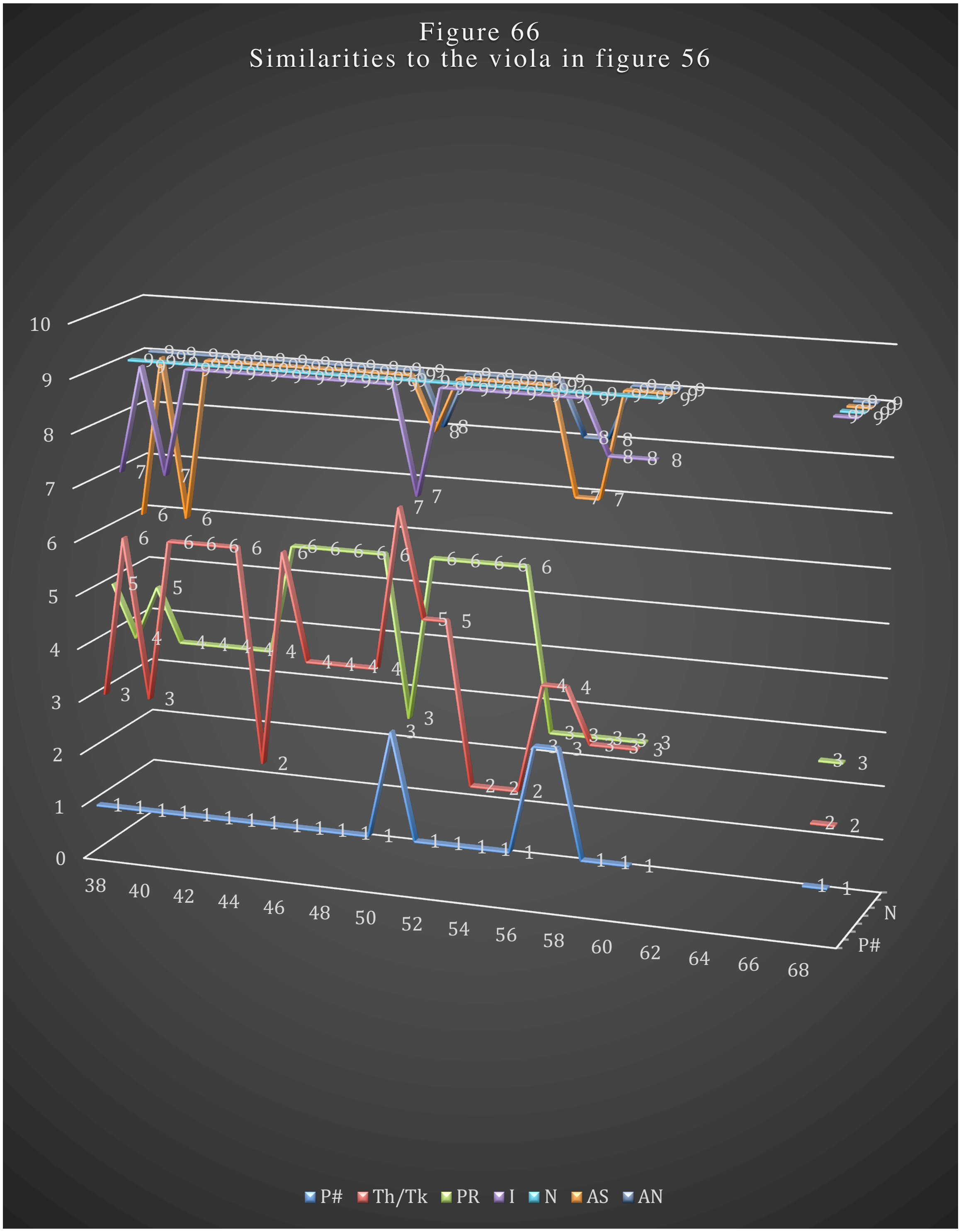


Figure 66 functions in a similar way as Figure 56. There is stagnant and parallelism relationship in the bottom portion of Figure 67 between the number of partials and thinness and thickness of sound, as well as in the top portion between the amount of noise category, the sharpness of attack category, and 7. The interactivity between series thinness and thickness of sound and 3, in the middle portion, contributes to the overall construction of form in Figure 66. In this way, Figure 66 can be divided into three sub-sections: A) bars 38 – 45; B) bars 45 – 57; A') bars 59 – 69. The interaction between these different elements of sound contributes to the form in Figure 66 of Crama.

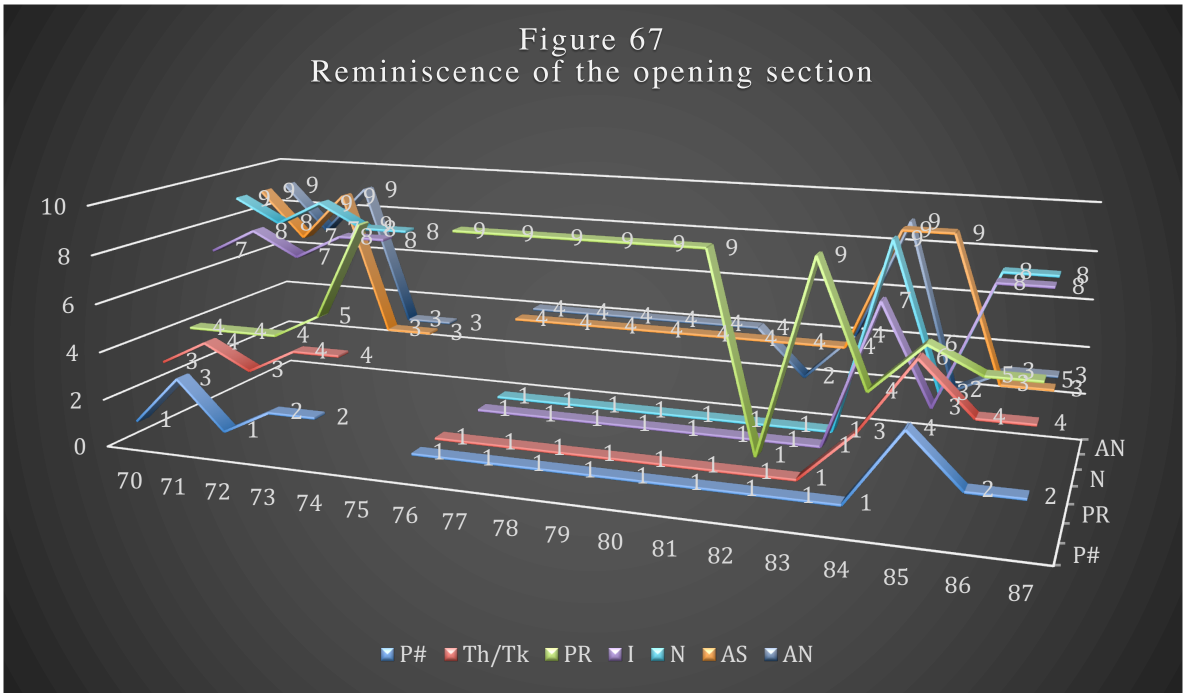


Figure 67 presents similarities and contrast to Figure 66. While there are many fewer parallelism between different elements of sound, these two Figures share a clear form. There are three subsections in this section: A) bars 70 – 74; B) bars 76 – 81; and A') bars 81 – 87.

The similarity in form and contrast in the construction of timbre between Figures 66 and 67 supports the idea of timbral transformation from one section to another. A similar pattern was also observed in Figures 64 and 57. Thus, it is becoming more clear which transformation of timbres from one section to another supports the continuity of sound in this sound-based composition.

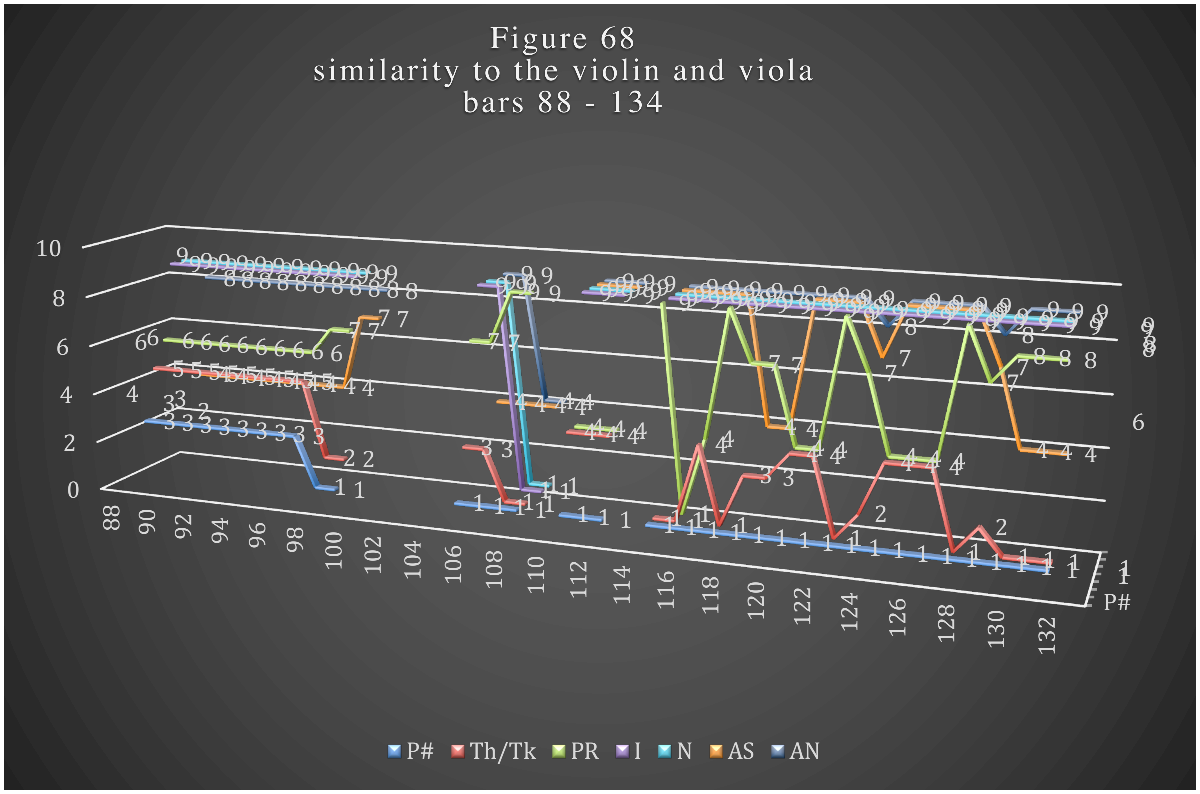


Figure 68
similarity to the violin and viola
bars 88 - 134

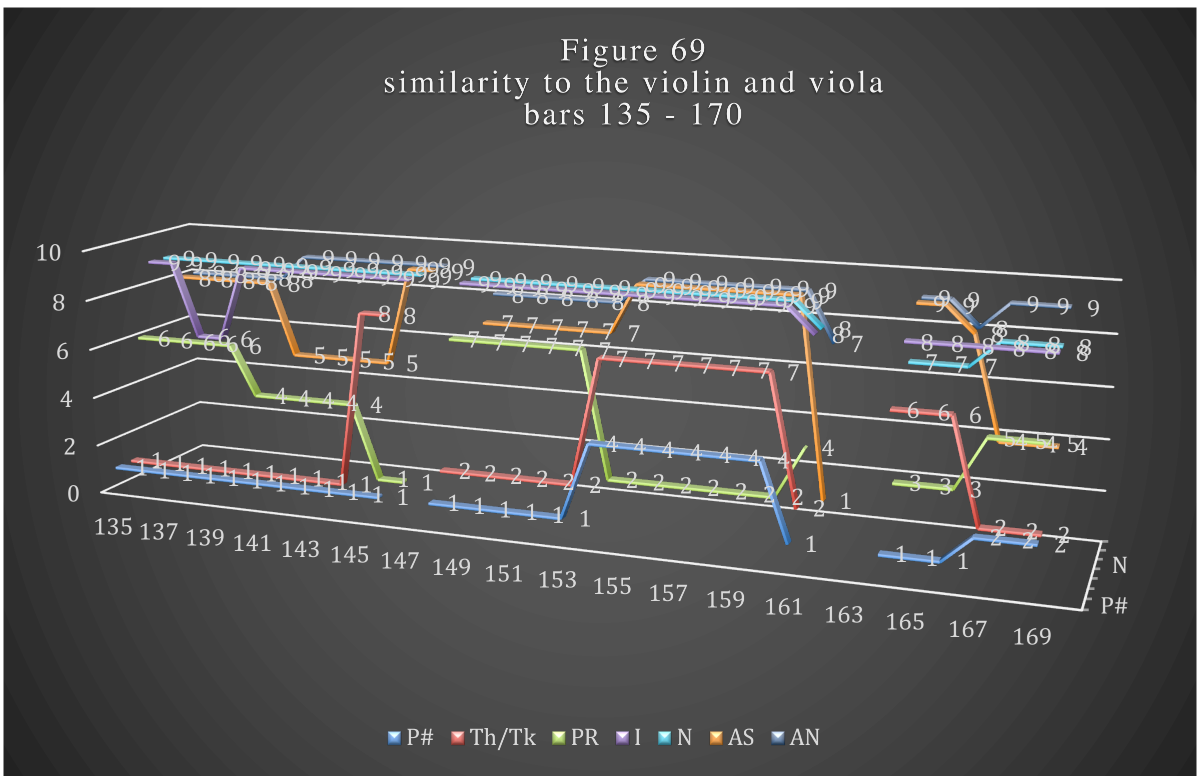


Figure 69
similarity to the violin and viola
bars 135 - 170

Notice the stagnant motion in the number of partials of Figure 68 and 69, which contrasts with the spiked-and-dropped motion of number of partials in Figure 58. Also, the range of strongest partials of Figures 68 and 69 fluctuates between one and nine, which contrasts with the motion of the range of strongest partials in Figure 49. Furthermore, the sharpness of attack category fluctuates between four and nine the majority of the time, whereas the sharpness of attack category in Figure 58 remains mostly stagnant. There are other similarities between Figures 55 and 58, including the stagnant motion in Irregularity of sound category and sharpness of attack category. Notice the contrast between the almost-stagnant motion of the amount of noise category in Figure 49, with the spiked-and-dropped motion in Figure 58. The similarities, contrasts, stagnation, and parallel motion within the string section contribute to the complexity in the anatomy of timbre between different instruments and, in turn, contribute to form in Crama.

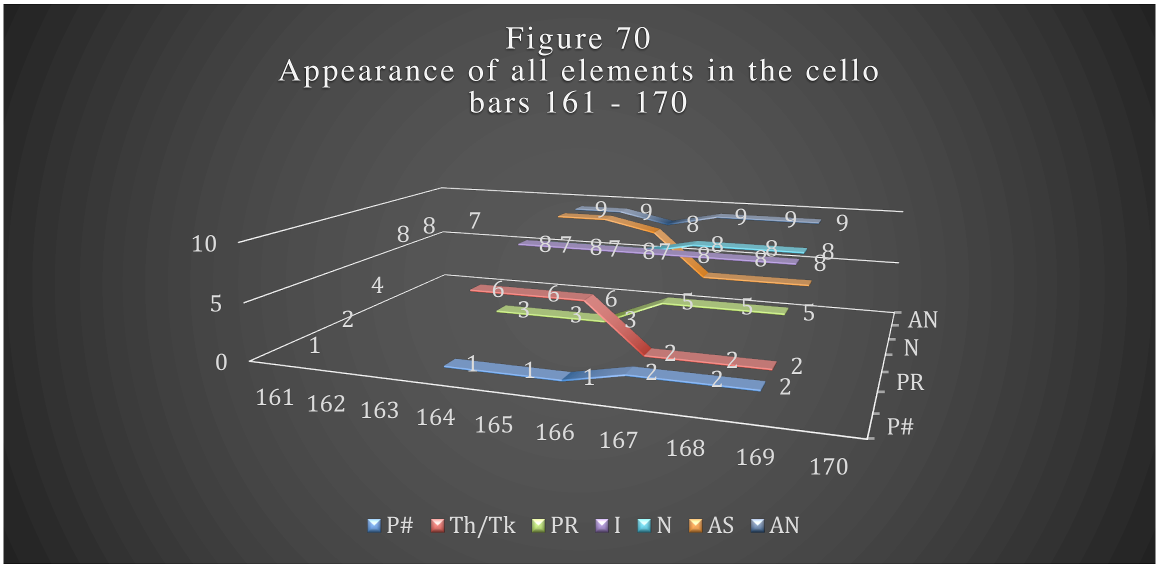
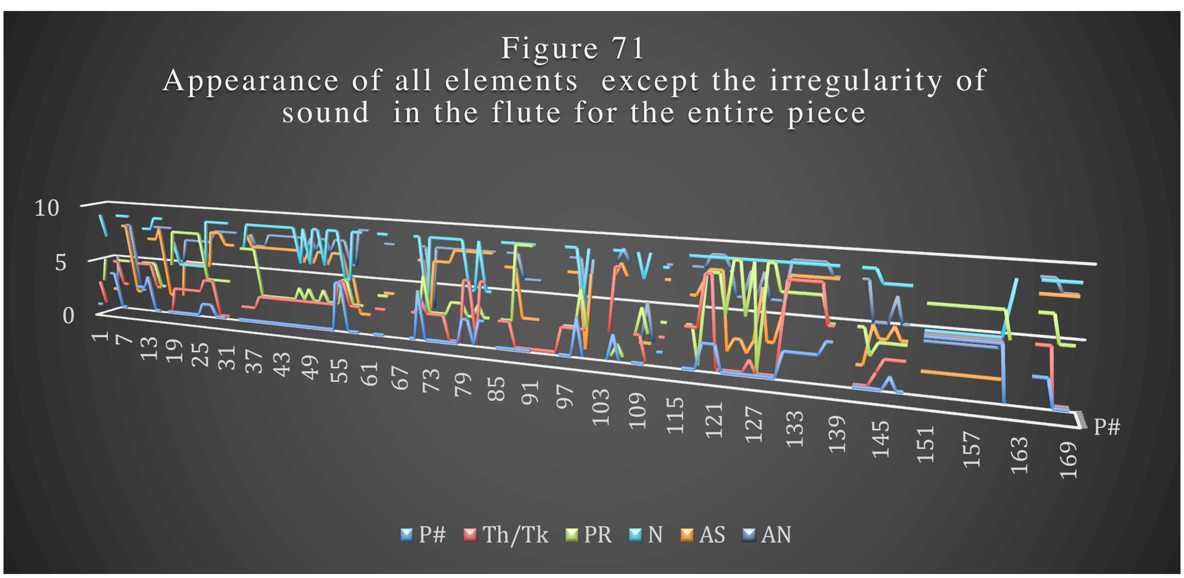


Figure 70, the ending section, presents all the same values, except value four, as Figure 64, the opening section, which shows these two sections to be almost identical. The identical character of Figures 64 and 68/69 contributes to form and coherency between the beginning and the ending sections, which shows timbre to be the primary element of form in a sound-based composition like Crama.



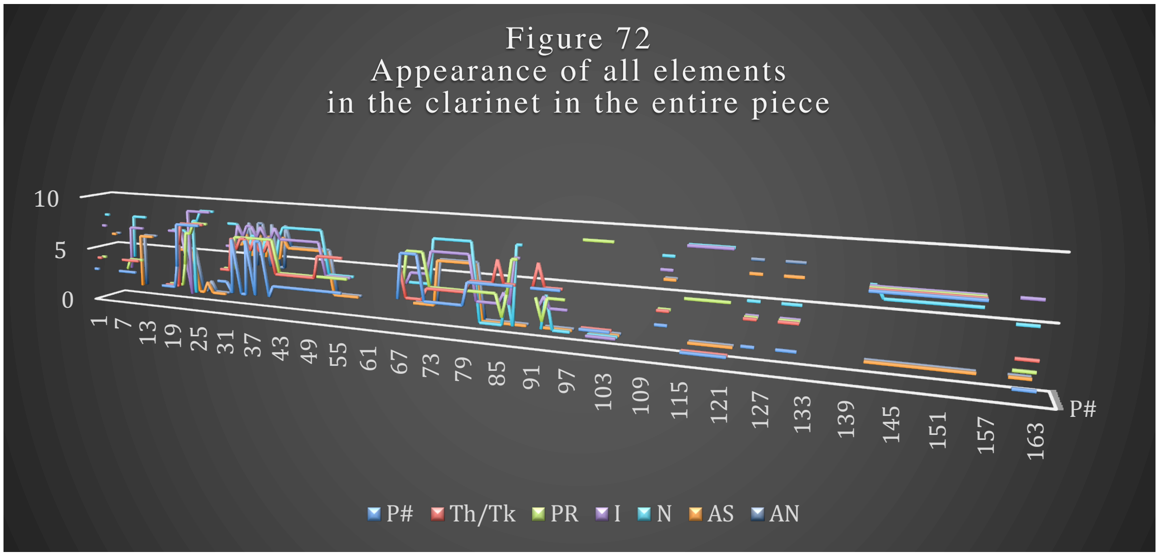


Figure 72
Appearance of all elements
in the clarinet in the entire piece

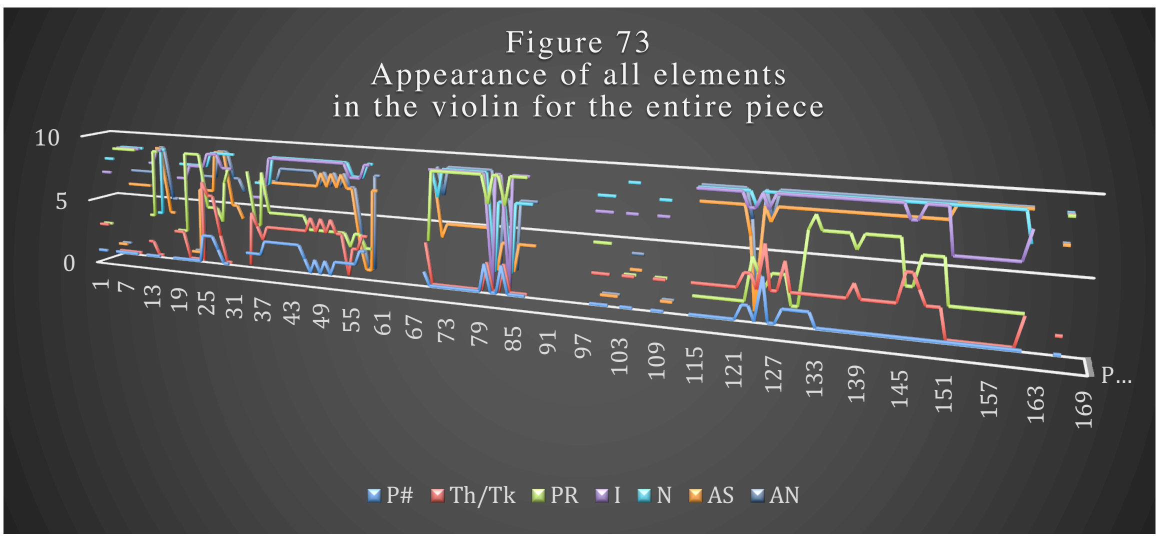


Figure 73
Appearance of all elements
in the violin for the entire piece

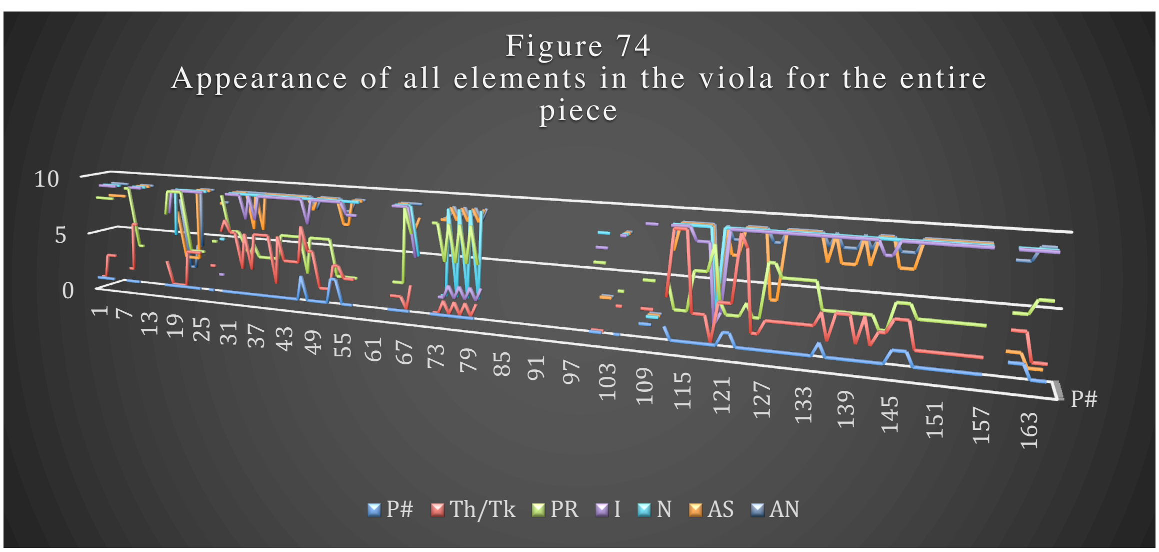
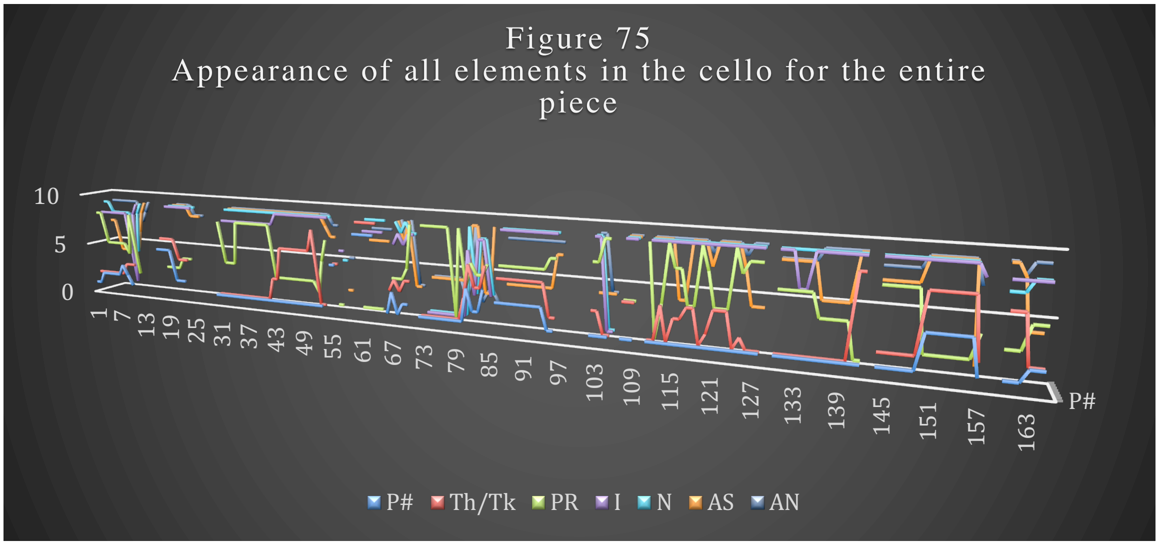


Figure 74
Appearance of all elements in the viola for the entire piece



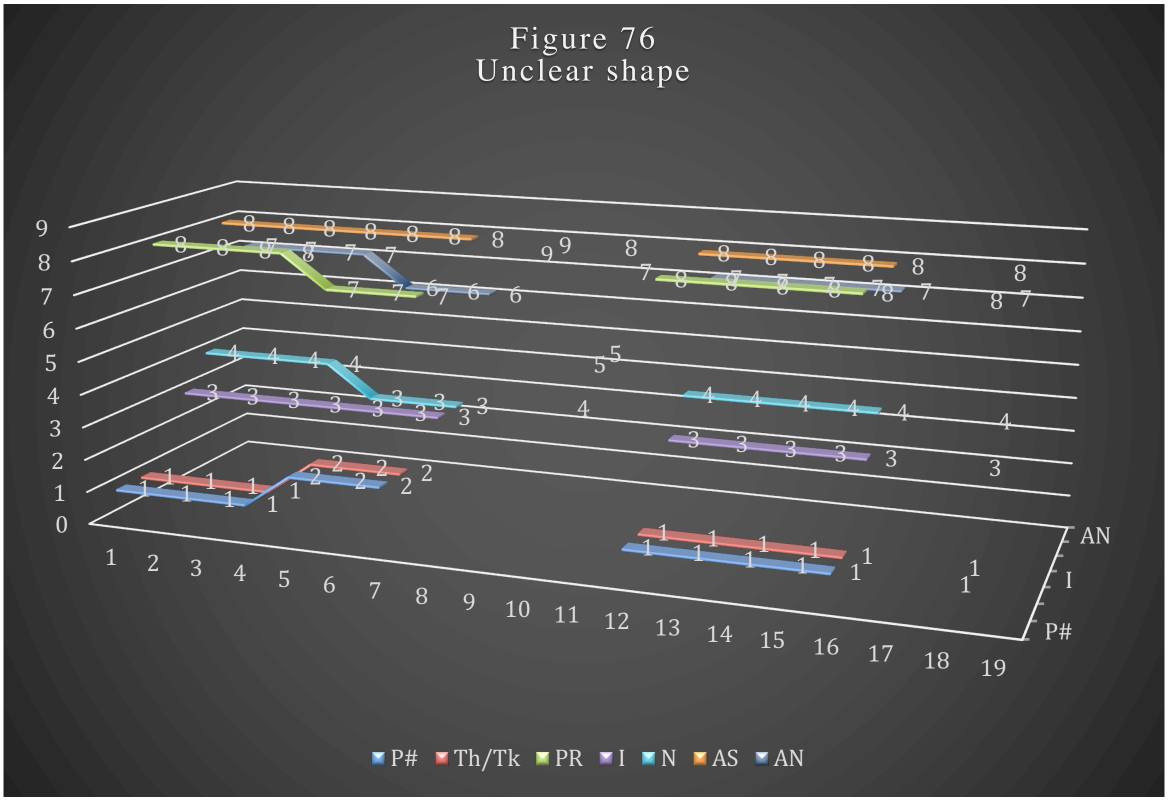
Conclusion:

Figure 64 revealed that the three-part form of cello contributes to the overall sense of abstract counterpoint or correlation between the contributing elements of sound in the string section. Later on, in Figures 68/69, the abstract counterpoint was conceived via spike, drops, imitation, stagnant parallelism, parallelism, and deviations of contributing elements of sound. The cello plays a principle role in the abstract counterpoint via its contrast with violin and viola, and, in this way, the cello has an essential function in structuring timbres in the string section.

Chapter 8: The Importance of Piano

Introduction:

Of all the instruments in Crama, the piano is the only instrument which uses pitch-oriented materials, appearing for about 66 out of 170 bars. In this chapter, I will apply all seven contributing elements to the quality of sound to the piano part.



Due to the repetition of stagnant parallelism, Figure 76 does not demonstrate phrase, shape, or a clear form. While the formless character of Figure 76 is similar to Figures 35, 52, and 55, it contrasts with Figures 64 and 77. The appearance of a definite form is not common in the opening sections of different instruments in Crama. In the absence of form, repetition is the primary tool to construct a shapeless opening section in a sound-based composition such as Crama.

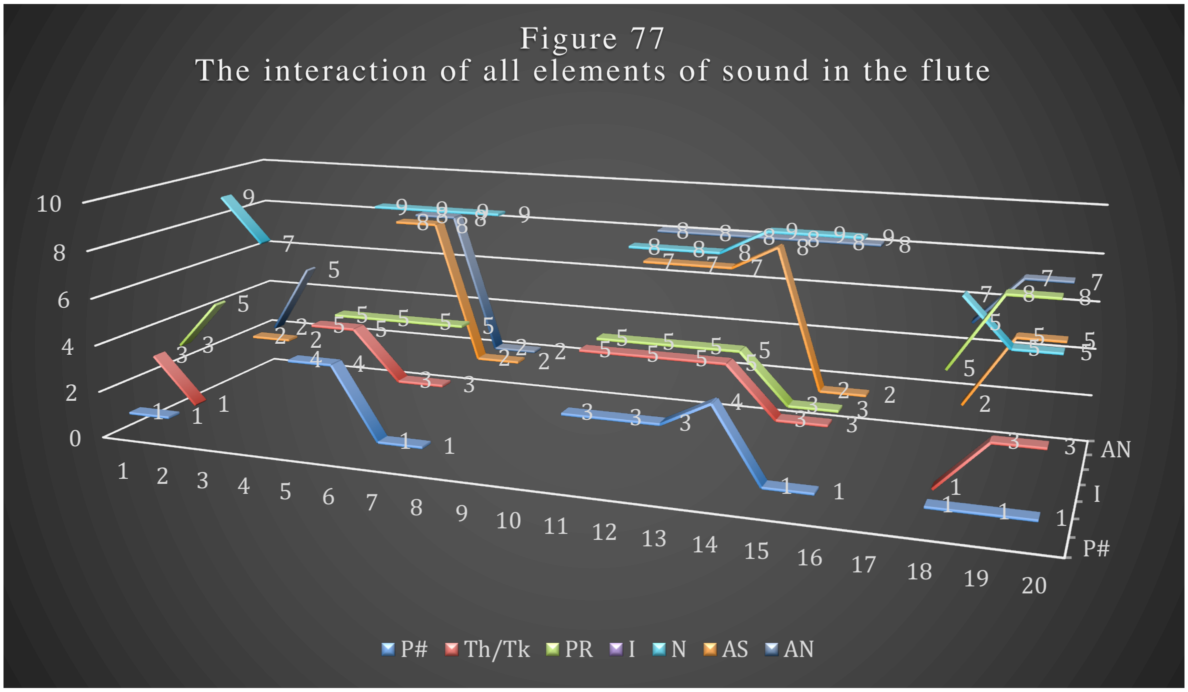


Figure 77
The interaction of all elements of sound in the flute

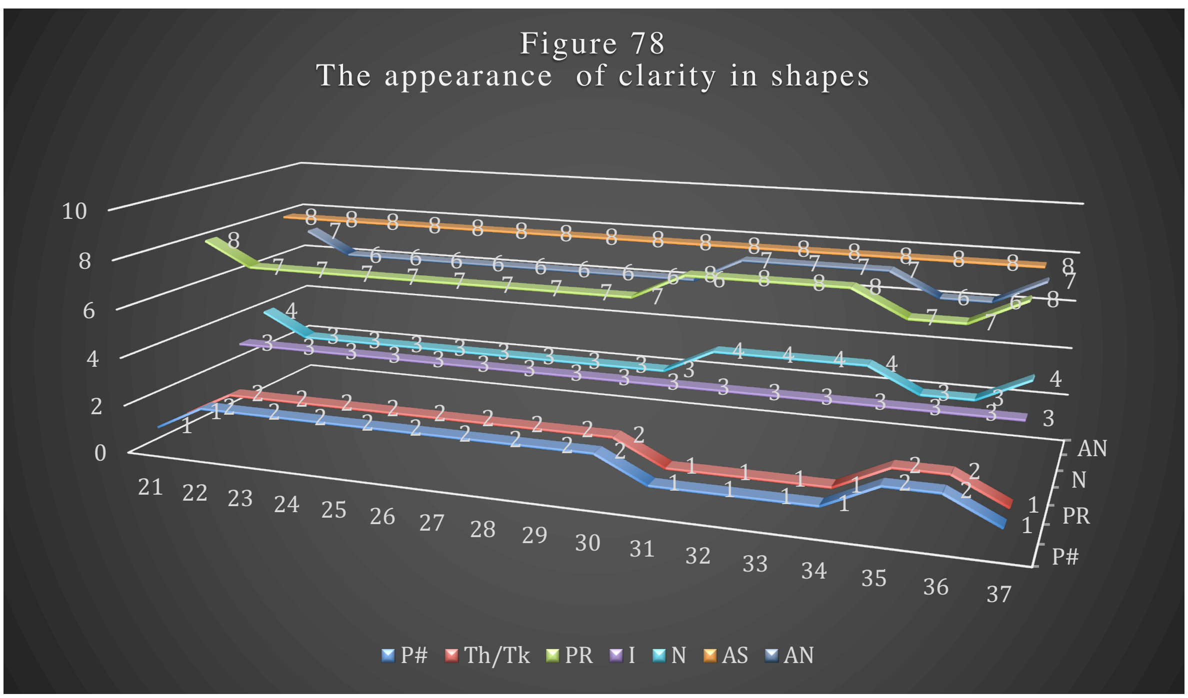


Figure 78
The appearance of clarity in shapes

As form evolves, the shapes of contributing elements of sound become clear. Phrases appear in bars 30 – 35. This long and extended stagnant parallelism and soft transition to phrases bars 30 – 31 and 34 – 35, is in contrast to bars 21 – 37 of all the other instruments thus far.

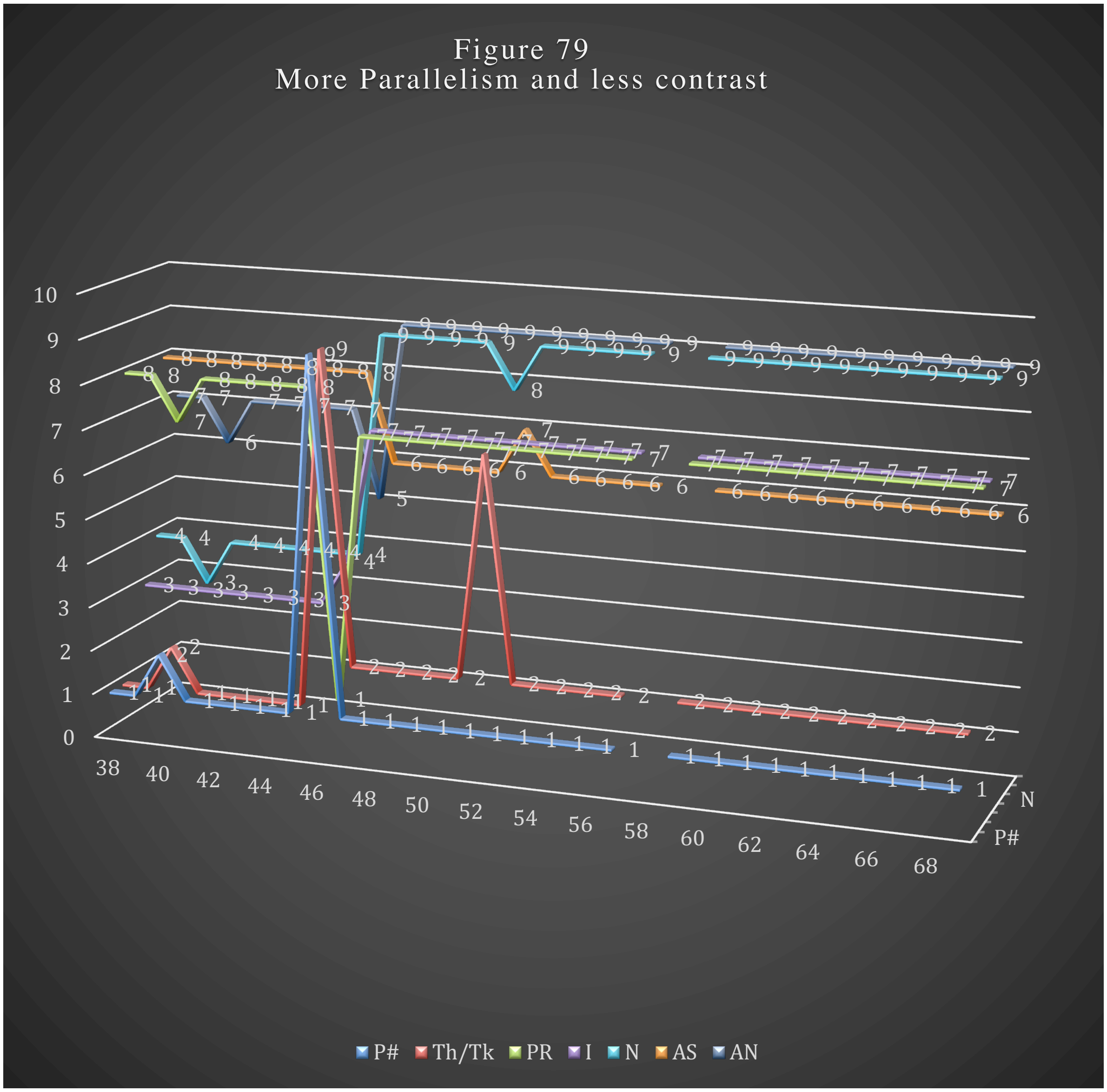
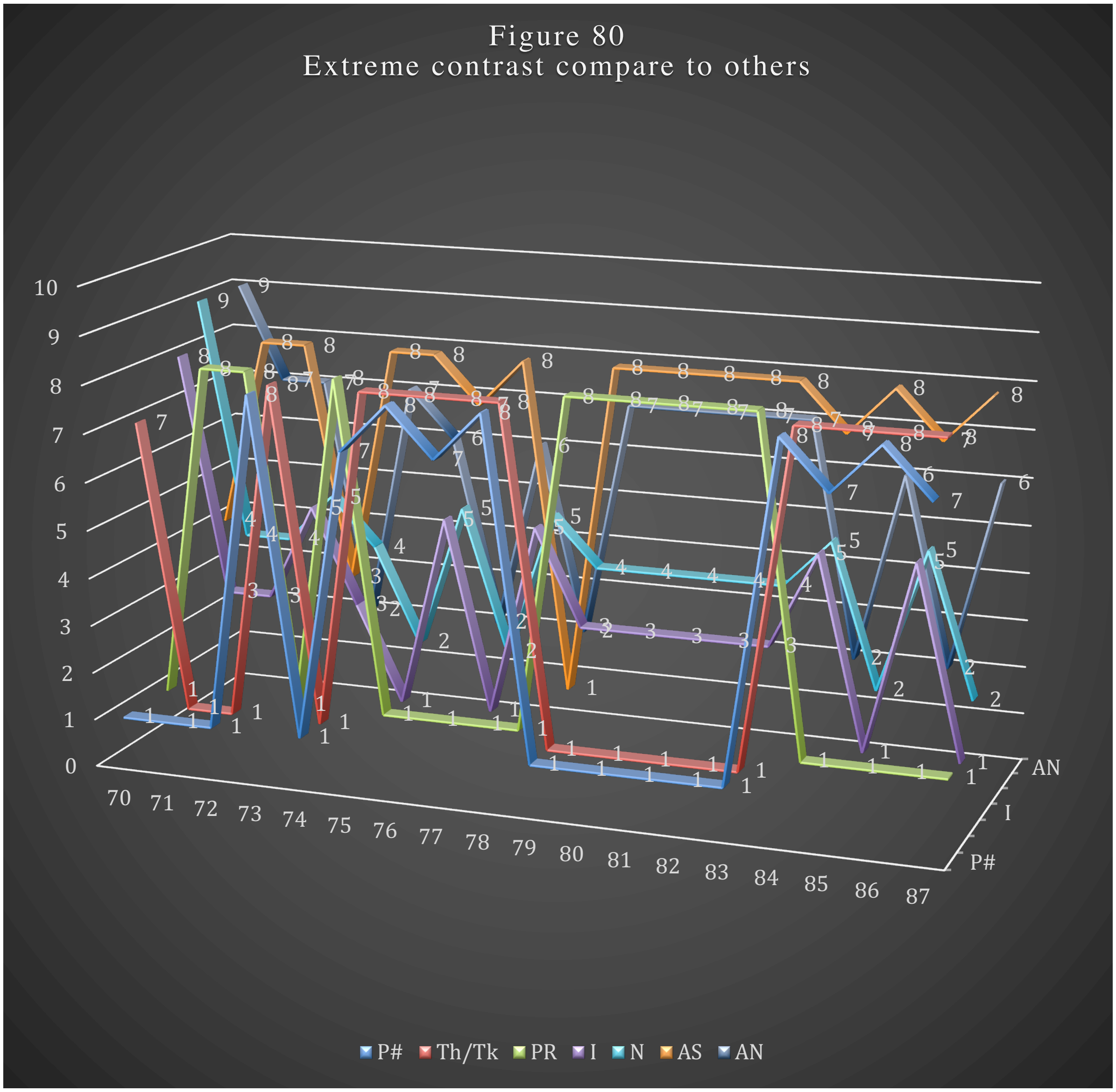


Figure 79
More Parallelism and less contrast

In this section, there are only three instances which demonstrate a contrast between different contributing elements of sound: bars 39 – 41, 45 – 47, and 51 – 53. Conversely, there are 26 bars of stagnant parallelism between different elements of sound. This large ratio between stagnant parallelism and contrast in Figure 79 is not present thus far among the other instruments in Crama. This ratio suggests that there is less contrast between the timbre of piano and other instruments within bars 1 – 69, and, as a result, piano blends with the timbre of the other instruments within bars 1 – 69.



The amount of imitation in spikes, drops, and stagnant parallelism dramatically increases in Figure 80. This increase suggests a contrast between Figure 80 and Figures 70, 76, and 78. This section also shows the first time that the evolution of timbres completely varies in shape, in the piano, which contrasts Figure 80 with the other sections in the piano thus far. As a result of this contrast, timbre in Figure 80 contributes to the form in Crama.

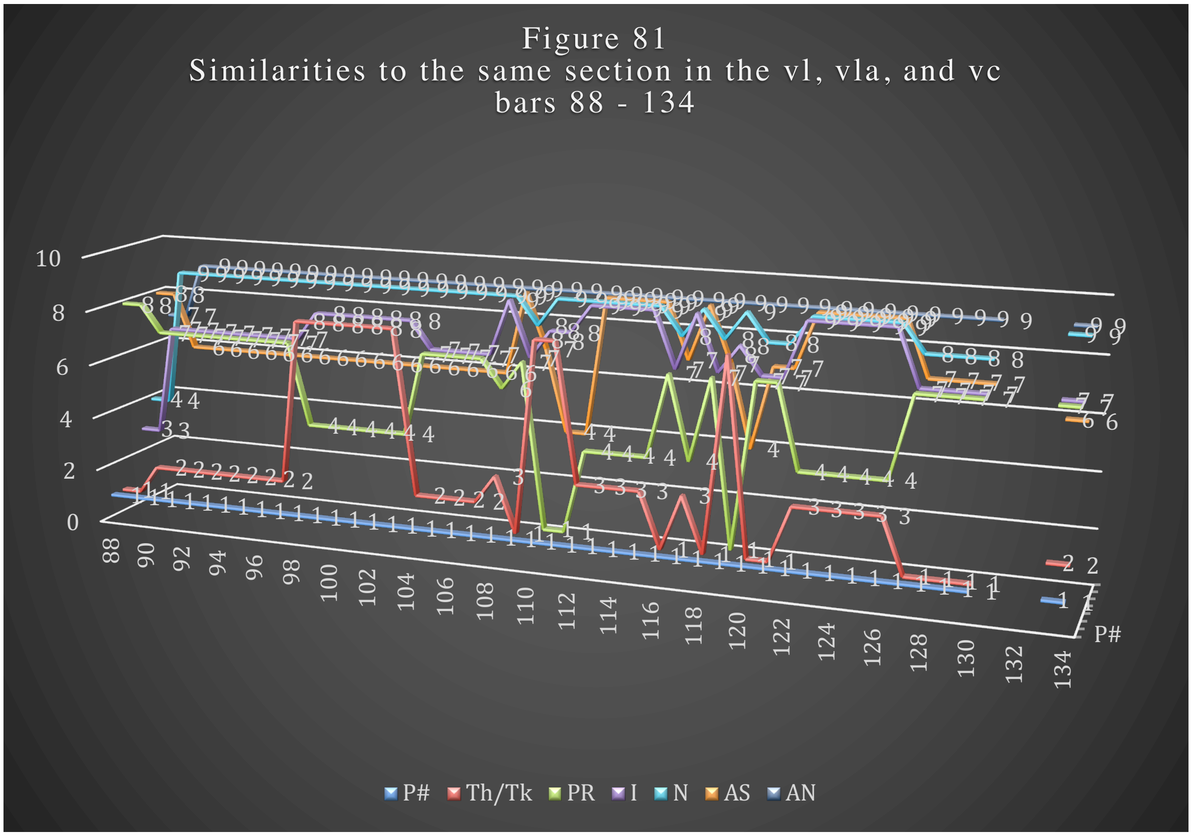


Figure 81
Similarities to the same section in the vl, vla, and vc
bars 88 - 134

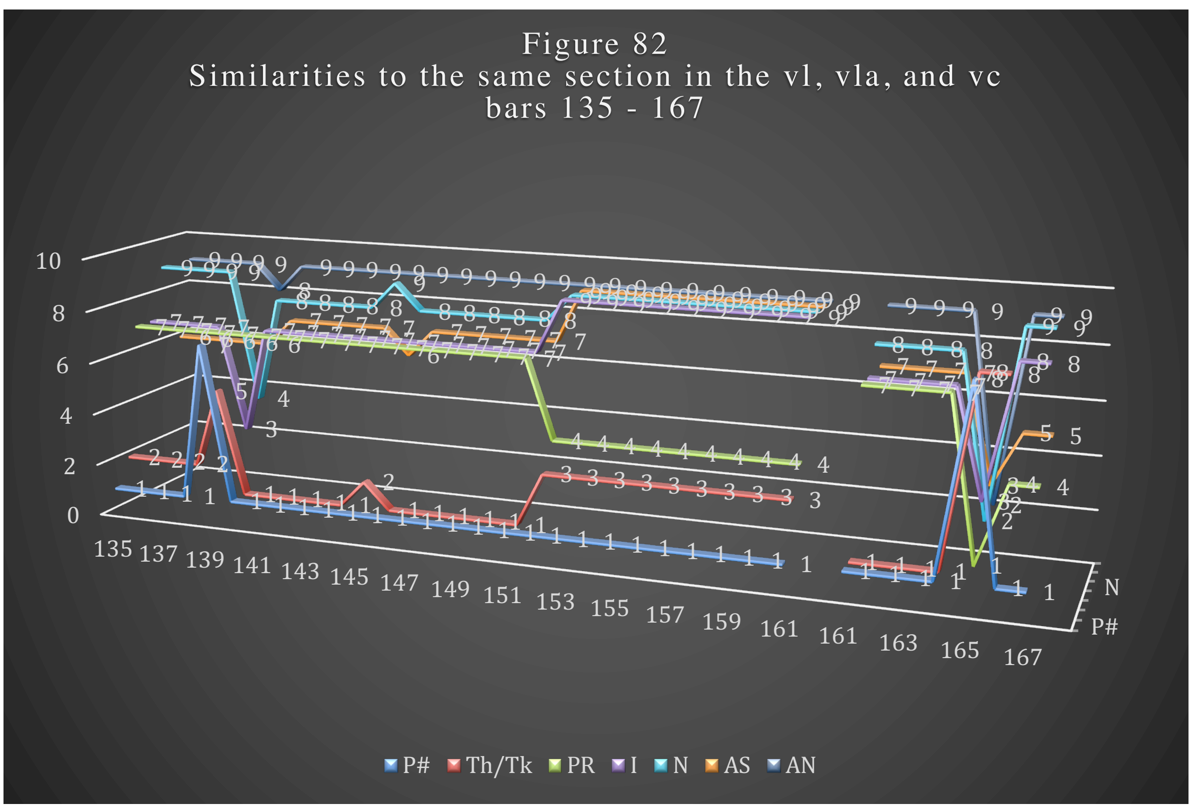


Figure 82
Similarities to the same section in the vl, vla, and vc
bars 135 - 167

In terms of interactivity between different elements of sound, Figure 82 is similar to Figures 49, violin, 58, viola, and 68/69, cello. Figure 82 suggests interactivity between all the categories except the thinness and thickness of the sound category. Notice that the number of partials is in its lowest value, one, and the noisiness of attack is in its highest value, nine. The number of partials and the noisiness of attack category show stagnant parallelism within bars 88 – 162, which is similar to Figures 49, violin, 58, viola, and 68/69, cello. The similarities and contrast between this Figure and others suggest a timbral correlation or imitation between piano and the string instruments in Crama. In other words, the string section imitates the sound of the piano, and, as a result, these imitations form a section. For example, the piano projects the "roar sound,"[30] which is paired with "ring sound,"[31] in cello in bar 99, the "clang sound,"[32] which is paired with col legno battuto in the viola and cello in bar 108, and the "saw sound,"[33] which is paired with pulsed "ring sound," in violin, viola and saw sound in cello in bar 154. All of the above create the similarities between Figure 82 and Figures 49, violin, 58, viola, and 68/69, cello, and 162 of the string sections. Timbral imitation between different instruments thus contributes to structuring phrases, sections, and form in a sound-based composition like Crama.

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[30] "ROAR SOUND: [b.108] This usually follows the clang sound and in fact is like the release of the previous. The sound should be obtained by pressing and moving faster the plectrum at the beginning and then decrease the speed to slow the pressure to normal and the dynamic to decrescendo." From page 2 of the preface in Crama.

[31] "RING SOUND: square notehead followed by triangle line. Hold firmly the note down and bow slowly with some pressure at the [xST] area. The sound obtained better on 1st open string and at the frog of the bow. The further from the frog of the bow the less bright and resonant the sound becomes. [b.45]" From page 2 of the preface in Crama.

[32] "CLANG SOUND: obtained by bowing with pressure with the hairs of the bow flat to the string. It is best achieved at the frog of the bow. The sound produced is broken, irregular and syncopated. NOTE: The notated values on the score are one possibility and should not be followed. The result of this gesture is always slightly different in terms of rhythm although there is always a particular and distinctive articulation." From page 4 of the preface in Crama.

[33] "SAW SOUND: The 16th notes indicate the rhythm of the gesture. Within each up and down movement (ca. 1cm width) of the plectrum along the string several 'clangs' will be played. The guitar plectrum should be hard type (not soft). Hold firmly and deeply the plectrum almost vertical to the string. The fingers might touch the string. It should not sound as a plastic card clanging along the string. The sound produced is a very raspy and coarse tone and resembles the sound of hand sawing." From page 4 of the preface in Crama.

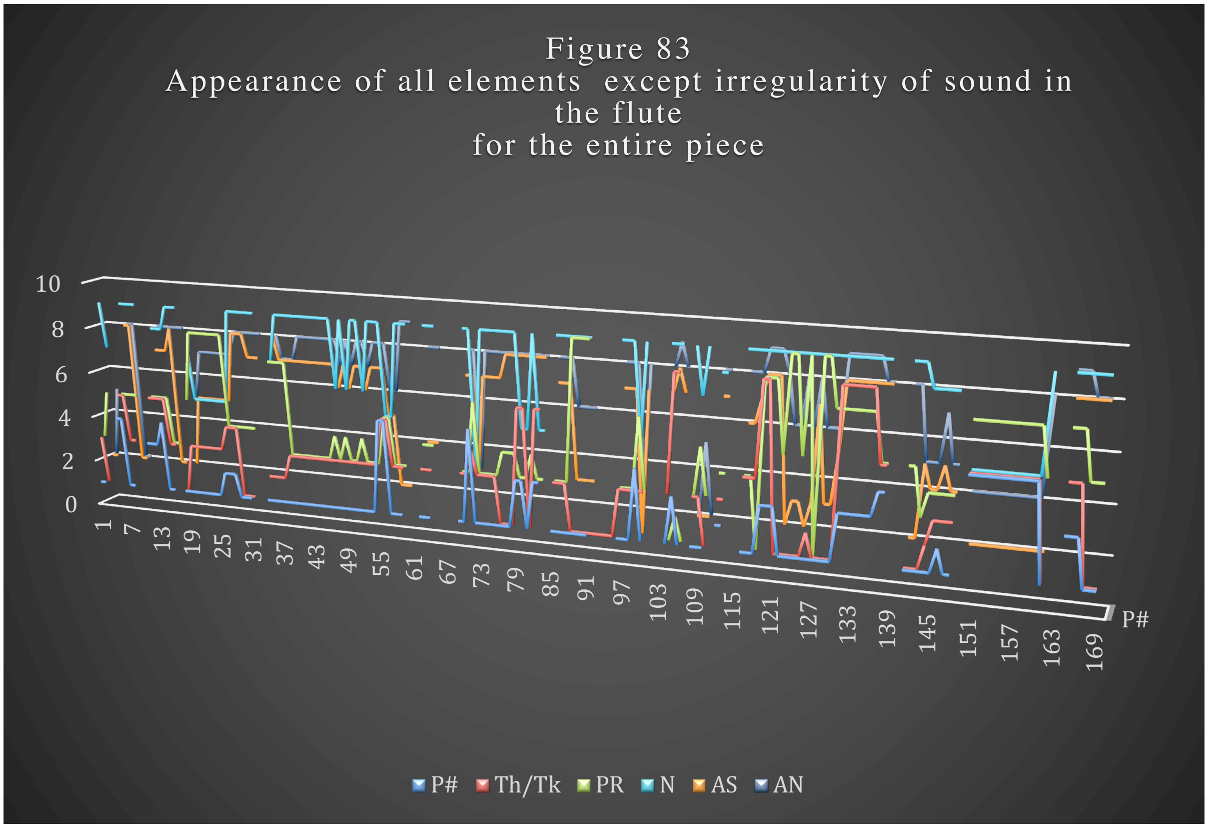
Figure 83
Appearance of all elements except irregularity of sound in the flute
for the entire piece
10
8
6
4
2
0
1
7
13
19
25
31
37
43
49
55
61
67
73
79
85
91
97
103
109
115
121
127
133
139
145
151
157
163
169
P#
P#
Th/Tk
PR
N
AS
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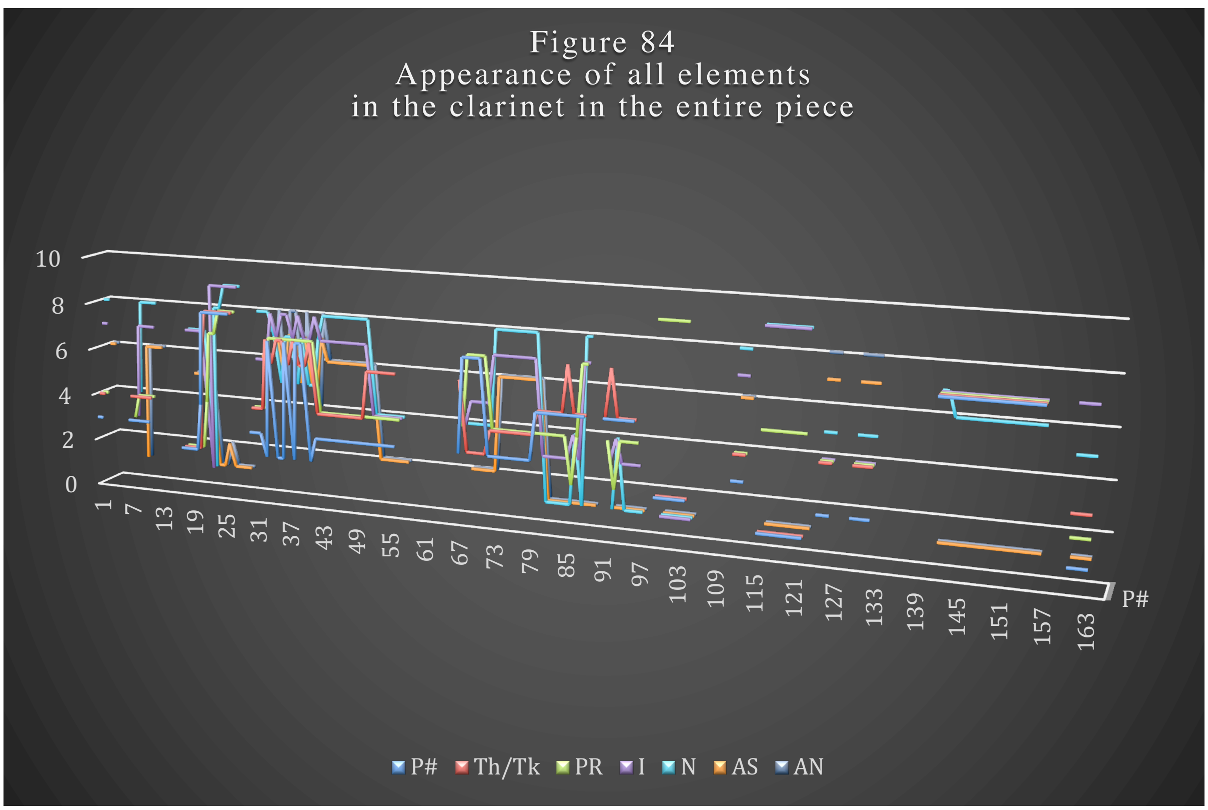
Figure 84
Appearance of all elements
in the clarinet in the entire piece
10
8
6
4
2
0
1
7
13
19
25
31
37
43
49
55
61
67
73
79
85
91
97
103
109
115
121
127
133
139
145
151
157
163
P#
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I
N
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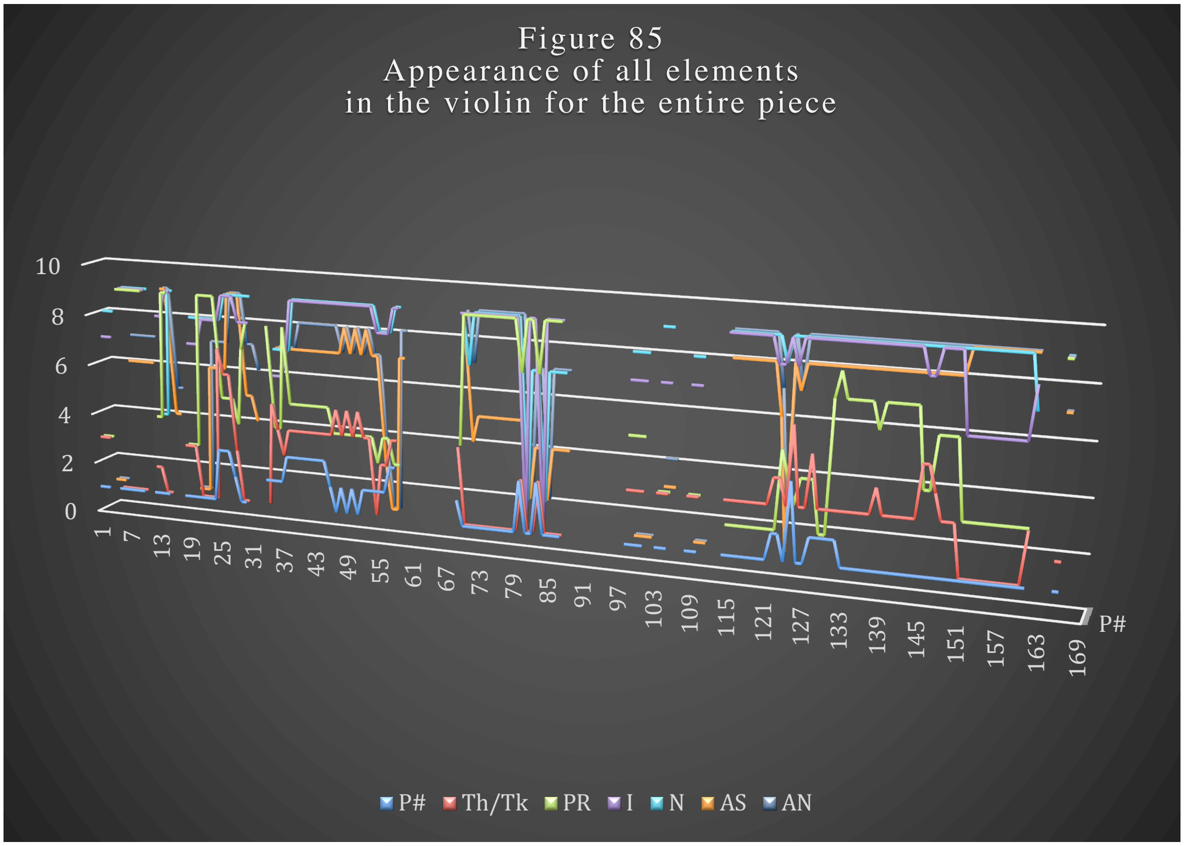


Figure 85
Appearance of all elements
in the violin for the entire piece
10
8
6
4
2
0
1 7 13 19 25 31 37 43 49 55 61 67 73 79 85 91 97 103 109 115 121 127 133 139 145 151 157 163 169
P#
P# Th/Tk PR I N AS AN

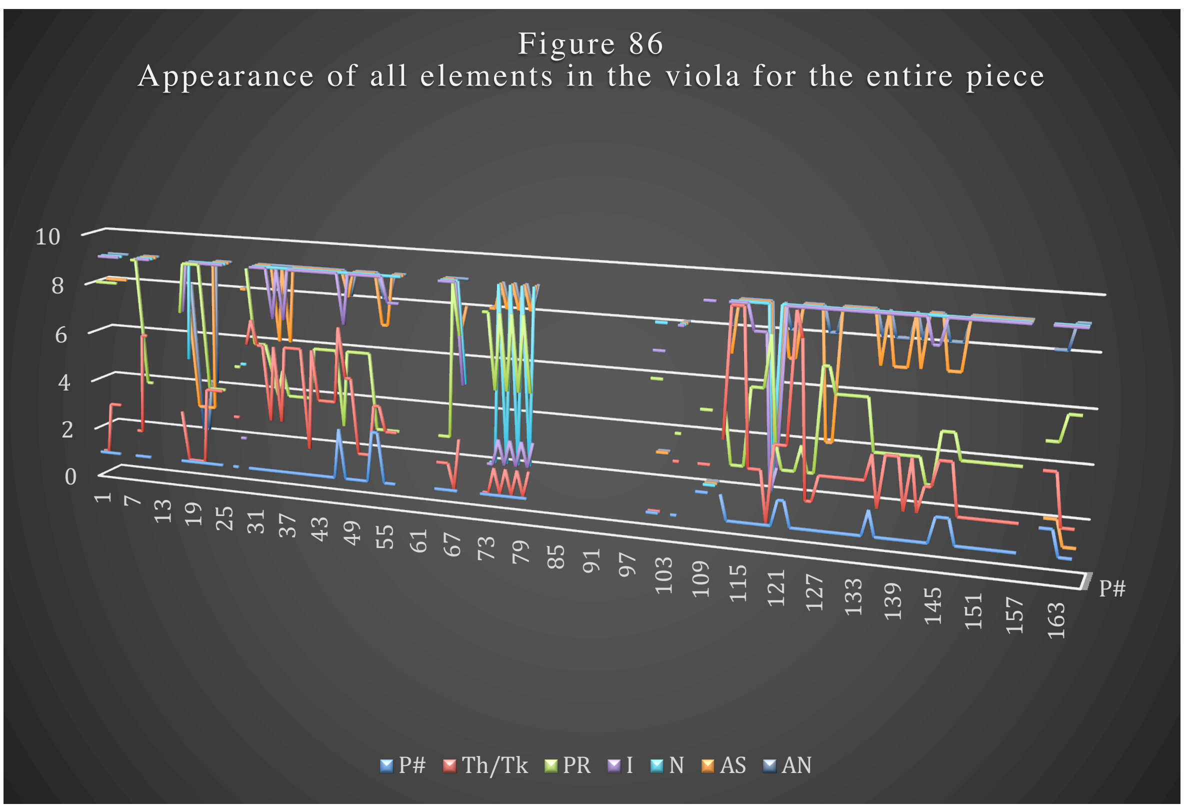


Figure 86
Appearance of all elements in the viola for the entire piece
10
8
6
4
2
0
1 7 13 19 25 31 37 43 49 55 61 67 73 79 85 91 97 103 109 115 121 127 133 139 145 151 157 163
P#
P# Th/Tk PR I N AS AN

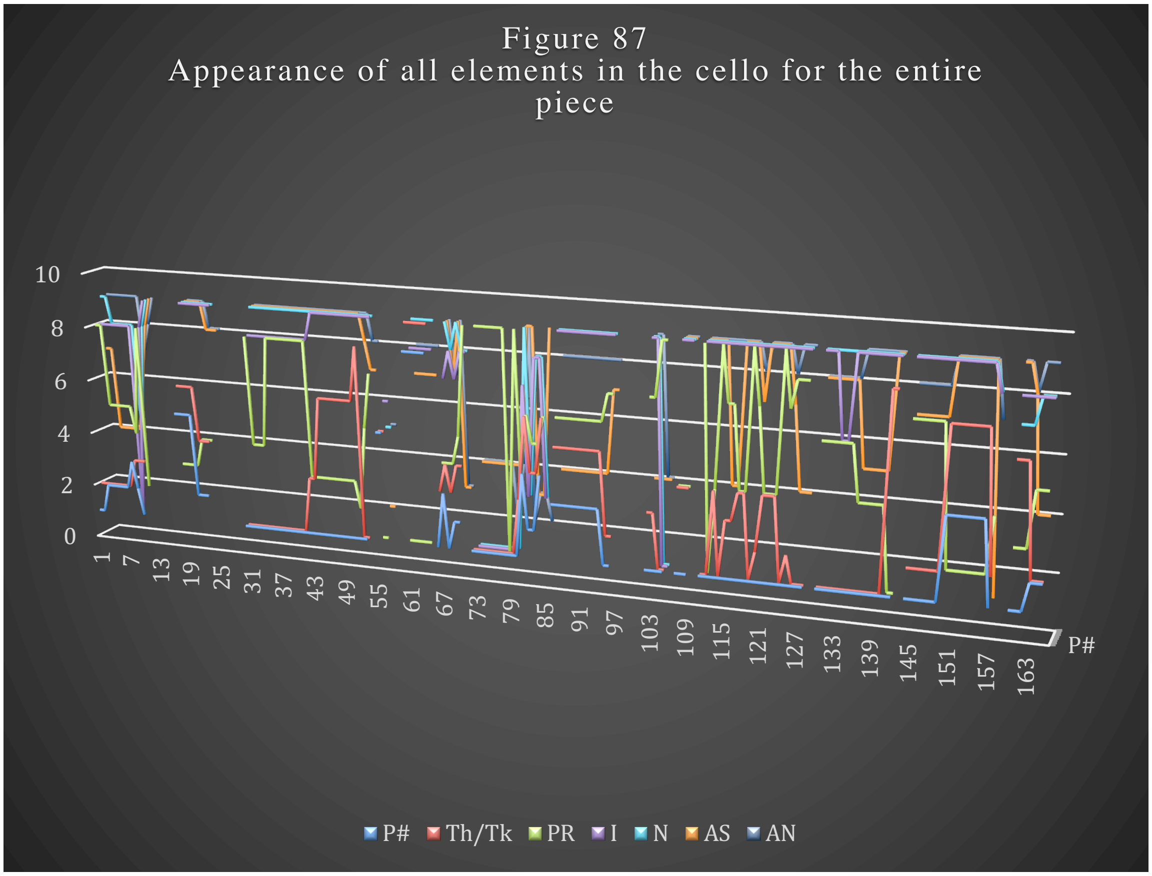


Figure 87
Appearance of all elements in the cello for the entire piece
10
8
6
4
2
0
1 7 13 19 25 31 37 43 49 55 61 67 73 79 85 91 97 103 109 115 121 127 133 139 145 151 157 163
P#
P# Th/Tk PR I N AS AN

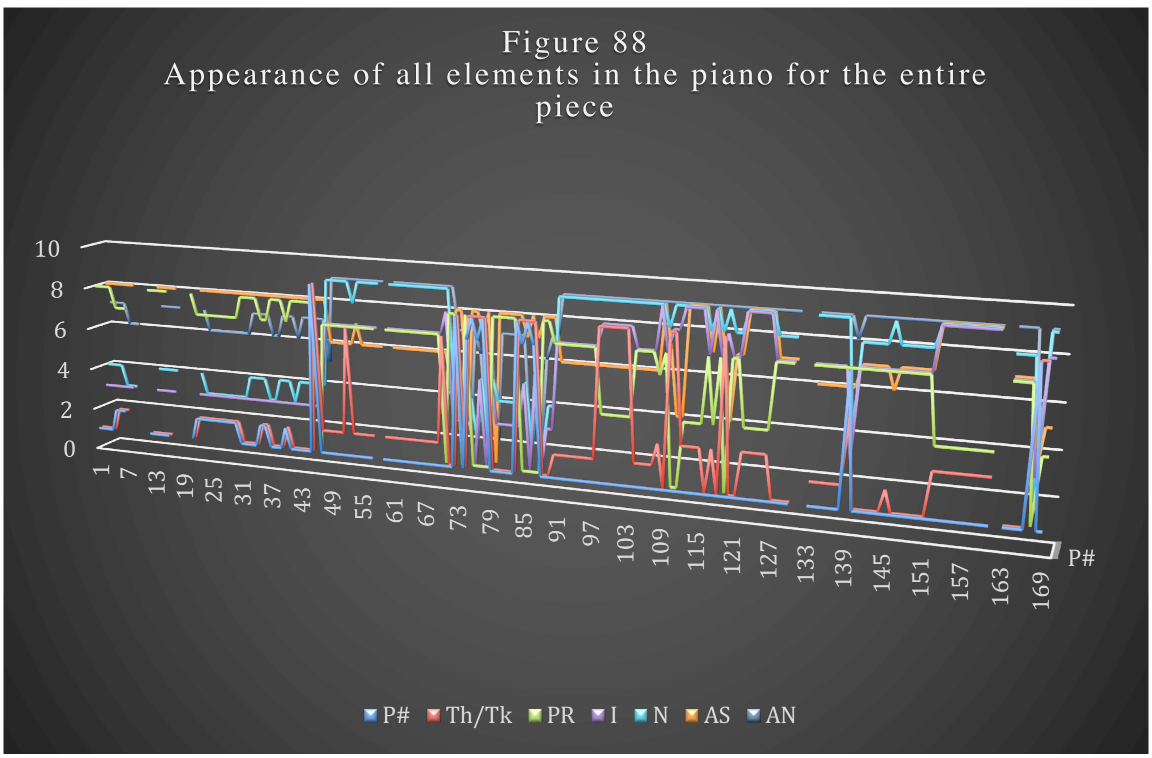


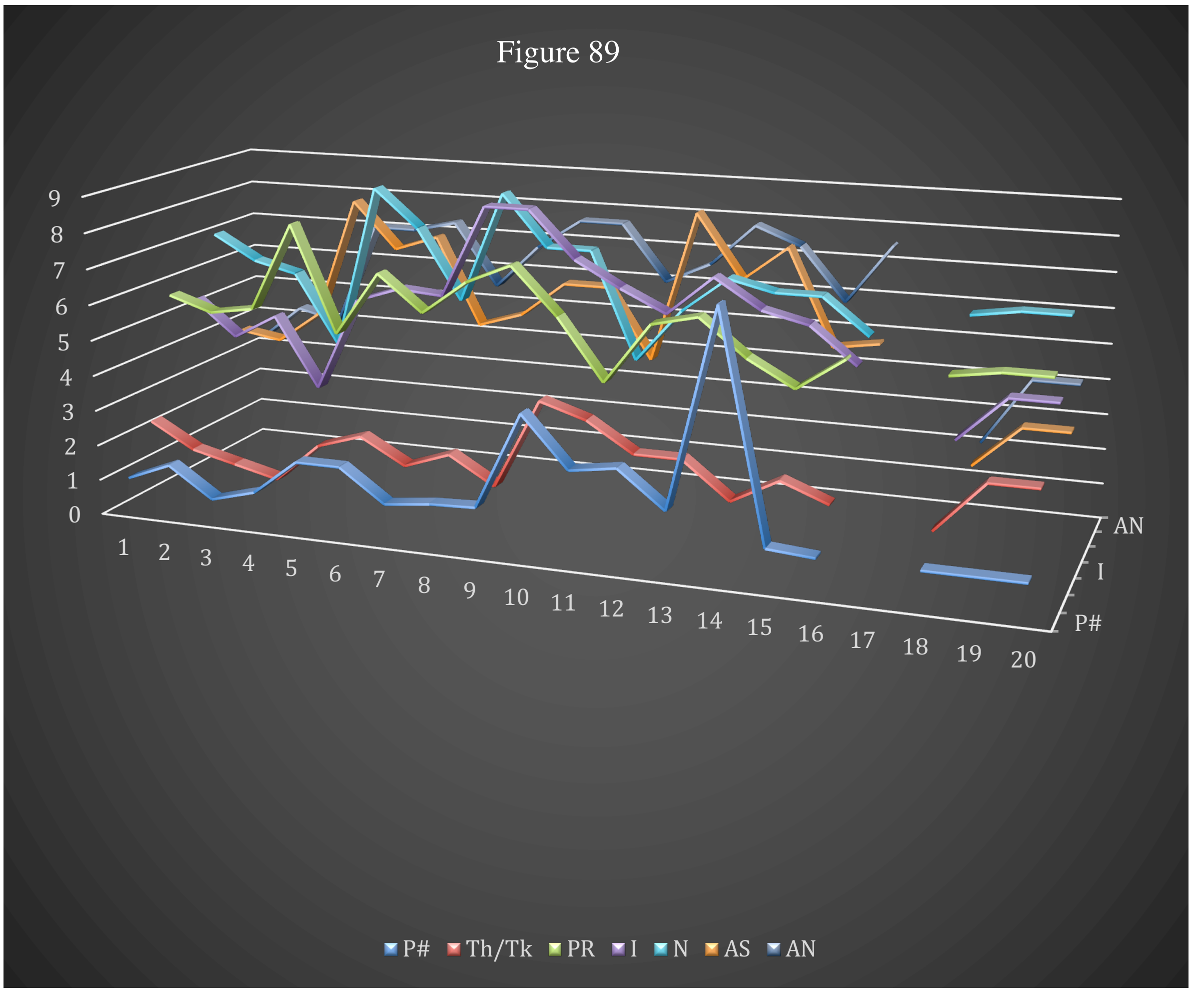
Figure 88
Appearance of all elements in the piano for the entire piece
10
8
6
4
2
0
1 7 13 19 25 31 37 43 49 55 61 67 73 79 85 91 97 103 109 115 121 127 133 139 145 151 157 163 169
P#
P# Th/Tk PR I N AS AN

Conclusion:

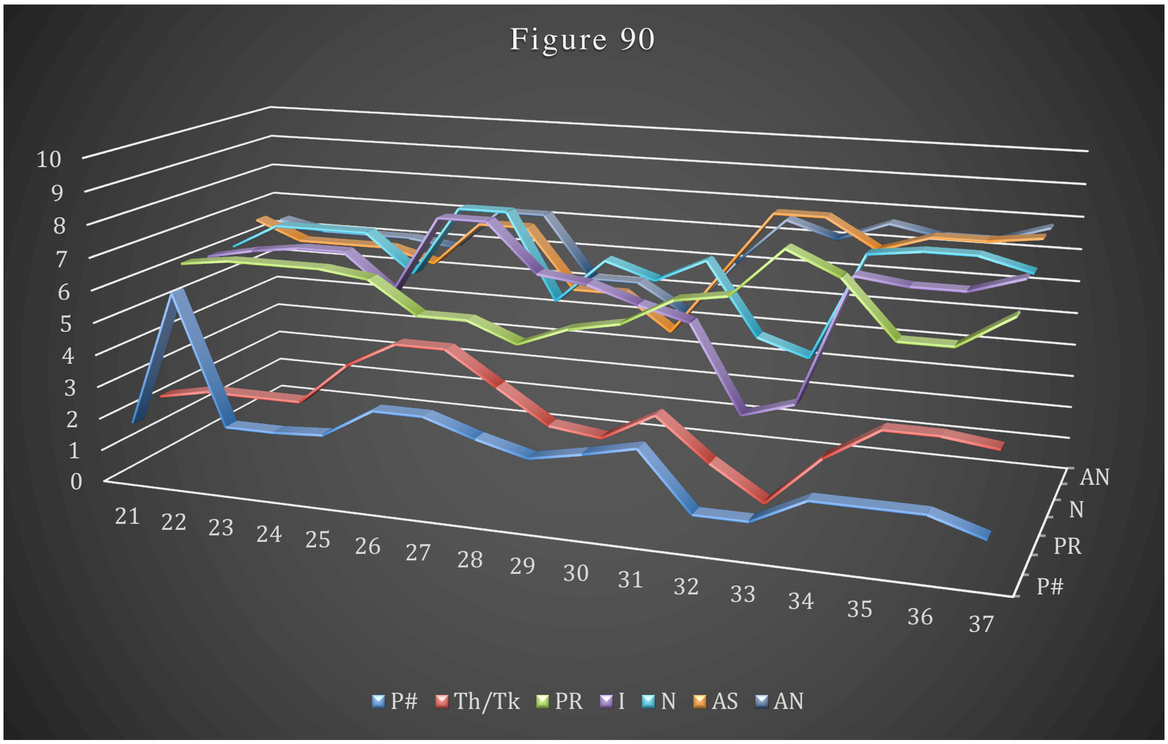
The piano begins with no shape or form, but then its shape becomes clear as Crama evolves. The piano evolves and creates a contrast with the previous section until, ultimately, it becomes the principal aspect in creating Figure 82. In other words, the piano begins as an instrument that is less important than the other instruments before it gradually evolves and transforms into a leading timbral role that the string section imitates. This imitation creates a section, and Figure 82 creates contrast with all the other sections in the piano, which do not play an essential role, bars 1 – 87. Overall, the piano plays a vital role in structuring the form of Crama.

Chapter 9: Overall Average Values

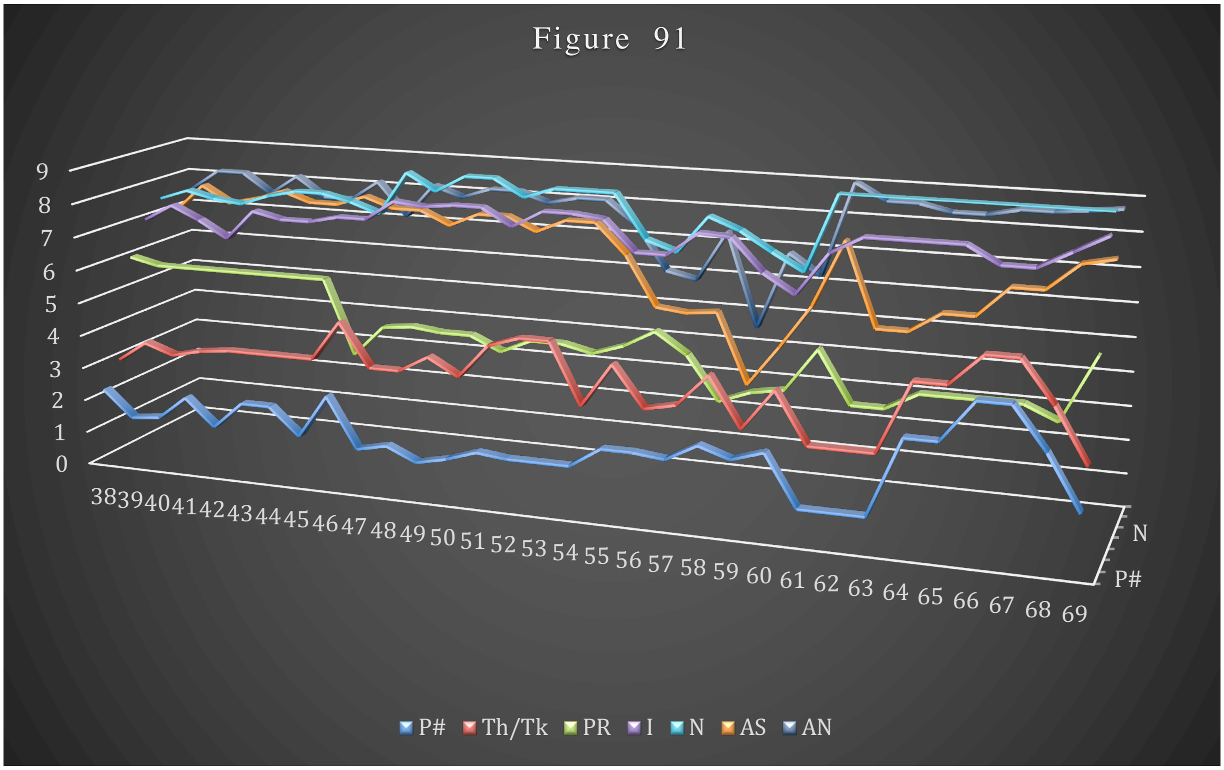
This study explores in great detail the interactivity and functions between contributing elements of sound and their effect on creating form. In this chapter, I examine the overall average values across all the instruments to confirm the previous activities and perhaps discover more.



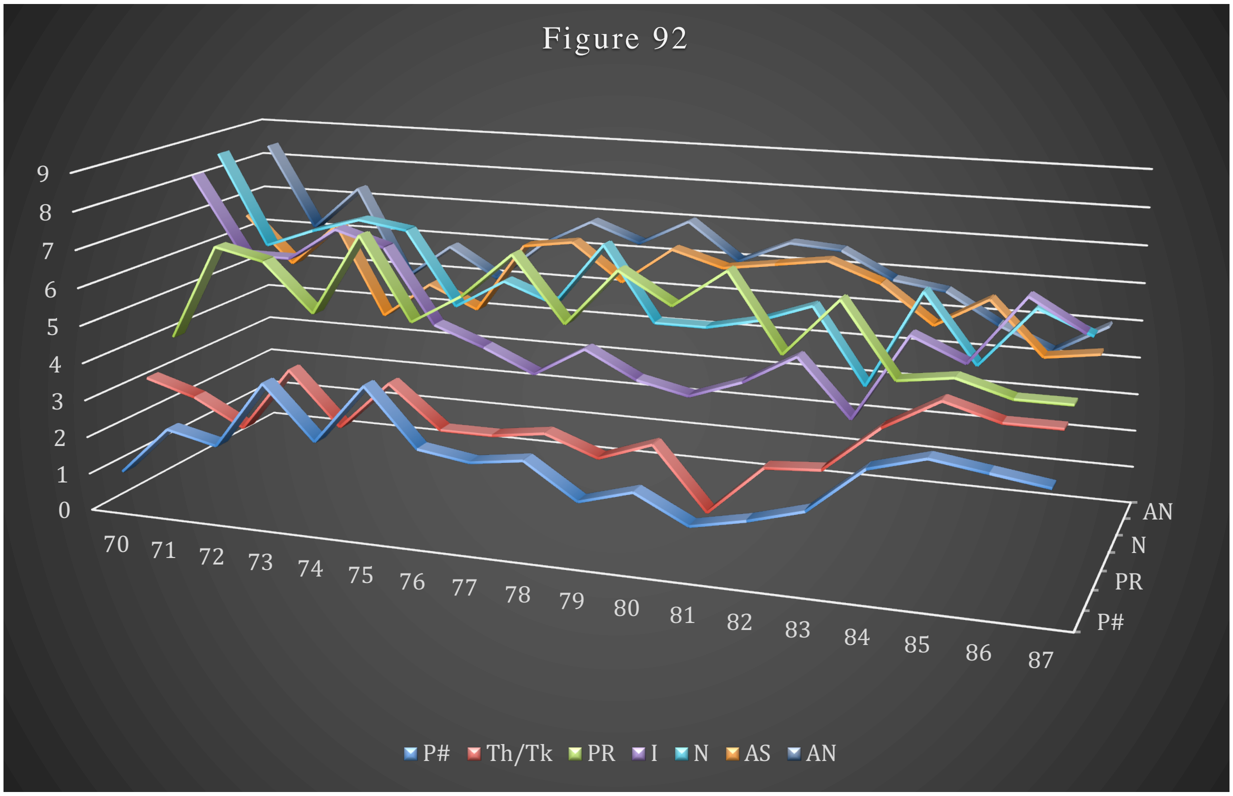
The number of partials category and thinness or thickness of sound are almost at their lowest value, while the other contributing elements of sound show fluctuations between four and nine. The semi-imitative relationship between the number of partials and thinness and thickness of sound, and their interaction with the other contributing elements of sound indicates the importance of imitation, contrast, and correlation and their contribution to the timbre in Crama. Spikes, drops, parallel, and contrast contributes to structuring this section, and overall form in Crama.



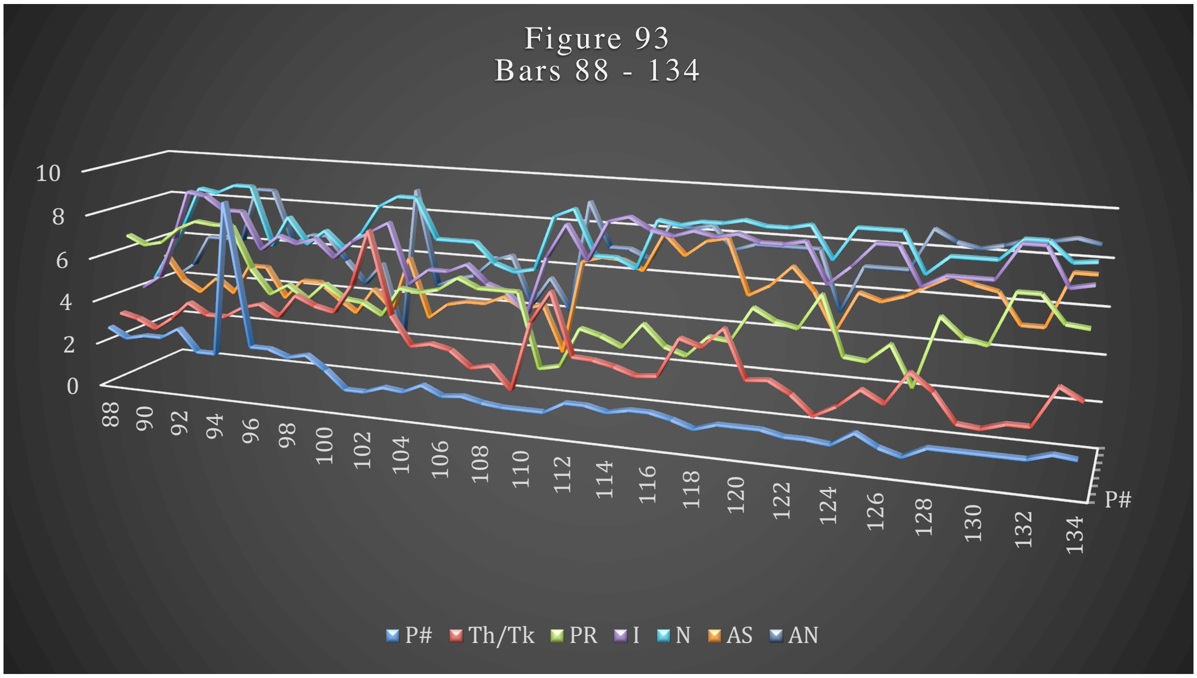
Similar to Figure 89, the number of partials and the thinness or thickness of sound are still at their lowest value here. While the sharpness and noisiness of attack, are parallel to each other, the range of strongest partials, irregularity of sound, and the amount of noise category contain similar parallelism among themselves. Notice the imitative parallelism between all series except the range of partials between bars 25 – 28. Figure 90 seems to be a variation of the materials that were presented in Figure 89. Therefore, this section can be labeled as transformation A.

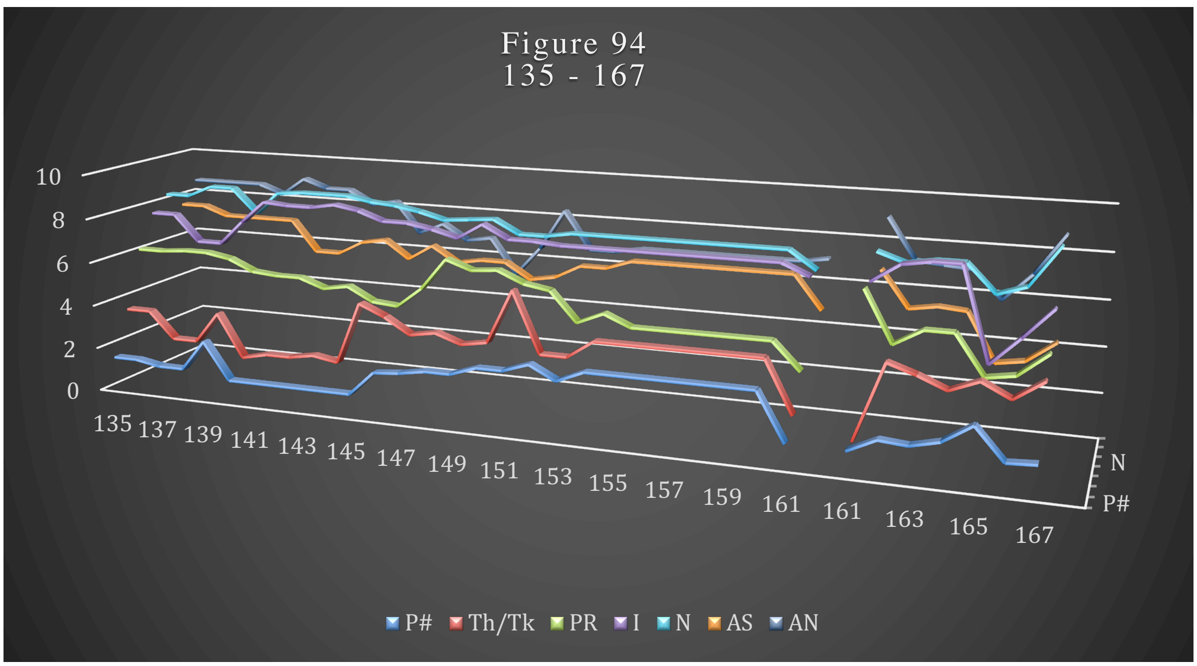


Notice the relative interaction, not always parallel, between the number of partials category and thinness or thickness of sound, in Figure 91. There is also a relative interactive relationship between Irregularity of sound, the amount of noise, and the noisiness of attack categories, up to bar 56, which then deviates until bar 89. The range of strongest partials hovers in the middle range. This suggests a relationship between all parameters in high, middle, and low ranges, which is in contrast to Figure 80, which did not present this type of organized relationship between the elements of sound, making Figure 91 a contrasting section to Figure 90.

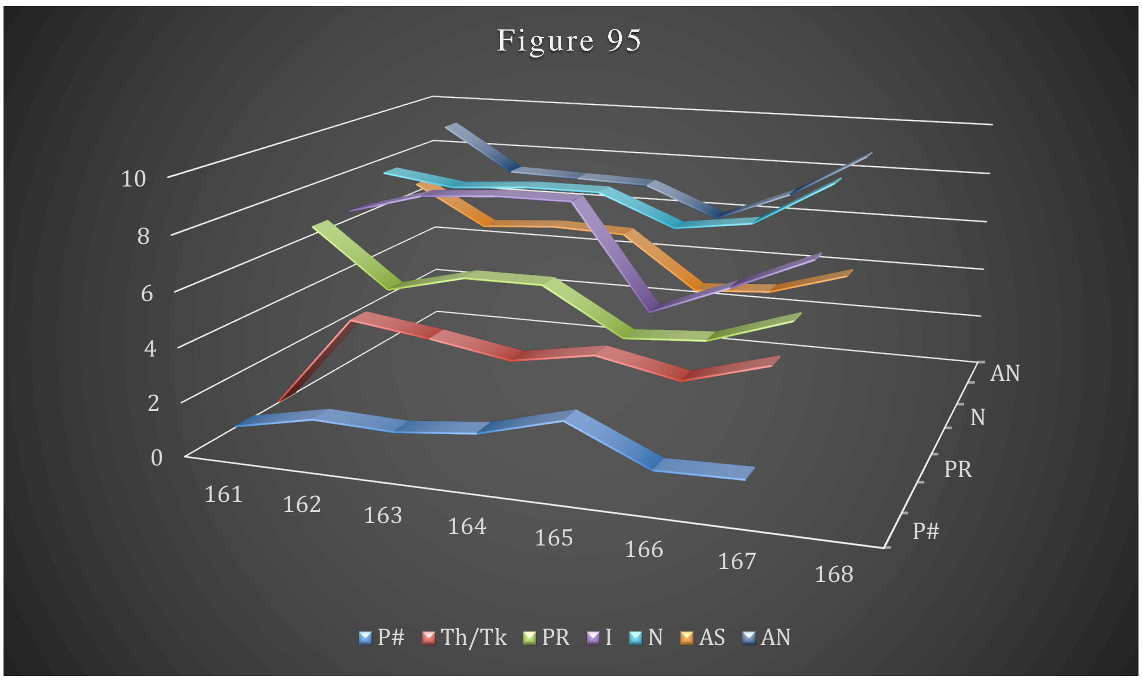


In contrast to Figure 91, the thinness or thickness of sound in Figure 92 and the range of strongest partials are parallel with Irregularity of sound category, the amount of noise, the sharpness of attack category, and the noisiness of attack category. Similar to Figure 79, the number of partials category and thinness and thickness of sound closely imitate one another in a very close range from bars 70 – 87. The similarity and contrast between Figures 90 and 91 contribute to the timbre in this section. A closer look at Figure 92 reveals a tighter range of correlation between the elements of sound, which contrasts Figure 91. The correlation, imitation, and contrast between different elements of sound contribute to the transformational variation from one section to another. In this way, the sound within itself contributes to the form in Crama.





In contrast to Figures 92, 91, 90, and 89, the number of partials and the thinness or thickness of sound is less imitative. On the other hand, the sharpness and noisiness of attack are strictly imitative in Figure 73. There are many types of motion within the range of strongest partials and the amount of noise, which create interactive relationships among themselves and with the other series. In other words, Figure 93/94 suggests variations and contrasts to Figures 89, 90, 91, and 92. This section recycles materials present in prior sections and to some extent, shows repetition and variation from the preceding sections. This correlation and contrast create an interactive relationship that contributes to the overall construction of timbre in Figure 93/94, just as timbre contributes to the creation of form in Crama.



In this section, the sharpness of attack category and the range of strongest partials are parallel. Also, the number of partials and thinness and thickness of sound are in almost imitative parallel. Furthermore, the amount of noise category has a combination of parallelism and imitative parallel motion. In contrast, the irregularity of sound category has almost no apparent correlation with the other elements. The element of similarity between Figure 95 and all the other Figures thus far, along with the contrast among the correlation of different elements of sound, reveals the transformational variation character of this Figure. Form in each section is a variation of the prior section but suggests a sense of contrast, and, in this way, a new section is created.

Chapter 10: The Flute Compared to Other Instruments: Fictitious Timbral Recapitulation

Introduction:

Thus far, comparing different contributing elements of sound in each instrument has revealed different techniques that contribute to the growth of form in Crama.

Reminder and Clarification:

For the next five chapters, only the absolute timbral value of each sound in each bar will be compared to the instruments themselves and other instruments. The "absolute timbral value"[34] of each sound, in each bar is the sum of the seven contributing aspects of sound. As mentioned earlier, each contributing element is assigned a value ranging from 1 to 9, so the absolute value represents the total of timbral saturation. For example, the flute in m.1, breathy sound, is represented by the following numerical values for each contributing element of sound: Number of harmonic partials =1, Thinness and thickness of sound = 3, Range of strongest partials = 3, Irregularity of sound = 6, Amount of noise = 9, Sharpness of attack = 2, Noisiness of attack = 2. Thus, the absolute timbral value of the breathy sound in flute in bar one of Crama is twenty-six.

Furthermore, if the absolute timbral value of the second bar of the flute is determined, then the absolute value difference between these two bars will identify the progression of timber in the flute from bar 1 to 2. If we set the absolute value difference between bar 1 and itself as zero, the

[34] I understand that, <magnitude of the timbral vector> value—determined as the square root of the sum of the squares of the 7 timbral saturation values—is a more accurate measure of total timbral saturation, but that absolute value—determined as the sum of the 7 timbral saturation values—is a more intuitive measure and produces an integer, and so is used here for purposes of easier reader comprehension.

absolute value difference between bar 1 to 2, then 1 to 3, 1 to 4, and … 1 to 170 will generate a line chart which expresses the progression of timber when the timbral value of bar 1 is compared to itself and all the other bars of flute in Crama. In this way, the appearance of zero indicates the return of the total timbral saturation of bar one.

In this chapter, I will apply this process to flute vs. flute, clarinet vs. clarinet… violin, viola, cello, and piano. The final goal is to discover facts that relate to the contribution of timbre to the creation of form in Crama.

In all line charts in chapters 10 – 15, the Y-axis indicates the range of absolute timbral values. The X-axis shows the range of the bar numbers of the comparison.

As previously mentioned, chapters 10 – 15 will compare the absolute timbral value of one instrument to another. For example, the absolute timbral value of the flute, 15, will be subtracted from clarinet, 10, and the answer, 5, will appear in a line chart. As a result, one can observe the timbral progression of the flute in the form of a line as part of a line chart.

What does flute vs. clarinet mm. 38 – 61 mean?

This notation means the absolute timbral value of bar 38 in flute will be subtracted from the absolute timbral value of clarinet in bars 38 – 61 of the clarinet. The result of this comparison will appear as a line in the line chart. This same process will then be applied to compare bar 39 of the flute to bars 38 – 61 of the clarinet. Finally, bar 61 of the flute will be compared to bars 38 – 61 of the clarinet.

Maximum and Minimum values:

As a result of comparisons between different instruments, some values will appear as smaller values, while some will appear as larger values. The minimum values represent those that have more timbral similarities with the instruments against which they are compared. On the other hand, maximum values indicate large timbral differences between the instruments compared.

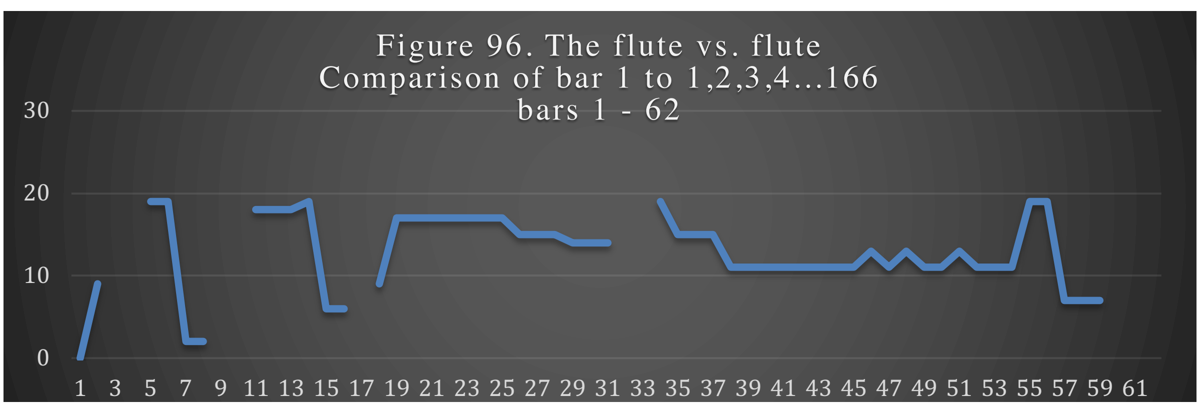
Timbral space:

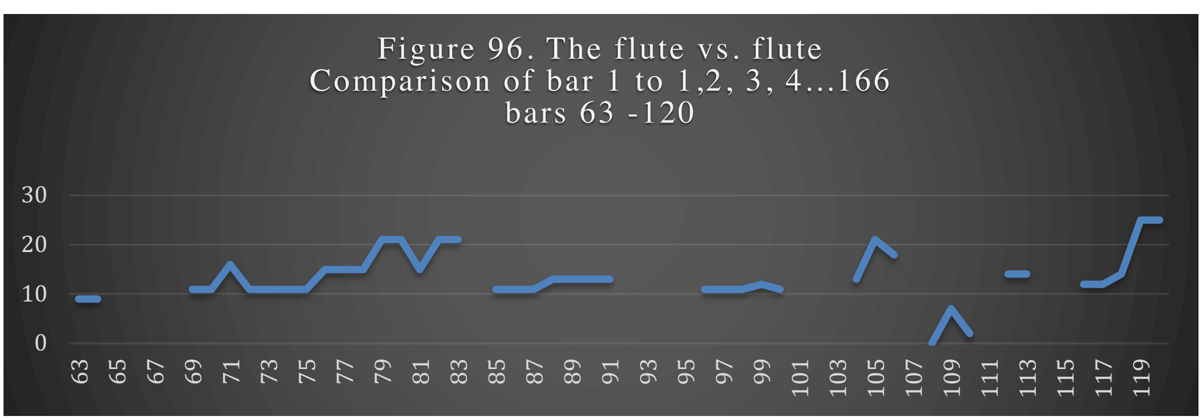
The absolute value difference between the minimum and maximum values, which is derived from comparing either two identical (or nearly-identical) instruments or two very different instruments, can be called timbral space. For example, the minimum and maximum values in Figure 109 are twenty and thirty-eight. Therefore, the timbral space in Figure 109 is 19. Similarities in the absolute timbral values of two instruments result in smaller timbral space values. Large differences in absolute timbral values of two instruments result in a larger timbral space value. In theory, smaller timbral space could be the result of the instruments within the same family, since instruments from the same family have relatively similar timbres. However, this statement is not practically true at all times. Figure 97, flute vs. clarinet mm. 38 – 61, is an exception to this smaller timbral space theory. Also, one might think instruments within two or more families have a higher chance of creating larger timbral space. However, this is also not always true. Figure 101, flute vs. piano mm. 70 – 87, is an exception, as the timbral space between instruments from different families is 18. Therefore, timbral space is affected not only by the mechanics of sound production, but also by the interference of register, dynamic, and articulation.

Two additional considerations about the properties of timbral space are: 1) Timbral space can be considered a tool to create phrases and shapes. For example, the appearance of a larger timbral space can stretch a phrase and create contrast with smaller timbral values. 2) Timbral space can also be used as a sectional contrast. For example, the smaller timbral values in section A contrast with the larger timbral space values in section B. As a result, both of these properties can be considered tools that contribute to the creation of form in a sound-based composition.

Reminder: The structure of analysis in chapters 10 – 15:

In order to analyze the function of timbre and the process of its contribution to form, I divide Crama into smaller sections. These sections, which are slightly different from those in chapters 3 – 9, were chosen based upon the progression, evolution, and transformation of motif and timbre, and how they contribute to structuring the form in Crama.





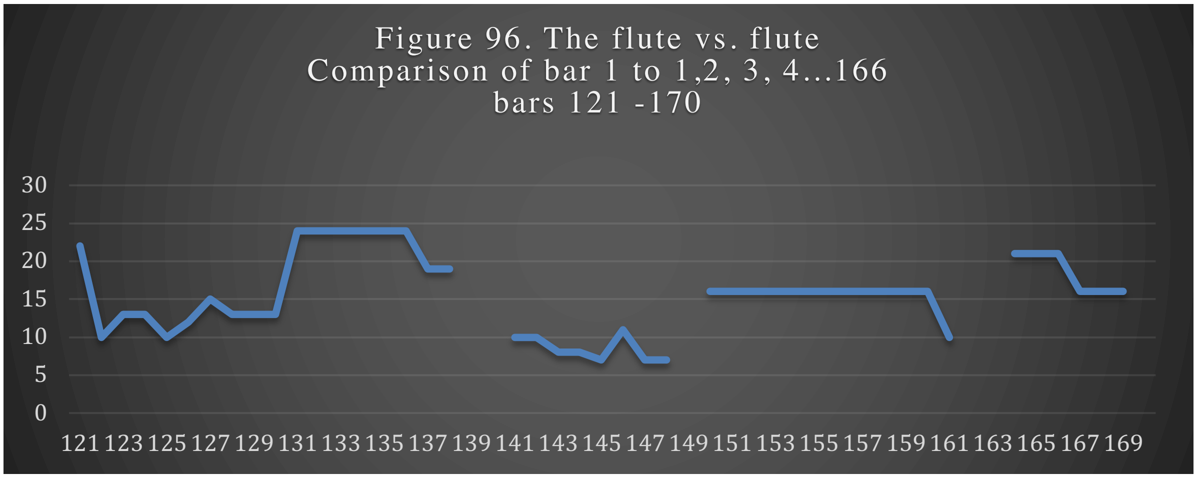


Figure 96 exhibits the timbral progression when the absolute timbral value of the flute is compared to measure one of itself. The minimum and maximum values in this comparison are zero and twenty-four. A closer look reveals the multiple repetitions of the same values, which contributes to the consistency of different timbral values in Crama. For example, bars 11 – 13 repeat the value of eighteen, three times in a row, bars 18 – 25 repeat the value of seventeen, seven times, bars 26 – 29 repeat the value of fifteen, three times in a row. The recurrence of the identical timbral values shows how repetition is a tool that creates consistency, and, in turn, consistency provides organization and logic in the creation of phrase, section, and form. Thus, based on the consistent recurrence of exact absolute timbre values, one can say that repetition contributes to the form in Crama.

Furthermore, notice the return of identical or virtually identical values. For example, timbral value fifteen returns in bars 76 – 78, timbral value sixteen returns in bars 167 – 169, timbral value eighteen returns in bars 35 – 37, and timbral value seventeen, virtually identical, returns at the end of Crama in bars 150 – 160. The recurrence of timbral value zero in bar 108 suggests a sense of the return in bar 108 of the first bar. The reoccurrence of identical timbral values in different sections, therefore, contributes to the consistency and form in Crama.

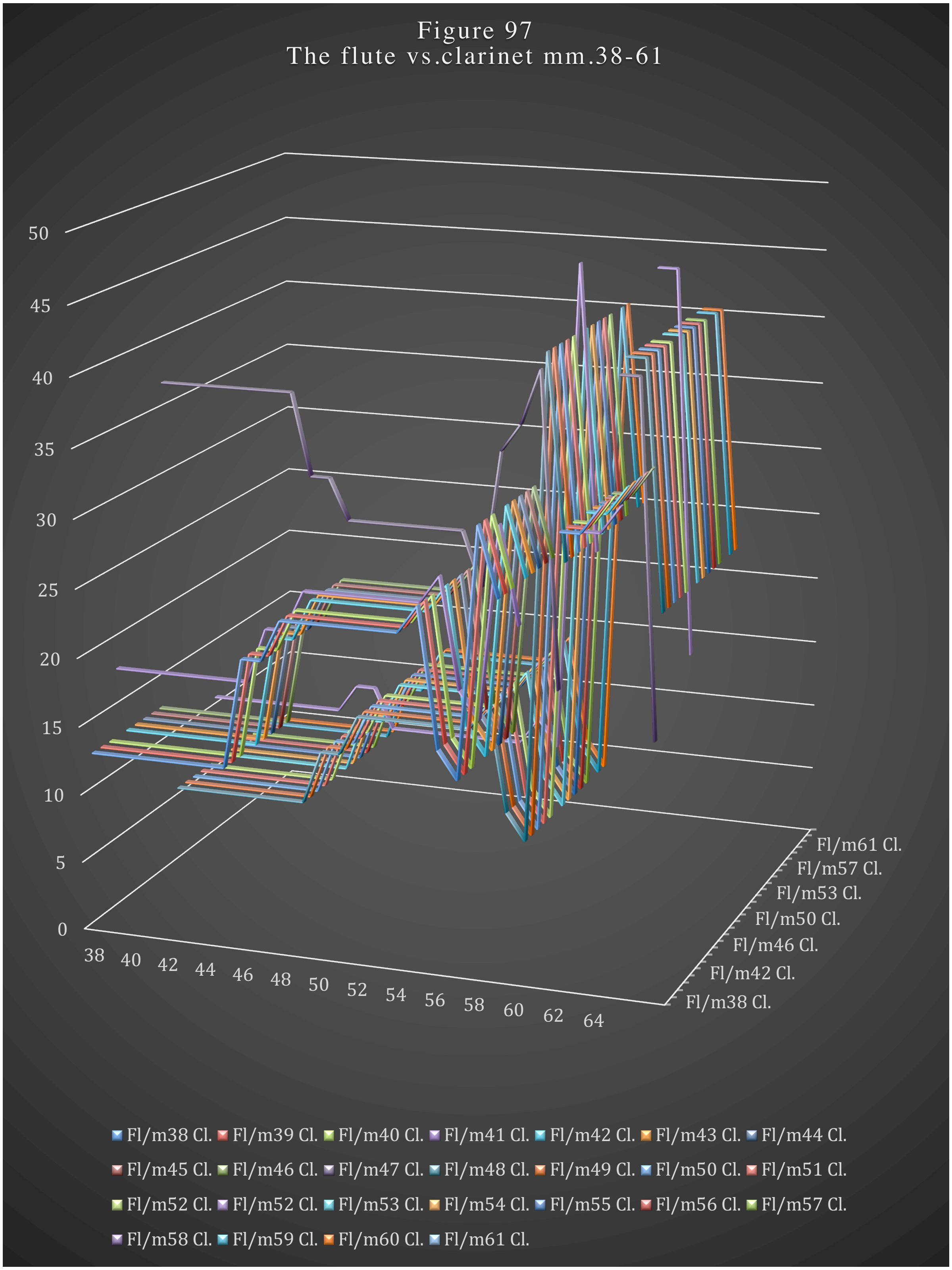


Figure 97
The flute vs.clarinet mm.38-61
50
45
40
35
30
25
20
15
10
5
0
38
40
42
44
46
48
50
52
54
56
58
60
62
64
Fl/m61 Cl.
Fl/m57 Cl.
Fl/m53 Cl.
Fl/m50 Cl.
Fl/m46 Cl.
Fl/m42 Cl.
Fl/m38 Cl.
Fl/m38 Cl. Fl/m39 Cl. Fl/m40 Cl. Fl/m41 Cl. Fl/m42 Cl. Fl/m43 Cl. Fl/m44 Cl.
Fl/m45 Cl. Fl/m46 Cl. Fl/m47 Cl. Fl/m48 Cl. Fl/m49 Cl. Fl/m50 Cl. Fl/m51 Cl.
Fl/m52 Cl. Fl/m52 Cl. Fl/m53 Cl. Fl/m54 Cl. Fl/m55 Cl. Fl/m56 Cl. Fl/m57 Cl.
Fl/m58 Cl. Fl/m59 Cl. Fl/m60 Cl. Fl/m61 Cl.

Figure 97 presents a comparison between bars 38 – 64 of the flute and bars 38 – 64 of the clarinet. There are three subsections from bars 38 – 64: 1) 38 – 45, which shows the appearance of timbral state A and its transformation via the sequence of timbral values to 2) timbral state B in bars 46 – 55, which transforms to 3) timbral state C in bars 56 – 60. Each of these sections can be considered a variation of the next. It seems each timbral state transforms to another via the sequence of previous timbral values. Also, there are many more instances of parallelism than contrast in Figure 97. Therefore, the sequence of different timbral values along with parallelism are the main component of the transformation in Figure 97.

The minimum and maximum values are five and forty-six. Notice the dramatic difference between the maximum and minimum values in Figure 97. Since the flute and clarinet are from the same family of instruments, they hypothetically should not have such a dramatic difference between the minimum and maximum values. However, a closer listen reveals that the appearance of a spike in the vicinity of bars 55 – 58 is the result of the appearance of flute in the C#6 register with ***ff*** dynamic while the clarinet is in C4 register with ***mp*** dynamic. Notice, the timbral difference between flute and clarinet can be quite close, timbral value 5, and far apart, timbral value forty-six. The timbral space between these two instruments is stimulated by the use of register and dynamic, and therefore, regardless of the appearance of instruments from similar or dissimilar families, timbral space can change by the interjection of register and dynamic.

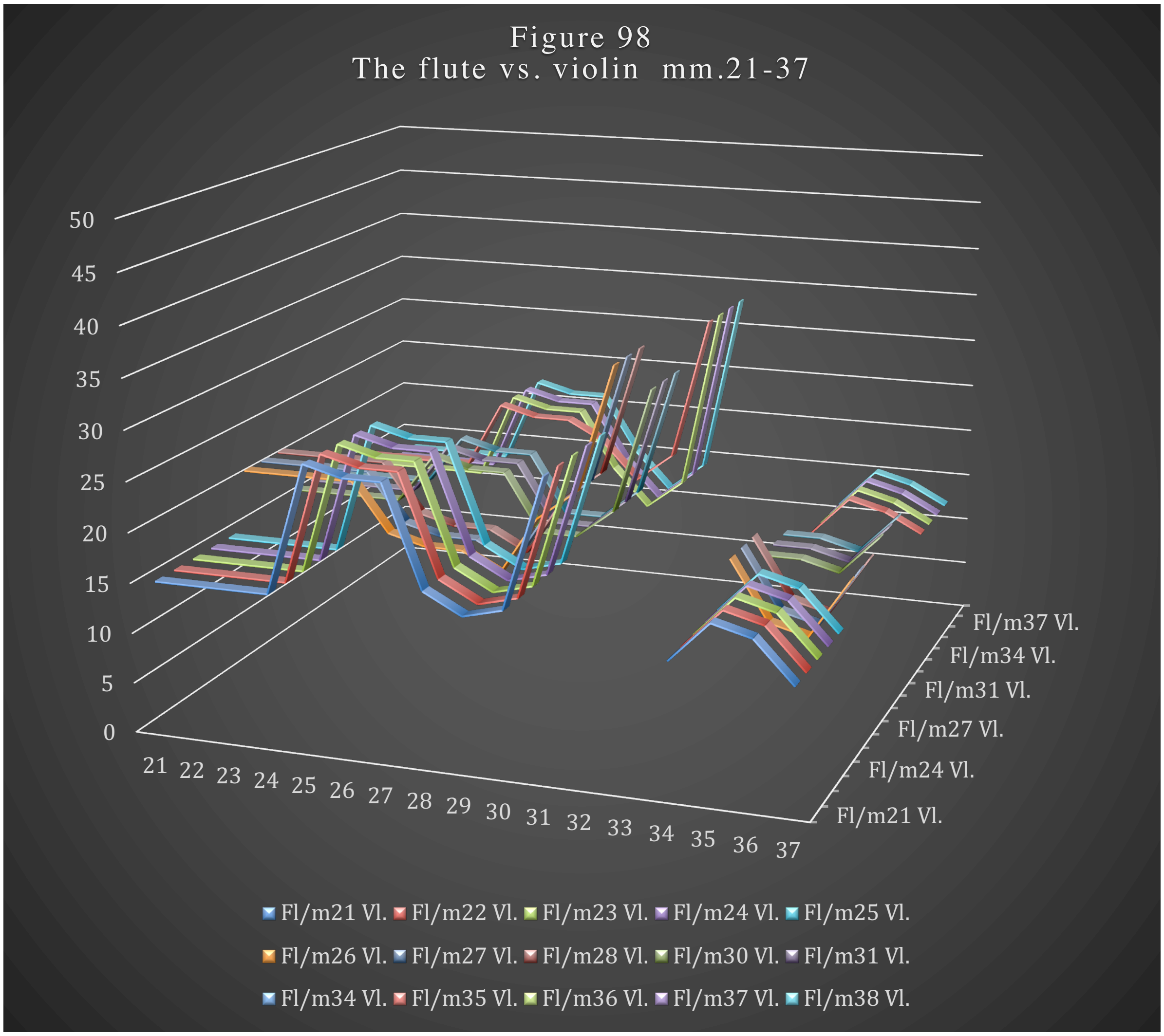


Figure 98 demonstrates the comparison between bars 21 – 37 of the flute and violin. The minimum and maximum values are fluctuating between thirteen and thirty-five. There are three noticeable facts about Figure 98. 1) Notice the significant amount of parallelism as opposed to the contrast between the comparisons. 2) Notice the parallelism between different comparisons, which proves the similarities between timbres in flute and violin in Figure 98. 3) Notice the lack of ABA or ABA' structure but the clarity in the appearance of variation to this section. These variations, bars 33 – 37 is a variation of 27 -29, can be linked to the transformational variation as a structural procedure in Crama.

The appearance of "xSP,"[35] in violin in bars 28 – 29 results in the initiation of a dramatic spike in bars 29 – 31. The minimum and maximum values are eleven and nineteen in bar 29. There is a dramatic drop in maximum values from bar 29, as the maximum value of twenty-seven drops to the minimum value of fifteen. Note how the appearance of the flute is in F6 register and the violin performing a glissando is between B5 and C#7 registers. The very wide range of glissando with the extreme sul ponticello contributes to the extreme squeaky sound, which is the result of the appearance of a dramatic spike between bars 29 – 31 in figure 98.

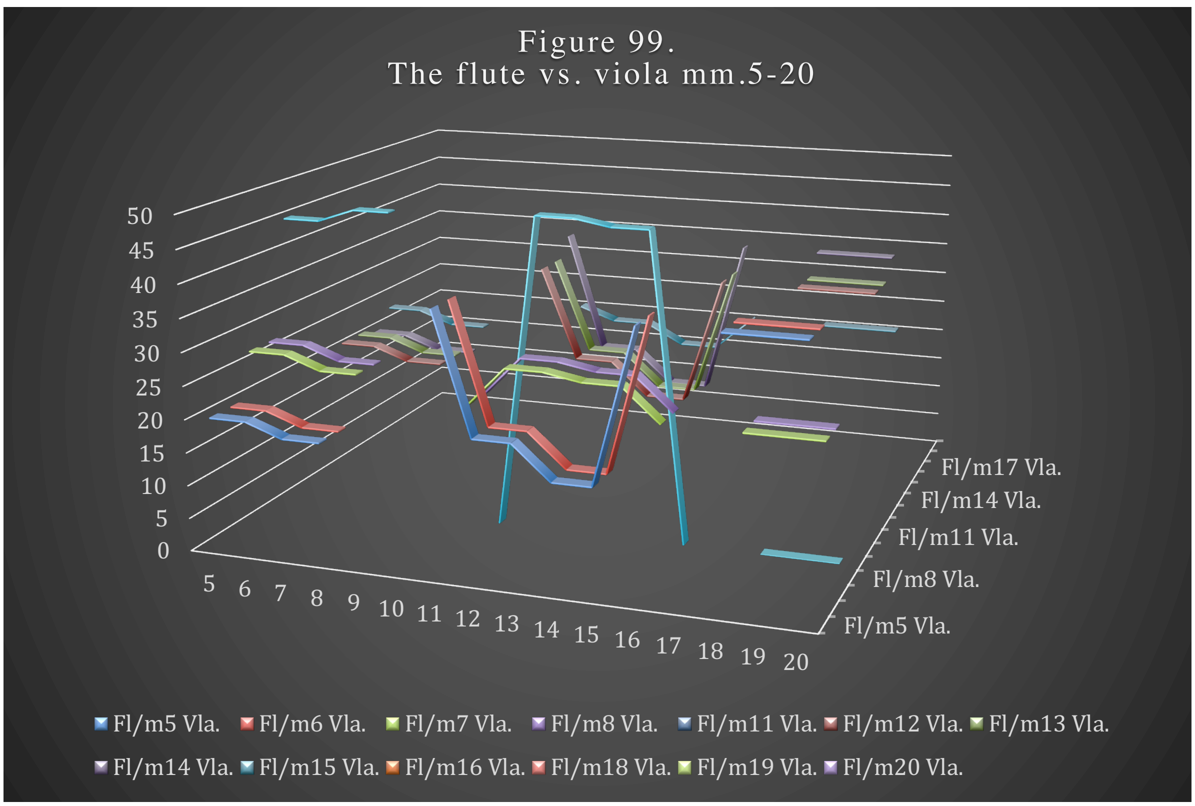
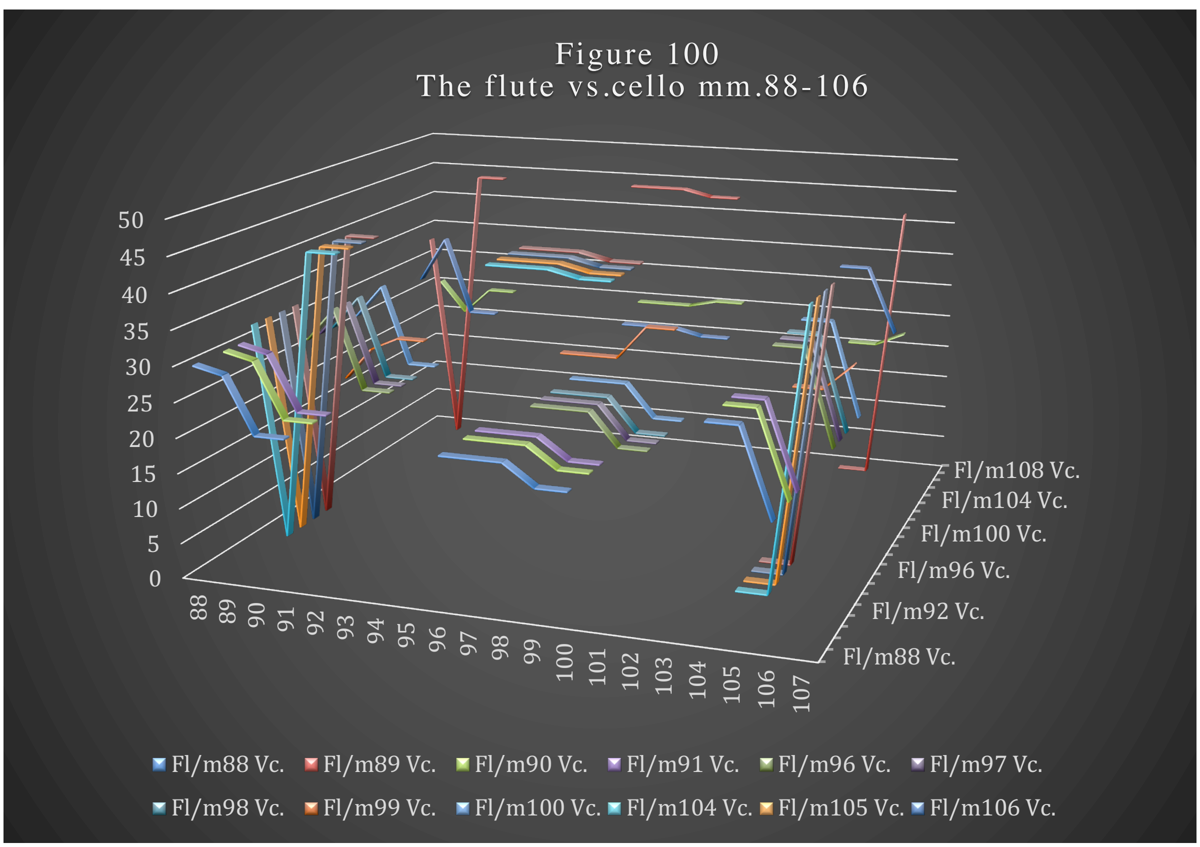


Figure 99 shows a comparison between bars 5 – 20 of the flute to the viola. The minimum and maximum values are zero and forty-seven. Zero returns in bars 11, 16, 18, 19, and 20, whereas

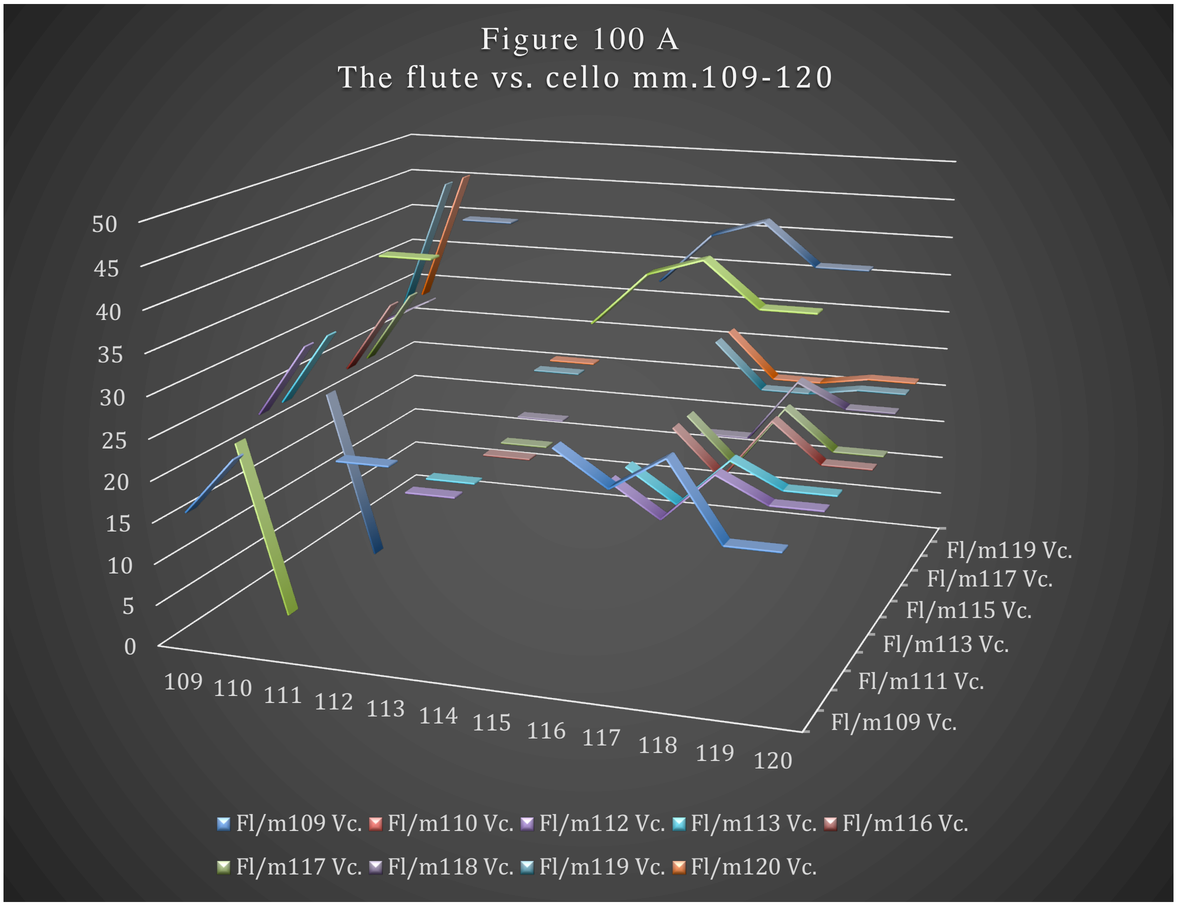
[35] "Extreme sul ponticello, bow as near to the bridge as is practical (some bow hairs might touch the bridge); the sound is filled with dissonant overtones which give it an unearthly, glassy, metal-scratchy quality." From page 5 of the preface in Crama.

the maximum value appears in bars 7, 8, 12, 13. A closer listen to Crama confirms that there is a timbral imitation between the flute and viola, and, as a result, there is less contrast between them. This is not unexpected, due to the introductory character of this section, since introductory sections do not aim to create contrast with other sections.

Notice the dramatic appearance of minimum and maximum values between bars 11 – 16. A closer listen to bars 11 – 16 reveals that the appearance of "whish sound,"[36] very squeaky noise, contributes to the appearance of a dramatically larger timbral space in this section. Otherwise, bars 1 – 8 and 18 – 20 do not display a large timbral space in relation to bars 11 – 16.



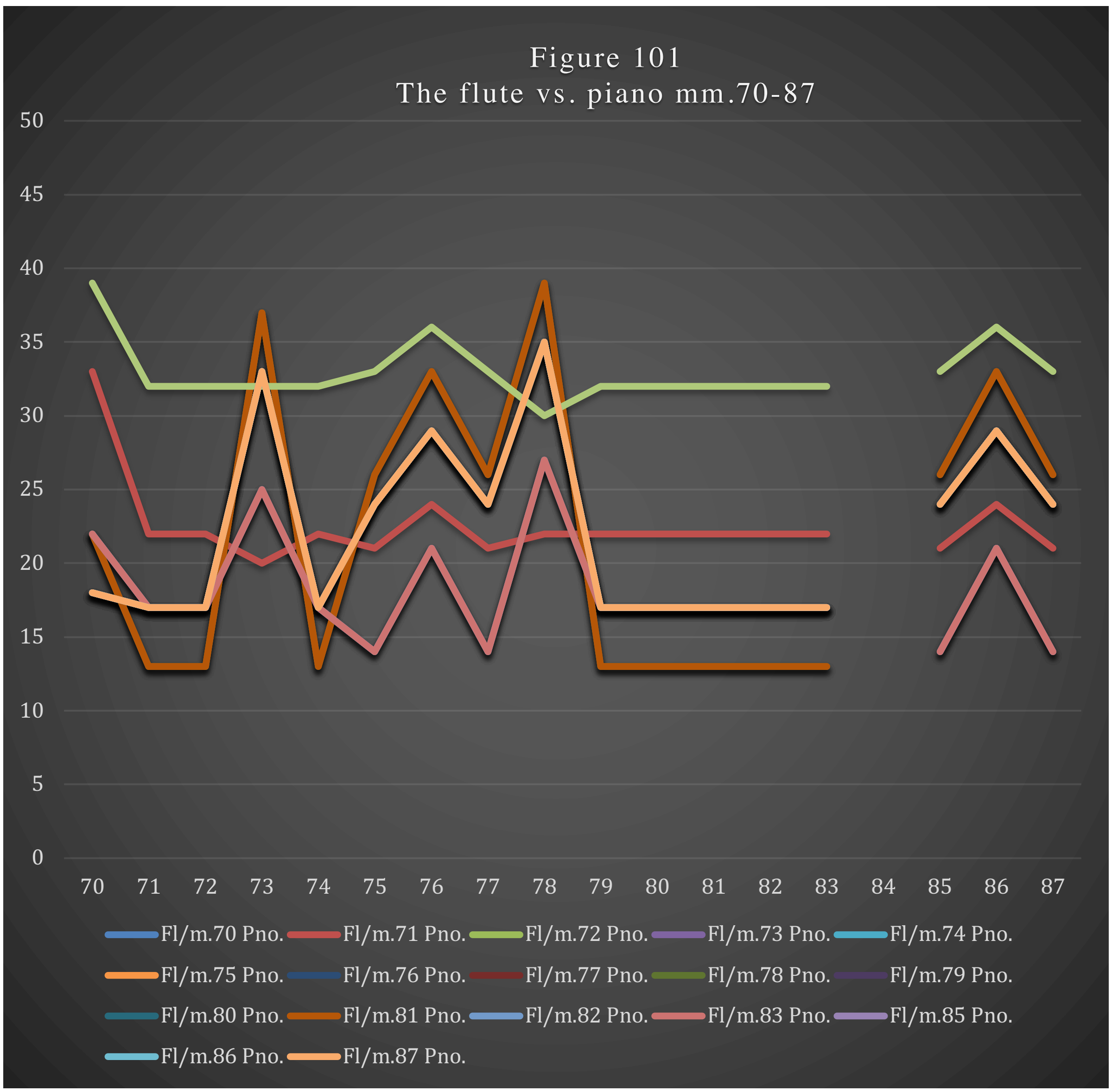
[36] "Whish Sound: Play the bow at xSP area and the Left Hand should move within the area from the xST to xSP. The limits of glissando are indicated by the parenthesized (xSP), (ST), and the direction by the line labeled 'LH gliss'.The effect is a very high, scream-like sound. [b.5]" From page 6 of the preface in Crama.



Figures 100 and 100A demonstrate the comparison of the flute to cello in bars 88 – 120. The minimum and maximum values are zero and forty-eight. There are no instances of direct spikes between zero and forty-eight, but there are spikes between zero and forty-three. These large fluctuations contribute to the shape of each of the section's three subsections: 1) bars 88 – 100, which shows a spike between zero and forty-three; 2) bars 104 – 110, which shows a similar spike; 3) bars 112 – 120, which shows spikes between eleven and fifty-eight.

The spikes in bars 88 – 91 and 105 – 106, are interrelated. The shapes of these three spikes suggest a set of shape variations. The horizontal straight lines in bars 96 – 100, 112 – 113, and 119 – 120 contrast with the spikes. Therefore, in addition to the variation between spikes, there is a contrast between straight lines and spikes. The contrast between the shapes of the spikes and the straight lines contributes to form in Figures 100 and 100A.

Notice the broad range, zero to forty-eight, derived from the comparisons between the absolute timbral values of flute and cello. Since the absolute timbral value between these two instruments is dissimilar, there is a broad timbral space as a result of this comparison.



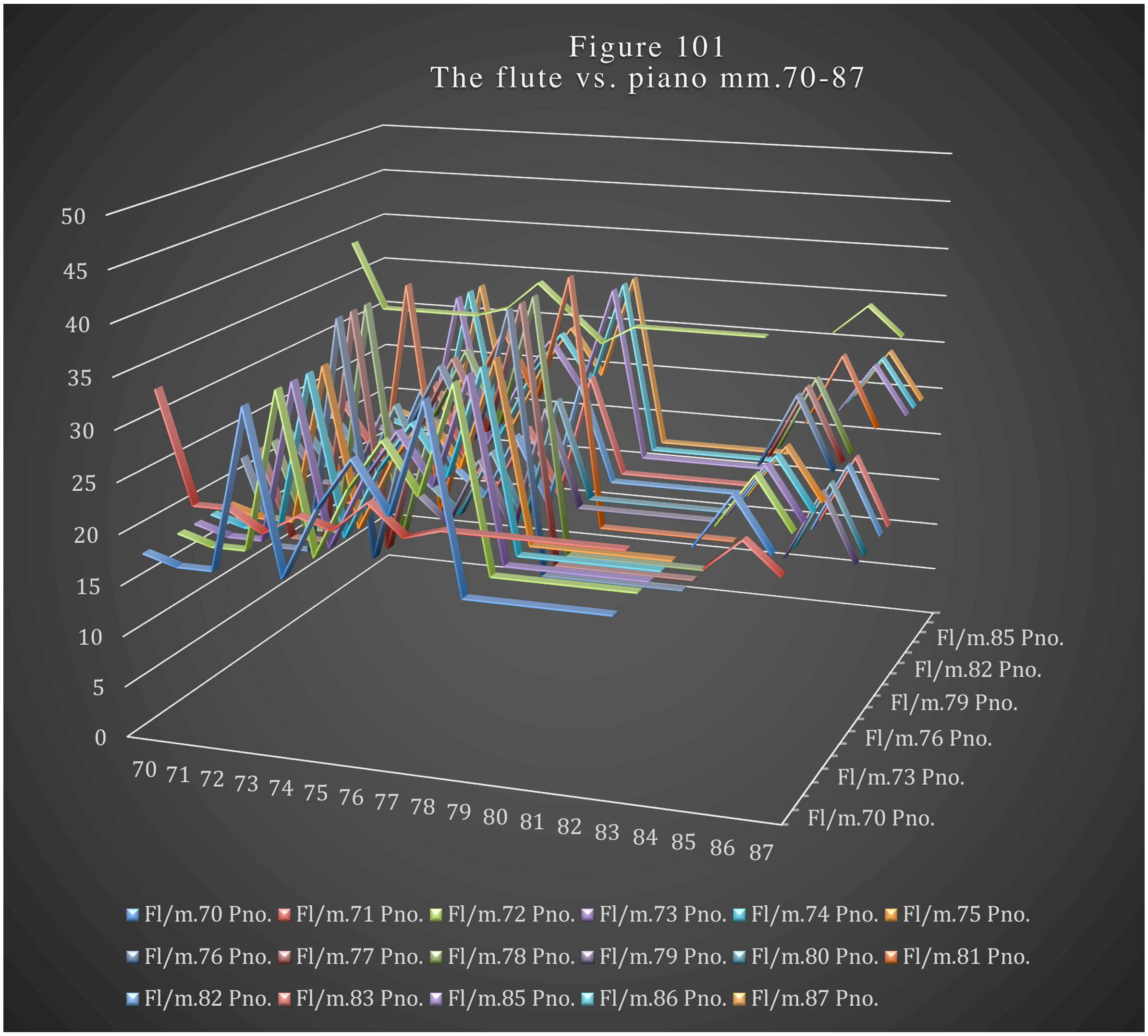


Figure 101 exhibits the comparison between bars 70 – 87 of the flute to the piano. The minimum and maximum values fluctuate between eleven and thirty-nine. The absence of zero may indicate the timbral difference between the piano and the flute. Also, notice the maximum difference values are substantially lower than between the flute and the cello and are lower than between the flute and all the other instruments.

The piano in bars 70 – 87 performs pitches, whereas the flute performs mostly noise or pitch-less material almost at all times. The difference in the timbre value between the piano and the flute is the main reason for the absence of zero in Figure 101. Also, notice the relatively low maximum value, which indicates the similarities between the timbre of the piano in the C7 register and the noisy timbre, “breath gesture,”[37] in flute, as compared with other comparisons thus far in this chapter.

The timbral difference between these two instruments contributes to the lack of clear organization and construction of timbre in this section. The timbral difference resonates with Pierre Schaeffer’s idea of the organizing sound and its relation to the form. “In his description of Solfege de l’objet Sonore, Schaeffer proposes seven morphological criteria”:[38] “mass, harmonic timbre, dynamic, grain, allure, melodic profile, and profile of mass. Under these criteria, the whole structure gets clearer and smoother direction through unified and coherent sound identities.”[39]

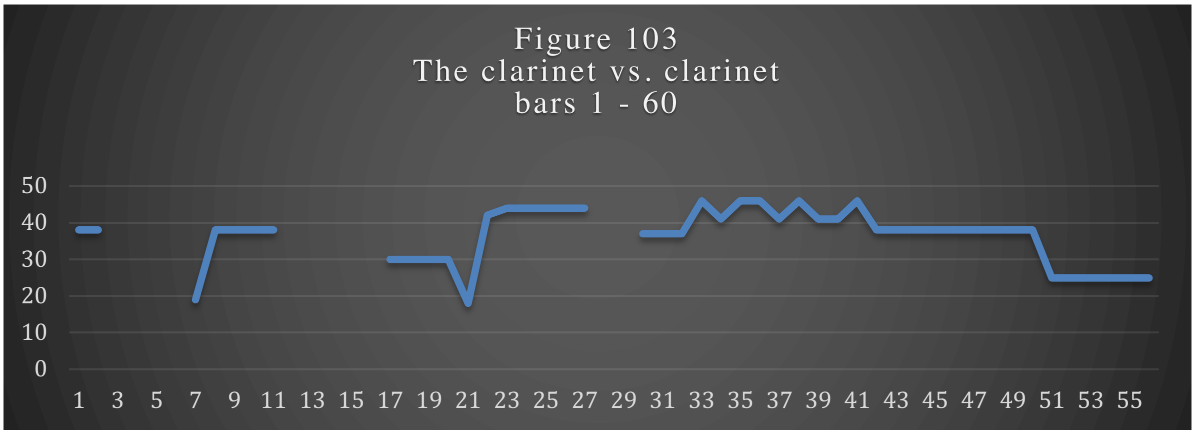
[37] “BREATH GESTURE: The first part of this gesture can be related to the inhalation with an increased effort towards the end of the inhalation and a very short pause. The second part can be related to the exhalation with an attack at the beginning although it should be softer than the end of the first part. A glissando is combined with the decrescendo. Note that you should not inhale or exhale in the instrument, you play normally and simply the articulation of the gesture should imply the process of inhalation and exhalation.” From page 5 of the preface in Crama.

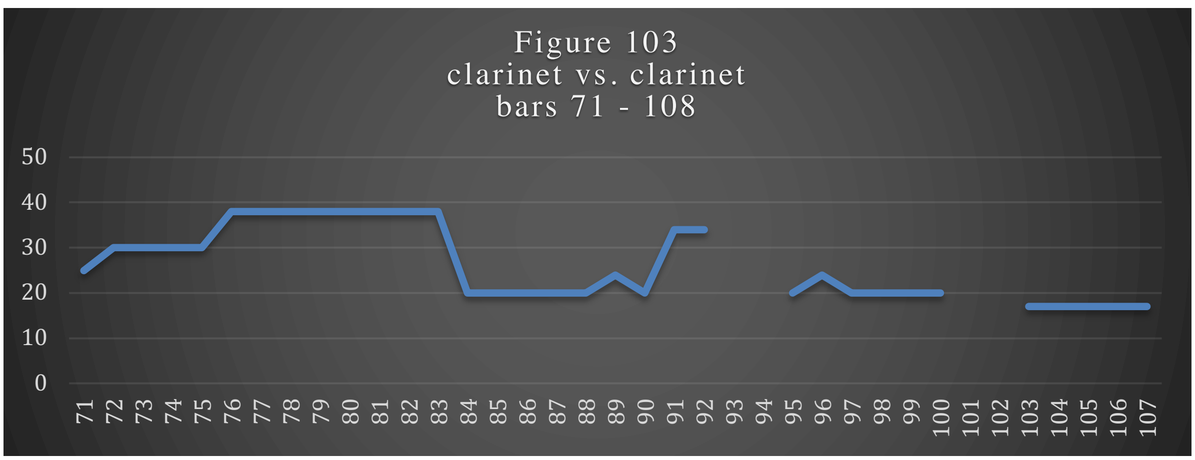
[38] Panayiotis Kokoras, *Morphopoiesis: An Analytical Model for Electronic Music*, 2005.

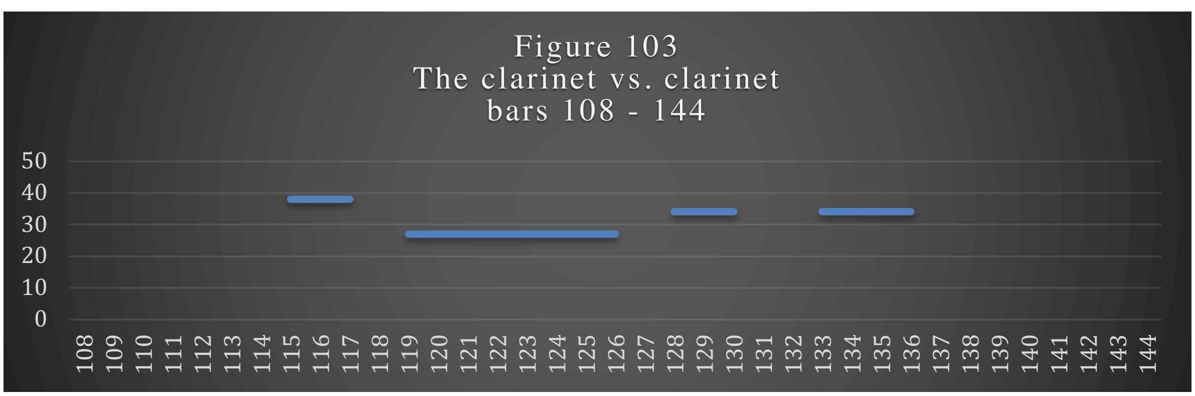
[39] Pierre Schaeffer, *In search of Concrete Music* (A la recherche d’une musique concrete), 201.

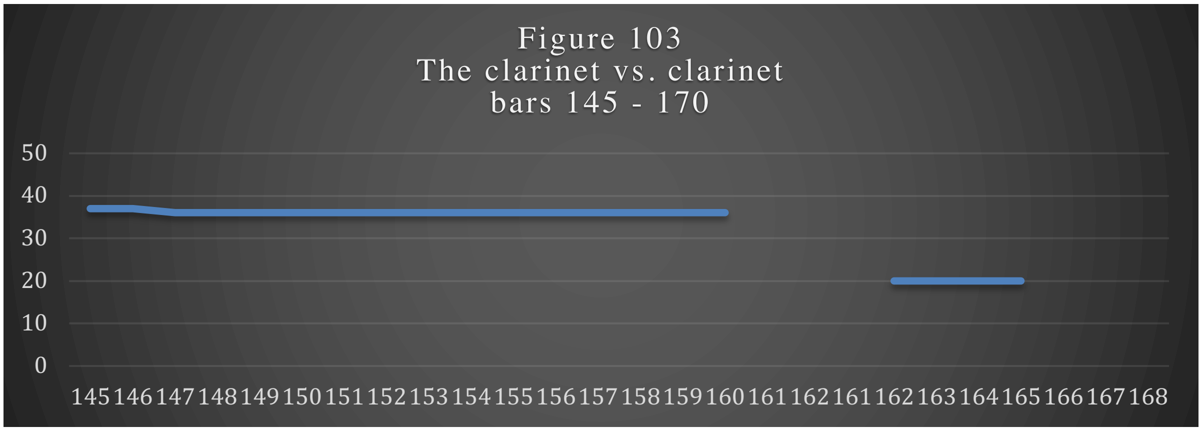
Chapter 11: Clarinet Compared to other Instruments:

The Diappearance of Zero









As a reminder, the Y-axis indicates the absolute timbral value difference between different instruments in different bars. The X-axis shows the range of bar numbers in the comparison.

Figure 103 exhibits the timbral progression when the absolute timbral value of the clarinet is compared to measure 1 of itself. The minimum and maximum values fluctuate between seventeen and forty-six. Zero does not appear in Figure 103, which is a contrast to the progression of timbre in Figure 96, as zero appears in bars 1 and 109. The first appearance of zero in clarinet is in bar 5. Unlike the flute, there are other appearances of zero, in bars 12 – 15, 46 – 54, and 115 – 117.

The timbral value of zero does not appear when bar 5 of the clarinet is compared to itself and all the other bars in the clarinet. The disappearance of zero in the clarinet might reject the idea of timbral recapitulation. The answer to this quandary will be revealed as this case study moves forward.

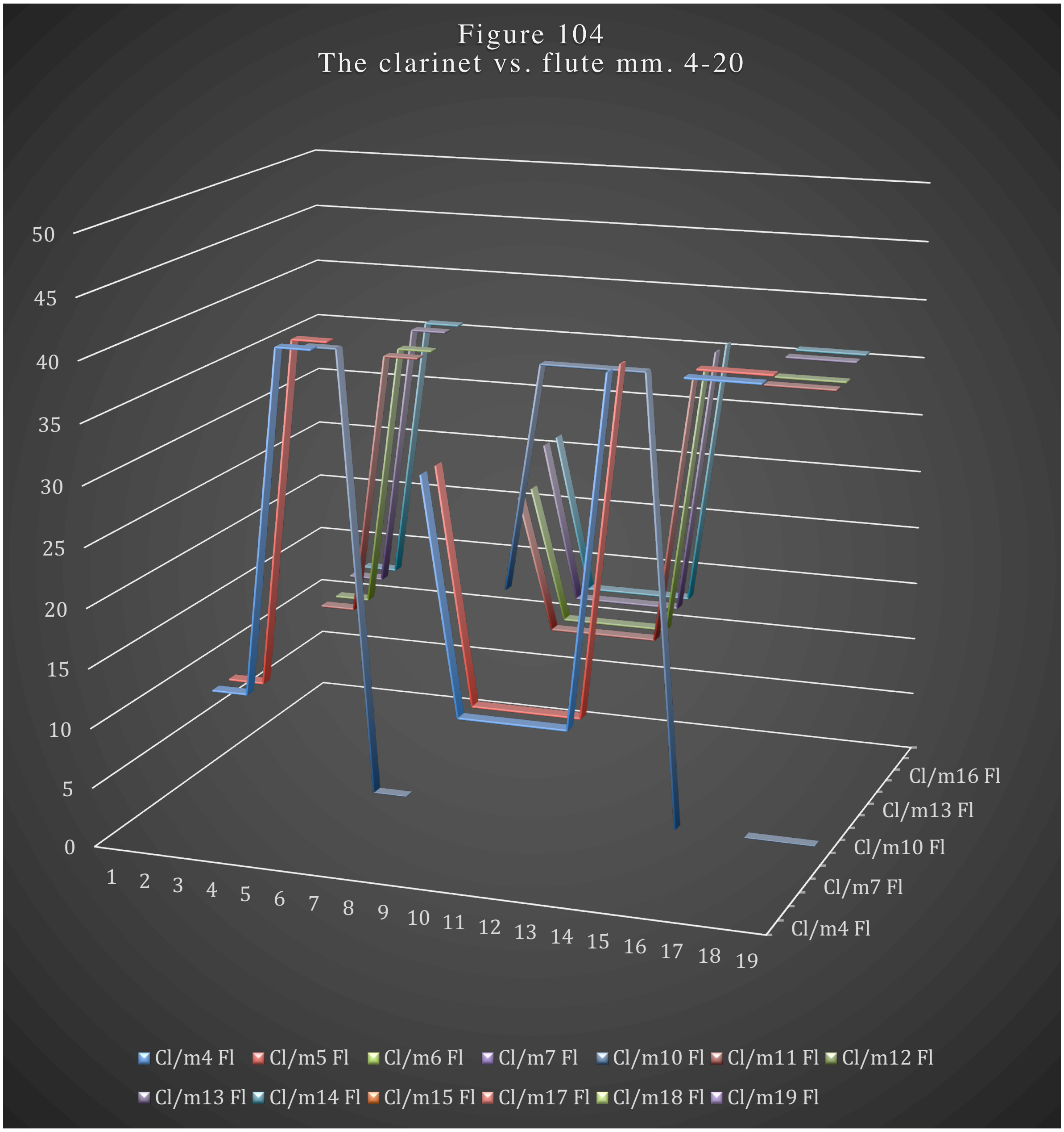


Figure 104 compares bars 4 – 20 of the clarinet to the flute. The minimum and maximum values are zero and forty-two. There are many more instances of parallelism than contrast in Figure 54. The minimal appearance of contrast might relate to the introductory characteristic of this section. The unbalanced appearance of parallelism indicates the timbral similarity between clarinet and flute. Therefore, timbral parallelism and contrast between these two instruments contribute to the construction of timbre between the clarinet and flute in Figure 104.

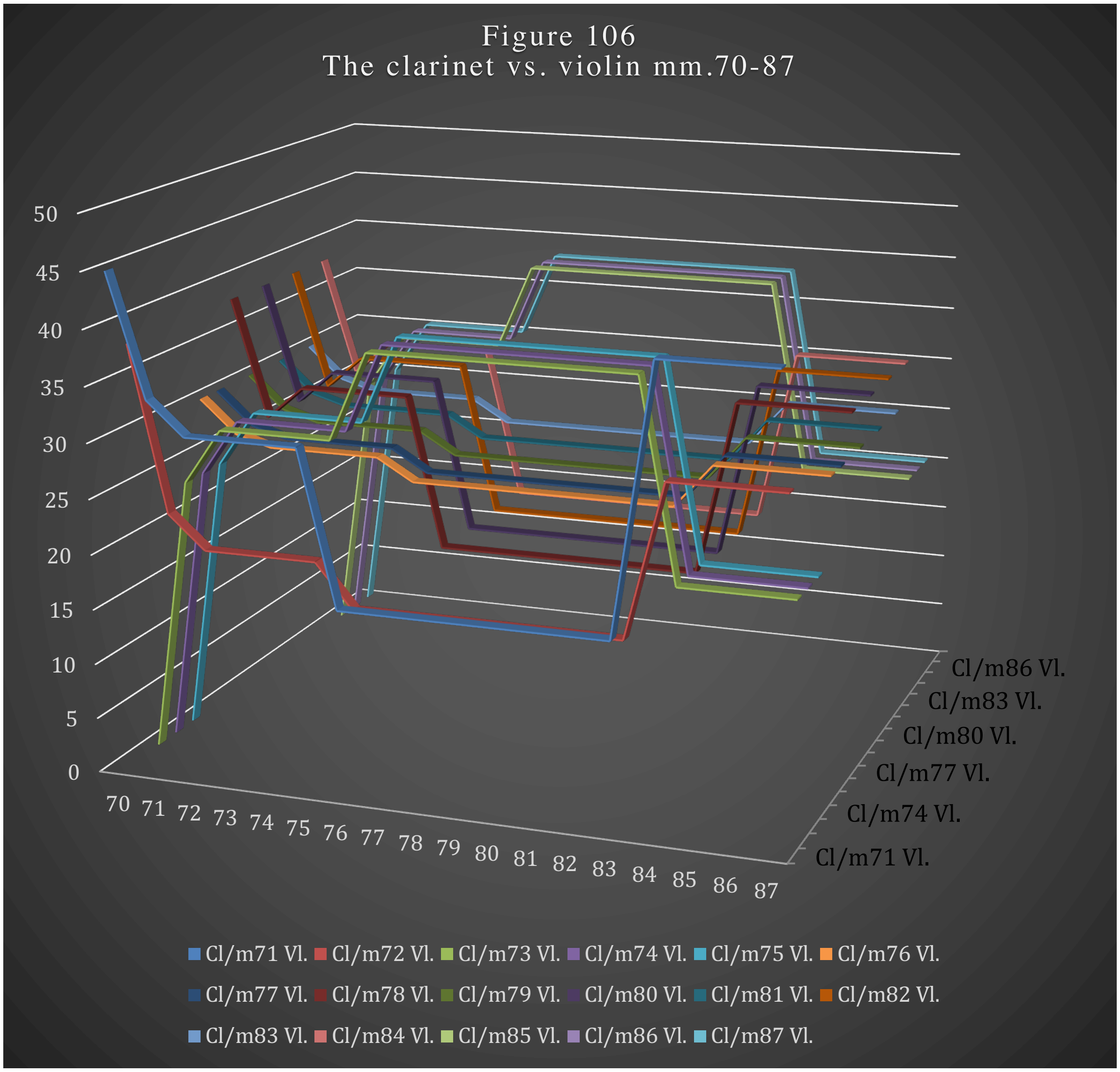


Figure 106 demonstrates the progression of timbres between clarinet and violin. There is an ABA' structure to this section, with the following subsections: A) bars 70 – 76, B) bars 76 – 84, A') bars 84 – 87.

The repetition of identical timbral values creates continuity in Figure 106. For example, the stagnant and imitative parallelism motion in subsection B is formed by the repetition of the identical timbral values. In addition, the change in the timbral values, and their sequences are expressed via imitative parallel motion. Hence, repetition and sequence are the main contributing elements to the imitative and parallel motion in Figure 106.

Note the dramatic contrast between the single appearance of the minimum value of zero and the maximum value of forty-five in bar 71 of Figure 106. The timbral space between clarinet and violin is forty-five in bar 71, which is very significant. A closer listen to bar 71 of Crama reveals that the appearance of "whish sound,"[40] of the violin and "natural multiphonic sound,"[41] of the clarinet in bar 71 contributes to the large timbral space of forty-five. The squeaky noise of the violin, which does not blend with the preferably non-squeaky and somewhat warmer sound of the clarinet, contributes to the larger timbral space between clarinet and violin in bar 71. Therefore, the appearance of extremely dissimilar timbres between two instruments can contribute to the creation of more significant timbral space.

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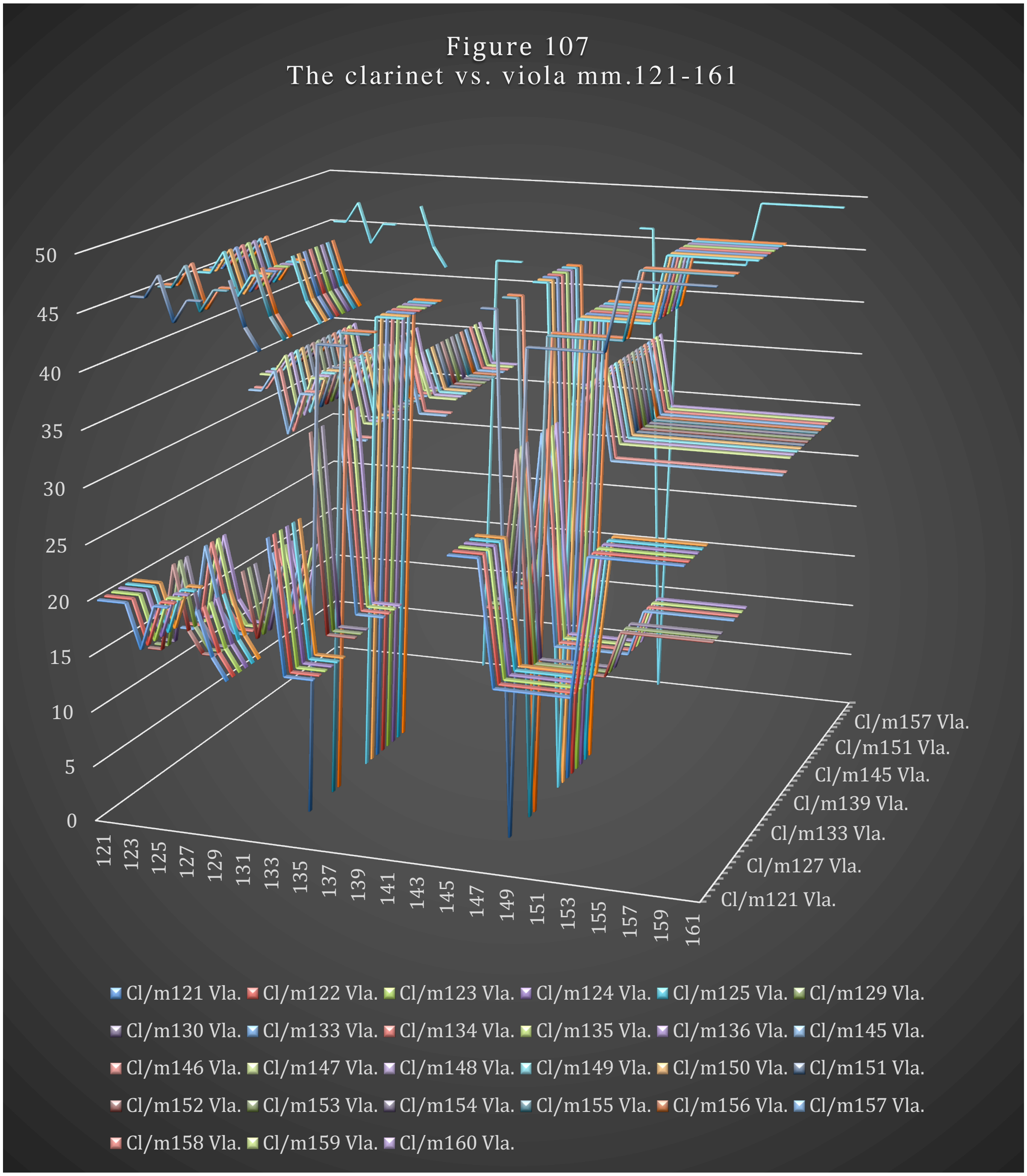
[40] "TRIANGLE NOTEHEAD (Whish Sound): Play the bow at xSP area and the Left Hand should move within the area from the xST to xSP. The limits of glissando are indicated by the parenthesized (xSP), (ST) and the direction by the line labeled 'LH gliss'. The effect is a very high, scream-like sound. [b.5]" From page 5 of the preface in Crama.

[41] "NATURAL MULTIPHONIC SOUND: 1st Type harmonics. Play the harmonics of the fundamental as blocks. The sound is produced by greater pressure of the lips. This type of multiphonic is more effective and rich in tones in the lowest register of the instrument. It can also be effective when it is combined with trills." From page 3 of the preface in Crama.



The minimum and maximum values are between zero and forty-nine in Figure 107. In contrast to Figure 106, zero does not appear in the beginning, but rather in bars 133 and 147. There are many reappearances of the higher timbral values, which contribute to the construction of timbre in Figure 107, while the consistent appearance of higher values creates a contrast between Figures 106 and 107.

The structure of Figure 107 is not as clear as the ABA' structure of Figure 106. Every shape seems to be a variation or repetition of shapes from the previous section. Therefore, the majority of the development and continuity of Figure 107 derives from variations and repetitions, rather than shaping arcs and phrases**.**

The appearances of dramatic spikes in bars 133 and 147 are due to the display of "angled bowing sound,"[42] in viola and "natural multiphonic sound,"[43] in clarinet. The viola in bar 133 produces middle- and low-pitched squeaky noises, with the absolute timbral value of 46, that sticks out compared to the low-pitch warm sound of clarinet, with the absolute timbral value of 34. Note how the low-pitched squeaky noise in the viola is doubled with the same sound in violin in bars 133 and 147, which supports the dramatic appearance of spikes in bars 133 and 147 of Crama.

[42] "ANGLED BOWING SOUND: (triangle notehead) The bow moves horizontal to the strings and the same time with a slightly vertical (ordinary) motion. It should be played close to the frog area and in between extreme sul pont [xSP] to sul tasto [xST]. Some extra pressure in order to maintain the strong and rough sound might be required. [b.25] The line on top of the staff labeled 'bow gliss' shows approximately the horizontal movement of the bow in time from xSP to xST position. The Left Hand, with the fingers muffling the resonating strings, occasionally moves up and down across the fingerboard. The sound produced is a rich granular texture." From page 6 of the preface in Crama.

[43] "NATURAL MULTIPHONIC SOUND: 1st Type harmonics. Play the harmonics of the fundamental as blocks. The sound is produced by greater pressure of the lips. This type of multiphonic is more effective and rich in tones in the lowest register of the instrument. It can also be effective when it is combined with trills." From page 3 of the preface in Crama.

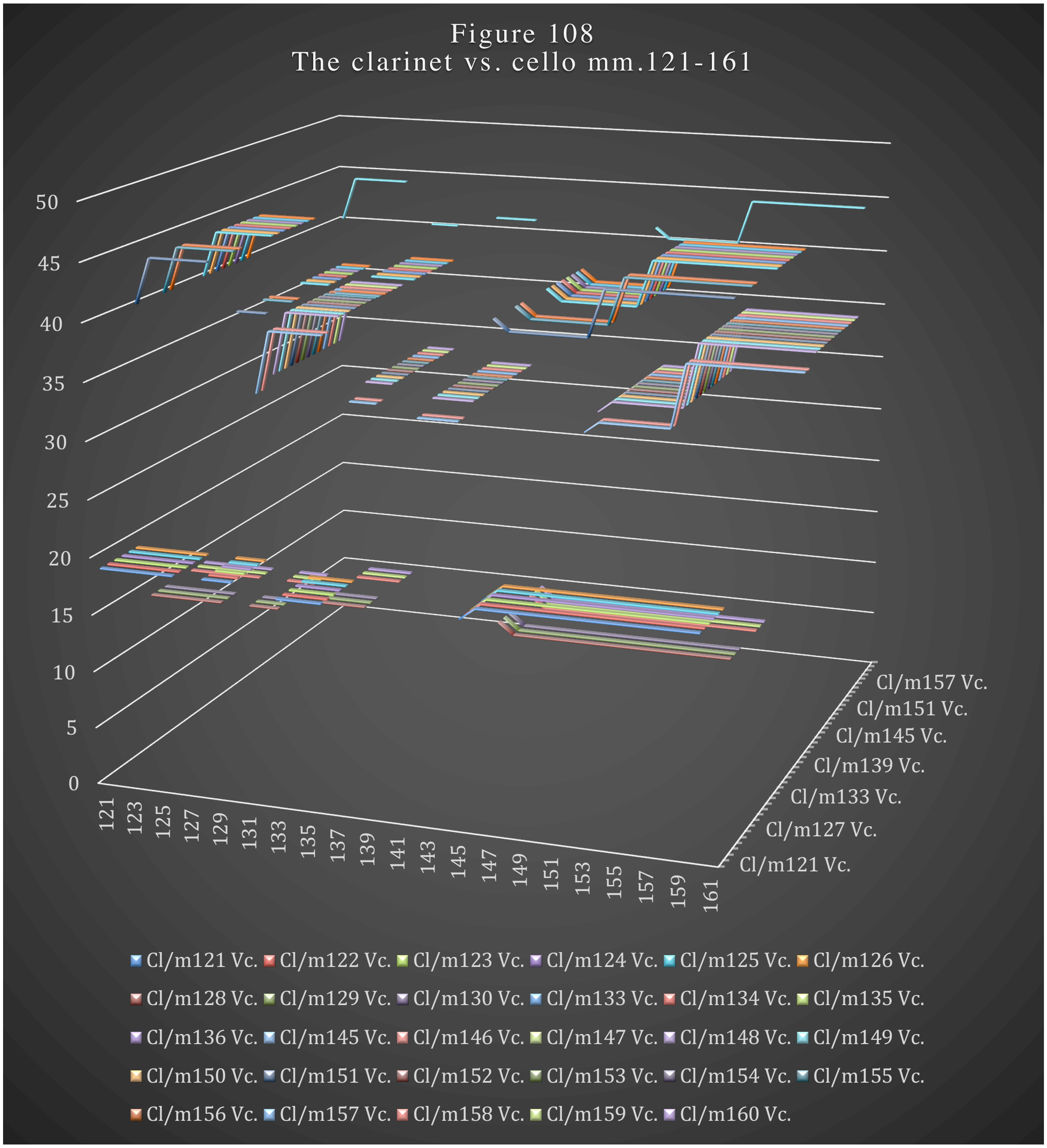


Figure 108 shows similarities to Figure 106. Both sections use the repetitions of identical timbral values as the primary tool to create form. In Figure 108, the ratio of stagnant parallelism to imitative parallelism is slightly higher when compared to Figure 106. The minimum and maximum values in Figures 107, 106 fluctuates between zero and 49. Also, it seems the continuity of sound is the result of the repetition of similar timbral values in Figure 107.

Therefore, not only do Figures 106 and 108 complement each other but also, they complement Figure 107.

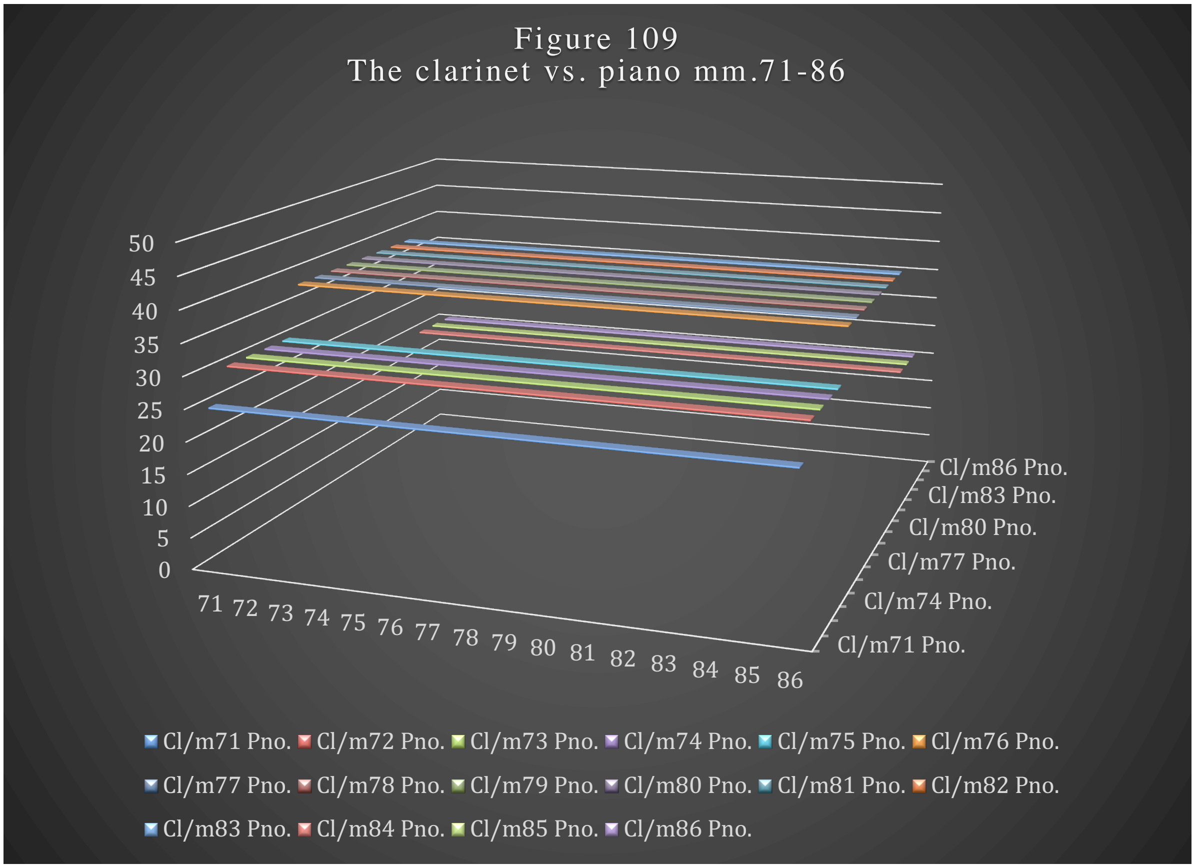
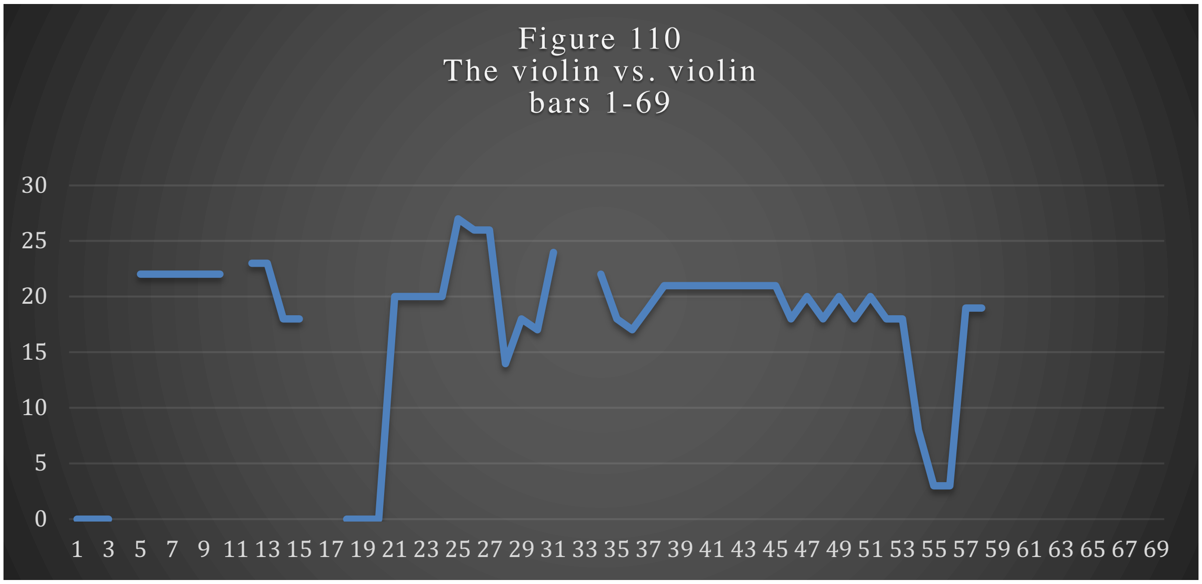


Figure 109 displays a comparison between the clarinet and piano. The minimum and maximum values fluctuate between twenty and thirty-eight. Notice the extreme parallelism in this section. Two factors create similarity and contrast between Figure 109 and 108. First, the absence of zero is similar to Figure 108. Second, extreme parallelism is unique to this Figure in comparison to Figures 108 and 107. These long parallel lines represent the repetition of identical timbral values in the clarinet and piano. Spikes, drops, and contrast cannot be created when identical timbral values are repeated. A closer listen to Figure 86 proves the repetition of similar timbres in this Figure.

Chapter 12: Violin Compared to Other Instruments:

Unpredictable Appearance of Timbral Space



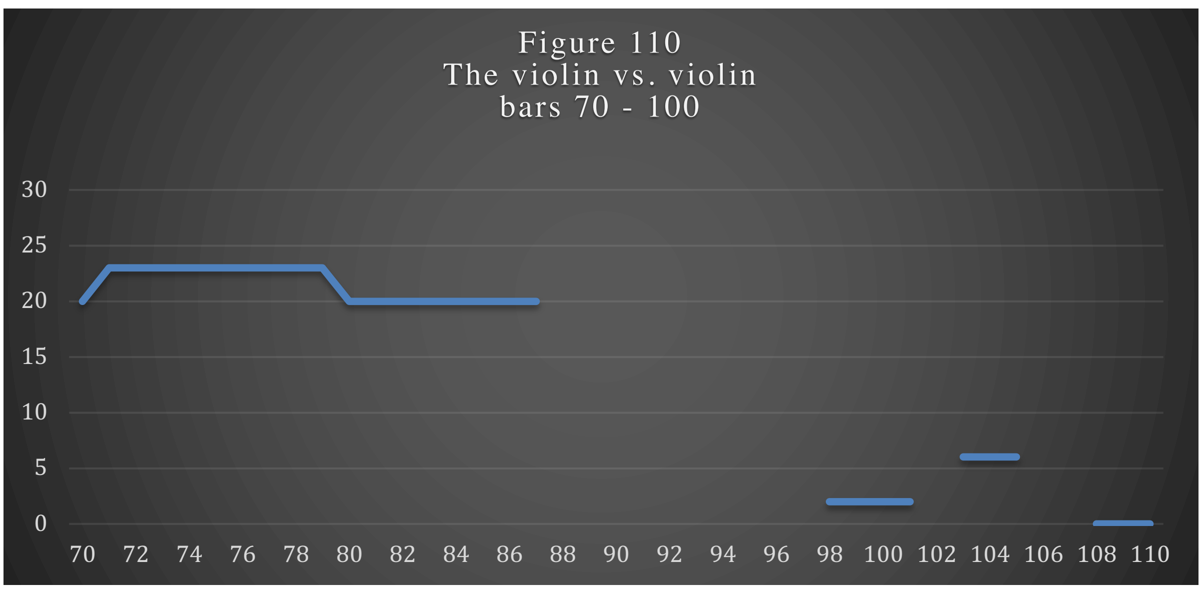
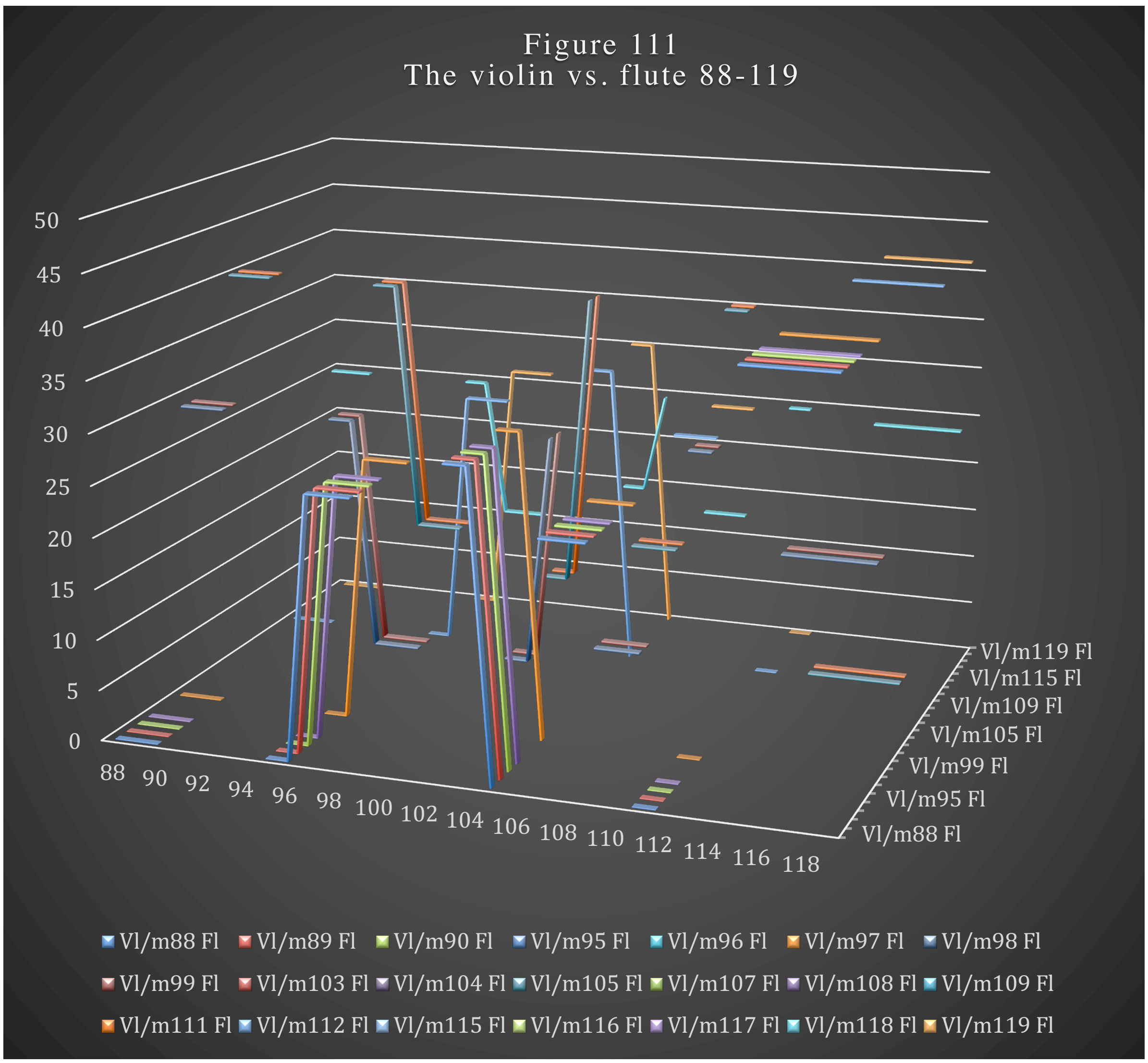
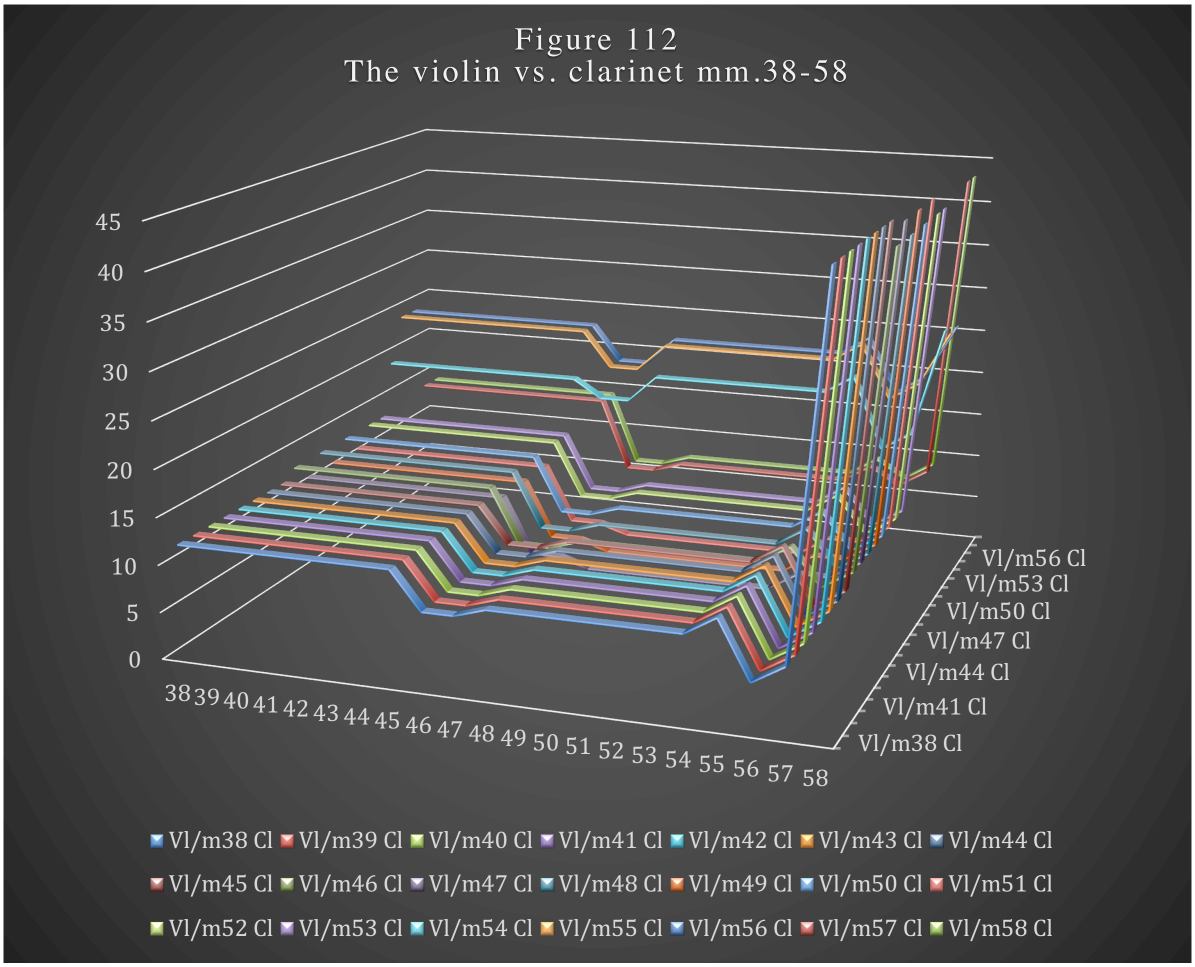


Figure 110 exhibits the timbral progression when the absolute timbral value of the violin is compared to measure one of itself. The minimum and maximum values are zero and twenty-six. Zero appears in bars 1, 2, 3, 18, 19, 20, 108, 109, and 110, which is in contrast to the progression of timbre in the flute vs. flute and clarinet vs. clarinet figures. In the flute's timbral progression, zero appears in bars 1 and 109. In the clarinet, zero does not appear at all. Since zero appears in bar 109 of the flute and violin, one might claim there is a timbral recapitulation in the flute and violin but not the clarinet. The return of zero in bar 109 in violin and the flute, as a recapitulation, might suggest a sense of form and overall timbral architecture in Crama, which will be discovered in the course of this analysis.



The minimum and maximum values in Figure 111 fluctuate between zero and forty-one. Zero appears in bars 88 – 90, 95 – 96, 105, 111 – 112. Figure 111 mostly consists of parallel or imitative parallel motion between timbral values. Since parallel motion between all comparisons occupies the majority of Figure 111, the imitative parallel motion (in mm. 95 – 99 and 103 – 105) acts as a contrast to parallel motion. As a result, parallel motion, as well as imitative parallel motion, are the main components of Figure 111.



The minimum and maximum values are zero and forty-six in Figure 112. Stagnant parallelism plays the primary role as opposed to spikes and drops. In bars 38 – 58, repetition, transition to a new idea, and then repetition of that new idea, are the main components of the structure. Notice the long-stagnant parallel motions in bars 38 – 45. Then, the imitative parallel motions in bars 45 – 46. Also, notice the appearance of new stagnant parallelism in bars 47 – 54, and imitative parallel and contrast in bars 54 – 58. All of the above motions justify repetition, transition, and further repetition as the primary tools in the creation of form in Figure 112.

Notice the appearance of a dramatic spike in bars 57 – 58, which is evidence of the appearance of "slow bow sound,"[44] in violin and "natural multiphonic sound,"[45] in clarinet. Although the sound of the violin is expressed via ***p*** dynamic, it can still be heard as a distinguished yet soft squeaky noise that is doubled with the viola and overpowers the sound of the clarinet. Therefore, the soft and squeaky noise in the violin contributes to the appearance of the spike in bars 57 – 58 in Crama.

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[44] "SLOW BOW SOUND (Slash notehead): The left hand fingers should touch the strings but should not hold them down firmly (like natural harmonic). It is necessary to bow at slower speed than normal at sul tasto area with light bow pressure. The sound produced is dark, muffled with noisy qualities without very clear pitch intonation. ATTENTION: the written note does not always correspond to the one that is sounded. In this case the performer should follow the written note regardless of the sounding result." From page 5 of the preface in Crama.

[45] "NATURAL MULTIPHONIC SOUND: 1st Type harmonics. Play the harmonics of the fundamental as blocks. The sound is produced by greater pressure of the lips. This type of multiphonic is more effective and rich in tones in the lowest register of the instrument. It can also be effective when it is combined with trills." From page 3 of the preface in Crama.

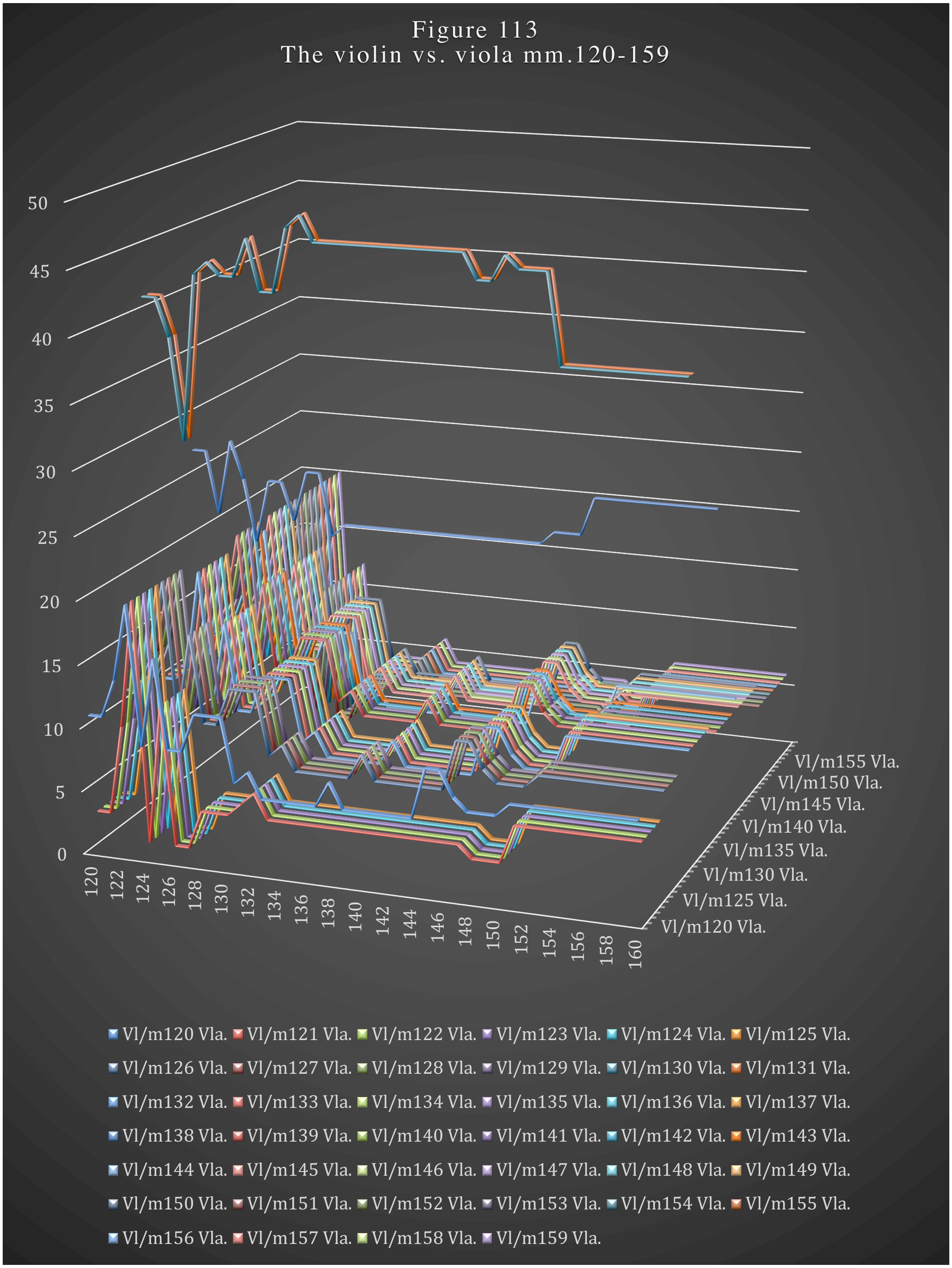


Figure 113
The violin vs. viola mm.120-159
0
5
10
15
20
25
30
35
40
45
50
120
122
124
126
128
130
132
134
136
138
140
142
144
146
148
150
152
154
156
158
160
Vl/m120 Vla.
Vl/m125 Vla.
Vl/m130 Vla.
Vl/m135 Vla.
Vl/m140 Vla.
Vl/m145 Vla.
Vl/m150 Vla.
Vl/m155 Vla.
Vl/m120 Vla. Vl/m121 Vla. Vl/m122 Vla. Vl/m123 Vla. Vl/m124 Vla. Vl/m125 Vla.
Vl/m126 Vla. Vl/m127 Vla. Vl/m128 Vla. Vl/m129 Vla. Vl/m130 Vla. Vl/m131 Vla.
Vl/m132 Vla. Vl/m133 Vla. Vl/m134 Vla. Vl/m135 Vla. Vl/m136 Vla. Vl/m137 Vla.
Vl/m138 Vla. Vl/m139 Vla. Vl/m140 Vla. Vl/m141 Vla. Vl/m142 Vla. Vl/m143 Vla.
Vl/m144 Vla. Vl/m145 Vla. Vl/m146 Vla. Vl/m147 Vla. Vl/m148 Vla. Vl/m149 Vla.
Vl/m150 Vla. Vl/m151 Vla. Vl/m152 Vla. Vl/m153 Vla. Vl/m154 Vla. Vl/m155 Vla.
Vl/m156 Vla. Vl/m157 Vla. Vl/m158 Vla. Vl/m159 Vla.

The imitative parallel motion in bars 122 – 124 and 124 – 126, as well as other instances of imitative parallelism, indicates a transition to a new section or a return to the previous section. Conversely, the stagnant parallelism motion in bars 140 – 144 and 152 – 160 contribute to the continuity of sound that is conceived via the repetition of similar timbral values. Multiple repetitions of the same values, transitions away, and returns to the same ideas are the main components in form in Figure 113.

A closer look at the score reveals three facts which contribute to the shape and overall growth of form in bars 120 – 160: 1) repetition of the same motives between violin and viola, bars 154 – 160; 2) imitation of the same motive, bars 123, 125, and 126, between violin and viola; 3) virtually similar timbres expressed via different motivic ideas in imitative or non-imitative fashion, bars 133, 134, 141 and 142.

Note the blue, red, and green lines. These three lines fluctuate between the timbral values twenty and forty-five. The blue line appears when bar 138 of the violin, "slow bow sound,"[46] and "angled bowing sound,"[47] is compared to bars 121 – 160 of the viola. The green line appears

[46] "SLOW BOW SOUND (Slash notehead): The left-hand fingers should touch the strings but should not hold them down firmly (like natural harmonic). It is necessary to bow at slower speed than normal at sul tasto area with light bow pressure. The sound produced is dark, muffled with noisy qualities without very clear pitch intonation. ATTENTION: the written note does not always correspond to the one that is sounded. In this case the performer should follow the written note regardless of the sounding result." From page 5 of the preface in Crama.

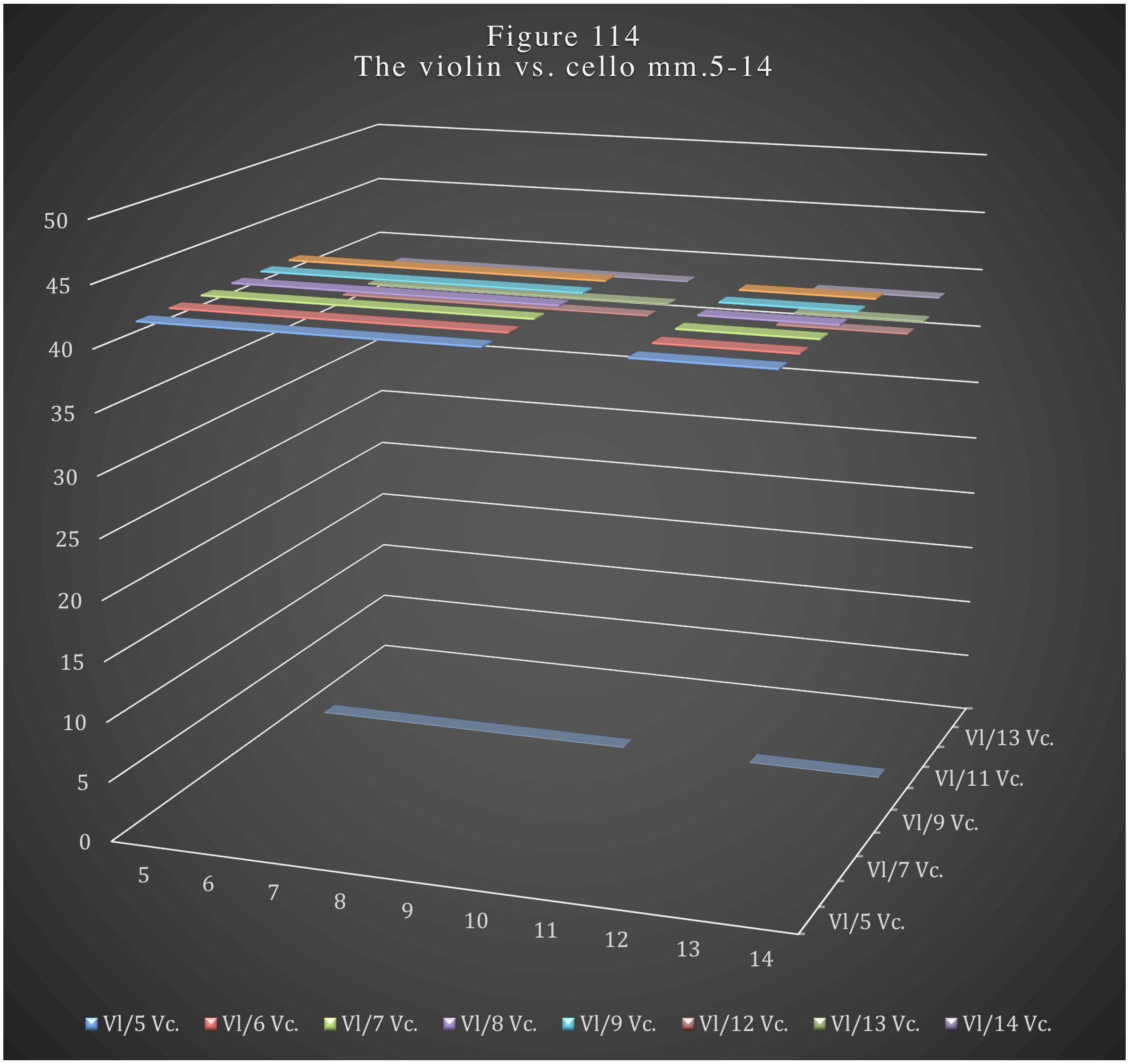
[47] "ANGLED BOWING SOUND: (triangle notehead) The bow moves horizontal to the strings and the same time with a slightly vertical (ordinary) motion. It should be played close to the frog area and in between extreme sul pont [xSP] to sul tasto [xST]. Some extra pressure in order to maintain the strong and rough sound might be required. [b.25] The line on top of the staff labeled 'bow gliss' shows approximately the horizontal movement of the bow in time from xSP to xST position. The Left Hand, with the fingers muffling the resonating strings, occasionally moves up and down across the fingerboard. The sound produced is rich granular texture." From page 6 of the preface in Crama.

when bar 130 of the violin, “ring sound,”[48] is compared to bars 121 – 160 of the viola. The red line appears when bar 131 of the violin, “ring sound,” is compared to bars 121 – 160 of the viola.

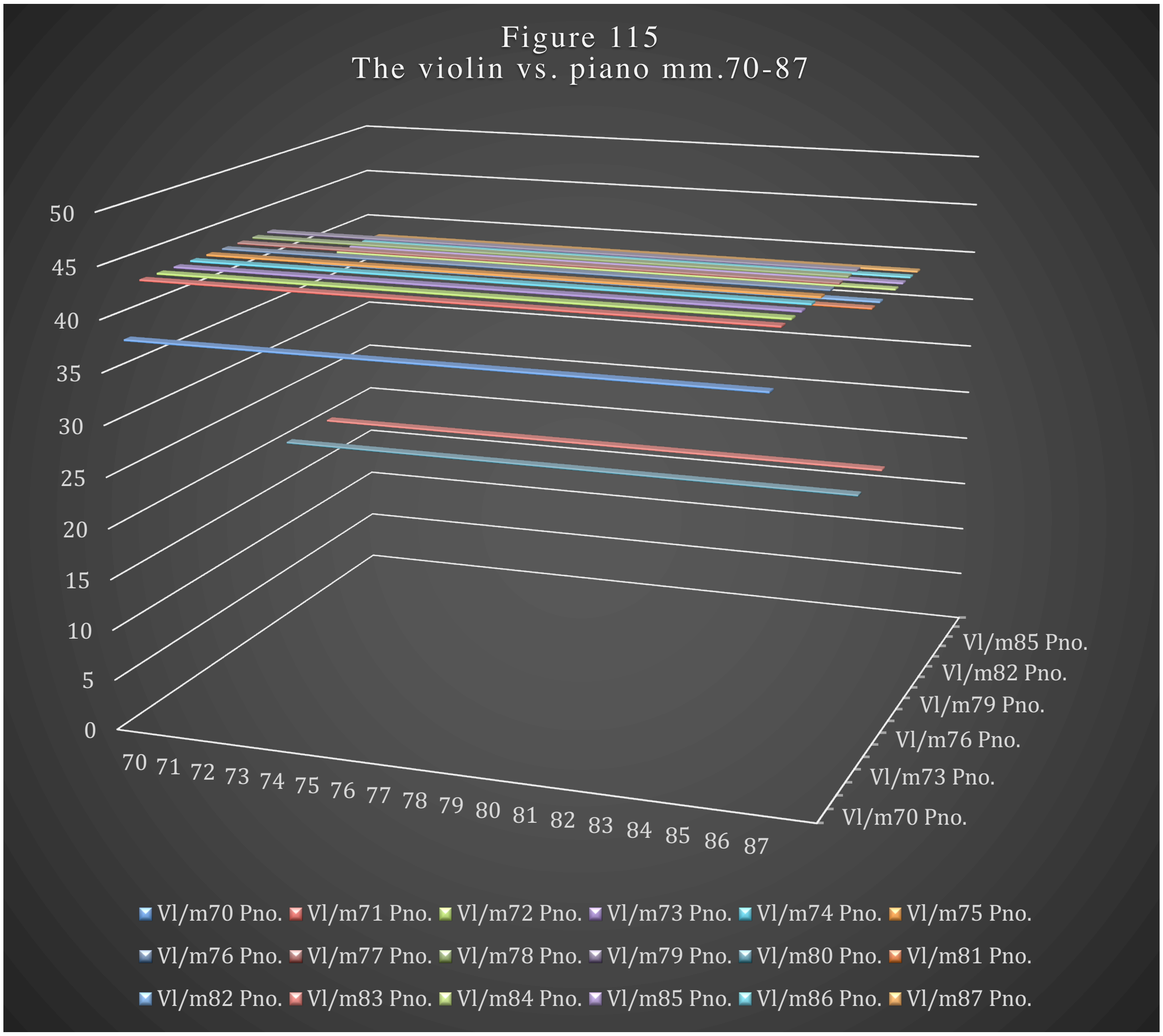
A close listen to bars 130, 131, and 138 of the violin reveals the squeaky and very noisy character, which stands out and creates a dramatic contrast to bars 121 – 160 of the viola. The primary contribution to the distinguished appearance and higher timbral values of the red, green, and blue lines is the squeaky and very noisy character in bars 130, 131, and 38 of the violin.

In this way, the appearance of conspicuous sonic events that do not blend with other sonic events contributes to the appearance of dramatically higher timbral values. As a result, the appearance of such a non-blending sonic event can create a larger timbral space.

[48] “RING SOUND: square notehead followed by triangle line. Hold firmly the note down and bow slowly with some pressure at the [xST] area. The sound obtained better on 1st open string and at the frog of the bow. The further from the frog of the bow the less bright and resonant the sound becomes. [b.45]” From page 6 of the preface in Crama.



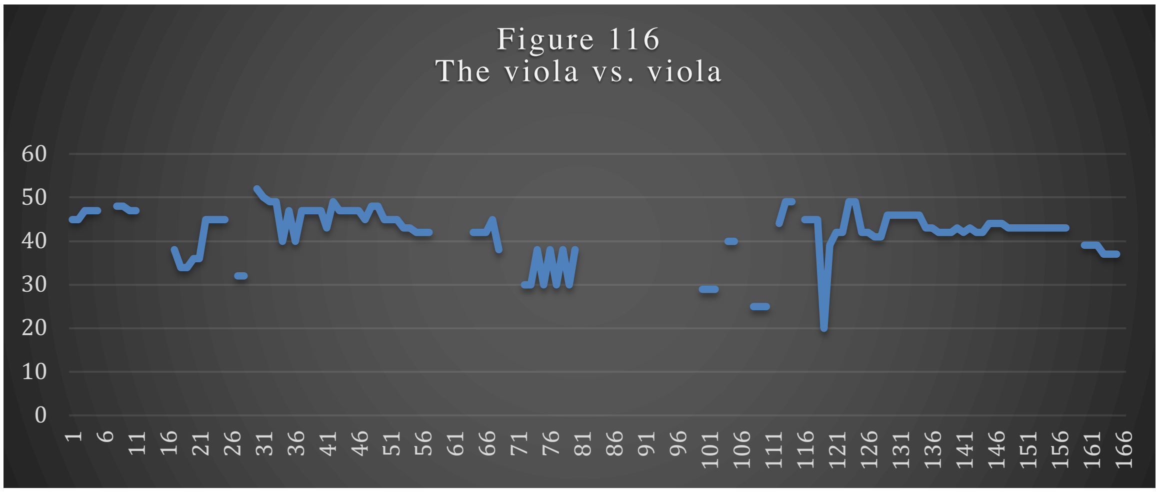
The minimum and maximum values in Figure 114 are zero and forty-two. Following Figure 109, Figure 114 presents the second appearance of extreme parallelism. Notice the synchronized appearance of minimum and maximum values in Figure 114, which is almost similar to Figure 111. Figure 114 is also an introduction section; hence, it does not display a clear form, which makes it similar to other introductory sections lacking a clear form. As a result, the avoidance of spikes and drops via repetition of the same timbral motive can be considered a mindset in creating an opening section in a sound-based composition.

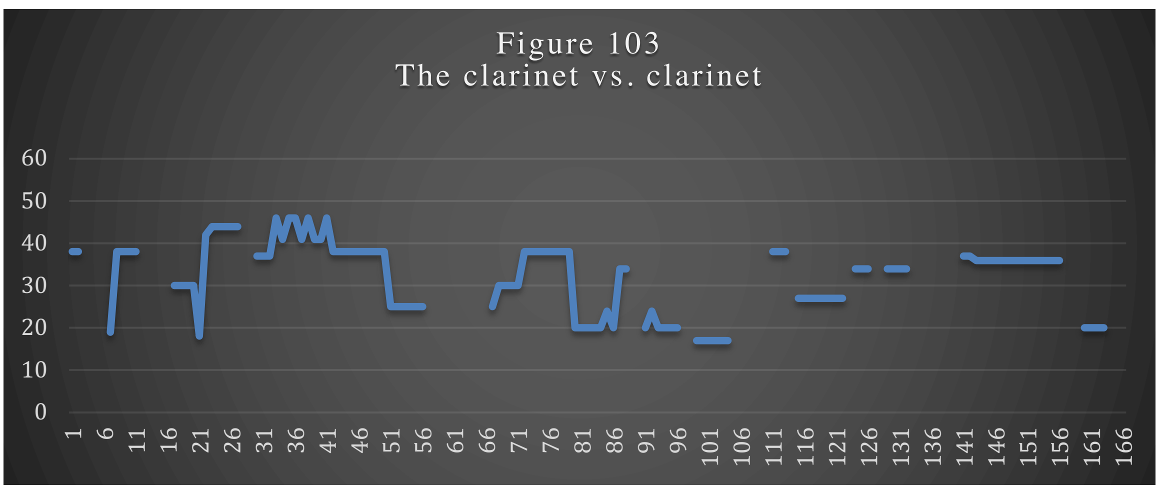


The minimum and maximum values in Figure 115 are twenty and forty-three. Notice the absence of zero and the dominant appearance of extreme parallel motion. There are no spikes and drops in Figure 115. This type of motion occurs in Figure 114, making Figure 115 the second appearance of extreme parallel motion—without any spikes and drops—between the minimum and maximum values in Crama. The second appearance of this type of motion proves that a repetition is a tool that contributes to the continuity of sound in Figure 115.

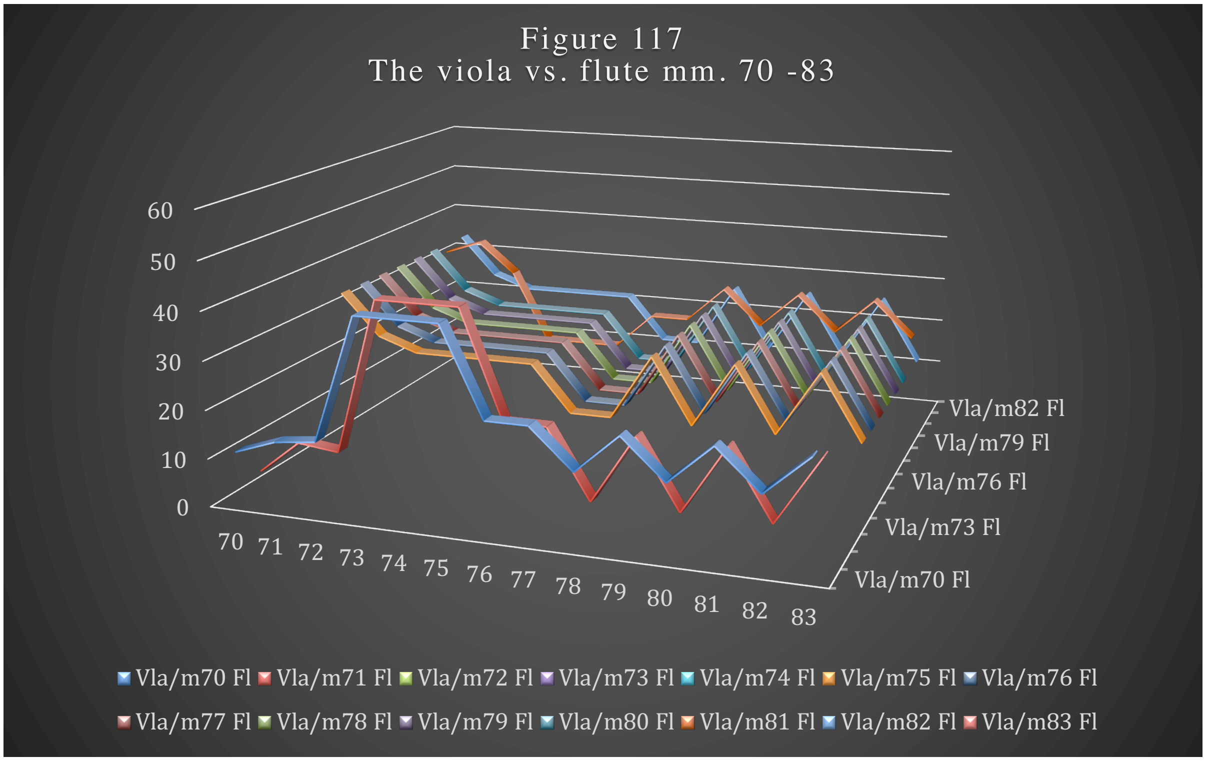
Chapter 13: Viola Compared to Other Instruments:

Extreme Parallelism and Vague Form



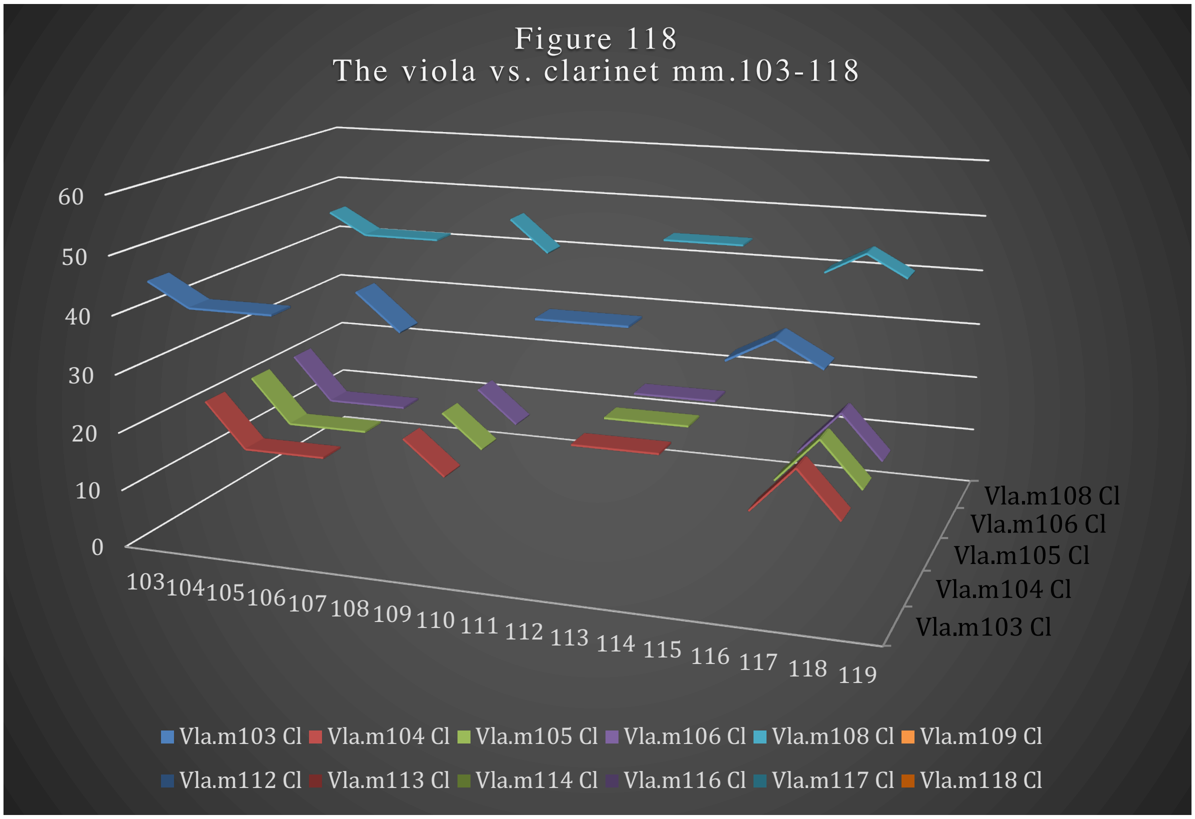


Figures 81 and 93 exhibit the timbral progressions of the flute and the clarinet when the absolute timbral value of each instrument is compared to themselves and all the other bars. The absolute value difference between bar 1 of the viola and all other bars generates a minimum value of twenty and a maximum value of fifty-two. Notice that zero does not appear in Figure 116, which contrasts with the flute and violin, in which zero returns in bars 108 and 109. With this in mind, do the flute, and the violin contribute to the timbral recapitulation in Crama? The answer will be revealed in the course of this case study.



The maximum and minimum values are one and forty-two. Figure 117 can be divided into two sub-sections: A) bars 70 – 77, which occupies minimum and maximum values of one and forty-two, and B) 77 – 83, which occupies minimum and maximum values of six and twenty-five. Note how the minimum and maximum values of the B section do not appear in the A section, and vice versa. It seems sub-section A transforms to sub-section B via a sequence in bars 75 – 76. Also, note the appearance of timbral space of forty-two in sub-section A, which is larger than the timbral space of seventeen in sub-section B.

The minimum and maximum values contribute to the creation of shapes in each section. The repetition of the identical timbral values also supports the continuity of each section. Therefore, the minimum and maximum values, along with the timbral space, contribute to the organization of each section. Repetition also supports the growth of each section in Figure 117.



Thus far, the progression of timbre within bars 103 – 120 has not been examined. What are the contributions of this section to the form in Crama?

The maximum and minimum values fluctuate between ten and forty-six in Figure 118. Parallelism, in bars 104 – 106 and 112 – 114, and imitative parallelism, in bars 103 – 104, 108 – 109, and 116 – 118, are the main components of growth. Notice the parallelism in the absence of contrast, which we observed in Figures 109, 114, and 115. Also, note the lack of clear form ABA or ABA' in Figure 118. All the comparisons can be related to others. For example, bars 108 and

109 are repetitions of bars 103 – 104. It seems parallelism, imitative parallelism, and unclear ABA or ABA’ structure are the structural components of Figure 118.

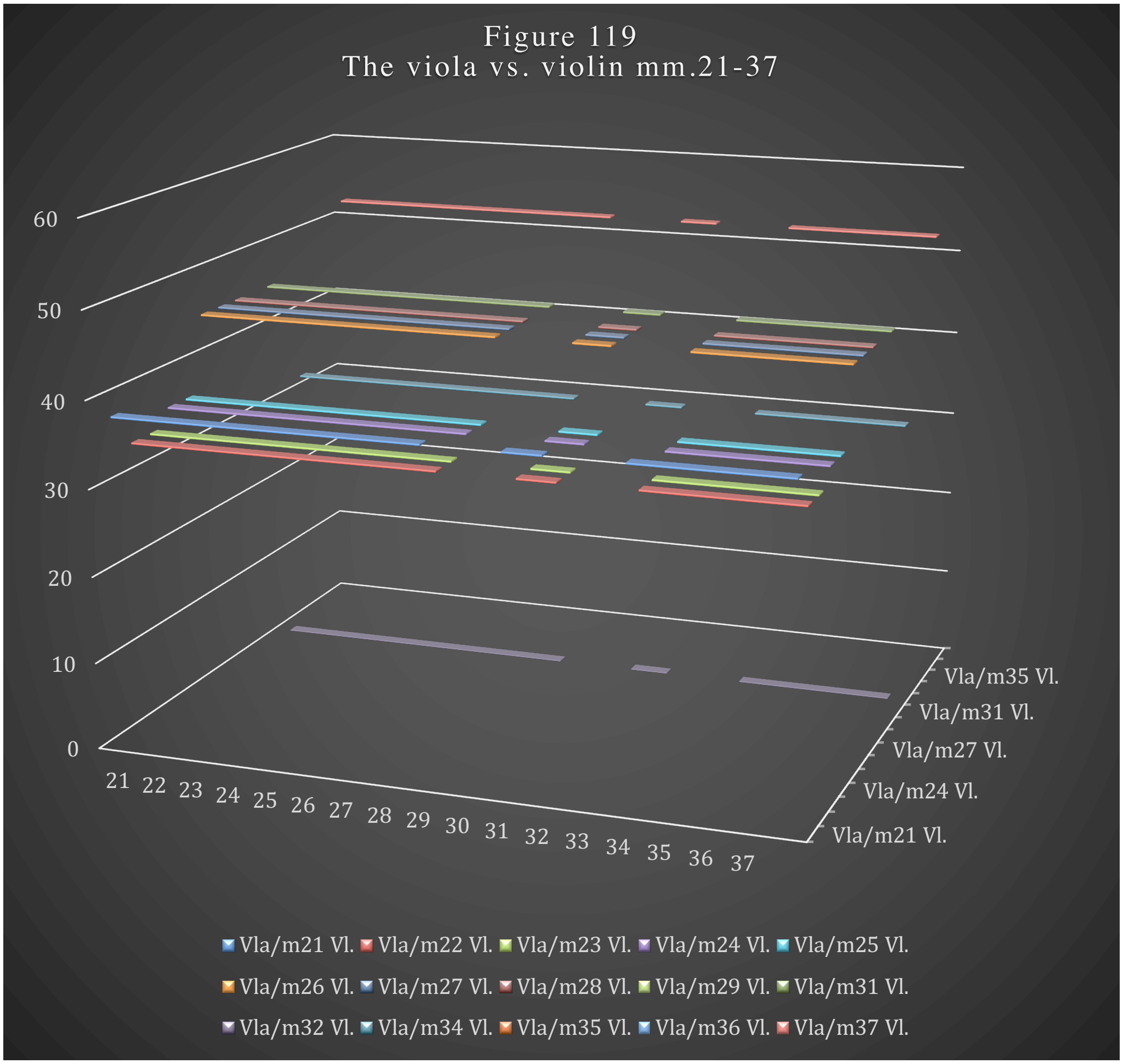
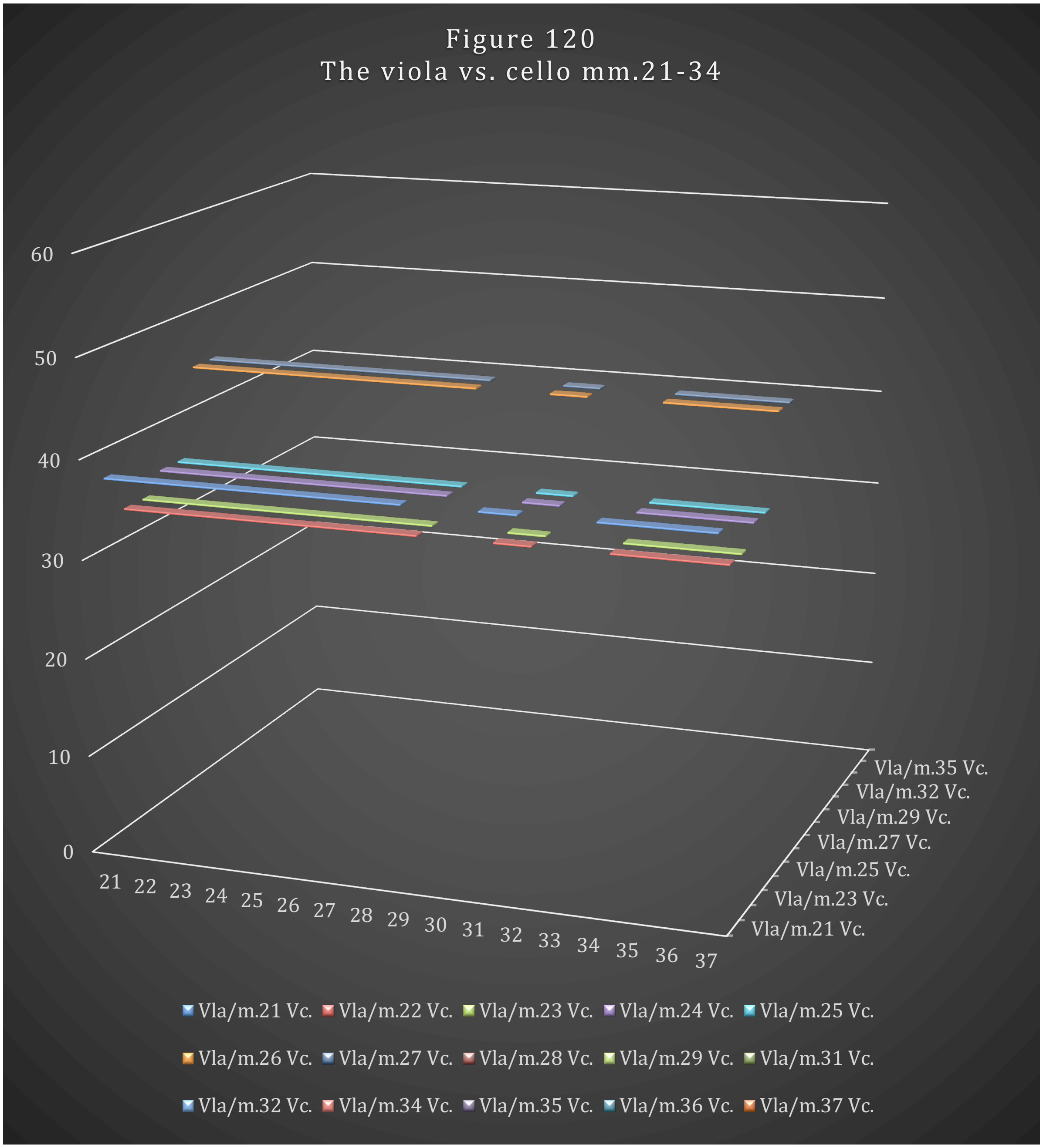


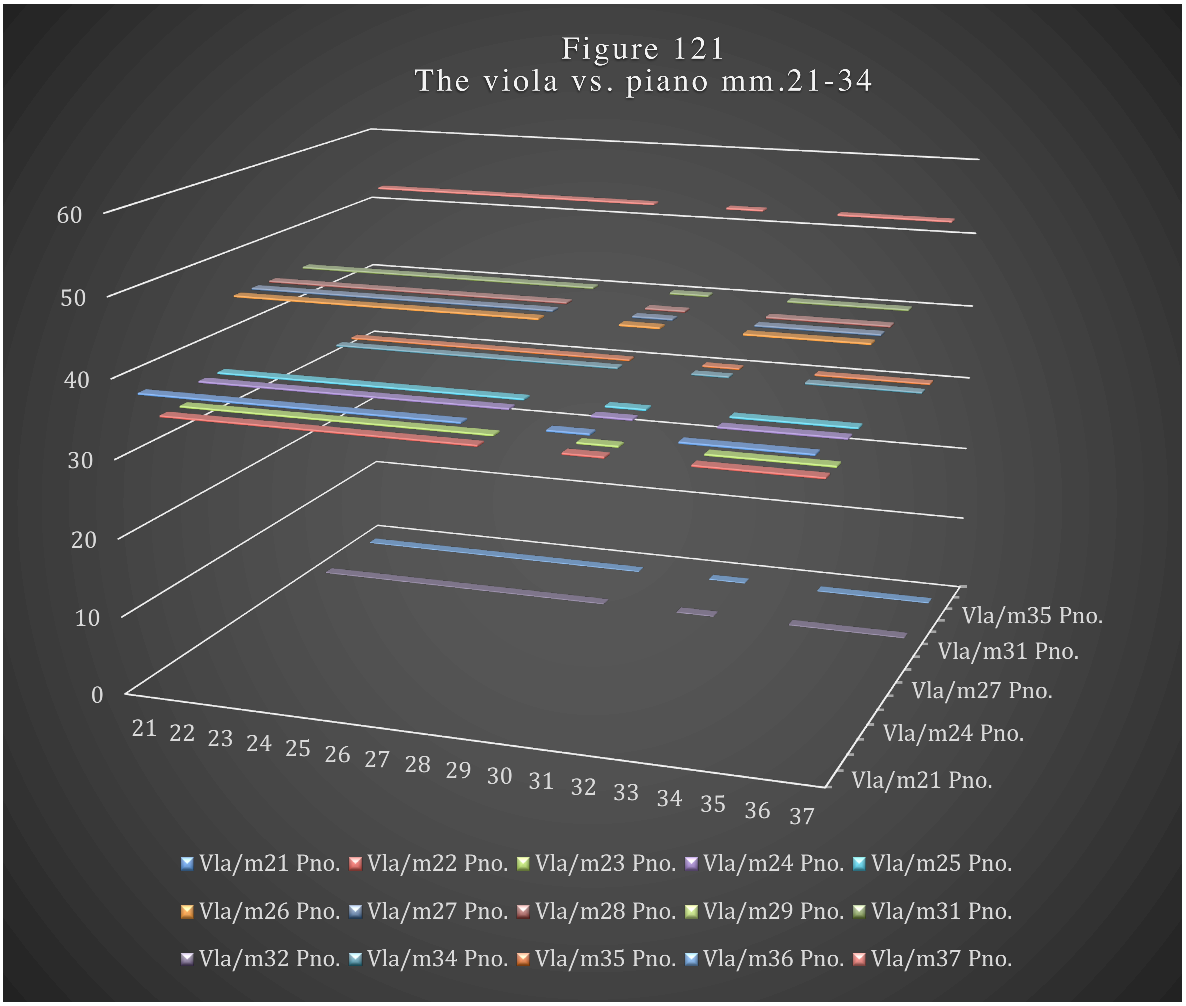
Figure 119 demonstrates the progression of timbre deriving from the comparison of the viola to the violin. The minimum and maximum values are zero and fifty-two. This Figure also exhibits an extreme parallel motion, between zero and all other values, which is not presented between viola and other instruments up to this point. Notice the lack of shape, arc, or any clear form, which is further evidence of contrast between Figure 119 and all other comparisons in the viola category.

The appearance of dramatic spikes in the timbral space relates to the appearance of sounds that stand out and do not blend with the timbre of other instruments. Notice the large timbral space of fifty-two, in Figure 119, between these two instruments from the same family. One might assume, since the violin and viola are from the same family, that they should occupy a smaller timbral space. However, this is not always correct. Although there is a large timbral space between these two instruments, no timbre sticks out, and there is never a dramatic change in the timbral space. Therefore, the large timbral space values do not express only the timbral differences, but also the appearance of non-blending timbres in instruments from similar or different families.

There is a direct relationship in comparisons between contrasting motion and timbral space when two lines deviate from each other. In other words, a dramatic appearance of timbral space, when compared to the rest of the passage, usually occurs when there is a contrasting motion between two lines, which derives from the comparison of any two instruments. As a result, timbral space usually contributes to the existence of contrast and vice versa.



The minimum and maximum values in Figure 120 are thirty-four and fifty-two. The maximum is identical to Figure 119. Figures 119 and 120 are incredibly similar. Note the lack of shape, arc, or a definite form in both Figures. Also, all the upper portion values in both instruments are between thirty and fifty-two. The disappearance of zero in Figure 120 is the main point of contrast between Figures 119 and 120, which contribute to the timbral space and timbral variety among violin, viola, and cello between bars 21 – 37 of Crama.



The minimum value in Figure 121 is zero, which is the same as that in Figure 119. The maximum value is fifty-two, which matches Figures 119 and 120. Figures 119, 120, and 121 show many similarities in terms of minimum, maximum, and other values that contribute to the construction of timbre among the viola, cello, and the piano between bars 21 – 37 of Crama.

Notice the lack of arc, shape, or form in Figures 119, 120, and 121. The extreme parallelism across comparisons indicates the repetition of the identical timbral values to be the main component in structuring Figures 119, 120, and 121. Hence, repetitive timbral values contribute to the continuity of sound in any section of a sound-based composition such as Crama.

Chapter 14: Cello Compared to Other Instruments: The Single Appearance of Zero

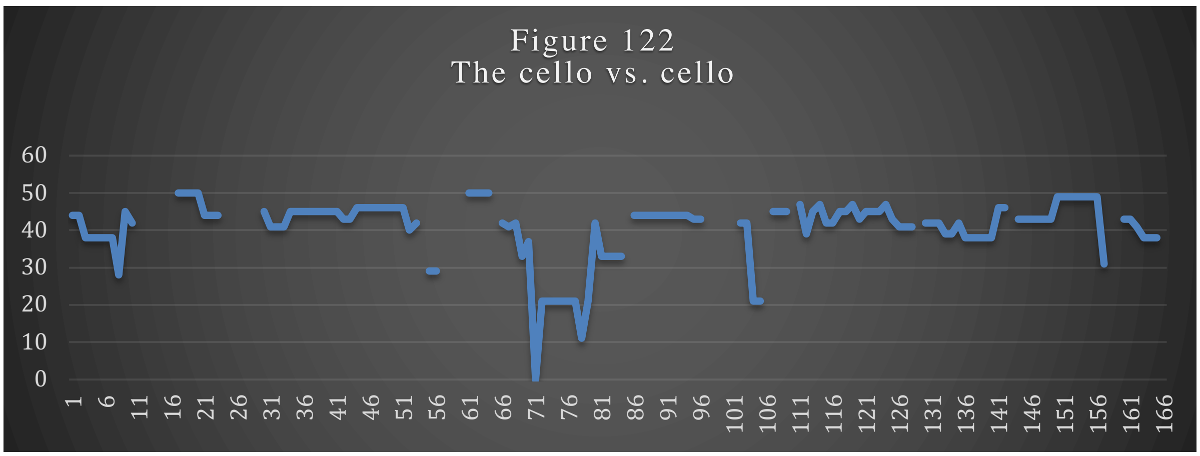


Figure 122 exhibits the timbral progression when the absolute timbral value of the cello is compared to measure one of itself. The minimum and maximum values are zero and fifty. Chart 1 exhibits the first and last appearance of zero when the progression of timbre was derived from the comparison between each instrument vs. measure one of themselves.

Chart 1. The first and last appearance of zero

Instrument	first and last appearance zero	appearances of zero
1. Flute vs. flute	mm.1 & 106	mm.1 & 106
2. Clarinet vs. clarinet	No zero	N/A
3. Violin vs. violin	mm.1 & 109	mm.1-3 & 18-19, 20, 108 - 110
4. Viola vs. viola	No zero	N/A
5. Cello vs. cello	mm.71	mm.71

There is a correlation between the first and last appearance of zero in numbers 1 and 3 of chart one, that is the flute vs. the flute and violin vs. violin. This correlation could lead to the conclusion that there is a timbral recapitulation in the vicinity of bars 106 – 109 in Crama. However, this correlation is not present in numbers 2, 4, and 5 of chart one, that is the clarinet vs. clarinet and the viola vs. viola. Bar 71 indicates the single appearance of zero in cello vs. cello. Since the appearance of zero is inconsistent among all the instruments, the idea of timbral recapitulation is not valid in the formal structure of Crama, thus far. As a result, transformational variation has a stronger case to be the structural procedure in creating form of Crama. This fact will be examined again with the piano vs. piano.

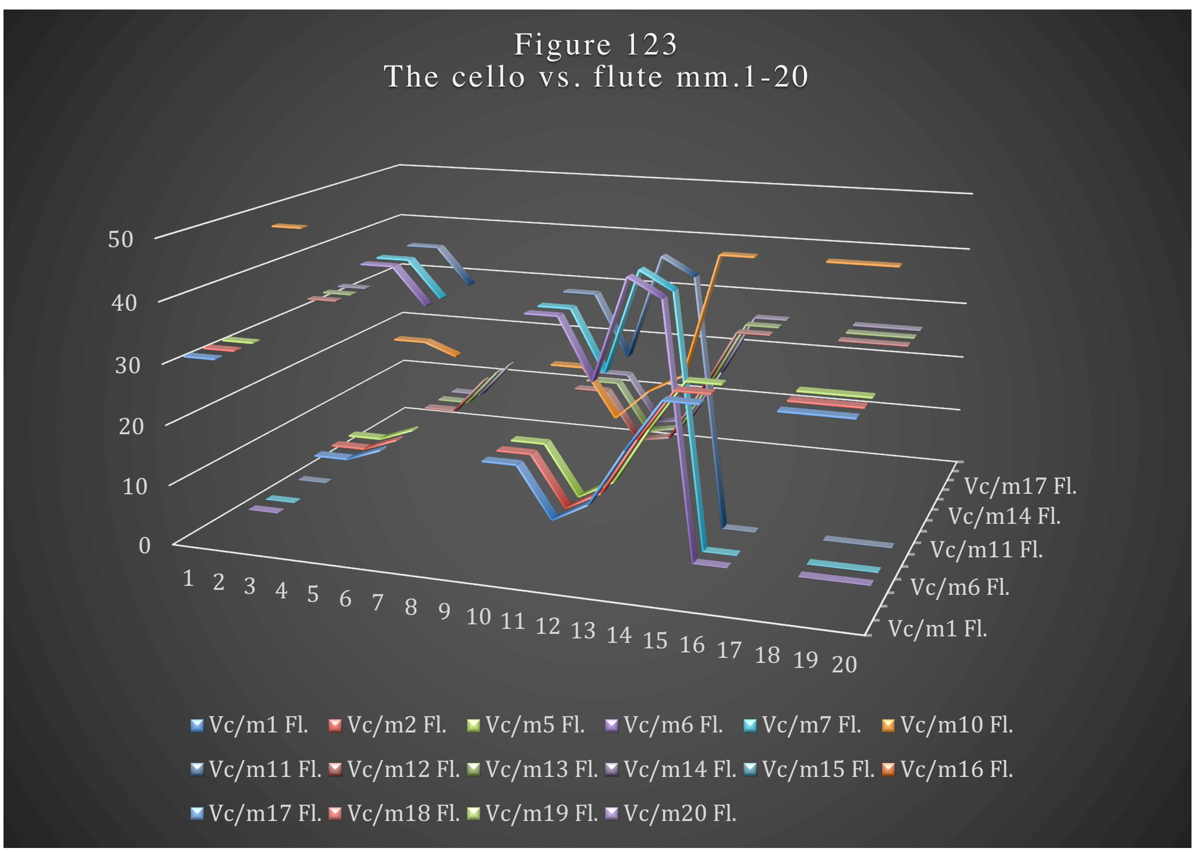


Figure 123 shows the comparison between the cello and the flute. The minimum and maximum values are zero and forty-seven. Notice the form in Figure 123. There is a clear ABA structure similar to many other Figures observed thus far. Note also the transformation of shapes and their return to their original shapes in this Figure. For example, the light orange line, Vc/m.10 Fl., begins with a straight line in bars 1 – 2. It then goes through two series of transformation in bars 5 – 7 and 10 – 16, and finally returns to a straight line in bars 18 – 20, with identical value to those in bars 1 – 2. Each series seems to begin with a simple straight line before transforming to different shapes, and then finally returning to the beginning shape. Since this Figure is structured via the transformation of shape and its return to its opening form, transformation is thus the primary tool which contributes to a clear structure, ABA, in Figure 123.

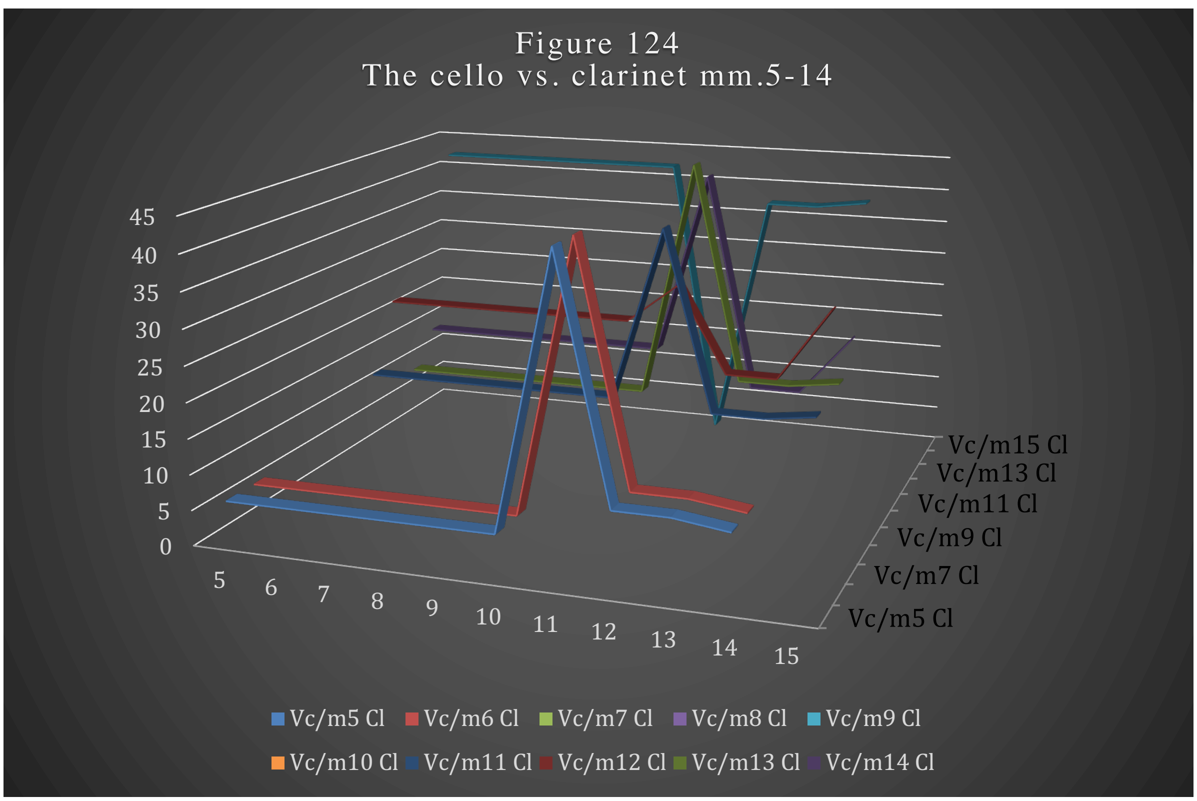
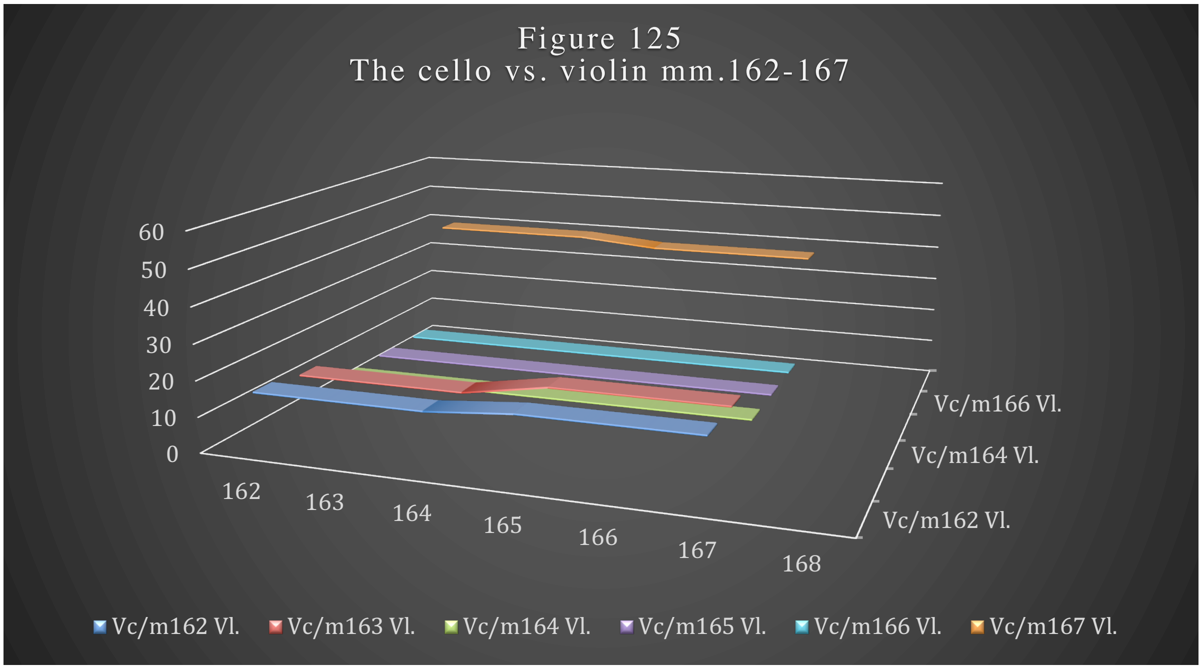
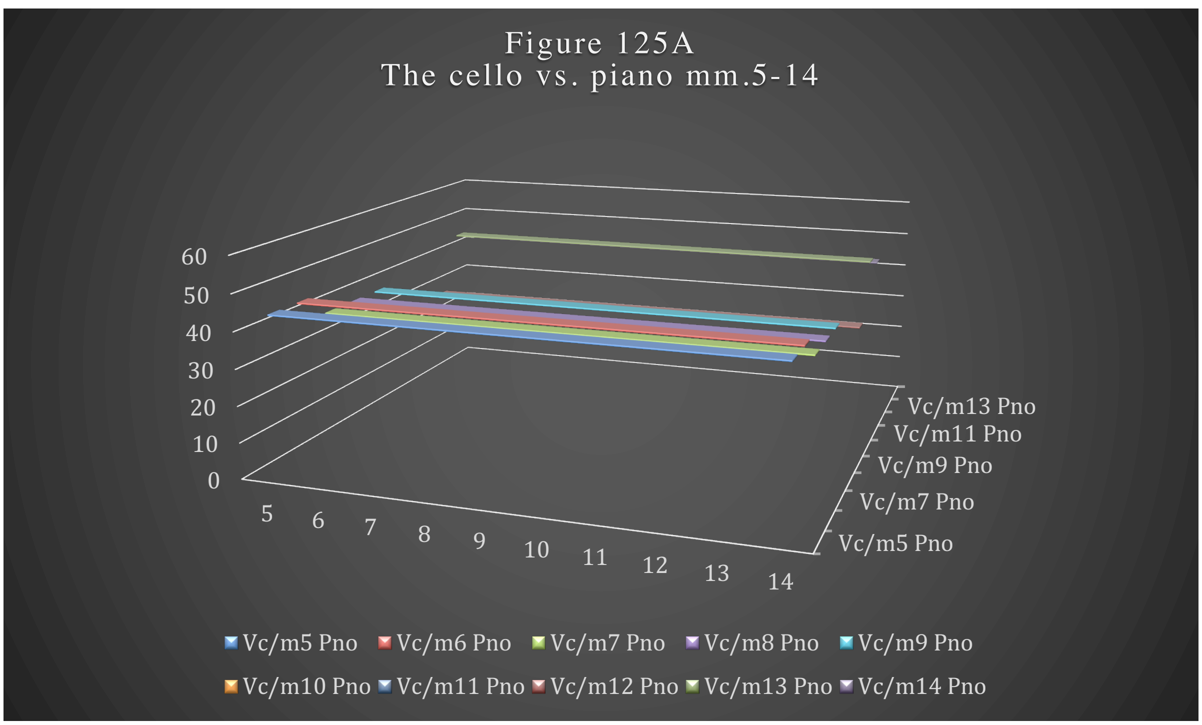


Figure 124 shows minimum and maximum values of zero and forty-four, with a structure of ABA'. Note how the shape of lines driven from different comparisons in Figures 123 and 124 are not similar. The dissimilarity among the shape of each line contributes to the complexity of timbre between the cello, flute, and the clarinet. Complex timbres created from different shapes between different instruments within the same range of measures can be a tool to create contrast with sections that do not offer such a feature. In turn, timbral space driven from contrast motion can contribute to the overall complexity of timbre in a section when blended with other lines driven from different comparisons within the same section. Stagnant parallelism in this Figure creates a contrast to the spikes and drops. In other words, spikes and drops contribute to the creation of phrases for individual instruments, and stagnant parallel motion creates a contrast with these spikes and drops. As a result, the appearance of spikes, drops, and stagnant parallelism contributes to creating phrases in Crama.

Note the appearance of a dramatic spike and drop in bars 10 – 12. A closer listen to this section reveals the dynamic differences between bars 10 – 12 and bars 5 – 10. Notice the appearance of ***fff*** in cello, bar 12, which partially contributes to the appearance of the dramatic spike in bar 11. Also, note the appearance of the clarinet with a crescendo, bar 11, which supports the appearance of spike and drop activity in the vicinity of bars 10 – 12. Therefore, in addition to squeaky timbres leading to a louder or softer dynamic, contrast contributes to the creation of spike and drop in a sound-based composition.





The minimum and maximum values in Figure 125 are seven and thirty-nine, while the minimum and maximum values in Figure 125A are three and forty-two. If timbral space is the subtraction of minimum from maximum values, the timbral space in Figure 125 is thirty-two and thirty-nine in Figure 125A. Note how both figures suggest a proximate timbral space. While Figure 125A shows comparisons driven from bars 5 – 14 between cello and violin, the opening section, Figure 125 exhibits lines that are the result of comparing bars 162 – 168. The appearance of proximate timbral space between the opening section and the ending section is evidence that timbre is the primary element of the form in Crama.

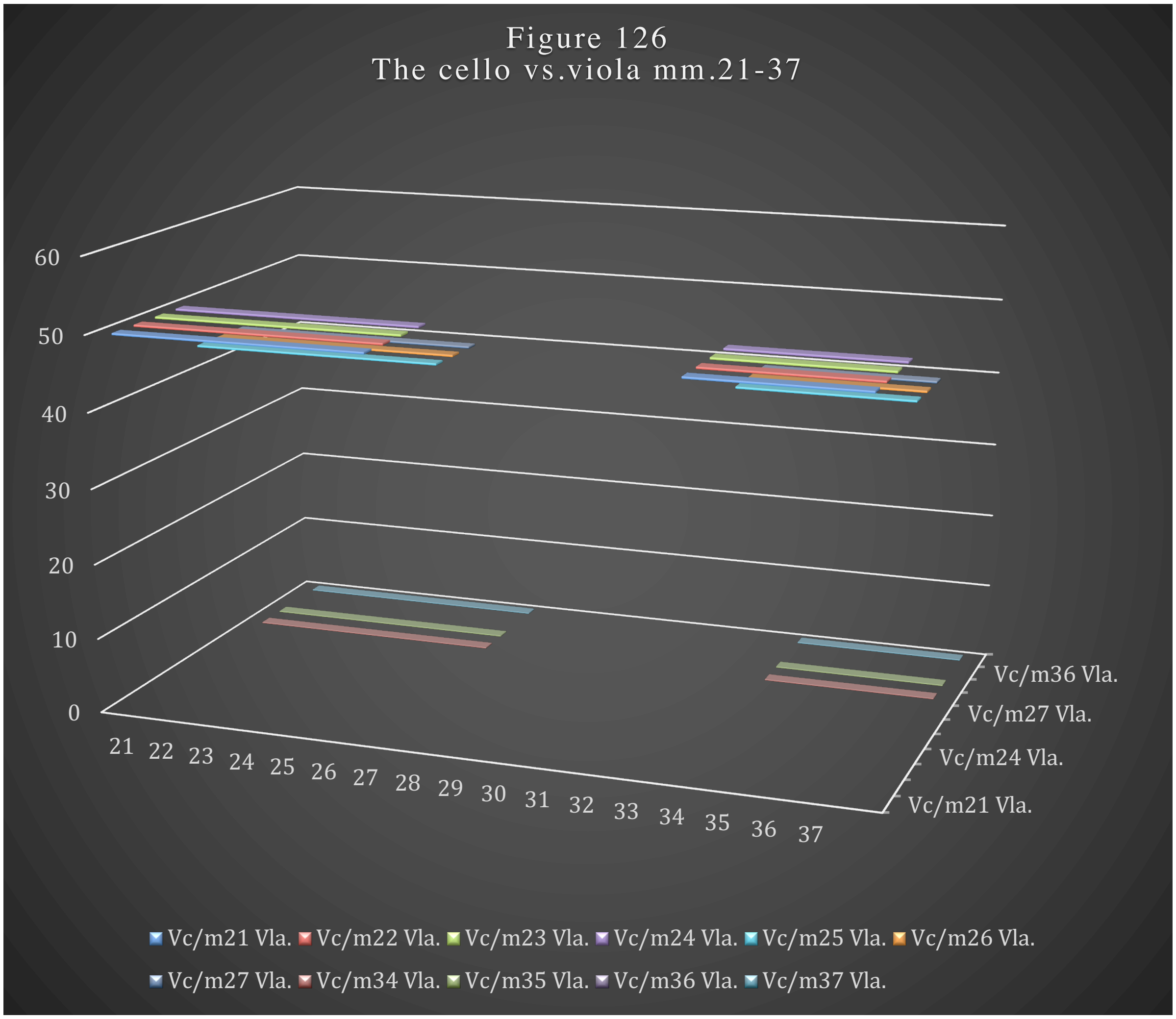
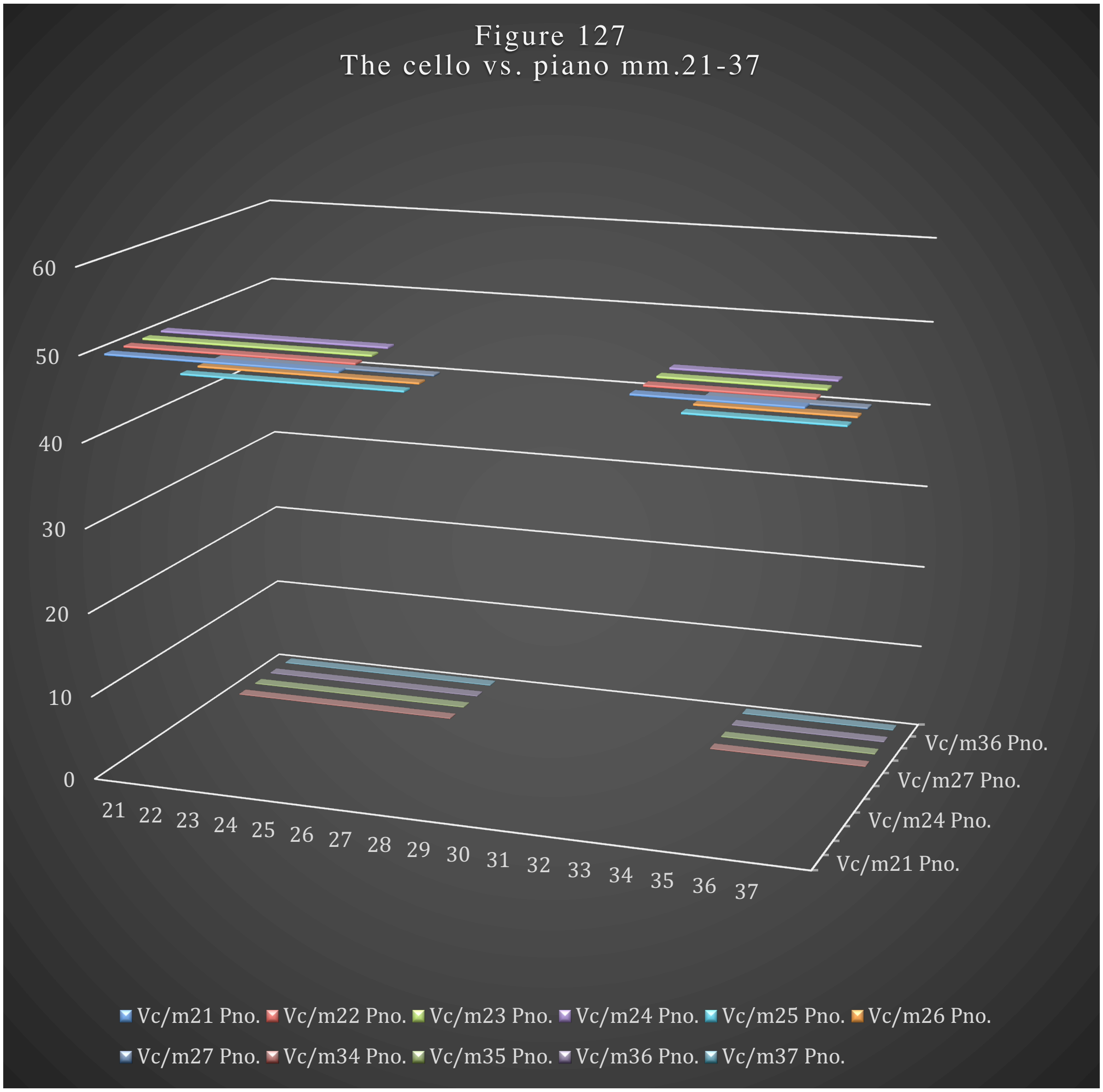


Figure 126 presents minimum and maximum values of zero and fifty and shows extreme and concurrent parallelism between all the series. It also lacks shape. This type of shapelessness derived from extreme parallelism, with or without the appearance of zero, also occurs in Figures 119, the viola vs. violin, 120 the viola vs. cello, and 121 the viola vs. piano. It seems there is a timbral similarity between the viola, violin, and the piano in all of the above Figures. The timbral relationship between the viola, violin, and the piano contributes to the construction of timbre in Figures 119, 120, 121, and 126. Ultimately, these related Figures create contrast with other sections that do not display such a character, and hence contribute to form in Crama.



In Figure 127, the minimum and maximum values are zero and fifty. All of the comparisons display stagnant parallelism. Figure 127 covers the same section as Figures 119, 120, 121, and 126 and displays the same extreme parallelism as these Figures. Figure 127 thus adds the piano to the idea of a timbral relationship between the viola, violin, and cello. This shows that timbral similarity contributes to timbre in a sound-based composition, just as contrast between sections with timbral similarities and differences contribute to the form in a sound-based composition.

Chapter 15: Piano Compared to Other Instruments: The Multiple Appearance of Zero

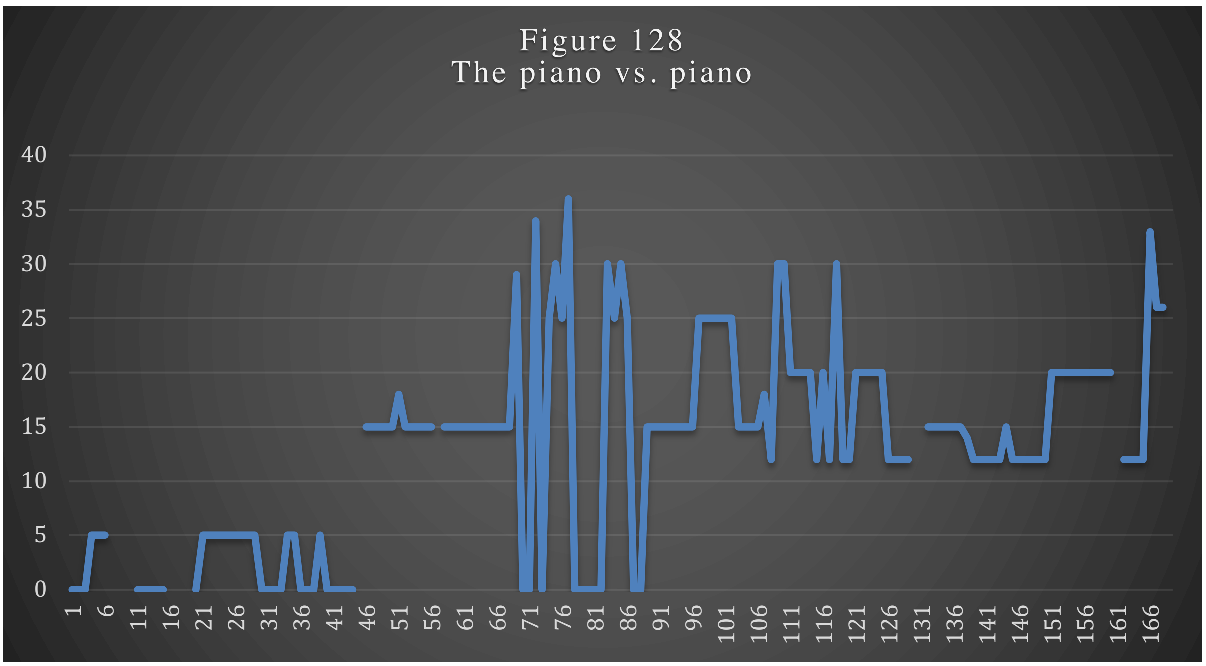
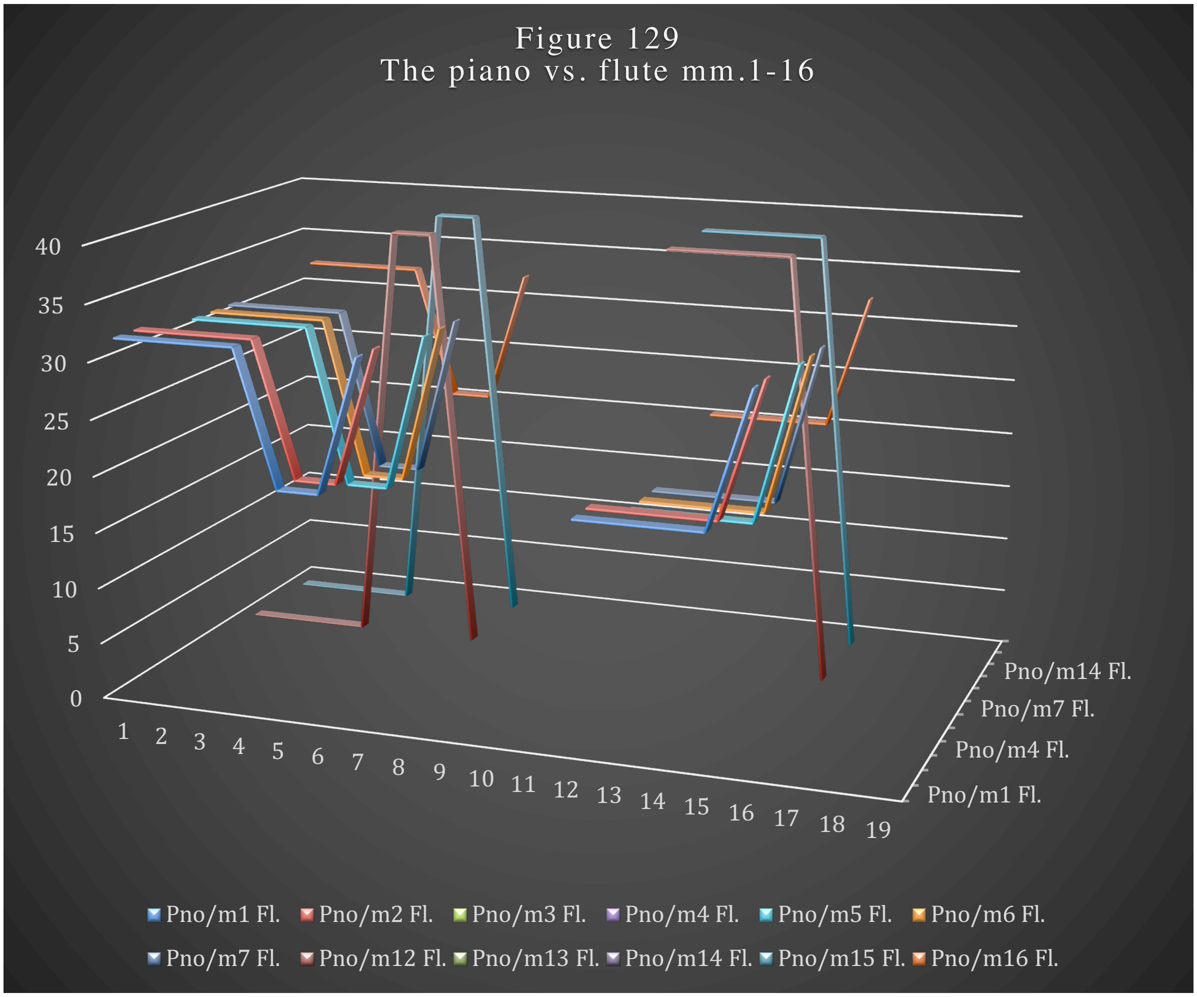


Figure 128 exhibits the timbral progression when the absolute timbral value of the piano is compared to measure 1 of itself. The minimum and maximum values are zero and thirty-six. The first and last appearances of zero are in bars 1 and 89; however, there are 32 other appearances of zero, which is a significant contrast between the piano and other instruments. The repetition of zero suggests two features about Crama: 1) Repetition of identical timbral values is one of the primary contributing elements to the coherence of form in the piece. 2) This rejects the timbral recapitulation idea proposed earlier. If zero were to appear in the beginning and reappear within the vicinity of bars 105 – 109, similar to how it does in other instruments, then there could be a stronger case for timbral recapitulation as part of the form. This, however, is not the case in Figure 128. In this way, the reappearance of zero in piano makes a strong case for transitional variation as the structural procedure in Crama.

Chart 2: The first and last appearance of zero

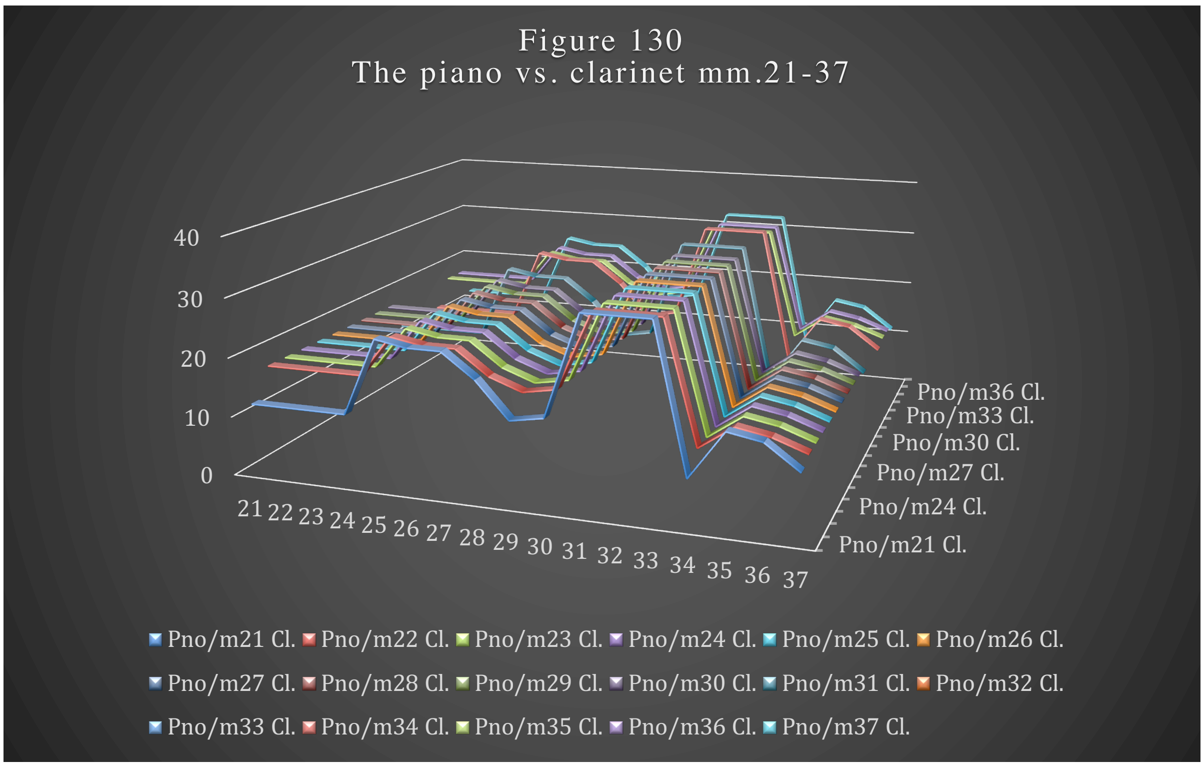
Instrument	first and last appearance zero	appearance of zero
1. Flute vs. flute	mm.1 & 106	mm.1 & 106
2. Clarinet vs. clarinet	No zero	N/A
3. Violin vs. violin	mm.1 & 109	mm.1-3, 18-19, 20, 108 - 110
4. Viola vs. viola	No zero	N/A
5. Cello vs. cello	mm.71	mm.71
6. Piano vs. piano	mm.1 & 89	mm.1 - 4, 12 - 16, 18, 20, 31 -34, 37 – 39, 41 – 45, 71 - 72 , 74 , 79 – 83, 88-89

In order to fully reject the notion of timbral recapitulation as a structural procedure in Crama, a new database was made, which consists of the sums of all the comparisons, including flute vs. flute, clarinet vs. clarinet, violin vs. violin, viola vs. viola, cello vs. cello, and piano vs. piano. While we would expect the appearance of zero to confirm the notion of recapitulation, zero was absent in bars 105 – 113, two-thirds of the way toward the end of Crama. The absence of zero in the vicinity of these bars shows there is no timbral recapitulation in Crama.



The minimum and maximum values fluctuate between zero and thirty-eight, and there are only twelve bars in this section. The absolute value difference of zero appears in six out of twelve bars, which is to say 50% of the section. This means that the absolute timbral value differences between piano and flute are identical 50% of the time in Figure 129. After comparing piano and flute in sections 1 – 20, 21 – 37, 38 – 69, 70 – 87, 88 – 162, and 163 – 170, it is clear that there are fewer occurrences of zero, which relates to the similarities between the timbre of the piano and the flute.

The question remains: Why is 50% of Figure 129 occupied by zero? The answer reveals that the air-like sound that occurs after each ***sff*** in piano is dovetailed by “breathy sound”[49] in flute in bars 1 – 4, 7, and 16 of Crama. The similarity beween these two timbers creates a timbral space of zero within these bars.



Notice also the parallelism between all comparisions throughout Figure 130. During the discourse of this case study thus far, the parallelism of comparisons manifested in stagnant parallel lines and not in the smooth arcs and curves in Crama. Figure 130 demonstrates a smoother arc, with more gradual spikes and drops, which contrasts with all other Figures in Crama.

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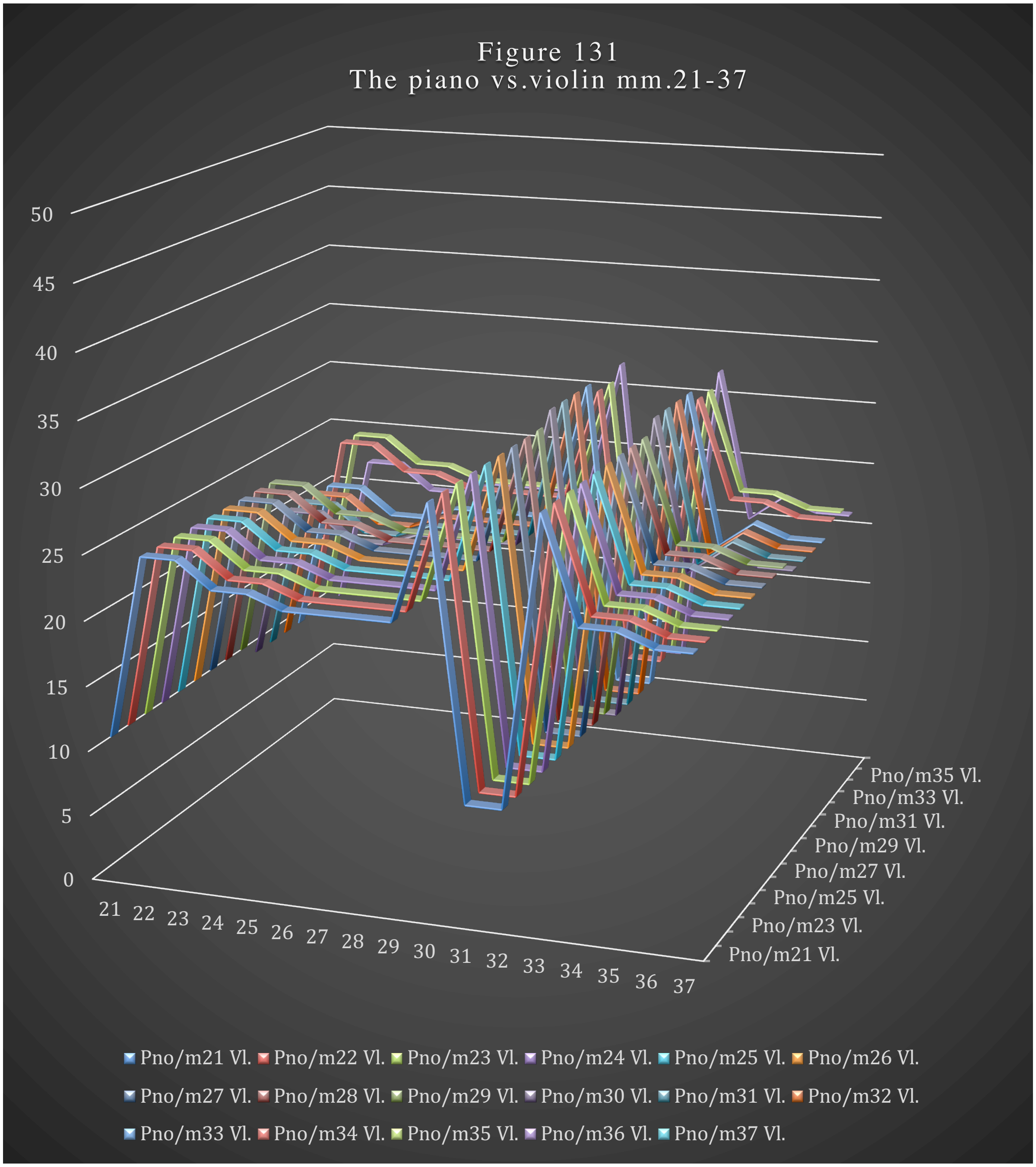
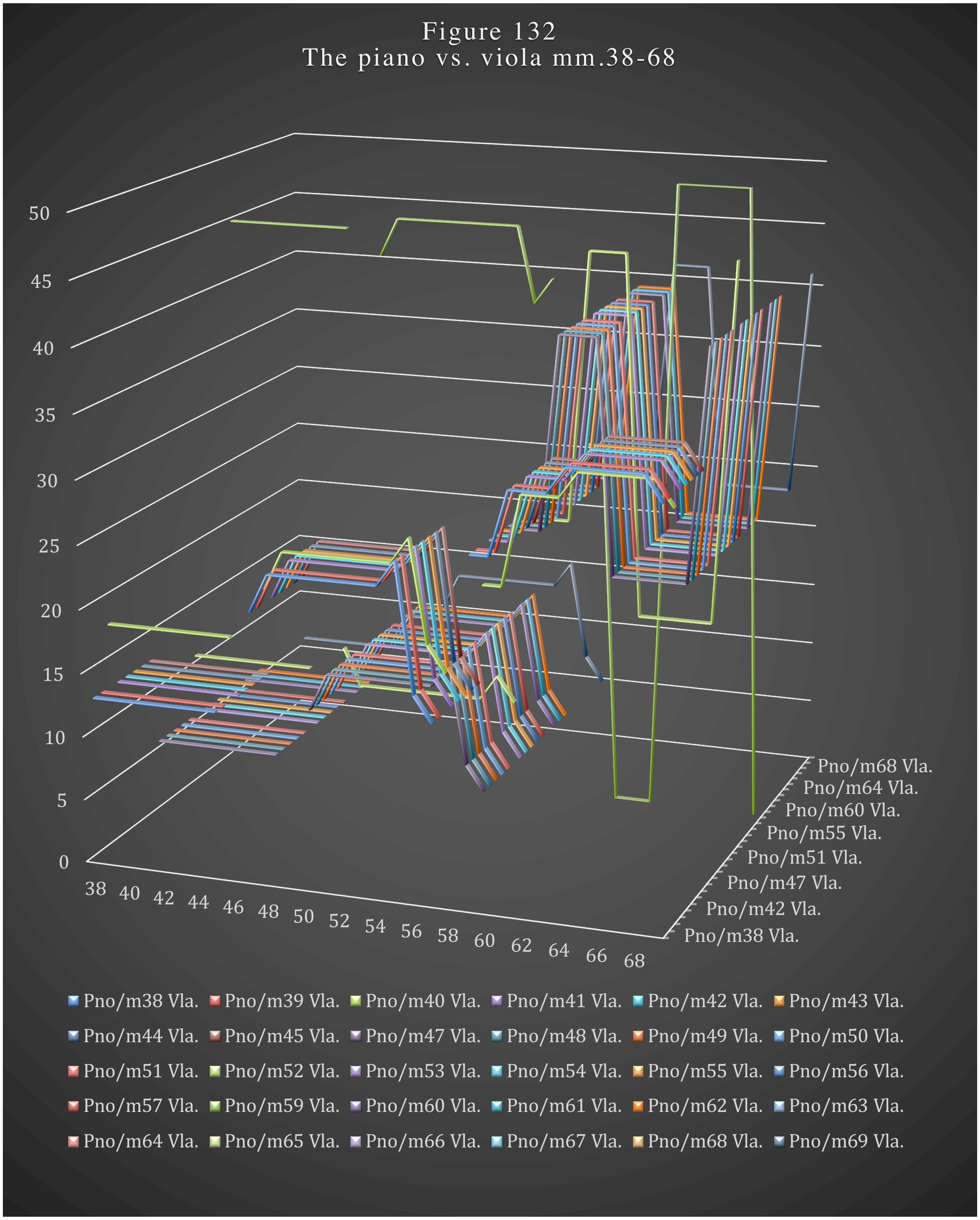
[49] “BREATHY SOUNDS: The square noteheads indicate the production of a rich sound mixture of tone and air together regardless of pitch range and dynamic. Direct the air flow in different angles and lip tensions to the embouchure in order to produce expressive variations of this type of sound. Blowing above and below the edges of the hole a rich mixture of sound and noise with varied harmonics can be produced. The accurate and stable pitch intonation is not desired. [b.1]” From page 1 of the preface in Crama.

It seems the piano and the clarinet share similar sonic qualities within the vicinity of bars 21 – 37. In other words, they both perform pitch or pitch-related materials. Furthermore, both instruments express a horizontal continuity of timbre, which is achieved via excessive repetition. Overall, the excessive repetition along with pitch or pitch-related materials contributes to parallelism in the comparisons between piano and clarinet in Figure 130.



The minimum and maximum values are eight and thirty-two. Parallelism is an element of similarity in Figures 130 and 131. The appearance of virtually identical timbral values within the vicinity of bars 21 – 31 results in parallelism with almost no contrast. Thus, dissimilarities between the shapes of each comparison contribute to the overall complexity of timbre between Figures 130 and 131.



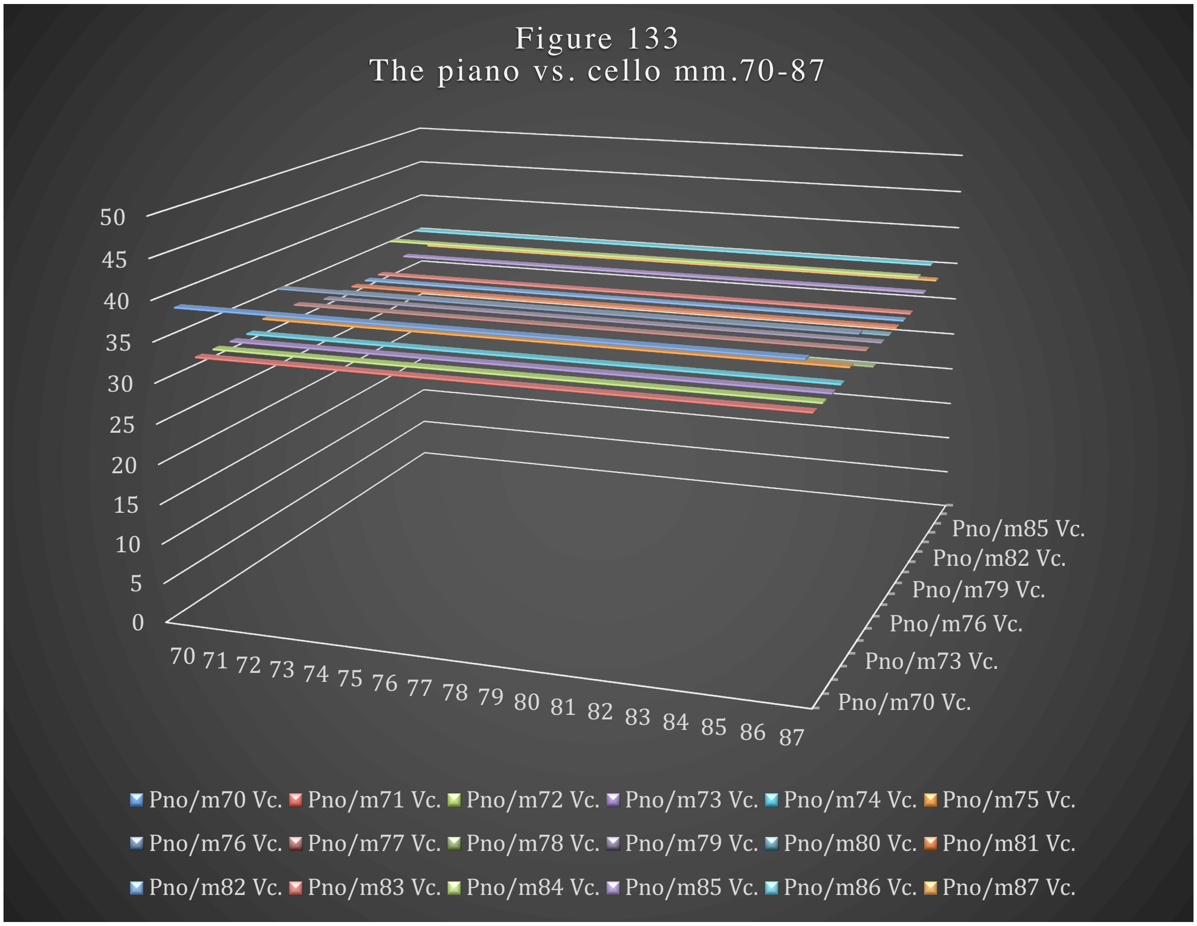
The appearance of zero in Figure 132 is the most critical element distinguishing it from Figure 130 and 131. Thus far, zero has appeared only in the comparison between piano and flute, in bars

1 – 4, 7, and 16. The idea that comparing pitch with pitch, and noise with noise, produces more instances of zero is becoming clearer, as zero appears more frequently in comparisons.

It seems the structures revealed by the comparisons including the piano are different from those revealed by the comparisons between other instruments, which partially relates to the lack of the appearance of zero. Therefore, the similarities and differences in the sonic structure, pitch with pitch and noise with noise, contribute to either clear or unclear structure and forms within the construction of timbre in each section. As a result, the idea of comparing pitch with pitch and noise with noise can contribute to creating similarities and contrast between different sections; hence, it contributes to the form in a sound-based composition.

Figures 130 and 131 arguably do not suggest any form, but rather demonstrate a potential to create form. Figure 129 suggests transformational variation because the shape of each line relates to the other lines as a kind of variation. Figure 131 expresses a transformational form similar to that in 129, in which each line of comparison grows and transforms into a new line that maintains the essence of the previous line.

It seems the level of parallelism decreases in different comparisons as Crama moves forward. Note how there are no contrasts between different comparisons in Figures 130 and 131, which is similar to 129. This statement will be supported in the next comparison between piano and cello.



The minimum and maximum values are thirty and thirty-nine, and the absence of zero continues in Figure 133. Note the extreme stagnant parallelism, which is similar to Figures 115, 119, and 120.

Note the small timbral space of nine in Figure 133, which shows the similarities in timbre between cello and piano. The piano in the C7 & G#7 register with ***pp*** dynamic can be heard as a pitch-less repeated motivic block, whereas the cello repeats the "duck bowing sound,"[50] which is

[50] "DUCK BOWING SOUND: (filled arrow notehead) Place the bow hairs flat against the string, pressing down into the string. Make short and very sharp movements of the bow close to the frog point. Two L.H. fingers should touch the string lightly on the indicated note. By touching the string with two fingers (slightly angled), most of the harmonic content of the sound is muffled. The sound produced is noisy with a blurred sense of pitch content. [b.7]" From page 5 of the preface in Crama.

very noisy and pitch-less. The similarity in timbres between cello and piano contributes to the smaller timbral space.

Thus far, there have been many types of ABA' transformation and extreme stagnant motion to create similarity and contrast between different sections. Neither clear form nor unclear structures of any variation are meant to define the structural process of a particular section, but rather, the reverse is true. In other words, in a sound-based composition, the sonic quality and timbre dictate the form, not vice versa. Perhaps this is the reason that transitional variation as a structural process is the main element in creating the form in a sound-based composition such as Crama.

Conclusion and More:

As previously mentioned, pitch has been the primary element in the creation of form for many centuries. "*It was not until the 1930s that composers began to use sonic attributes as a form bearing element in a musical composition.*"[51] Replacing pitch with timbre contributes to sonorities. It also requires a different set of rules and regulations about what can contribute to form in the absence of pitch. The structural process of a musical composition might transform into a new procedure if pitch is not the primary element of form. As a result, new sets of rules will help the piece communicate a musical meaning to the audience.

What type of structural procedure might contribute to conceiving a musical composition in which pitch is suppressed?

Crama, by Panayiotis Kokoras, (b. 1974), is a perfect example of a sound-based composition. This study discovered that the structural procedure in Crama is transformational variation, in which a motive, texture, or a block of sound undergoes a process of transformation to obtain the resultant. In this way, arriving at the transformation via a series of transformational variations might be considered an essential tool. Achieving form and coherence in a musical composition, however, should not have priority over form. The process and form are equally essential to arrive at a musical composition that is intrinsic and extrinsic.

What are some of the ingredients for structuring a sound-based composition?

There are many instances in which the repetition of similar timbres creates a parallelism between different instruments. As a result, repetition contributes to the continuity of sound and structuring

[51] Panayiotis Kokoras, *Morphopoiesis: An Analytical Model for Electronic Music,* 2005.

phrases and sub-sections. It also contributes to transitions and supports transformation from one section to another. Repetition of the same timbre, as well as the gradual appearance of a new timbre, contributes to the growth of a new section as the older timbral state decays. Repetition of the same timbral values supports the forward motion of a particular section. As a result, it becomes an essential tool in a sound-based composition.

Furthermore, I discovered that repetition of the identical timbral values contributes to the contrast between different sections. Contrast is a valuable tool that contributes to the growth of form in many sections. This is evident in sections in which the main form is ABA'. As repetition contributes to the creation of contrast, repetition and contrast are among the primary tools which contribute to transformational variation. Subsequently, repetition and contrast, along with transformation, count among the tools which can contribute in conceiving a modest-length form.

Transformation:

The ABA' structure was discovered in many Figures in Crama. The structure of ABA' can be interpreted as timbral state A, transformed to timbral state B, transformed to timbral state A'. There are also other types of transformation, such as AB, a binary transformation, or ABCBA, which is an arc transformation. Transformational variation is the most practical tool to achieve form in a sound-based composition because it contributes to growth and decay of different phrases or sections in and outside of each other. This type of growth and transformation structures a sound-based composition in the absence of cadence. As a result, transformation has replaced the function of cadence. Variation, repetition, and imitation between similar and virtually similar timbres of similar or different instruments are the main components of the transformational variation. All these aspects contribute to the continuity of sound and forward motion of sound and, thus, to the form.

When pitch is not the primary element of the form in a musical composition, how would a listener be engaged in such a post-pitch world?

The presence of pitch dominates the form in a musical composition. In other words, pitch engages the listener with form, and it is the primary element in processing form in a pitch-based composition. However, in a sound-based composition, the structural procedure of transformational variation is the primary element of form. As a result, the listener must be engaged with the process of transformations in a sound-based composition, since pitch ceases to exist. Aspects such as variation, repetition, and imitation between similar and virtually similar timbres of different instruments are the main components of the transformational variation. All of the following aspects contribute to form in the absence of pitch. The listener may follow the guidelines below to engage with a sound-based composition.

Timbre as the Primary Element of the Phrase:

The interrelation between different contributing elements of sound contributes to the complexity of timbre and phrase. Timbre, as the primary element of the phrase, contributes to the structure of section, which thus creates an interrelation between phrase and section. As a result, timbre contributes to the structure of phrase, section, and, ultimately, the overall form.

There are instances in which the progression of timbre changes from one bar to another or stays static, as in instances of parallelism. More importantly, however, there is always a reoccurrence of the same value a few bars later, which contributes to the construction of phrase in Crama. For the most part, a sense of start, process, and return brings coherency to the structure of the phrase, sub-section, section, and form in Crama.

Timbral Space:

The comparison between different instruments creates minimum and maximum values. There were cases in which the absolute value differences between minimum and maximum values were small, such as nine in Figure 133, and case in which this difference was much more significant. The absolute value difference between the minimum and maximum values indicates the timbral space. Thus, timbral space can be considered a tool to create contrast within a phrase in order to shape the phrase. Imagine a phrase that begins with smaller timbral space and then suddenly grows to larger timbral space. This can also create contrast between different sections, as in the way section B, with a timbral value of 10, contrasts with section A, which has a timbral space value of 45.

Density and Textures in a Sound-Based Composition:

Granularity of Textures:

Another contributing element in timbre is the granularity of texture which derives from the dissonant rhythmic relationship between modules stacked on top of one another. As was mentioned in attempt two, Crama's forward motion arrives via modules and their repetitive nature. For example, the density in bar 12, the clarinet with repeated 32nd notes and piano with 16th notes sextuplets, is generated as a result of the dissonant relationship between the above rhythmic modules. The subdivision of 6 against 8 in the above modules does not line up, which results in conflicting rhythm and its contribution to the density of texture in bar 12. The subdivision of 6 against eight is orchestrated between other instruments in bar 12, to support the density of texture and its arrival from conflicting rhythms.

Rhythmic and Intervallic Dissonance:

Rhythmic dissonance is not the only element creating the density of textures in Crama. Other aspects, such as register activity and intervallic dissonance, also contribute to the density of textures. A closer look at bar 23 reveals the rhythmic dissonance of piano, between the left hand and right hand, as it is marked in the score “two tremolos not in sync.” This also contributes to the rhythmic dissonance relationship, in a textural context, with the clarinet. This rhythmic-dissonance relationship between the piano and clarinet contributes to the density of the texture. The rhythmic dissonance is paired with intervallic dissonance as part of the density of texture in this bar. Note the interval of m2, in C8 register between violin and piano, left hand, which can be partially heard as part of the foreground and contributes as a dissonance to the density of texture in bar 23.

Aural Perception:

According to Boulez, *“an investigation into aural perception reveals that humans have a perceptual threshold whereby separate sound events occurring at intervals faster than about 20 per second (periodicity of about 0.05") will inevitably fuse into a single sound.”*[52] According to Bergman, the general region of events happening at a rate faster than ten times per second (periodicity of <0.10") has traditionally been reserved in music for trills, tremolo, ornamentation,

[52] Pierre Boulez, “Timbre and Composition-Timbre and Language,” *Contemporary Music Review* 2 (1987): 161–71.

arpeggiation, etc.”[53]

Boulez's sensory perception resonates with the definition of saturated textures. These textures can be defined when an event reaches a point of textural saturation and the ear can no longer discern individual components. In these cases, the human ear is compelled to experience the event primarily through timbre. In other words, in an orchestral passage including fast tremolos in strings, aural perception fuses all the tremolo to one texture, which also interprets it as a saturated texture.

Density and Periodicity:

The density of textures is defined by the periodicity of different events or layers, such as pitch, dynamics, and rhythm. Thus, there is a direct relationship between periodicity and the density of a saturated texture. This suggests a depth in musical texture that changes according to the number of events or layers which occur during a specific interval of time.

There are a few instances in which such saturations occur in Crama. For example, a closer look at the downbeat of bar 12 reveals that the appearance of 29 events, tremolos or the repetition of the same note, occur in almost every second, since quarter note equals 60-72. Also, there are 20 events, repetition or tremolo, which occur in the downbeat of bar 13. Density is achieved this way, via the periodicity of the same event, in many other cases, such as the downbeat of bar 34.

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[53] Albert S Bregman, *Auditory Scene Analysis: The Perceptual Organization of Sound*, Cambridge, MA: MIT Press, 1990.

Density and Saturation:

It seems the construction of density via saturated textures plays a vital role in Crama. Kokoras is almost always assured to arrive at density by the saturation of textures. Among many other events, the importance of density justifies a few samples which are mentioned in the discourse of Crama. The composer shows a particular and specific concern toward the production of saturated textures. He refers to sound as texture and too-saturated textures as holophony. Kokoras mentions:

"Holophonic musical texture is best perceived as the synthesis of simultaneous sound streams into a coherent whole with internal components and focal points. Holophonic music is the music whose texture is formed by the fusion of several sound entities which lose their identity and independence in order to contribute to the synthesis of a whole. The word Holophony is derived from the Greek word holos, which means 'whole/ entire,' and the word phone, which means 'sound/ voice.' In other words, each independent phone (sound) contributes to the synthesis of the holos (whole)."[54]

Kokoras implies specific details regarding the construction of holophonic textures. There are articulate details such as "simultaneous sound streams into a coherent whole," which contribute to the holophonic texture. This definition gives a clear direction for the construction of a particular type of density in which coherency is achieved via the functional relationship between internal components, sound blocks or modules, which results in the construction of a holophonic texture. As a result, the functional relationship between sound units creates a new sound and

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[54] Panayiotis Kokoras, *Auditory Fusion and Holophonic Musical Texture in Xenakis's Pithoprakta,* International Computer Music Association, 2014, 2.

contributes to the concept of holophonic texture. These precise directions result in generating the intrinsic relationship between sound units and the extrinsic relationship with the listener.

Forward Motion:

Among many other characteristics of a holophonic texture, forward motion is the essential feature which contributes to the continuity of a holophonic texture. This type of character is evident in bar 7, in violin and cello, as it is expressed via repetition and dynamics. The forward motion is conceived usually via the progression of modules, which are expressed by dynamic gestures. In bar 11, in flute, clarinet, and cello, in beat 2, the continued motion of these modules is paired with a crescendo that contributes to the forward motion of holophonic texture in bar 11 of Crama. Hence, forward motion in holophonic texture derives from a combination of repetition of modules along with dynamics, which can be understood as a gesture. Thus, gestures are one of the forming principles of holophonic texture.

Holophonic Texture as Wholeness:

Density is the essential requirement of holophonic texture. Density can be achieved via many solutions that have been previously mentioned. In Crama, however, density appears to be a crucial aspect of bringing a piece to life and helping to create form. On the other hand, the majority of textures are density-driven from saturated textures, meaning that density is a solution for holophonic texture. As Kokoras mentions, "*A holophonic musical texture does not consist of parts and cannot be partitioned. It exists as wholeness.*"[55] In Crama, there are many instances of saturated textures that derive from Boulez's investigation into aural perception. Therefore,

[55] Panayiotis Kokoras, "Sound Composition," Panayiotis KOKORAS – Projects, August, 2016, http://www.panayiotiskokoras.com/en/projects.html.

arriving at saturated textures via the periodicity of events which exceed the perceptual threshold can be considered one of the potential channels in creating a holophonic texture.

Background versus Foreground:

The holophonic texture is a fused-oriented texture in which every sound unit fuses with others in order to construct a new texture. Every sound unit contributes equally or unequally to the texture. In other words, in order to arrive at a holophonic texture, each sound unit is essential and as important as every other sound unit, regardless of its activity. A holophonic texture could not occur without participation from all of the sound units. As Kokoras mentions, *"Holophonic Texture is not a background versus foreground,"*[56] which resonates with the 20th-century explanation of texture. According to this explanation, the composer brings texture to the foreground and prioritizes its function, as opposed to the 18th or 19th century in which the composer uses texture as a backdrop for the melody or other aspects of a musical composition.

The Importance of Rhythm:

Pitch or noise are the results of fluctuating regular or irregular soundwaves. The act of fluctuation itself occurs with motion and energy. Faster fluctuations create higher pitches, and slower fluctuations contribute to lower pitches. The tempo, slowness or fastness, of fluctuations resonates with the concept of rhythm. As a result, different pitches blossom by the production of faster or slower rhythm. In this way, rhythm is key to forming pitch and timbre and a contributing element to a holophonic texture. As Kokoras notes, *"In holophonic musical texture*

[56] *Ibid.*

you cannot separate the rhythm from the pitch and the timbre. Therefore, sound-based composition expected to be rhythmical and gestural."[57]

Timbre Fused with Different Registers:

The primary objective of a holophonic texture is to achieve an effective fusion. As mentioned, holophonic textures can be achieved via the saturation of textures and/or the concurrent appearance of extreme timbre in different registers. Holophonic textures are conceived via density and the fluctuation of affairs between sound units which can occur in any register and create new textures. As Kokoras suggests, *"In holophonic texture it's natural to fuse timbres with different registers. The point is to find the right timbres so to create the fusion."*[58] Therefore, registers, or perhaps the contrast between registers, might be considered one of the primary tools to develop holophonic textures, as Rosemary Mountain refers to textures as the *"temporal and registral distribution of notes in any given passage."*[59]

The Importance of Leading Instrument/s and Imitation of Timbres:

In the discourse of this case study, it was discovered that the piano plays a significant contribution to the form of Crama. In bars 1 – 87, the piano is fused with other instruments to support the density of textures. However, in bars 88 – 162, the piano transforms to a leading timbral instrument, in that it leads other instruments to follow its own timbre. Thus, in a sound-based composition, one of the instruments that presents a variety of timbre can become the central leader of other instruments. This type of relationship was also observed in the string

[57] Panayiotis Kokoras, "Sound Composition," Panayiotis KOKORAS – Projects, August, 2016, http://www.panayiotiskokoras.com/en/projects.html.
[58] *Ibid.*
[59] Rosemary Mountain, *Periodicity and Musical Texture,* armchair-researcher.com, http://armchairresearcher.com/Rooms/Research/Rooms/writings/articles/PeriodicityMusical-Texture.pdf.

section, in an imitation of timbres in which the cello was the leader and the violin and the viola were the followers. The leader-follower relationship between different instruments might contribute to the form in a sound-based composition.

Is it possible to convey musical meaning if pitch is the least-prominent element in a composition?

Pitch has been the primary element of form for many centuries. The goal of this study, through the guidelines above, was to recover form in the absence of pitch in a sound-based composition. Since form suggests the intellectual engagement of the listener with structure, in any musical genre, wise use of these guidelines and discoveries can make a case for musical meaning in a sound-base composition. Crama, as a sound-based composition, employs all the guidelines discovered in the course of this dissertation. It creates musical meaning by employing timbre and textural density as the primary elements of form. As a result, in the absence of pitch, the presence of timbre communicates musical meaning.

The End:

This dissertation is not an attempt to disregard the importance of melody, harmony, or other elements of music from the past. My passion as a composer is to create a forward-thinking composition traced from that past. The evolution of music is unavoidable. This dissertation is my attempt to discover new guidelines that function in a sound-based composition. Perhaps these can be linked to the evolution of music, as Crama extracted principles from older music to create a sound-based composition. The primary goal of sound-based composition is not only creating a work of art which avoids pitch, but to make a connection with the listener. Therefore, the mission of a sound-based composition would not be complete without mesmerizing its audience. In the end, composition is the result of inspiration and intellectual justification. I hope the discoveries and guidelines provided in the discourse of this dissertation can provide new alternatives for whoever has passion and curiosity to create a sound-based composition.

Index:

List of rests for each instrument in Crama:

Flute	Clarinet	Violin	Viola	Cello	Piano
3-4	1-4	4	1-4	1-4	8-11
9-10	7-10	11	10-11	15-20	17
17	16-20	16	16-20	28-33	19-20
32-33	32-33	17	30	58	46
60-61	61-70	32-33	33	61-64	58
65-68	93-94	59-68	62-67	69	131-132
84	101-102	88-97	73-75	101-105	162
92-95	109-114	102	85-103	110	170
101-103	118	106-107	107	114	
107	127	111-113	110-111	133	
111	131-132	162-164	115	147	
114-115	137-144	167-170	119	170	
139-140	161-163		162-163		
149	168-170		170		
162-163					
170					

Contributing Elements to Timbre

Seven contributing elements to timbre or the quality of sound.
8. Number of partials = **P#** (1 = fewer, 9 = more)
9. Thinness or thickness of sound = **Th/Tk** (1 = thin, 9 = rich)
10. Range of strongest partials = **PR** (1 = low, 9 = high) or, better: (1 = bottom, 9 = top)
11. Irregularity of sound = **I** (1 = regular, 9 = irregular)
12. Amount of noise = **N** (1 = clean, pure, 9 = noisy)
13. Sharpness of attack = **AS** (1 = gentle, 9 = sharp)
14. Noisiness of attack = **AN** (1 = non-noisy attack, 9 = noisy attack)

Table 2. Timbral Icv's for all instruments in *Crama*

Flute in m.1: Breathy sound	<1336922>
Flute in m.2: Breathy sound &Tap Sound	<1336922> & <1153725>
Flute in m.3: Rest	
Flute in m.4: Rest	
Flute in m.5: Multiphonic Trill	<4551988>
Flute in m.6: Multiphonic Trill	<4551988>
Flute in m.7: Multiphonic sound	<1357922>
Flute in m.8: Multiphonic sound	<1357922>
Flute in m.9: Rest	

Flute in m.10: Rest	
Flute in m.11: tu-ku sound	<3558878>
Flute in m.12: tu-ku sound	<3558878>
Flute in m.13: tu-ku sound	<3558878>
14: b.1&2: tu-ku sound, multiphonic trill	<3558878>&<4551988>
Flute in m.15: Multiphonic Sound	<1337928>
Flute in m.16: Multiphonic Sound	<1337928>
Flute in m.17: Rest	
Flute in m.18: Breathy sound & tap sound	<1336922> & <1153725>
Flute in m.19: Breathy sound	<1382557>
Flute in m.20: Breathy sound	<1382557>
Flute in m.21: Breathy sound	<1382557>
Flute in m.22: Breathy sound	<1382557>
Flute in m.23: Breathy sound	<1382557>
Flute in m.24: Breathy sound	<1382557>
Flute in m.25: Breathy sound	<1382557>
Flute in m.26: Multiphonic Trill	<2449988>
Flute in m.27: Multiphonic Trill	<2449988>
Flute in m.28: Multiphonic Trill	<2449988>
Flute in m.29: Multiphonic Trill & Breathy sound	<2449988> &<1148978>
Flute in m.30: Breathy sound	<1148978>

Flute in m.31: Breathy sound	<1148978>
Flute in m.32: Rest	
Flute in m.33: Rest	
Flute in m.34: Multiphonic Trill	<1278788>
Flute in m.35: [s]	<1279977> 40% noise, 60% air pressure
Flute in m.36: [s]	<1279977> 40% noise, 60% air pressure
Flute in m.37: [s]	<1279977> 40% noise, 60% air pressure
Flute in m.38: [s] & Breathy sound	<1279977> &<1338978>
Flute in m.39: Breathy sound	<1338978>
Flute in m.40: Breathy sound	<1338978>
Flute in m.41: Breathy sound	<1338978>
Flute in m.42: Breathy sound	<1338978>
Flute in m.43: Breathy sound	<1338978>
Flute in m.44: Breathy sound	<1338978>
Flute in m.45: Breathy sound	<1338978>
Flute in m.46: Breathy sound & aeolian sound	<1338978> & <1347667>
Flute in m.47: Breathy sound	<1338978>
Flute in m.48: Breathy sound & aeolian sound	<1338978>& <1347667>
Flute in m.49: Breathy sound	<1338978>
Flute in m.50: Breathy sound	<1338978>
Flute in m.51: Breathy sound & aeolian sound	<1338978>& <1347667>

Flute in m.52: Breathy sound	<1338978>
Flute in m.53: Breathy sound	<1338978>
Flute in m.54: Breathy sound	<1338978>
Flute in m.55: ord.	<5556556>
Flute in m.56: ord.	<5556556>
Flute in m.57: Breathy sound	<1339929> Overblow Sound
Flute in m.58: Breathy sound	<1339929> Overblow Sound
Flute in m.59: Breathy sound	<1339929> Overblow Sound
Flute in m.60: Rest	
Flute in m.61: Rest	
Flute in m.62: tu-ku sound	<1349948>
Flute in m.63: tu-ku sound	<1349948>
Flute in m.64: tu-ku sound	<1349948>
Flute in m.65: Rest	
Flute in m.66: Rest	
Flute in m.67: Rest	
Flute in m.68: Rest	
Flute in m.69: Breathy sound	<1338978>
Flute in m.70: Breathy sound	<1338978>
Flute in m.71: tap sound	<5464333>
Flute in m.72: Breathy sound	<1338978>

Flute in m.73: Breathy sound	<1338978>
Flute in m.74: Breathy sound	<1338978>
Flute in m.75: Breathy sound	<1338978>
Flute in m.76: Breathy sound & Pizz sound	<1338978>&<1141988>
Flute in m.77: Breathy sound & Pizz sound	<1338978>&<1141988>
Flute in m.78: Breathy sound & Pizz sound	<1338978>&<1141988>
Flute in m.79: Pizz sound	<3635588>
Flute in m.80: Pizz sound	<3635588>
Flute in m.81: Pizz sound & Breathy sound	<3635588>&<1141988>
Flute in m.82: Pizz sound	<3635588>
Flute in m.83: Pizz sound	<3635588>
Flute in m.84: Rest	
Flute in m.85: Breathy sound	<1338978>
Flute in m.86: Breathy sound	<1338978>
Flute in m.87: Breathy sound	<1338978>
Flute in m.88: [sss] sound sound	<1197936>
Flute in m.89: [sss] sound sound	<1197936>
Flute in m.90: [sss] sound sound	<1197936>
Flute in m.91: [sss] sound sound	<1197936>
Flute in m.92: Rest	
Flute in m.93: Rest	

Flute in m.94: Rest	
Flute in m.95: Rest	
Flute in m.96: Breathy sound	<1338978>
Flute in m.97: Breathy sound	<1338978>
Flute in m.98: Breathy sound	<1338978>
Flute in m.99: Breathy sound & ord.	<1338978>& <4463513>
Flute in m.100: Breathy sound	<1338978>
Flute in m.101: Rest	
Flute in m.102: Rest	
Flute in m.103: Rest	
Flute in m.104: Breathy sound & Roar Sound	<1338978>&<1718978>
Flute in m.105: Breathy sound & Roar Sound	<3828989>&<1718978>
Flute in m.106: Breathy sound & Roar Sound	<3828989>&<1718978>
Flute in m.107: Rest	
Flute in m.108 : Breathy sound	<1336922>
Flute in m.109: Breathy sound and tap sound	<1336922> & <1153725>
Flute in m.110 : Breathy sound and tap sound	<1336922> & <1153725>
Flute in m.111: Rest	
Flute in m.112: tu-kh sound	<2348878>
Flute in m.113: tu-kh sound	<2348878>
Flute in m.114: Rest	

Flute in m.115: Rest	
Flute in m.116: Breathy sound	<1449968>
Flute in m.117: Breathy sound	<1449968>
Flute in m.118: Breathy sound & Roar sound	<1449968>&<1718978>
Flute in m.119: Fluttertongue	<3878989>
Flute in m.120: Fluttertongue	<3878989>
Flute in m.121: Breathy sound	<1158928>
Flute in m.122: Breathy sound	<1158928>
Flute in m.123: Breathy sound & Trumpet sound with air pressure	<1158928>&<1197936>
Flute in m.124: Trumpet sound with air pressure	<1197936>
Flute in m.125: Roar Sound & trumpet sound	<1158928>&<1197936>
Flute in m.126: trumpet sound	<1197936>
Flute in m.127: trumpet sound & roar sound	<1197936>&<1718978>
Flute in m.128: trumpet sound & roar sound	<1197936>&<1718978>
Flute in m.129: trumpet sound	<1197936>
Flute in m.130: air pressure	<1177956>
Flute in m.131: air pressure & Fluttertongue	<1177956>&<3878989>
Flute in m.132: Fluttertongue	<3878989>
Flute in m.133: Fluttertongue	<3878989>
Flute in m.134: Fluttertongue	<3878989>
Flute in m.135: Fluttertongue	<3878989>

Flute in m.136: Fluttertongue	<3878989>
Flute in m.137: Multiphonic trill	<4551988>
Flute in m.138: Multiphonic trill	<4551988>
Flute in m.139: Rest	
Flute in m.140: Rest	
Flute in m.141: Breathy sound	<1158928>
Flute in m.142: Breathy sound	<1158928>
Flute in m.143: Breathy sound & tu-kh sound	<1158928>&<1239955>
Flute in m.144: tu-kh sound & Multiphonic sound	<1239955>&<1348845>
Flute in m.145: Multiphonic sound	<1348845>
Flute in m.146: Aeolian Sound	<2349857>
Flute in m.147: Fluttertongue-multiphonic sound	<1348845>
Flute in m.148: Fluttertongue-multiphonic sound	<1348845>
Flute in m.149: Rest	
Flute in m.150: multiphonic sound	<5575524>
Flute in m.151: multiphonic sound	<5575524>
Flute in m.152: multiphonic sound	<5575524>
Flute in m.153: multiphonic sound	<5575524>
Flute in m.154: multiphonic sound	<5575524>
Flute in m.155: multiphonic sound	<5575524>
Flute in m.156: multiphonic sound	<5575524>

Flute in m.157: multiphonic sound	<5575524>
Flute in m.158: multiphonic sound	<5575524>
Flute in m.159: multiphonic sound	<5575524>
Flute in m.160: multiphonic sound	<5575524>
Flute in m.161: roar sound	<1158928>
Flute in m.162: Rest	
Flute in m.163: Rest	
Flute in m.164: Fluttertongue	<3578989>
Flute in m.165: Fluttertongue	<3578989>
Flute in m.166: Fluttertongue	<3578989>
Flute in m.167: multiphonic trill	<1151988>
Flute in m.168: multiphonic trill	<1151988>
Flute in m.169: multiphonic trill	<1151988>
Flute in m.170: Rest	
Clarinet in m.1: Rest	
Clarinet in m.2: Rest	
Clarinet in m.3: Rest	
Clarinet in m.4: Rest	
Clarinet in m.5: Flop sound	<3447866>
Clarinet in m.6: Flop sound	<3447866>

Clarinet in m.7: Rest	
Clarinet in m.8: Rest	
Clarinet in m.9: Rest	
Clarinet in m.10: Rest	
Clarinet in m.11: ord.	<3433411>
Clarinet in m.12: Flop sound	<3447866>
Clarinet in m.13: Flop sound	<3447866>
Clarinet in m.14: Flop sound	<3447866>
Clarinet in m.15: Flop sound	<3447866>
Clarinet in m.16: Rest	
Clarinet in m.17: Rest	
Clarinet in m.18: Rest	
Clarinet in m.19: Rest	
Clarinet in m.20: Rest	
Clarinet in m.21: smorzato	<2227755>
Clarinet in m.22: smorzato	<2227755>
Clarinet in m.23: smorzato	<2227755>
Clarinet in m.24: smorzato	<2227755>
Clarinet in m.25: smorzato & ord.	<2227755>&<4641111>
Clarinet in m.26: natural multiphonic.	<8879811>
Clarinet in m.27: n. multiphonic & moltiphonic trill	<8879822>&<8889911>

Clarinet in m.28: moltiphonic trill	<8889911>
Clarinet in m.29: moltiphonic trill	<8889911>
Clarinet in m.30: moltiphonic trill	<8889911>
Clarinet in m.31: moltiphonic trill	<8889911>
Clarinet in m.32: Rest	
Clarinet in m.33: Rest	
Clarinet in m.34: Flop sound	<3446866>
Clarinet in m.35: Flop sound	<3446866>
Clarinet in m.36: Flop sound	<3446866>
Clarinet in m.37: Flop sound	<2778778>
Clarinet in m.38: natural multiphonic & Flop sound	<7677554>&<2778778>
Clarinet in m.39: natural multiphonic & Flop sound	<7677554>&<2778778>
Clarinet in m.40: Flop sound	<2778778>
Clarinet in m.41: natural multiphonic & Flop sound	<7677554>&<2778778>
Clarinet in m.42: natural multiphonic & Flop sound	<7677554>&<2778778>
Clarinet in m.43: Flop sound	<7677554>
Clarinet in m.44: Flop sound	<7677554>
Clarinet in m.45: natural multiphonic & Flop sound	<7677554>&<2778778>
Clarinet in m.46: Flop sound	<3447866>
Clarinet in m.47: Flop sound	<3447866>
Clarinet in m.48: Flop sound	<3447866>

Clarinet in m.49: Flop sound	<3447866>
Clarinet in m.50: Flop sound	<3447866>
Clarinet in m.51: Flop sound	<3447866>
Clarinet in m.52: Flop sound	<3447866>
Clarinet in m.53: Flop sound	<3447866>
Clarinet in m.54: Flop sound	<3447866>
Clarinet in m.55: Multiphonic trill	<3644422>
Clarinet in m.56: Multiphonic trill	<3644422>
Clarinet in m.57: Natural multiphonic	<3644422>
Clarinet in m.58: Natural multiphonic	<3644422>
Clarinet in m.59: Natural multiphonic	<3644422>
Clarinet in m.60: Natural multiphonic	<3644422>
Clarinet in m.61: Rest	
Clarinet in m.62: Rest	
Clarinet in m.63: Rest	
Clarinet in m.64: Rest	
Clarinet in m.65: Rest	
Clarinet in m.66: Rest	
Clarinet in m.67: Rest	
Clarinet in m.68: Rest	
Clarinet in m.69: Rest	

Clarinet in m.70: Rest	
Clarinet in m.71: Flop sound	<3644422>
Clarinet in m.72: Natural Multiphonic	<7375422> Breathy sound
Clarinet in m.73: Natural Multiphonic	<7375422> Breathy sound
Clarinet in m.74: Natural Multiphonic	<7375422> Breathy sound
Clarinet in m.75: Natural Multiphonic	<7375422> Breathy sound
Clarinet in m.76: Flop Sound	<3447866>
Clarinet in m.77: Flop Sound	<3447866>
Clarinet in m.78: Flop Sound	<3447866>
Clarinet in m.79: Flop Sound	<3447866>
Clarinet in m.80: Flop Sound	<3447866>
Clarinet in m.81: Flop Sound	<3447866>
Clarinet in m.82: Flop Sound	<3447866>
Clarinet in m.83: Flop Sound	<3447866>
Clarinet in m.84: Natural Multiphonic	<5543111>
Clarinet in m.85: Natural Multiphonic	<5543111>
Clarinet in m.86: Natural Multiphonic	<5543111>
Clarinet in m.87: Natural Multiphonic	<5543111>
Clarinet in m.88: Natural Multiphonic	<5543111>
Clarinet in m.89: ord & Natural Multiphonic	<5724411>&<5543111>
Clarinet in m.90: Natural Multiphonic	<5543111>

Clarinet in m.91: Multiphonic trill	<5577811>
Clarinet in m.92: Multiphonic trill	<5577811>
Clarinet in m.93: Rest	
Clarinet in m.94: Rest	
Clarinet in m.95: Natural multiphonic	<5543111>
Clarinet in m.96: ord. & Natural multiphonic	<5724411>&<5543111>
Clarinet in m.97: Natural multiphonic	<5543111>
Clarinet in m.98: Natural multiphonic	<5543111>
Clarinet in m.99: Natural multiphonic	<5543111>
Clarinet in m.100: Natural multiphonic	<5543111>
Clarinet in m.101: Rest	
Clarinet in m.102: Rest	
Clarinet in m.103: ord.	<2291111>Press with teeth
Clarinet in m.104: ord.	<2291111> Press with teeth
Clarinet in m.105: ord.	<2291111> Press with teeth
Clarinet in m.106: ord.	<2291111> Press with teeth
Clarinet in m.107: ord.	<2291111> Press with teeth
Clarinet in m.108: ord.	<2291111> Press with teeth
Clarinet in m.109: Rest	
Clarinet in m.110: Rest	
Clarinet in m.111: Rest	

Clarinet in m.112: Rest	
Clarinet in m.113: Rest	
Clarinet in m.114: Rest	
Clarinet in m.115: Flop sound	<3447866>
Clarinet in m.116: Flop sound	<3447866>
Clarinet in m.117: Flop sound	<3447866>
Clarinet in m.118: Rest	
Clarinet in m.119: Blow at the edge of reed	<1159911>
Clarinet in m.120: Blow at the edge of reed	<1159911>
Clarinet in m.121: Blow at the edge of reed	<1159911>
Clarinet in m.122: Blow at the edge of reed	<1159911>
Clarinet in m.123: Blow at the edge of reed	<1159911>
Clarinet in m.124: Blow at the edge of reed	<1159911>
Clarinet in m.125: Blow at the edge of reed	<1159911>
Clarinet in m.126: Blow at the edge of reed	<1159911>
Clarinet in m.127: Rest	
Clarinet in m.128: fluttertongue-natural multiphonic	<2444578>
Clarinet in m.129: fluttertongue-natural multiphonic<	2444578>
Clarinet in m.130: fluttertongue-natural multiphonic	<2444578>
Clarinet in m.131: Rest	
Clarinet in m.132: Rest	

Clarinet in m.133:	fluttertongue-natural multiphonic	<2444578>
Clarinet in m.134:	fluttertongue-natural multiphonic	<2444578>
Clarinet in m.135:	fluttertongue-natural multiphonic	<2444578>
Clarinet in m.136:	fluttertongue-natural multiphonic	<2444578>
Clarinet in m.137:	Rest	
Clarinet in m.138:	Rest	
Clarinet in m.139:	Rest	
Clarinet in m.140:	Rest	
Clarinet in m.141:	Rest	
Clarinet in m.142:	Rest	
Clarinet in m.143:	Rest	
Clarinet in m.144:	Rest	
Clarinet in m.145:	natural multiphonic	<7777711>
Clarinet in m.146:	natural multiphonic	<7777711>
Clarinet in m.147:	natural multiphonic	<7777611>
Clarinet in m.148:	natural multiphonic	<7777611>
Clarinet in m.149:	multiphonic sound	<7777611>
Clarinet in m.150:	multiphonic sound	<7777611>
Clarinet in m.151:	multiphonic sound	<7777611>
Clarinet in m.152:	multiphonic sound	<7777611>
Clarinet in m.153:	multiphonic sound	<7777611>

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Clarinet in m.158:	multiphonic sound	<7777611>
Clarinet in m.159:	multiphonic sound	<7777611>
Clarinet in m.160:	multiphonic sound	<7777611 >
Clarinet in m.161:	Rest	
Clarinet in m.162:	Rest	
Clarinet in m.163:	Rest	
Clarinet in m.164: fluttertongue-natural multiphonic		<1327511>
Clarinet in m.165: fluttertongue-natural multiphonic		<1327511>
Clarinet in m.166:	fluttertongue-natural multiphonic	<1327511>
Clarinet in m.167:	fluttertongue-natural multiphonic	<1327511>
Clarinet in m.168:	Rest	
Clarinet in m.169:	Rest	
Clarinet in m.170:	Rest	
Piano in m.1: ord.		<1183487>
Piano in m.2: ord.		<1183487>
Piano in m.3: ord.		<1183487>

Piano in m.4: ord.	<1183487>
Piano in m.5: ord.	<2273386 >
Piano in m.6: ord.	<2273386 >
Piano in m.7: ord.	<2273386 >
Piano in m.8: Rest	
Piano in m.9:Rest	
Piano in m.10: Muffle the string	<9945587>
Piano in m.11: Rest	
Piano in m.12: ord.	<1183487>
Piano in m.13: ord.	<1183487>
Piano in m.14: ord.	<1183487>
Piano in m.15: ord.	<1183487>
Piano in m.16: ord.	<1183487>
Piano in m.17: Rest	
Piano in m.18: ord.	<1183487>
Piano in m.19: Rest	
Piano in m.20: Rest	
Piano in m.21: ord.	<1183487>
Piano in m.22: ord.	<2273386>
Piano in m.23: ord. two tremolo in sync	<2273386>
Piano in m.24: ord. two tremolo in sync	<2273386>

Piano in m.25: ord. two tremolo in sync	<2273386>
Piano in m.26: ord. two tremolo in sync	<2273386>
Piano in m.27: ord. two tremolo in sync	<2273386>
Piano in m.28: ord. two tremolo in sync	<2273386>
Piano in m.29: ord. two tremolo in sync	<2273386>
Piano in m.30: ord. two tremolo in sync	<2273386>
Piano in m.31: ord.	<1183487>
Piano in m.32: ord.	<1183487>
Piano in m.33: ord.	<1183487>
Piano in m.34: ord.	<1183487>
Piano in m.35: ord.	<2273386 >
Piano in m.36: ord.	<2273386>
Piano in m.37: ord.	<1183487>
Piano in m.38: ord.	<1183487>
Piano in m.39: ord.	<1183487>
Piano in m.40: ord.	<2273386>
Piano in m.41: ord.	<1183487>
Piano in m.42: ord.	<1183487>
Piano in m.43: ord.	<1183487>
Piano in m.44: ord.	<1183487>
Piano in m.45: ord.	<1183487>

Piano in m.46: ord. harp bridge	<9914485>&<1277969>
Piano in m.47: harp bridge	<1277969>
Piano in m.48: harp bridge	<1277969>
Piano in m.49: harp bridge	<11277969>
Piano in m.50: harp bridge	<1277969>
Piano in m.51: harp bridge	<1277969>
Piano in m.52: harp bridge & roar sound	<1277969>&<1777879>
Piano in m.53: roar sound & harp bridge	<1177879>&<1277969>
Piano in m.54: harp bridge	<1277969>
Piano in m.55: harp bridge	<1277969>
Piano in m.56: harp bridge	<1277969>
Piano in m.57: harp bridge	<1277969>
Piano in m.58: Rest	
Piano in m.59: harp bridge	<1277969>
Piano in m.60: harp bridge	<1277969>
Piano in m.61: harp bridge slow	<1277969>
Piano in m.62: harp bridge	<1277969>
Piano in m.63: harp bridge	<1277969>
Piano in m.64: harp bridge	<1277969>
Piano in m.65: harp bridge	<1277969>
Piano in m.66: harp bridge	<1277969>

Piano in m.67: harp bridge	<1277969>
Piano in m.68: harp bridge	<1277969>
Piano in m.69: harp bridge	<1277969>
Piano in m.70: ord. harp bridge	<1183487>&<1718949>
Piano in m.71: ord.	<1183487>
Piano in m.72: ord.	<1183487>
Piano in m.73: ord. RH & ord. LH	<1183487>&<8815532>
Piano in m.74: ord. RH & ord. LH	<1183487>&<8815532>
Piano in m.75: ord. LH	<7811286>
Piano in m.76: ord. RH & ord. LH	<7811286>&<8815572>
Piano in m.77: ord. RH & ord. LH	<7811286>&<8815512>
Piano in m.78: ord. RH & ord. LH	<7811286>&<8815512>
Piano in m.79: ord.	<1183487>
Piano in m.80: ord.	<1183487>
Piano in m.81: ord.	<1183487>
Piano in m.82: ord.	<1183487>
Piano in m.83: ord.	<1183487>
Piano in m.84: ord. RH & ord. LH	<7811286>&<8815572>
Piano in m.85: ord. RH & ord. LH	<7811286>&<8815572>
Piano in m.86: ord. RH & ord. LH	<7811286>&<8815572>
Piano in m.87: ord. LH	<7811286>

Piano in m.88: ord.	<1183487>
Piano in m.89: ord.	<1183487>
Piano in m.90: harp bridge	<1277969>
Piano in m.91: harp bridge	<1277969>
Piano in m.92: harp bridge	<1277969>
Piano in m.93: harp bridge	<1277969>
Piano in m.94: harp bridge	<1277969>
Piano in m.95: harp bridge	<1277969>
Piano in m.96: harp bridge	<1277969>
Piano in m.97: harp bridge	<1277969>
Piano in m.98: harp bridge slow	<1848969>
Piano in m.99: harp bridge slow	<1848969>
Piano in m.100: harp bridge slow	<1848969>
Piano in m.101: harp bridge slow	<1848969>
Piano in m.102: harp bridge slow	<1848969>
Piano in m.103: harp bridge slow	<1848969>
Piano in m.104: harp bridge	<1277969>
Piano in m.105: harp bridge	<1277969>
Piano in m.106: harp bridge	<1277969>
Piano in m.107: harp bridge	<1277969>
Piano in m.108: harp bridge clang sound, roar sound	<1369999>&<1177879>

Piano in m.109: roar sound	<1177879>
Piano in m.110: harp bridge	<1818949>
Piano in m.111: harp bridge	<1818949>
Piano in m.112: clang sound	<1349999>
Piano in m.113: clang sound	<1349999>
Piano in m.114: clang sound	<1349999>
Piano in m.115: clang sound & roar sound	<1349999>&<1177879>
Piano in m.116: roar sound	<1177879>
Piano in m.117: clang sound	<1349999>
Piano in m.118: roar sound	<1177879>
Piano in m.119: harp bridge & clang sound	<1818949>&<1349999>
Piano in m.120: clang sound & roar sound	<1349999>&<1177879>
Piano in m.121: roar sound	<1177879>
Piano in m.122: clang sound	<1349999>
Piano in m.123: clang sound	<1349999>
Piano in m.124: clang sound	<1349999>
Piano in m.125: clang sound	<1349999>
Piano in m.126: clang sound	<1349999>
Piano in m.127: clang sound & roar sound	<1349999>&<1177879>
Piano in m.128: roar sound	<1177879>
Piano in m.129: roar sound	<1177879>

Piano in m.130: roar sound	<1177879>
Piano in m.131: Rest	
Piano in m.132: Rest	
Piano in m.133: harp bridge	<1277969>
Piano in m.134: harp bridge	<1277969>
Piano in m.135: harp bridge	<1277969>
Piano in m.136: harp bridge	<1277969>
Piano in m.137: harp bridge	<1277969>
Piano in m.138: harp bridge	<1277969>
Piano in m.139: muffle sound & roar sound	<7573468>&<1177879>
Piano in m.140: roar sound	<1177879>
Piano in m.141: roar sound	<1177879>
Piano in m.142: roar sound	<1177879>
Piano in m.143: roar sound	<1177879>
Piano in m.144: roar sound	<1177879>
Piano in m.145: harp bridge	<1277969>
Piano in m.146: roar sound	<1177879>
Piano in m.147: roar sound	<1177879>
Piano in m.148: roar sound	<1177879>
Piano in m.149: roar sound	<1177879>
Piano in m.150: roar sound	<1177879>

Piano in m.151: roar sound & saw sound	<1177879>&<1349999>
Piano in m.152: saw sound	<1349999>
Piano in m.153: saw sound	<1349999>
Piano in m.154: saw sound	<1349999>
Piano in m.155: saw sound	<1349999>
Piano in m.156: saw sound	<1349999>
Piano in m.157: saw sound	<1349999>
Piano in m.158: saw sound	<1349999>
Piano in m.159: saw sound	<1349999>
Piano in m.160: saw sound	<1349999>
Piano in m.161: saw sound	<1349999>
Piano in m.162: Rest	
Piano in m.163: roar sound	<1177879>
Piano in m.164: roar sound	<1177879>
Piano in m.165: roar sound	<1177879>
Piano in m.166: roar sound	<1177879>
Piano in m.167: ord. & harp bridge	<8813232>&<1848959>
Piano in m.168: harp bridge	<1848959>
Piano in m.169: harp bridge	<1848959>
Piano in m.170: Rest	

Violin in m.1: ST sound	<1337811>
Violin in m.2: ST sound	<1337811>
Violin in m.3: ST sound	<1337811>
Violin in m.4: Rest	
Violin in m.5: Whish sound	<1199967>
Violin in m.6: Whish sound	<1199967>
Violin in m.7: Whish sound	<1199967>
Violin in m.8: Whish sound	<1199967>
Violin in m.9: Whish sound	<1199967>
Violin in m.10: Whish sound	<1199967>
Violin in m.11: Rest	
Violin in m.12: Saw sound	<1248499>
Violin in m.13: Saw sound	<1248499>
Violin in m.14: col legno batutto	<1199945>
Violin in m.15: col legno batutto	<1199945>
Violin in m.16: Rest	
Violin in m.17: Rest	
Violin in m.18: ST light bowing	<1337811>
Violin in m.19: ST light bowing	<1337811>
Violin in m.20: ST light bowing	<1337811>
Violin in m.21: xSP	<1198867>

Violin in m.22: xSP	<1198867>
Violin in m.23: xSP	<1198867>
Violin in m.24: xSP	<1198867>
Violin in m.25: xSP & ST slow bow sound	<1198867>&<3759999>
Violin in m.26: ST slow bow sound	<3659999>
Violin in m.27: ST slow bow sound	<3659999>
Violin in m.28: xSP	<2348957>
Violin in m.29: xSP	<1178957>
Violin in m.30: xSP	<1188946>
Violin in m.31: Rest	
Violin in m.32: Rest	
Violin in m.33: Rest	
Violin in m.34: xSP	<2186777>
Violin in m.35: xSP	<2546777>
Violin in m.36: xSP	<2446777>
Violin in m.37: xSP &ST	<2387777>&<3539978>
Violin in m.38: ST slow bow sound	<3459978>
Violin in m.39: ST slow bow sound	<3459978>
Violin in m.40: ST slow bow sound	<3459978>
Violin in m.41: ST slow bow sound	<3459978>
Violin in m.42: ST slow bow sound	<3459978>

Violin in m.43: ST slow bow sound	<3459978>
Violin in m.44: ST slow bow sound	<3459978>
Violin in m.45: ST slow bow sound	<3459978>
Violin in m.46: ST slow bow sound w/ extreme vibrato	<2449977>
Violin in m.47: angled bowing sound & slow bow w/ extreme vibrato	<1549988>&<2449977>
Violin in m.48: slow bow w/ extreme vibrato &angled bowing sound	<2449977>&<1549988>
Violin in m.49: slow bow extreme vibrato & angled bowing sound	<2449977>&<1549988>
Violin in m.50: angled bowing s. & slow bow extreme vibrato w/extreme vib.	<2449977>&<1549988>
Violin in m.51: slow bow extreme vibrato & angled bowing sound	<2449977>&<1549988>
Violin in m.52: slow bow extreme vibrato & angled bowing sound	<2449977>&<1549988>
Violin in m.53: slow bow sound w/ extreme vibrato	<2449977>
Violin in m.54: ST w/ not extreme vibrato	<2138833>
Violin in m.55: SP	<2348811>
Violin in m.56: ST	<2348811>
Violin in m.57: ST slow bow	<3439978>
Violin in m.58: ST slow bow	<3439978>
Violin in m.59: Rest	
Violin in m.60: Rest	
Violin in m.61: Rest	
Violin in m.62: Rest	
Violin in m.63: Rest	

Violin in m.64: Rest	
Violin in m.65: Rest	
Violin in m.66: Rest	
Violin in m.67: Rest	
Violin in m.68: Rest	
Violin in m.69: ring sound	<2449989>
Violin in m.70: ring sound & xSP col legno battuto (duck sound)	<2449989>&<1199747>
Violin in m.71: Whish sound	<1199959>
Violin in m.72: xSP col legno battuto (duck sound)	<1199747>
Violin in m.73: xSP col legno battuto (duck sound)	<1199747>
Violin in m.74: xSP col legno battuto (duck sound)	<1199747>
Violin in m.75: xSP col legno battuto (duck sound)	<1199747>
Violin in m.76: xSP col legno battuto (duck sound)	<1199747>
Violin in m.77: xSP col legno battuto (duck sound)	<1199747>
Violin in m.78: xSP col legno battuto (duck sound)	<1199747>
Violin in m.79: xSP col legno battuto (duck sound)	<1199747>
Violin in m.80: xSP col legno battuto (duck sound) & ord.	<1199747>&<3371222>
Violin in m.81: xSP col legno battuto (duck sound) & ord.	<1199747>&<3371222>
Violin in m.82: xSP col legno battuto (duck sound)	<1199747>
Violin in m.83: xSP col legno battuto (duck sound) & ord.	<1199747>&<337122>
Violin in m.84: xSP col legno battuto (duck sound)	<1199747>

Violin in m.85: xSP col legno battuto (duck sound)	<1199747>
Violin in m.86: xSP col legno battuto (duck sound)	<1199747>
Violin in m.87: xSP col legno battuto (duck sound)	<1199747>
Violin in m.88: Rest	
Violin in m.89: Rest	
Violin in m.90: Rest	
Violin in m.91: Rest	
Violin in m.92: Rest	
Violin in m.93: Rest	
Violin in m.94: Rest	
Violin in m.95: Rest	
Violin in m.96: Rest	
Violin in m.97: Rest	
Violin in m.98: ST light bowing	<1357811>
Violin in m.99: ST light bowing	<1357811>
Violin in m.100: ST light bowing	<1357811>
Violin in m.101: ST light bowing	<1357811>
Violin in m.102: Rest	
Violin in m.103: ST light bowing	<1337934>
Violin in m.104: ST light bowing	<1337934>
Violin in m.105: ST light bowing	<1337934>

Violin in m.106: Rest	
Violin in m.107: Rest	
Violin in m.108: ST light bowing	<1337811>
Violin in m.109: ST light bowing	<1337811>
Violin in m.110: ST light bowing	<1337811>
Violin in m.111: Rest	
Violin in m.112: Rest	
Violin in m.113: Rest	
Violin in m.114: clang sound	<1329989>
Violin in m.115: Roar sound & ring sound	<1329989>
Violin in m.116: ring sound	<1329989>
Violin in m.117: ring sound	<1329989>
Violin in m.118: ring sound	<1329989>
Violin in m.119: xST ring sound	<1349989>
Violin in m.120: xST ring sound	<1349989>
Violin in m.121: xST ring sound	<1349989>
Violin in m.122: pizz	<2428967>
Violin in m.123: pizz & slow bow sound	<2428967>&<2458812>
Violin in m.124: clang sound	<1349989>
Violin in m.125: roar sound & ring sound & clang sound	<4638977>&<2469989>&<1349989>
Violin in m.126: clang sound	<1349989>

Violin in m.127: clang sound	<1349989>
Violin in m.128: roar sound & ring sound	<2549989>&<2329989>
Violin in m.129: ring sound	<2329989>
Violin in m.130: ring sound	<2329989>
Violin in m.131: ring sound	<2379989>
Violin in m.132: ring sound	<2389989>
Violin in m.133: angled bowing sound	<1379989>
Violin in m.134: angled bowing sound	<1379989>
Violin in m.135: angled bowing sound &pulse ring sound	<1379989>
Violin in m.136: pulse ring sound	<1379989>
Violin in m.137: pulse ring sound slow bow sound	<1379989>
Violin in m.138: angled bow sound	<1469989>
Violin in m.139: angled bow sound	<1379989>
Violin in m.140: angled bow sound	<1379989>
Violin in m.141: angled bow sound	<1379989>
Violin in m.142: pulse ring sound	<1379989>
Violin in m.143: pulse ring sound	<1379989>
Violin in m.144: pulse ring sound	<1379989>
Violin in m.145: pulse ring sound & angled bowing sound	<1379989>&<1548989>
Violin in m.146: angled bowing sound	<1548989>
Violin in m.147: angled bowing sound	<1469989>

Violin in m.148: angled bowing sound &ring sound	<1469989>&<1369989>
Violin in m.149: ring sound	<1369989>
Violin in m.150: ring sound	<1369989>
Violin in m.151: ring sound & pulse ring sound	<1136999>
Violin in m.152: ring sound & pulse ring sound	<1136999>
Violin in m.153: pulse ring sound	<1136999>
Violin in m.154: pulse ring sound	<1136999>
Violin in m.155: pulse ring sound	<1136999>
Violin in m.156: pulse ring sound	<1136999>
Violin in m.157: pulse ring sound	<1136999>
Violin in m.158: pulse ring sound	<1136999>
Violin in m.159: pulse ring sound	<1136999>
Violin in m.160: pulse ring sound	<1136999>
Violin in m.161: slow bow sound	<1338711>
Violin in m.162: Rest	
Violin in m.163: Rest	
Violin in m.164: Rest	
Violin in m.165: xSP	<1299977>
Violin in m.166: xSP	<1299977>
Violin in m.167: Rest	
Violin in m.168: Rest	

Violin in m.169:Rest	
Violin in m.170:Rest	
Viola in m.1:Rest	
Viola in m.2: Rest	
Viola in m.3: Rest	
Viola in m.4: Rest	
Viola in m.5: Ring sound	<1189989>
Viola in m.6: Ring sound	<1189989>
Viola in m.7: Ring sound	<1389989>
Viola in m.8: Ring sound	<1389989>
Viola in m.9: Ring sound	<1389989>
Viola in m.10: Rest	
Viola in m.11: Rest	
Viola in m.12: whish sound	<1299999>
Viola in m.13: whish sound	<1299999>
Viola in m.14: slow bow sound	<1649999>
Viola in m.15: slow bow sound	<1649999>
Viola in m.16: Rest	
Viola in m.17: Rest	
Viola in m.18: Rest	

Viola in m.19: Rest	
Viola in m.20: Rest	
Viola in m.21: pizz.	<1377578>
Viola in m.22: pizz. & xSP	<1377578>&<1199932>
Viola in m.23: xSP	<1199932>
Viola in m.24: whish sound	<1199934>
Viola in m.25: whish sound	<1199934>
Viola in m.26: xSP short and sharp movement	<1449999>
Viola in m.27: Xsp short and sharp movement	<1449999>
Viola in m.28: Xsp short and sharp	<1449999>
Viola in m.29: Xsp short and sharp	<1449999>
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Viola in m.31: pizz.	<1352588>
Viola in m.32: pizz.	<1352588>
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Viola in m.35: slow bow sound	<1769999>
Viola in m.36: slow bow sound	<1669999>
Viola in m.37: slow bow sound	<1669999>
Viola in m.38: slow bow sound & duck sound	<1649999>&<1357969>
Viola in m.39: duck sound & slow bow sound	<1357969>&<1649999>

Viola in m.40: slow bow sound & duck sound	<1649999>&<1357969>
Viola in m.41: slow bow sound &pizz.	<1649999>&<3343334>
Viola in m.42: slow bow sound &duck sound	<1649999>&<1649999>
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Viola in m.44: slow bow sound	<1649999>
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Viola in m.46: ring sound & duck sound	<1249999>&<1669999>
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Viola in m.51: duck sound & angled bowing sound	<1469999>&<3737988>
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Viola in m.53: slow bow sound	<1569999>
Viola in m.54: slow bow sound& ring sound	<1569999>&<1269999>
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Viola in m.56: ring sound	<1269999>
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Viola in m.58: slow bow sound	<3439978>
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Viola in m.61: angled bow sound	<1338999>
Viola in m.62: Rest	
Viola in m.63: Rest	
Viola in m.64: Rest	
Viola in m.65: Rest	
Viola in m.66: Rest	
Viola in m.67: Rest	
Viola in m.68: ring sound	<1239999>
Viola in m.69: ring sound	<1239999>
Viola in m.70: ring sound	<1239999>
Viola in m.71: col legno battuto & pizz.	<1199979>&<1375589>
Viola in m.72: pizz.	<1375589>
Viola in m.73: Rest	
Viola in m.74: Rest	
Viola in m.75: Rest	
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Viola in m.79: hit w fingertip the body of the instrument/ muffle pizz	<1253999>&<1182288>
Viola in m.80: hit w fingertip the body of the instrument/ muffle pizz	<1253999>&<1182288>
Viola in m.81: hit w fingertip the body of the instrument/ muffle pizz	<1253999>&<1182288>

Viola in m.82: hit w fingertip the body of the instrument/ muffle pizz	<1253999>&<1182288>
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Viola in m.85: Rest	
Viola in m.86: Rest	
Viola in m.87: Rest	
Viola in m.88: Rest	
Viola in m.89: Rest	
Viola in m.90: Rest	
Viola in m.91: Rest	
Viola in m.92: Rest	
Viola in m.93: Rest	
Viola in m.94: Rest	
Viola in m.95: Rest	
Viola in m.96: Rest	
Viola in m.97: Rest	
Viola in m.98: Rest	
Viola in m.99: Rest	
Viola in m.100: Rest	
Viola in m.101: Rest	
Viola in m.102: Rest	

Viola in m.103: Rest	
Viola in m.104: xSp, xST	<1167833>
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Viola in m.110: Rest	
Viola in m.111: Rest	
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Viola in m.114: xSp	<2359222>
Viola in m.115: Rest	
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Viola in m.118: clang sound	<1939999>
Viola in m.119: clang sound	<1939999>
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Viola in m.124: nail sound & slow bow sound	<1443999>&<2459978>
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Viola in m.126: clang sound & slow bow sound	<1939999>&<2439978>
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Viola in m.129: ring sound	<1239999>
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Viola in m.145: pulsed ring sound & slow bow sound	<1449978>&<1249999>
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Viola in m.160: slow bow sound	<1249999>
Viola in m.161: slow bow sound	<1249999>
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Viola in m.163: Rest	
Viola in m.164: slow bow sound	<2459928>
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Viola in m.168: xSP	<1269919>
Viola in m.169: xSP	<1269919>
Viola in m.170: Rest	
Cello in m.1: Rest	
Cello in m.2: Rest	
Cello in m.3: Rest	
Cello in m.4: Rest	
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Cello in m.15: Rest	
Cello in m.16: Rest	

Cello in m.17:Rest	
Cello in m.18: Rest	
Cello in m.19:Rest	
Cello in m.20: Rest	
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Cello in m.28: Rest	
Cello in m.29: Rest	
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Cello in m.32: Rest	
Cello in m.33: Rest	
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Cello in m.57: ST sound	<1179978>
Cello in m.58: Rest	

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Cello in m.63: Rest	
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Cello in m.68: angled bow sound/muffle	<8918978>
Cello in m.69: Rest	
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Cello in m.72: slap & ord. to xSP	<1347999>&<5633323> to <2456733>
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Cello in m.74: xSP	<2498833>
Cello in m.75: Rest	
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Cello in m.78: duck sound-col legno batutto	<1191144>
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Cello in m.80: duck sound-col legno batutto	<1191144>
Cello in m.81: duck sound-col legno batutto	<1191144>
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Cello in m.87: xSP	<2458833>
Cello in m.88: slap	<4663392>
Cello in m.89: Rest	
Cello in m.90: xSP	<3569948>
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Cello in m.97: xSP	<3569948>
Cello in m.98: xSP	<3569948>
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Cello in m.100: ring sound	<1279978>

Cello in m.101: Rest	
Cello in m.102: Rest	
Cello in m.103: Rest	
Cello in m.104: Rest	
Cello in m.105: Rest	
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Cello in m.107: xSP, xST	<1379949>
Cello in m.108: xSP, xST & col legno batutto	<1379949> & <1191144>
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Cello in m.121: xSP & clang sound	<1379949>&<1449999>

Cello in m.122 clang sound	<1449999>
Cello in m.123: clang sound & roar sound	<1449999>&<1199999>
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Cello in m.125: clang sound	<1449999>
Cello in m.126: clang sound	<1449999>
Cello in m.127: clang sound	<1449999>
Cello in m.128: roar sound & ring sound	<1199999>&<1279978>
Cello in m.129: ring sound	<1279978>
Cello in m.130: ring sound & SP	<1279978>&<1189949>
Cello in m.131: SP	<1189949>
Cello in m.132: SP	<1189949>
Cello in m.133: Rest	
Cello in m.134: ST	<1169988>
Cello in m.135: ST	<1169988>
Cello in m.136: ST	<1169988>
Cello in m.137: ST	<1169988>
Cello in m.138: ST	<1169988>
Cello in m.139: ST	<1169988>
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Cello in m.141: xSP	<1149959>
Cello in m.142: xSP	<1149959>

Cello in m.143: xSP	<1149959>
Cello in m.144: xSP	<1149959>
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Cello in m.149: ring sound	<1279978>
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Cello in m.151: ring sound	<1279978>
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Cello in m.153: ring sound	<1279978>
Cello in m.154: ring sound & saw sound	<1279978>&<4729999>
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Cello in m.161: slow bow sound	<1248817>
Cello in m.162: Rest	
Cello in m.163: Rest	

Cello in m.164: slow bow sound	<1638799>
Cello in m.165: slow bow sound	<1638799>
Cello in m.166: slow bow sound	<1638788>
Cello in m.167: duck sound	<2258849>
Cello in m.168: duck sound	<2258849>
Cello in m.169: duck sound	<2258849>
Cello in m.170: Rest	

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ARASH MAJD

Metamorphosis on a Holophonic Texture

for Guitar Quartet

2020

Duration: ca. 13 min.

Program Note:

The genesis of *Metamorphosis on a Holophonic Texture* began in the fall of 2017. I heard the flesh-brush tremolo technique during a reading session for a previous guitar quartet, Etude, with the Minneapolis Guitar Quartet at UCLA. I was mesmerized by the color and the sound quality of this technique. When I heard the sound, I felt it was a sound I had been waiting for a long time. I informed my teacher, Ian Krouse, that I would not only start my next quartet with this technique, but use it as the basis for my entire piece. Krouse enthusiastically agreed!

During the rehearsal of Etude, I found myself distracted by all the pitches, melodies, and harmonies. I realized that I was far more intrigued by noise and timbre, and I vowed to suppress the traditional parameters in my next piece in favor of these pitch-less elements. I realized that composing works that prioritize timbre, and treat pitch as a secondary element, stimulated my passion. A world of possibilities opened up for me; working with timbre became not only my main inspiration but also my dissertation topic. As a result, I dedicated my dissertation to the notion that timbre could replace pitch and harmony as the primary element of form. Armed with this sensibility, I wrote the current work, *Metamorphosis on a Holophonic Texture.*

The structural procedure of this piece employs a naturally flowing transformation of sound, amidst an ongoing sonic continuity. Some of the techniques which contribute to the process of form in this piece are imitation and transformation between colors, usage of saturated textures to avoid the sense of pulse, continuity of sound and its interruption by postures and gestures, and rhythmic relationships between sounds with similar timbre to create forward motion. Sometimes this piece suggests a unified sonic image and other times it does not. Often, it uses similar timbre to create phrases or sections, whereas other times it employs disparate timbres to create a contrast. All of these processes require the engagement of the audience, the ultimate mission of sound-based composition.

Clarifications:

Metamorphosis on a Holophonic Texture is a sound-based composition, in which sound replaces pitch as the primary organizer. The mission of the performer is not merely to play correct pitches but to participate, like a sculptor, in the creation of sound. The performer collaborates with the composer, becoming, in effect, a "sculptor of sound."

Performance Notes:

1) Flesh-brush tremolo: Brush with the pad of the fingertips back and forth across the string. When performing flesh brush-tremolo, it is not necessary to perfectly control the stroke.

2) All the tremolos from bar 1 – 120 are flesh-brush tremolos. If the flesh-brush tremolos are soft, that is ***mf, p, pp, ppp***, they must be performed with fingertips. Louder dynamics such as ***f, ff, fff, sf, sff,*** may be performed as palm-brush tremolo.

3) Palm Tremolo: In order to achieve an effective and loud ***sf, sff, f, ff,*** use middle of the hand, the part of the palm at the base of the fingers.

4) Strum Sound: Mute any 3 – 4 note chord in the middle range, not too high or low, and strum. Must be pitch-less, dry-sounding chord, with no resonance.

5) Buzzing sound: Pull and hold the assigned string, V or VI (or indicated) with the left hand. Make a buzzing sound with the right hand as the written notes are performed. (This is sometimes called the "snare drum" effect.)

6) Nail sound: A castanets effect using the nails on the upper bout.

7) Knock sound: Knock on the main sound box with knuckles.

8) Scratch sound: Scratch back and forth along wound strings in approx. 1-inch increments, or scratch, if requested, with a guitar pick.

9) Boom sound: Hit the main sound box with flesh of the fingers or hand.

10) s.p.3: sul ponticello right on top of the saddle.

11) s.p.2: 1/2 inch away from the saddle.

12) s.p.1: 1 inch away from the saddle.

13) molto flautando: Over the fingerboard.

14) ord.: Over the sound hole.

15) s.t.: sul tasto (Not as extreme as flautando.)

16) Water-drop gliss: Please click on the link below to see a demonstration of this technique. Fast-forward the video to 2:37.

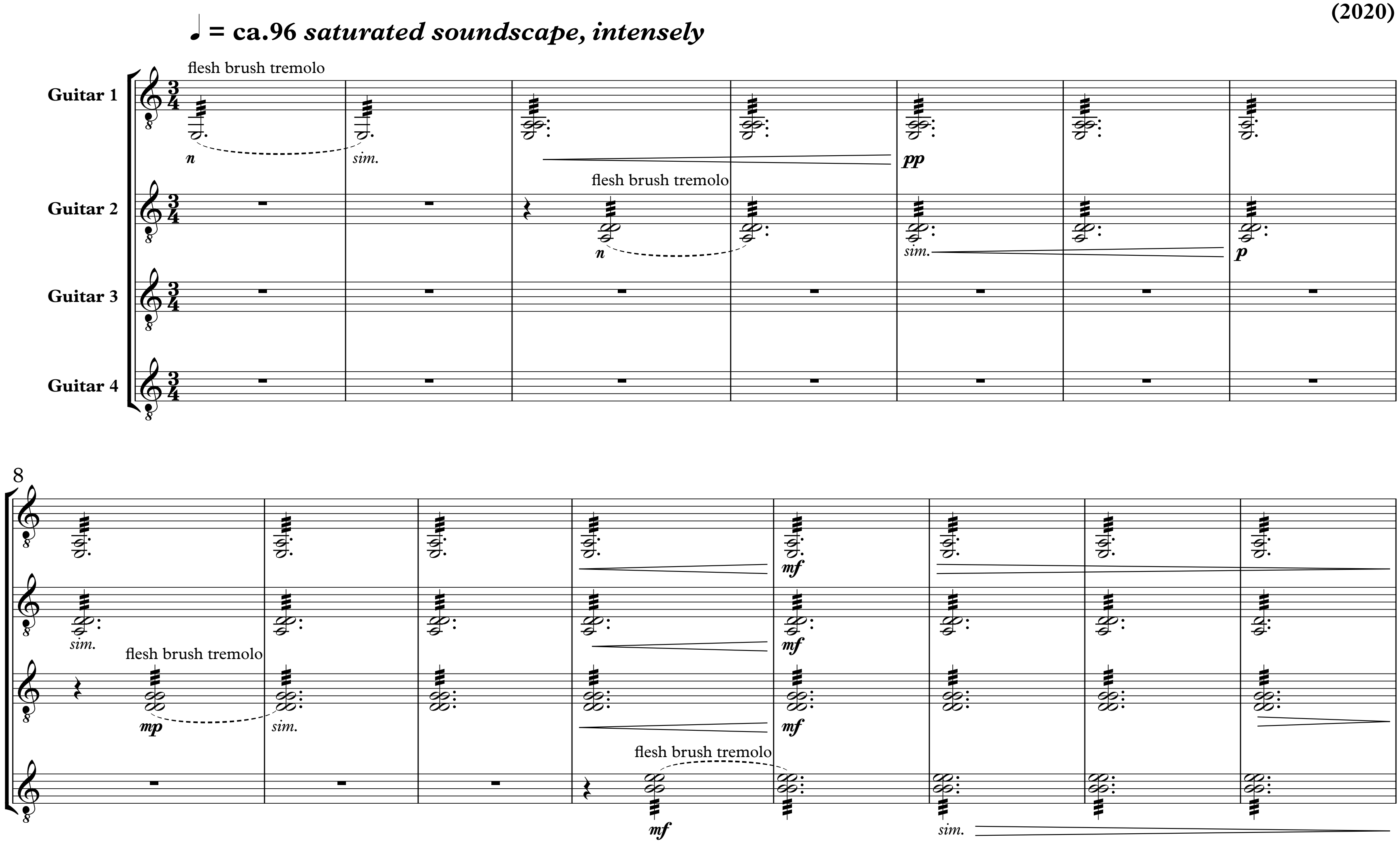
https://www.youtube.com/watch?v=p5r8Giss9hs

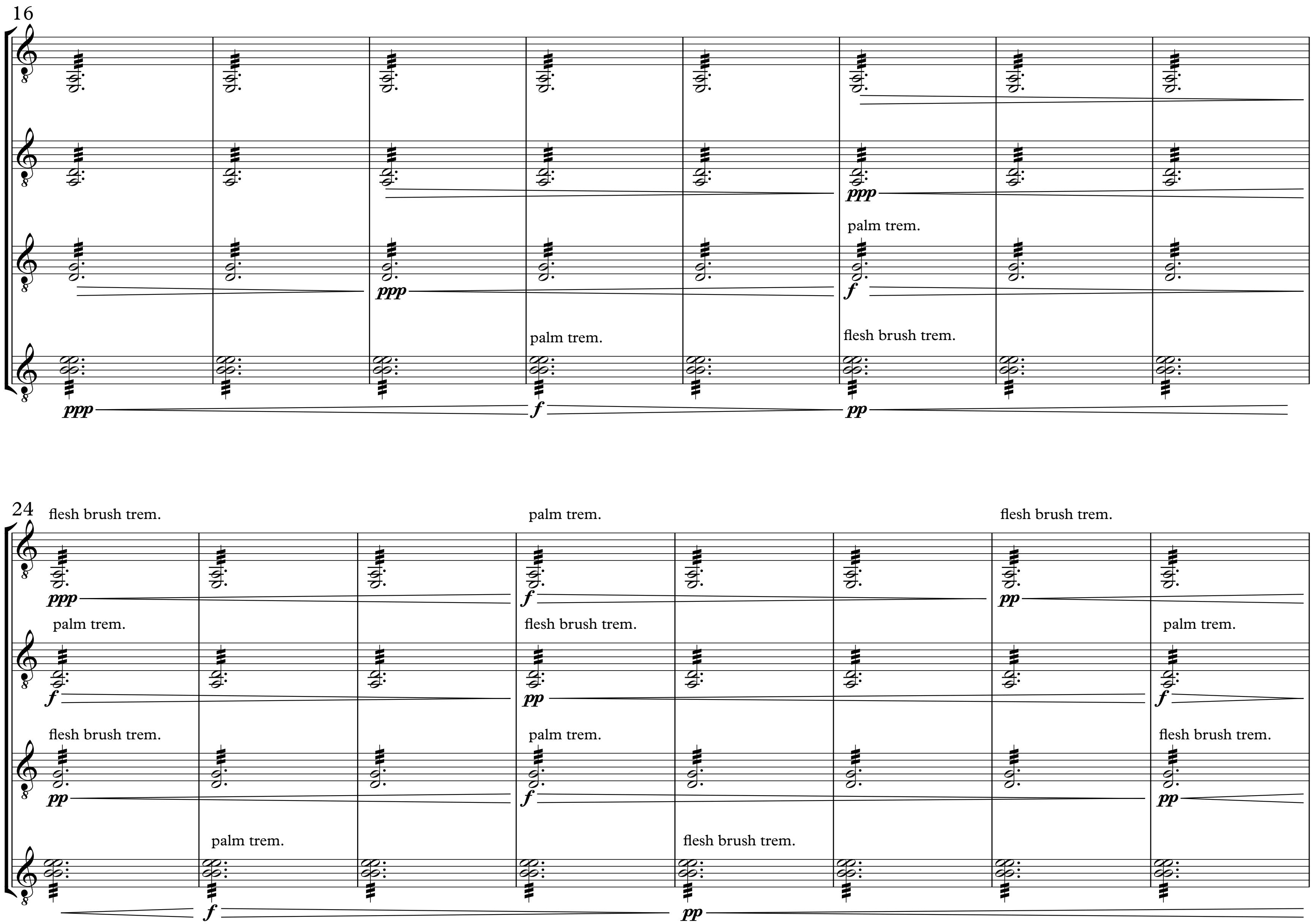
For my beloved wife, Veronica

Metamorphosis

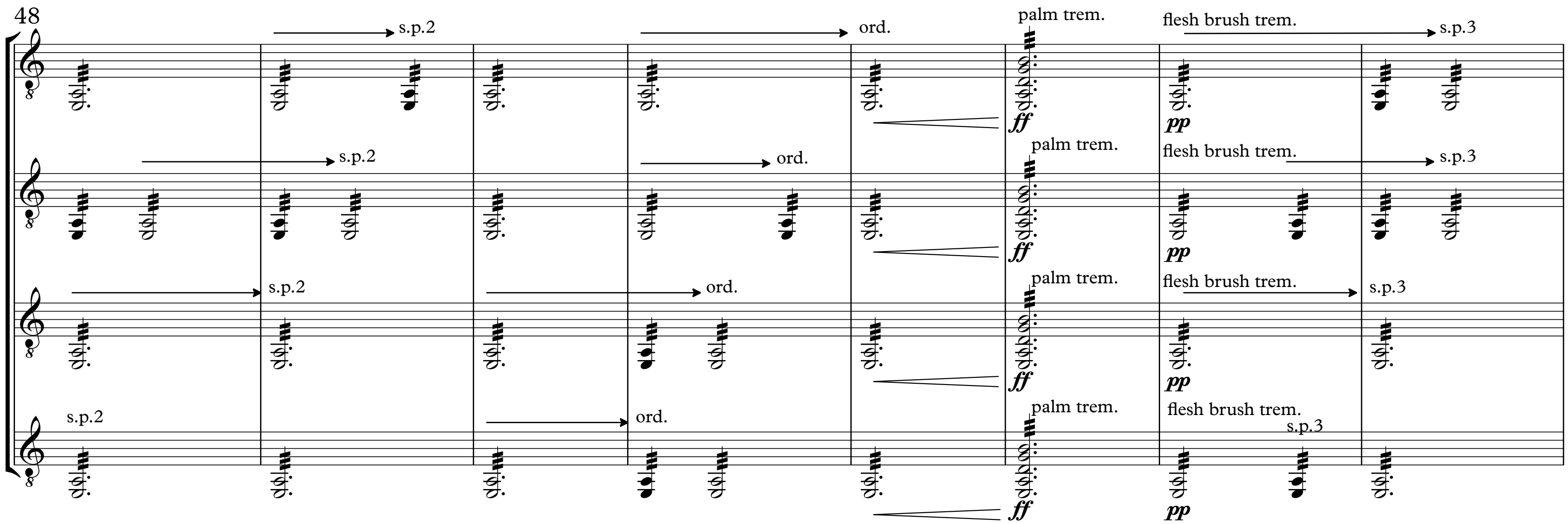
(on a Holophonic Texture)

Arash Majd
(2020)

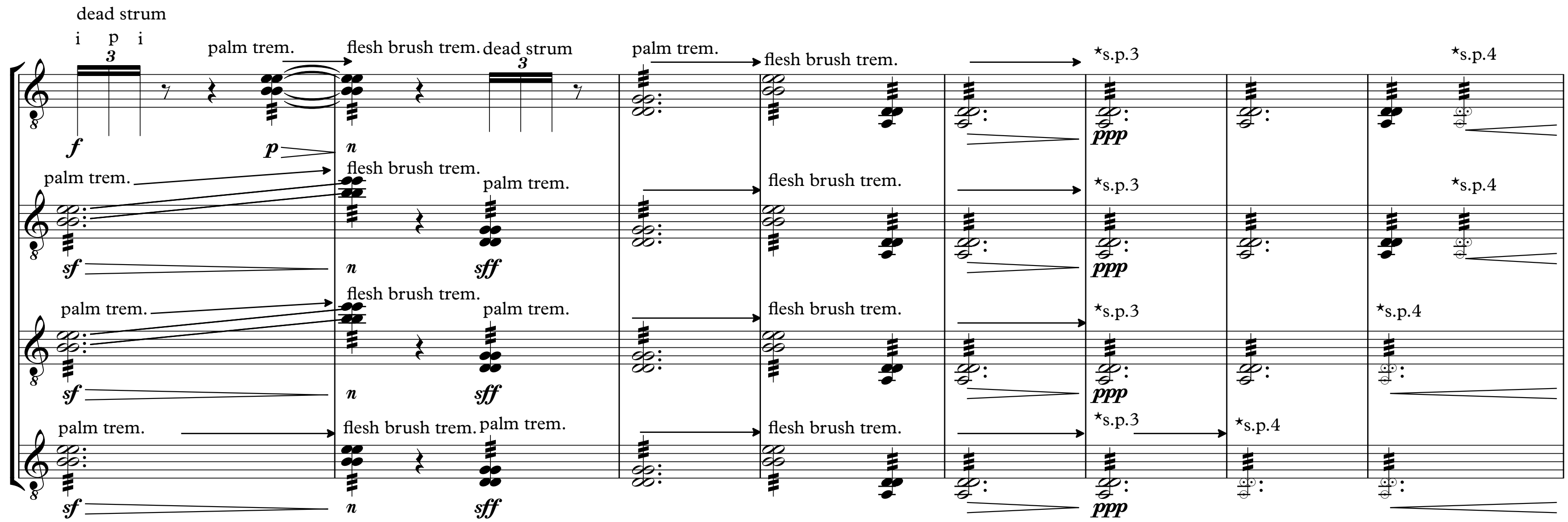


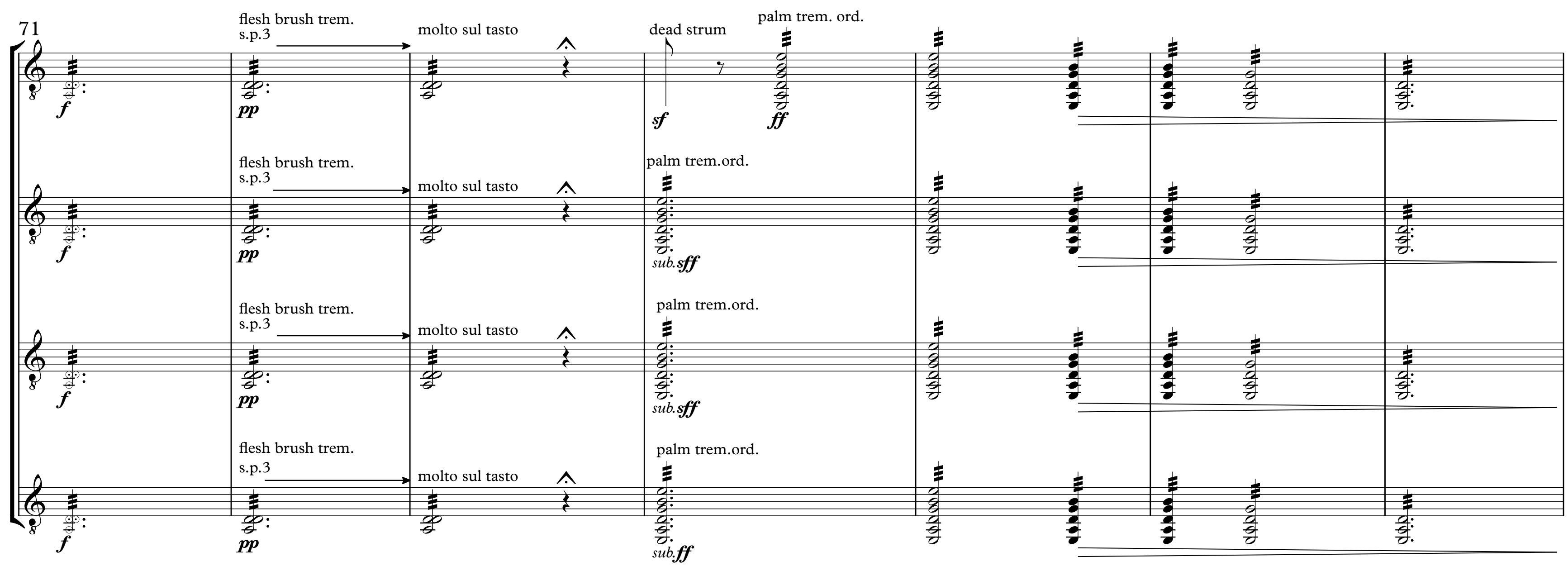

16
palm trem.
palm trem.
flesh brush trem.
ppp
f
pp
24
flesh brush trem.
palm trem.
flesh brush trem.
palm trem.
flesh brush trem.
palm trem.
flesh brush trem.
palm trem.
flesh brush trem.
palm trem.
flesh brush trem.
palm trem.
flesh brush trem.


32
palm trem.
palm trem.
ord.
f
pp
f
flesh brush trem.
s.p.3
palm trem.
ord.
pp
f
palm trem.
flesh brush trem.
s.p.3
f
pp
palm trem.
flesh brush trem.
s.p.3
palm trem.
ord.
f
pp
f
40
flesh brush trem.
s.p.3
palm trem.
ord.
flesh brush trem.
s.p.3
pp
f
pp
flesh brush trem.
s.p.3
palm trem.
ord.
flesh brush trem.
s.p.3
pp
f
pp
palm trem.
ord.
flesh brush trem.
s.p.3
palm trem.
ord.
flesh brush trem.
s.p.3
f
pp
f
pp
flesh brush trem.
s.p.3
palm trem.
ord.
flesh brush trem.
s.p.3
pp
f
pp


48
s.p.2
ord.
palm trem.
flesh brush trem.
s.p.3
ff
pp
s.p.2
ord.
palm trem.
flesh brush trem.
s.p.3
ff
pp
s.p.2
ord.
palm trem.
flesh brush trem.
s.p.3
ff
pp
s.p.2
ord.
palm trem.
flesh brush trem.
s.p.3
ff
pp


56
ord.
palm trem.
flesh brush trem.
s.p.2
palm trem.
flesh brush trem.
ff
pp
ff
ppp
ord.
palm trem.
flesh brush trem.
s.p.2
palm trem.
flesh brush trem.
ff
pp
ff
ppp
palm trem.
ord.
flesh brush trem.
s.p.2
palm trem.
flesh brush trem.
ff
pp
ff
ppp
palm trem.
ord.
flesh brush trem.
s.p.2
palm trem.
flesh brush trem.
ff
pp
ff
ppp





*__dead strum:__ Mute and strum the strings in the middle range, without pitch or resonance.

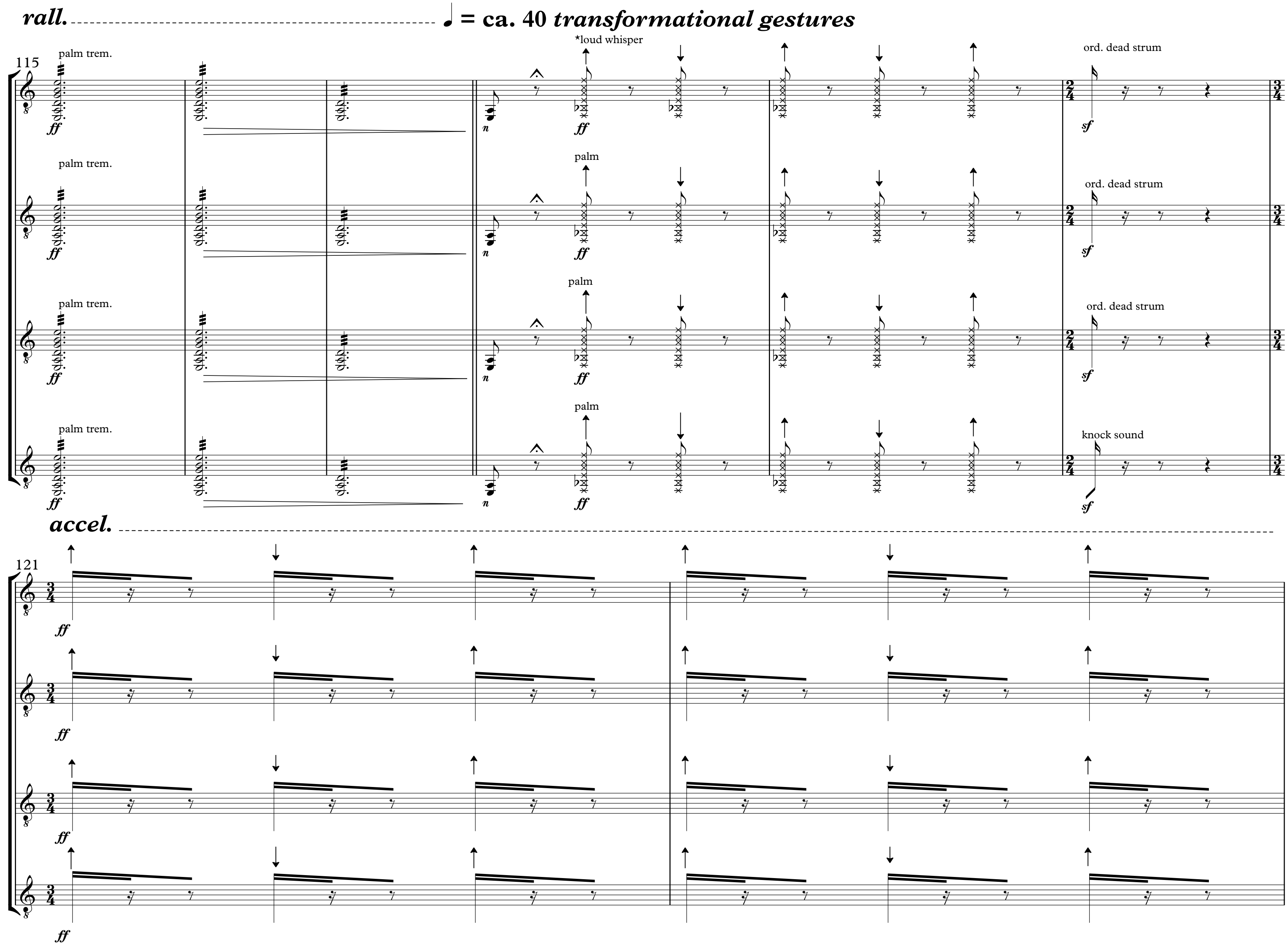
*__s.p.3__ = scrape at bridge right on top of the bridge

*__s.p.4__ = scratch behind the saddle

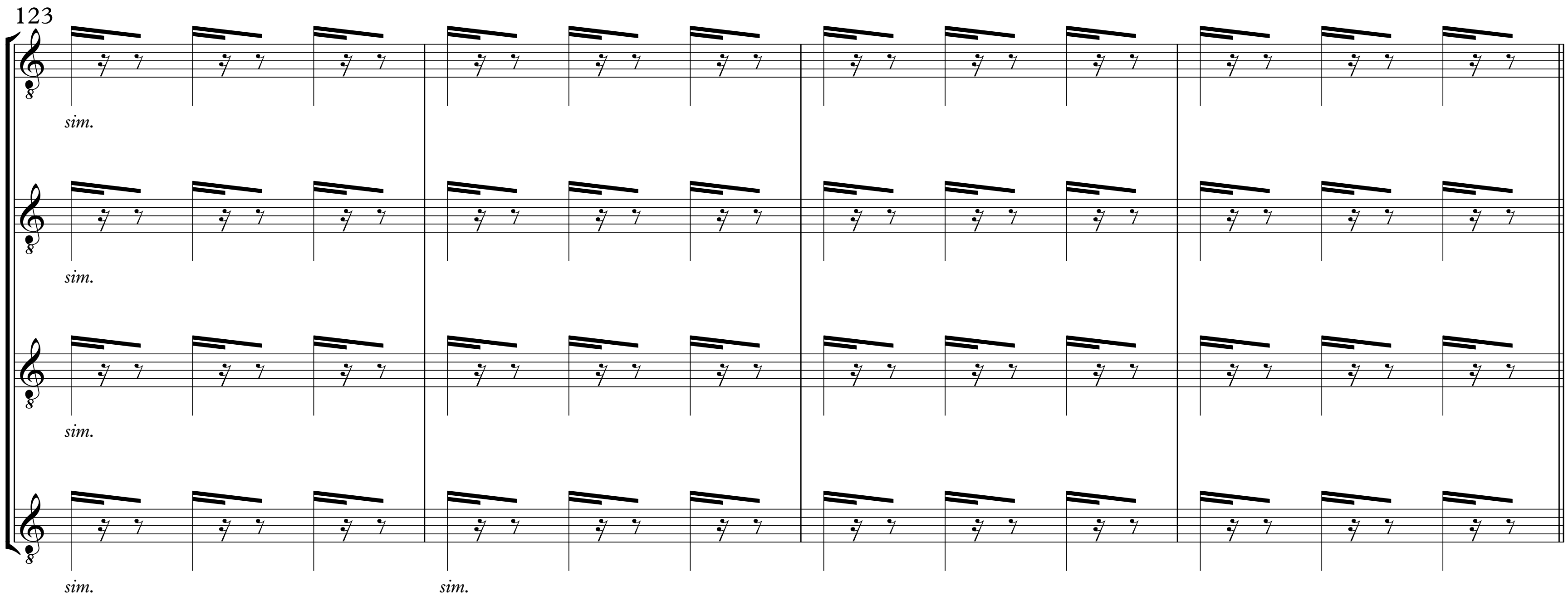

78
flesh brush trem.
s.p.3
ord.
s.p.2
ppp
84
dead strum
i p i
3
f
s.p.3
s.p.2
s.p.1
ord.
palm trem.
ff

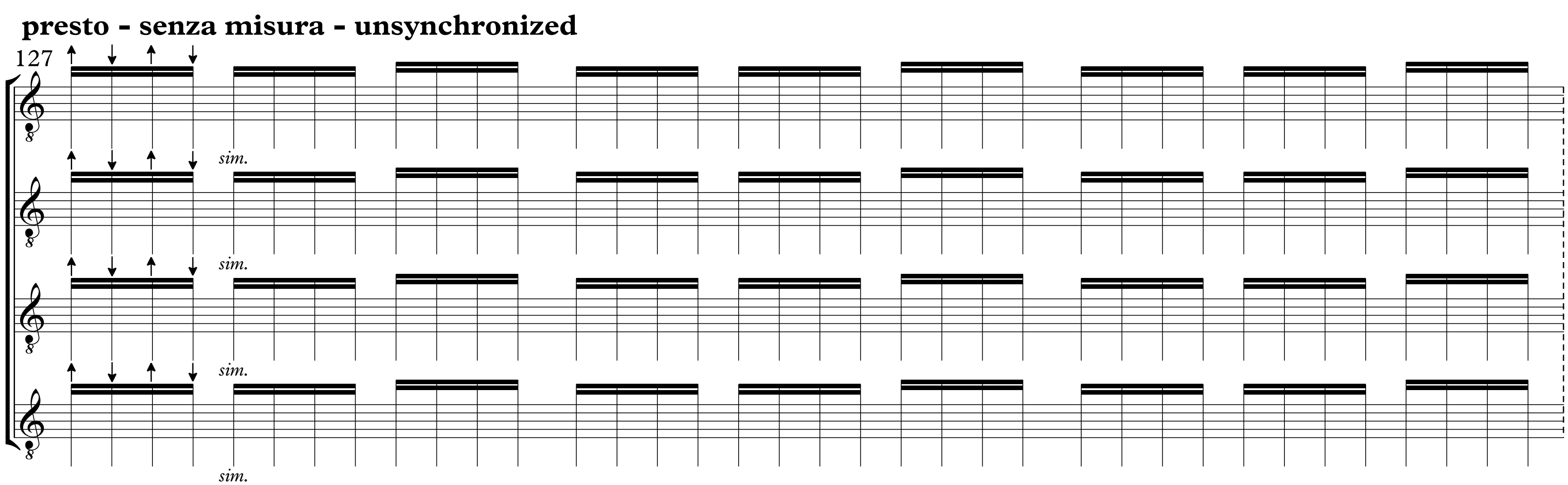

89
flesh brush trem.
s.p.3
s.t.
ppp
p
sim.
ord.
XII bring it out!
flesh brush trem.
s.p.3
ppp
p
mf
flesh brush trem.
s.p.3
ppp
p
flesh brush trem.
s.p.3
ppp
p
98 vertical interruptions
XII
flesh brush trem.
ppp
arp.
mf
sf
ppp
palm trem.
XII
palm trem.
XII
sub.ff
n
simile.
non arp.
mf
sff
n
mf
palm trem.
XII
sub.ff
n
simile.
mf
dead sound
i p i
3
palm trem.
flesh brush trem.
s.t.
flesh brush trem.
s.p.3
f
sf
ppp
f
n

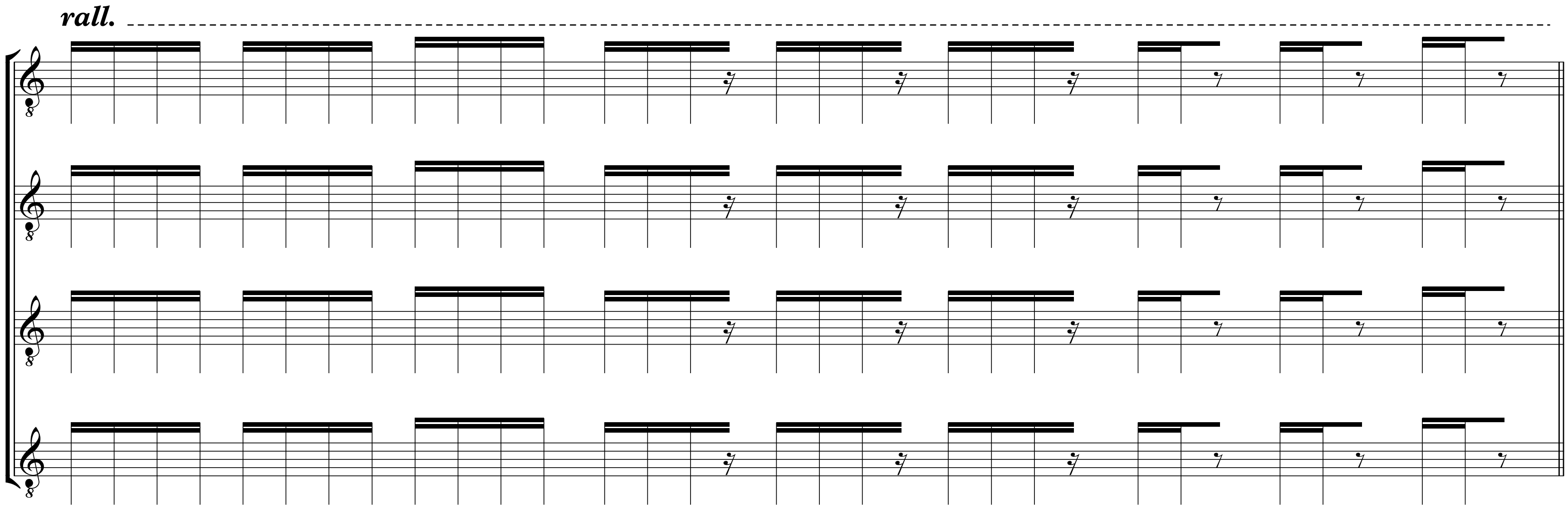
*__water drop gliss:__ Perform a glissando over the sound hole

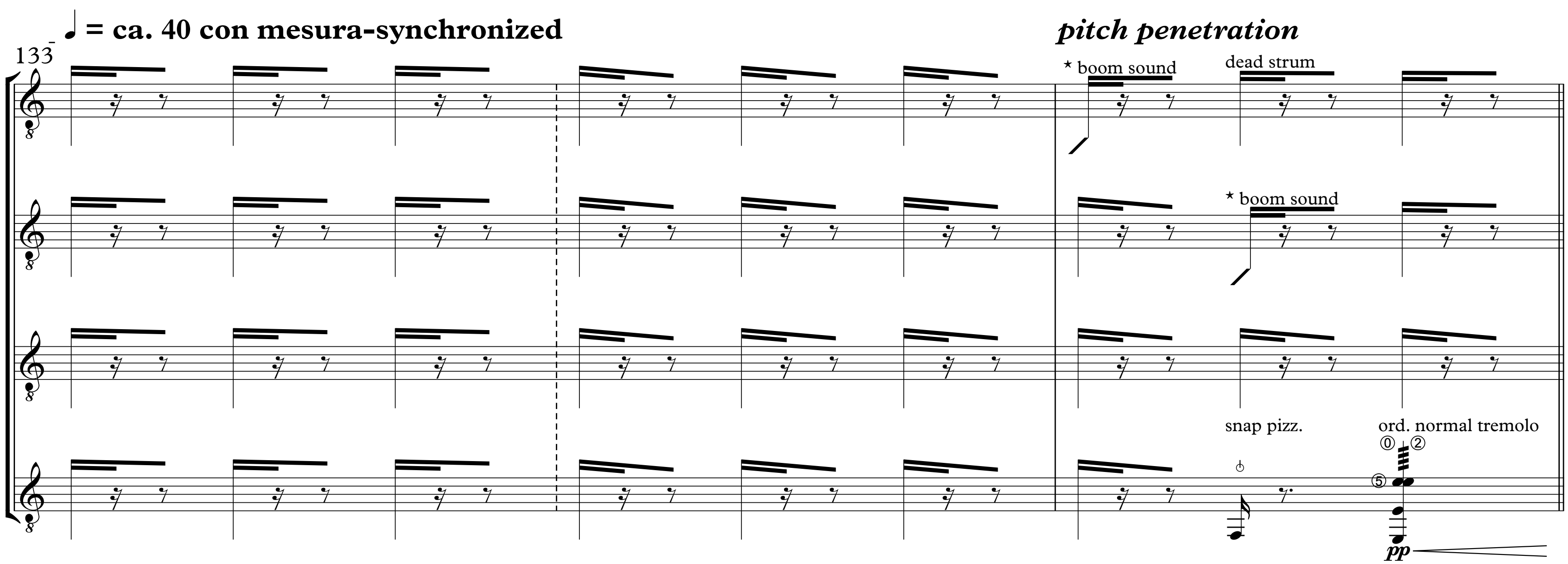


***loud whisper**: rapid strum with the skin of the palm
***Knock sound:** knock on the soundbox with knuckles.

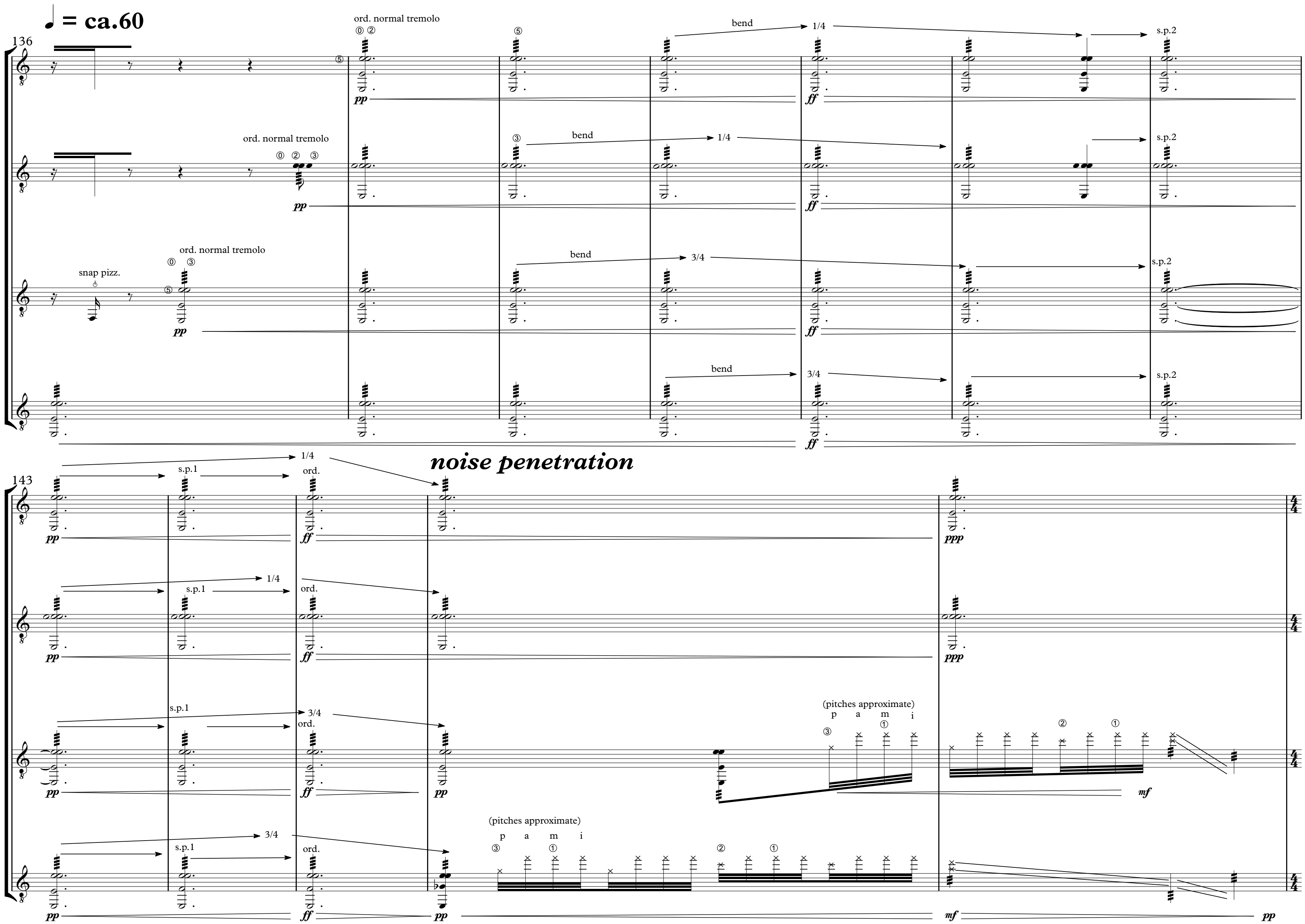

123
sim.
sim.
sim.
sim.
sim.


presto - senza misura - unsynchronized
127
sim.
sim.
sim.
sim.





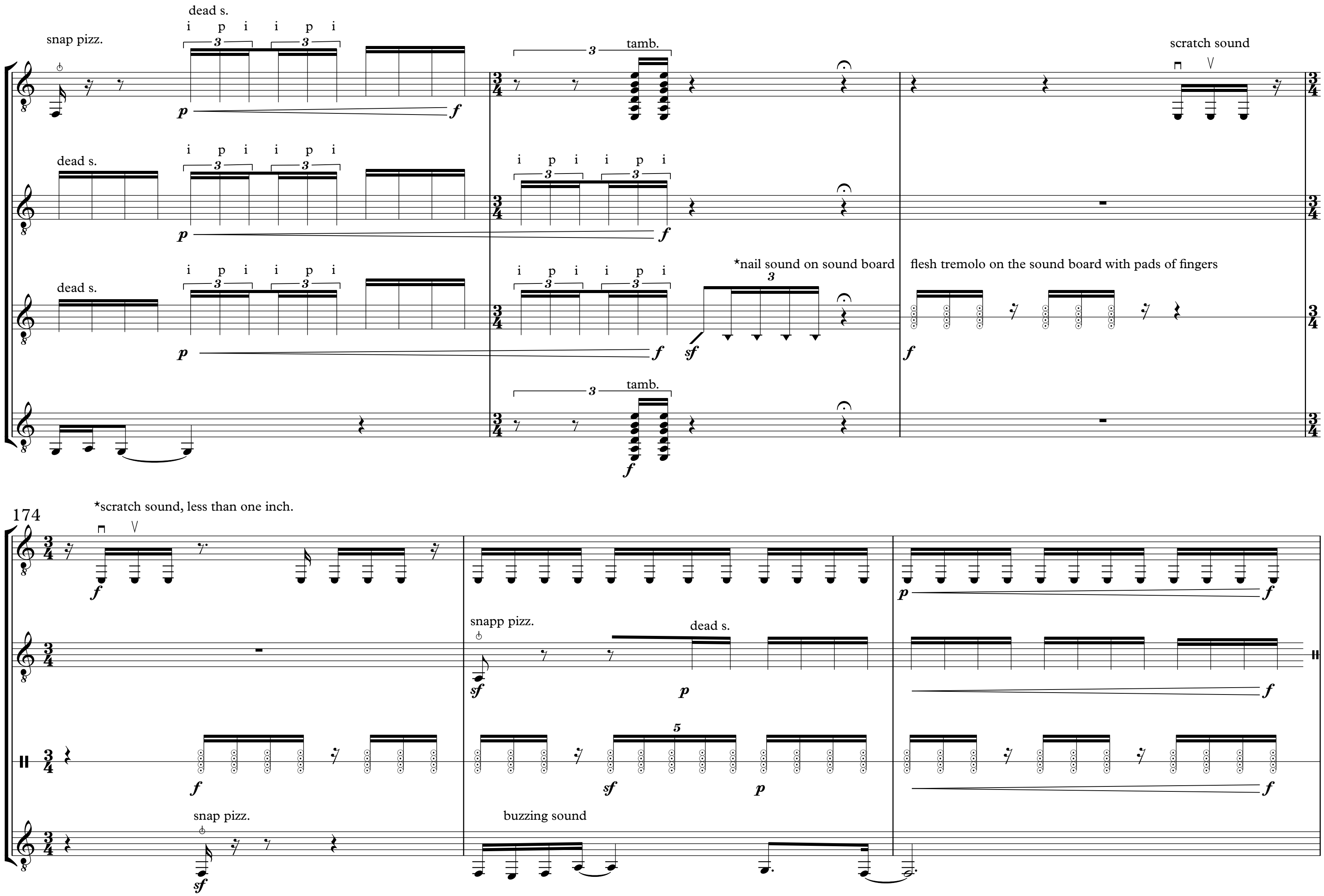
*boom sound: Hit the main soundbox with the flesh of the fingers of hand.


♩ = ca.60
136
ord. normal tremolo
bend
1/4
s.p.2
snap pizz.
3/4
143
s.p.1
ord.
noise penetration
(pitches approximate)
p a m i

148
1/4
s.p.1
pp
f
(pitches approximate)
p a m i
ord.
ppp
p a m i
ppp
mf
152
ord.
(pitches approximate)
p a m i
ppp
f
p

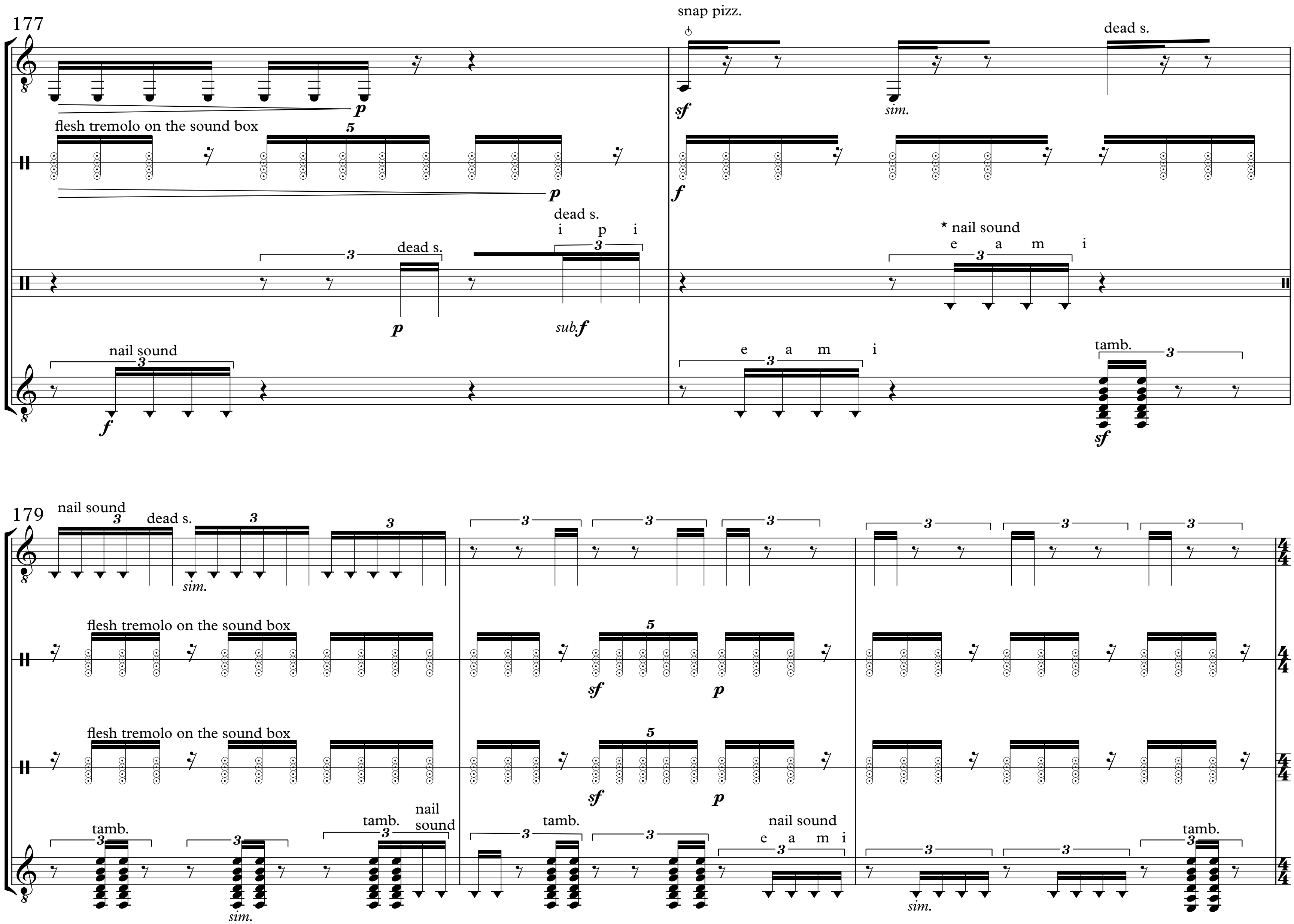

156
dead strum
i p i
3
= ca.100 - 110 Allegretto
n
dead strum
i p i
flesh tremolo on the sound board with pads of fingers
mf
f
5
sub.f
p
160
dead s.
i p
mf
sub.f
dead s.
sf
dead s.
i p i
sim.
dead s.
snap pizz.
sub.f
flesh tremolo on the sound box
boom sound
sf
n

***Buzzing sound:** Pull and hold the assigned string over the neck or the string next to it and make a buzzing sound.

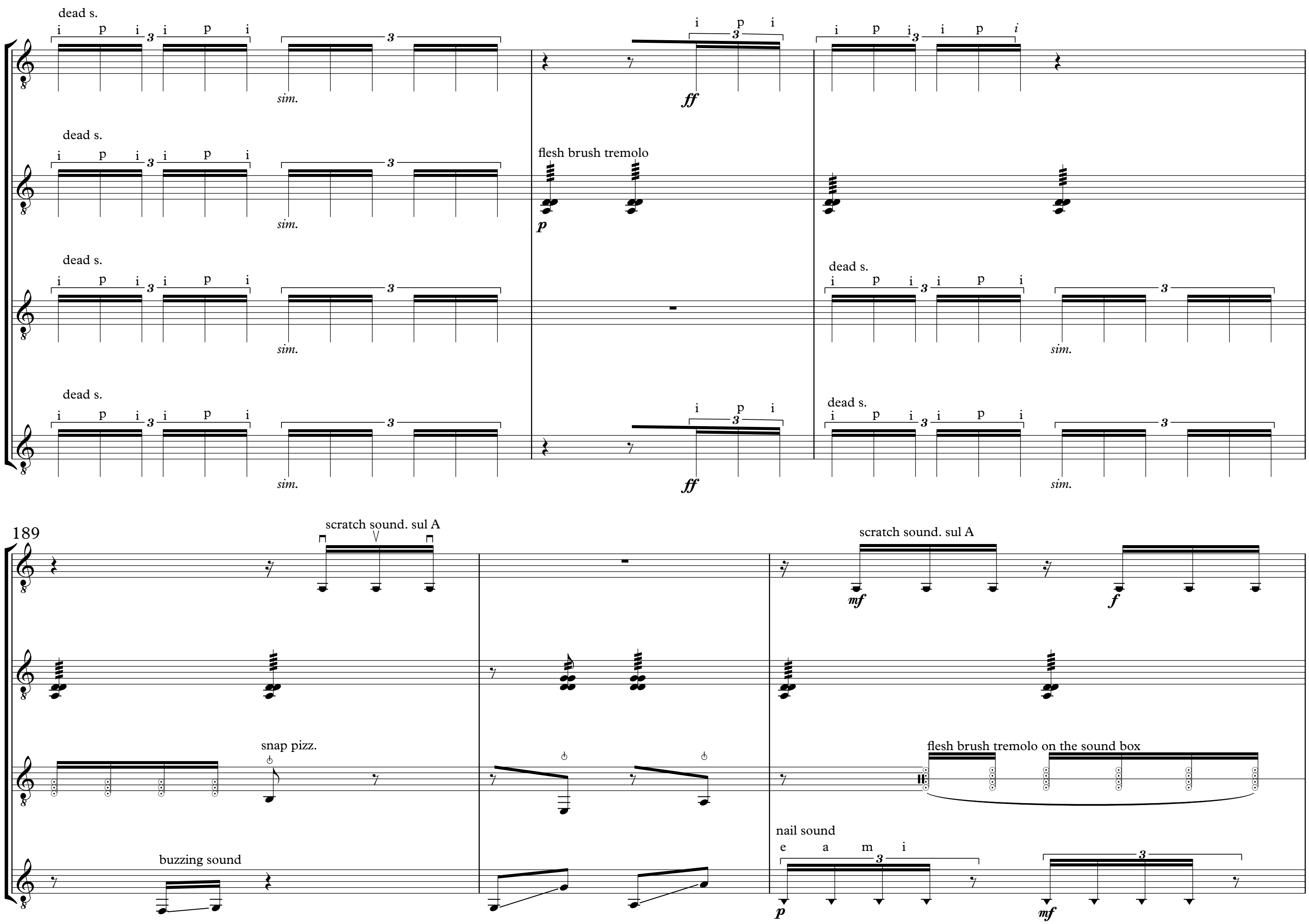


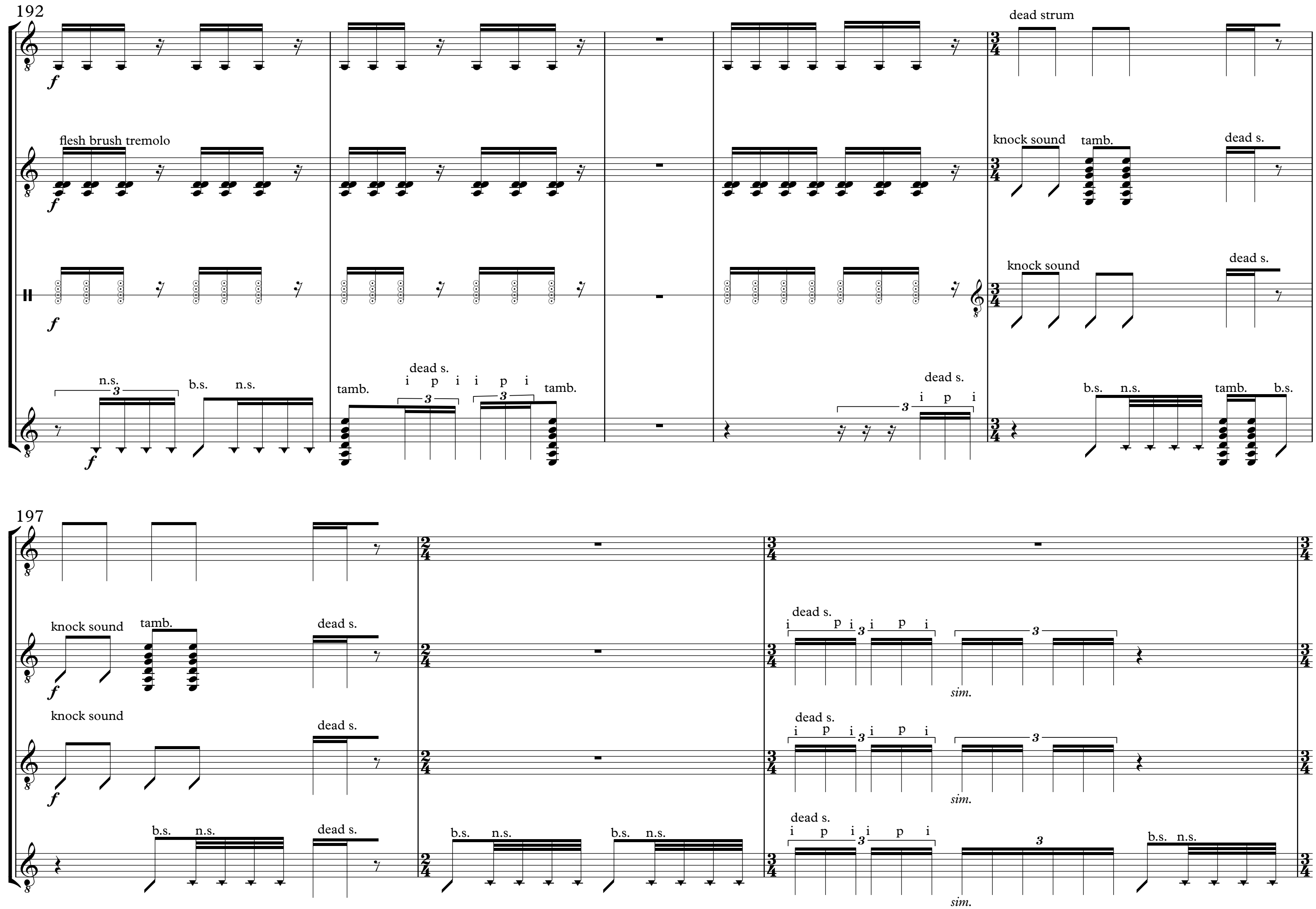
***Nail sound:** Flicker fist and hit the soundbox with nails as loud as possible.
***Scratch sound:** Scratch up and down in approx. 1-inch, or small if requested, diameter with a guitar pick**.**
***Boom sound and nail sound:** Upper bout with all finger and nails

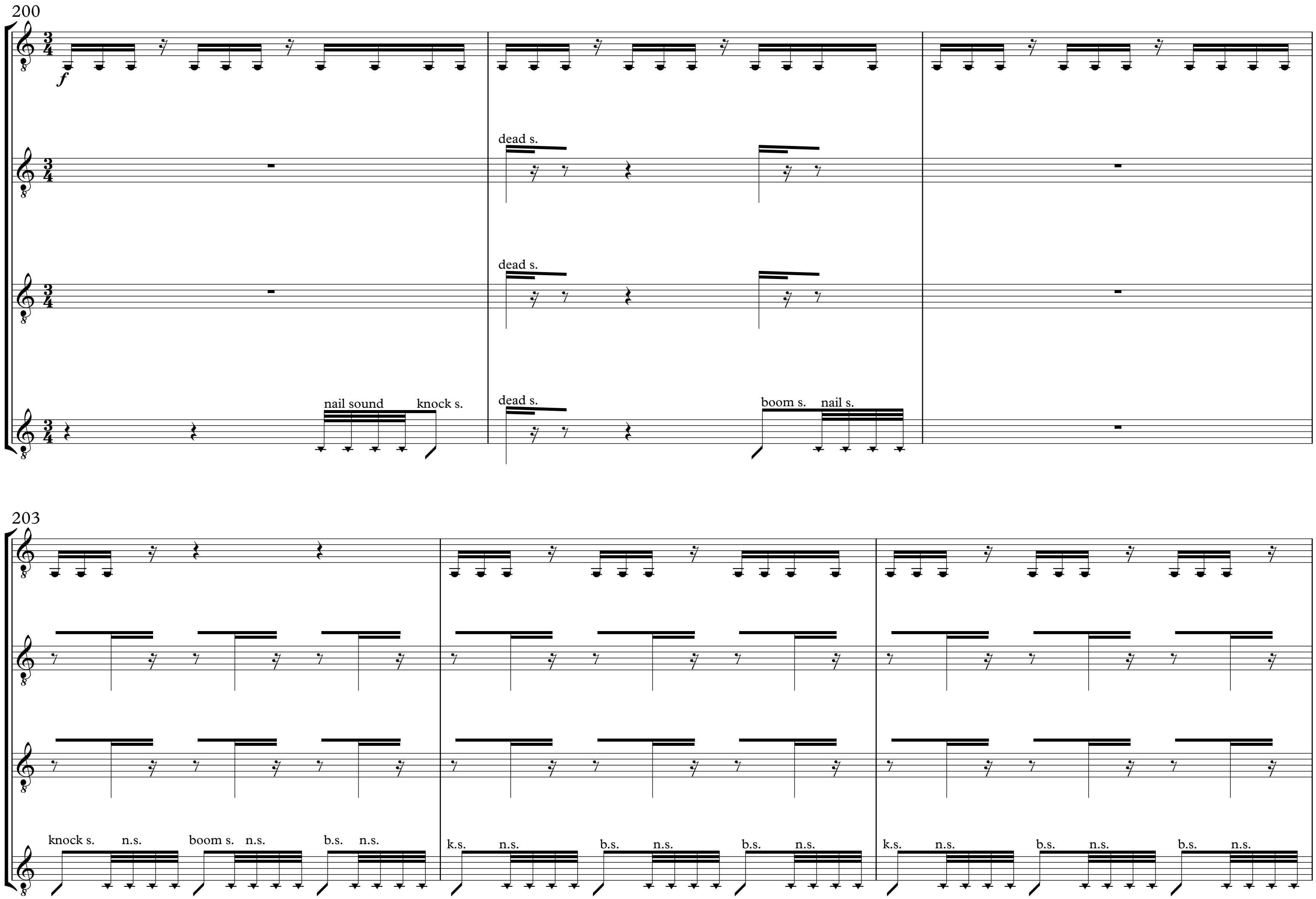
.


177
snap pizz.
dead s.
sim.
flesh tremolo on the sound box
5
dead s.
i p i
3
dead s.
sub.f
* nail sound
e a m i
nail sound
3
e a m i
tamb.
179
nail sound
dead s.
sim.
flesh tremolo on the sound box
flesh tremolo on the sound box
tamb.
nail sound
e a m i
sim.


182
dead s.
i p i i p i
ff
sim.
mute string and gliss
(pitches approximate)
p f
nail sound
e a m i P
knock sound
184
boom sound
flesh brush tremolo
f


dead s.
i p i i p i
sim.
ff
flesh brush tremolo
p
189
scratch sound. sul A
snap pizz.
buzzing sound
flesh brush tremolo on the sound box
nail sound
e a m i
mf
f

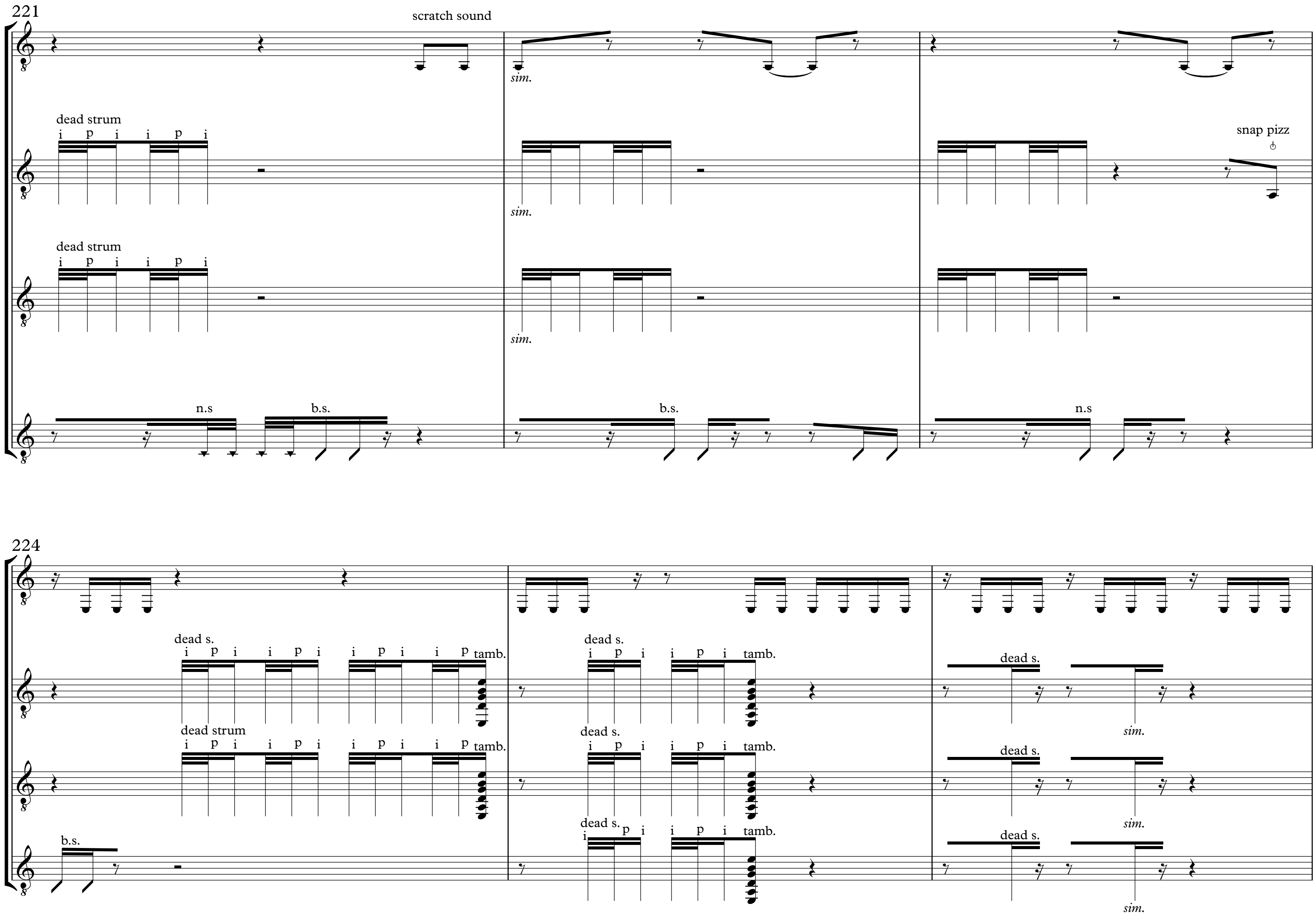

192
dead strum
flesh brush tremolo
knock sound
tamb.
dead s.
n.s.
b.s.
i p i i p i
197
sim.

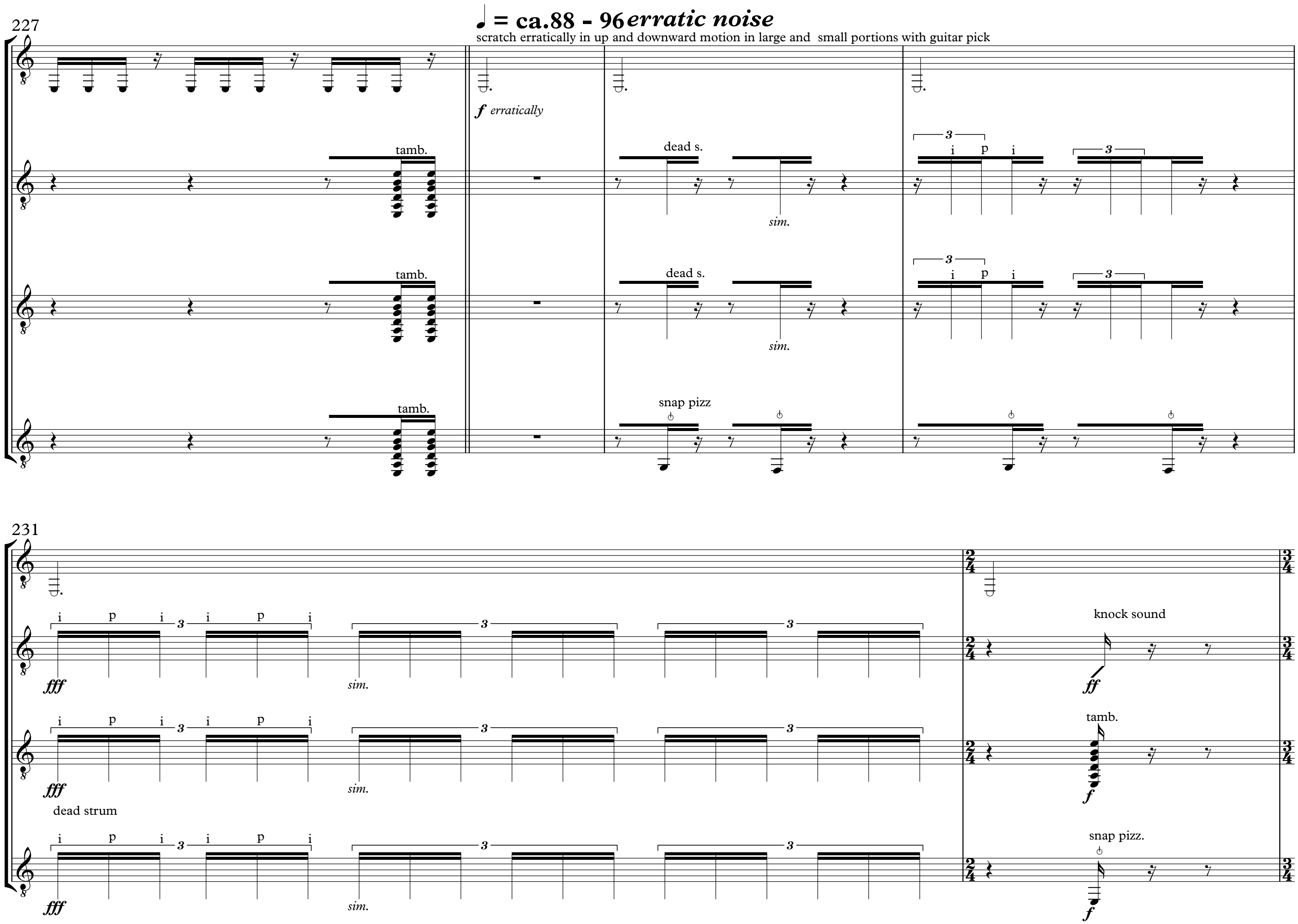

200
nail sound
knock s.
dead s.
dead s.
dead s.
boom s.
nail s.
203
knock s.
n.s.
boom s.
n.s.
b.s.
n.s.
k.s.
n.s.
b.s.
n.s.
b.s.
n.s.
k.s.
n.s.
b.s.
n.s.
b.s.
n.s.

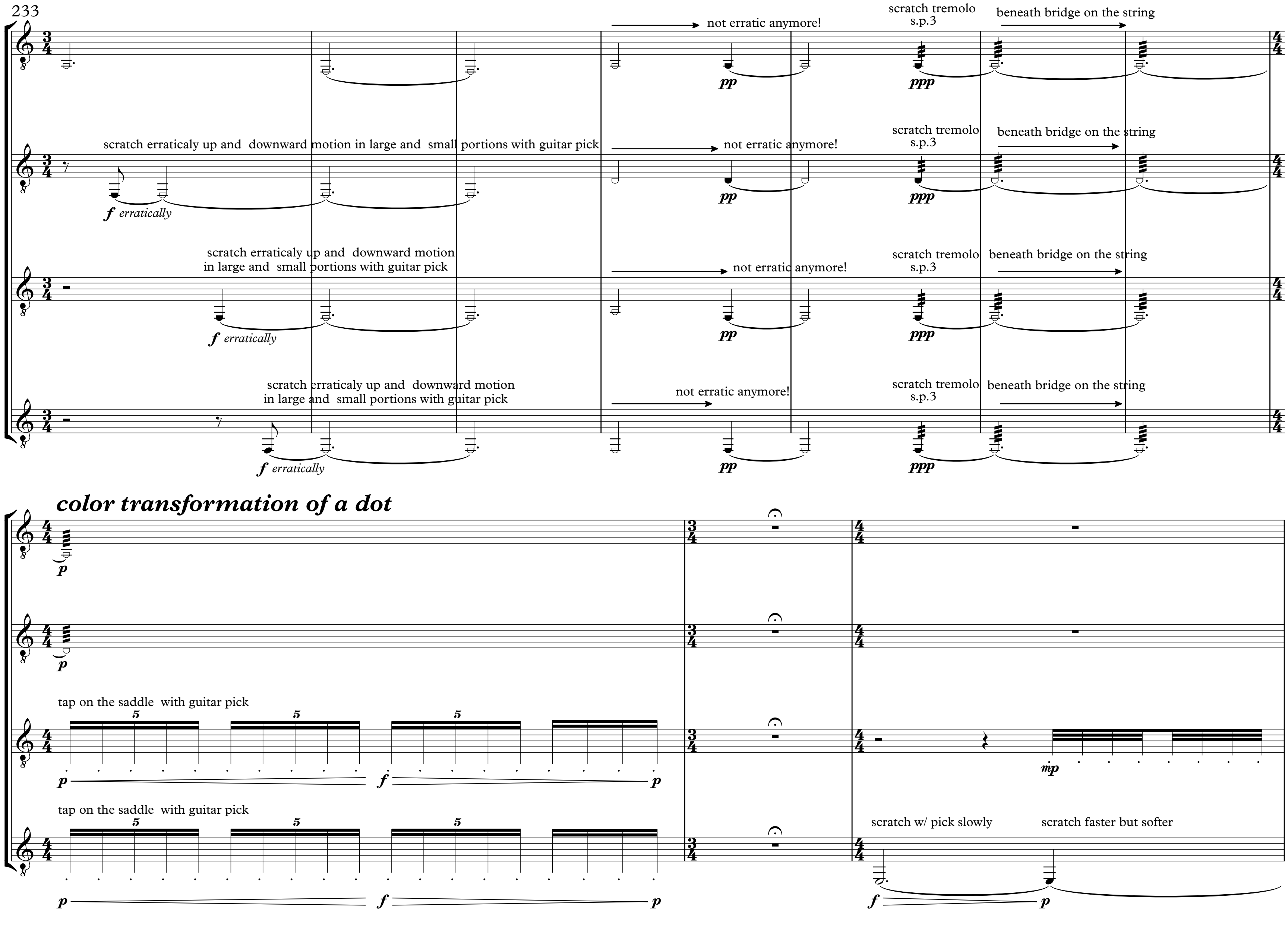
206
dead s.
i p i i p i
3
3
sim.
tamb.
n.s.
k.s.
209
e a m i p p
b.s.

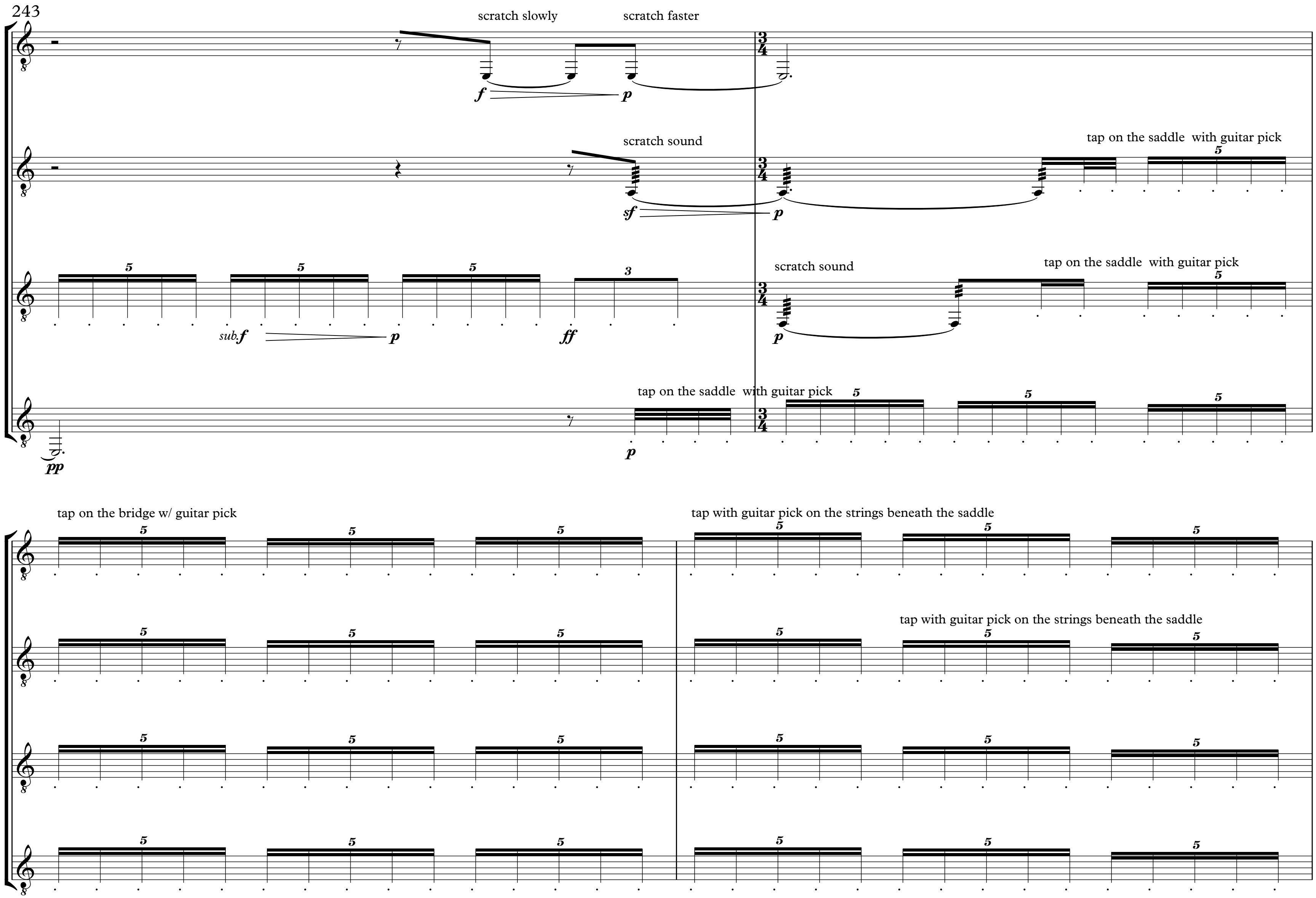

211
dead s.
sim.
i p i
3
tamb.
dead s.
tamb.
n.s.
k.s.
213
i p i

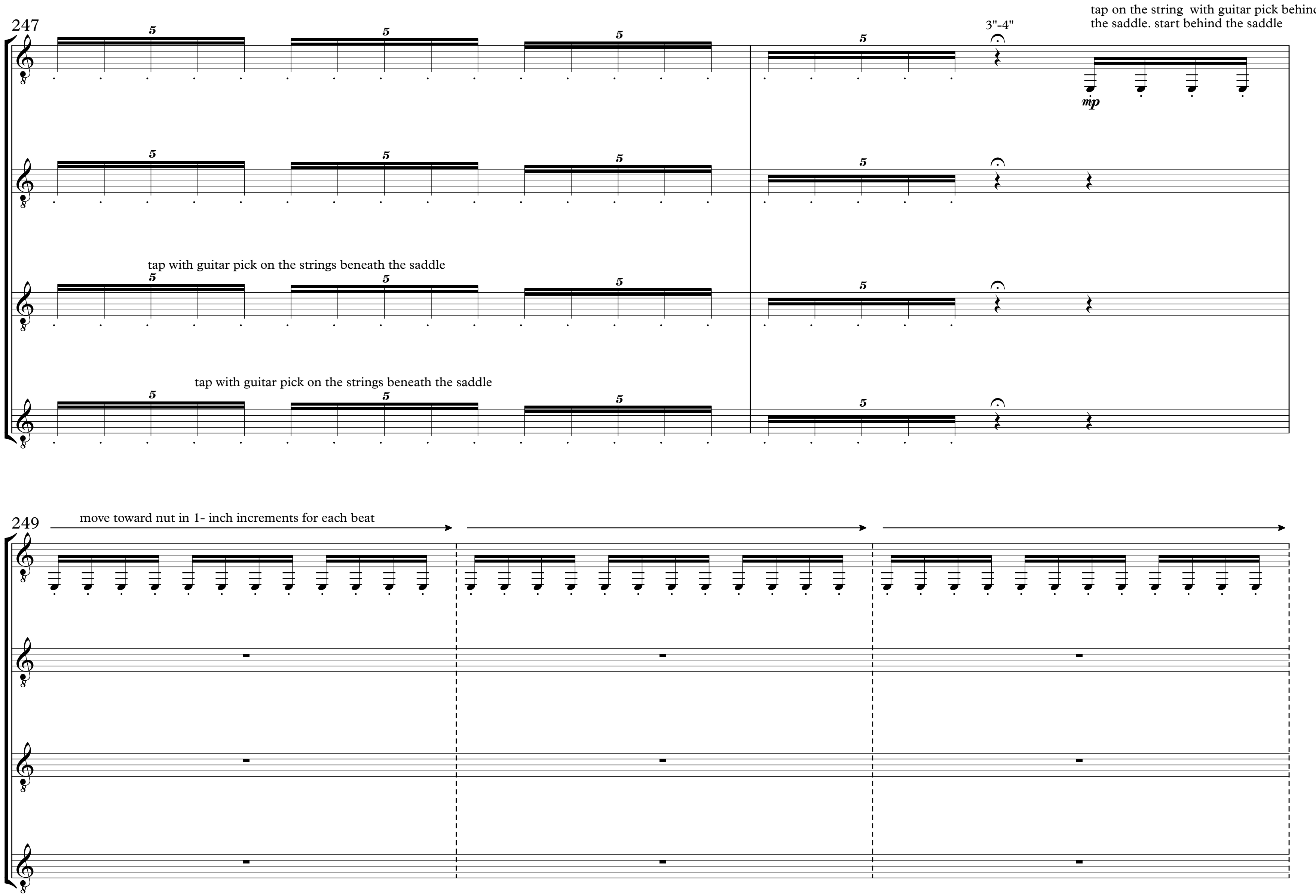

215
dead s.
tamb.
i p i i p i i p i
sim.
n.s.
scratch sound
p < f
snap pizz.
n.s
k.s.
b.s.

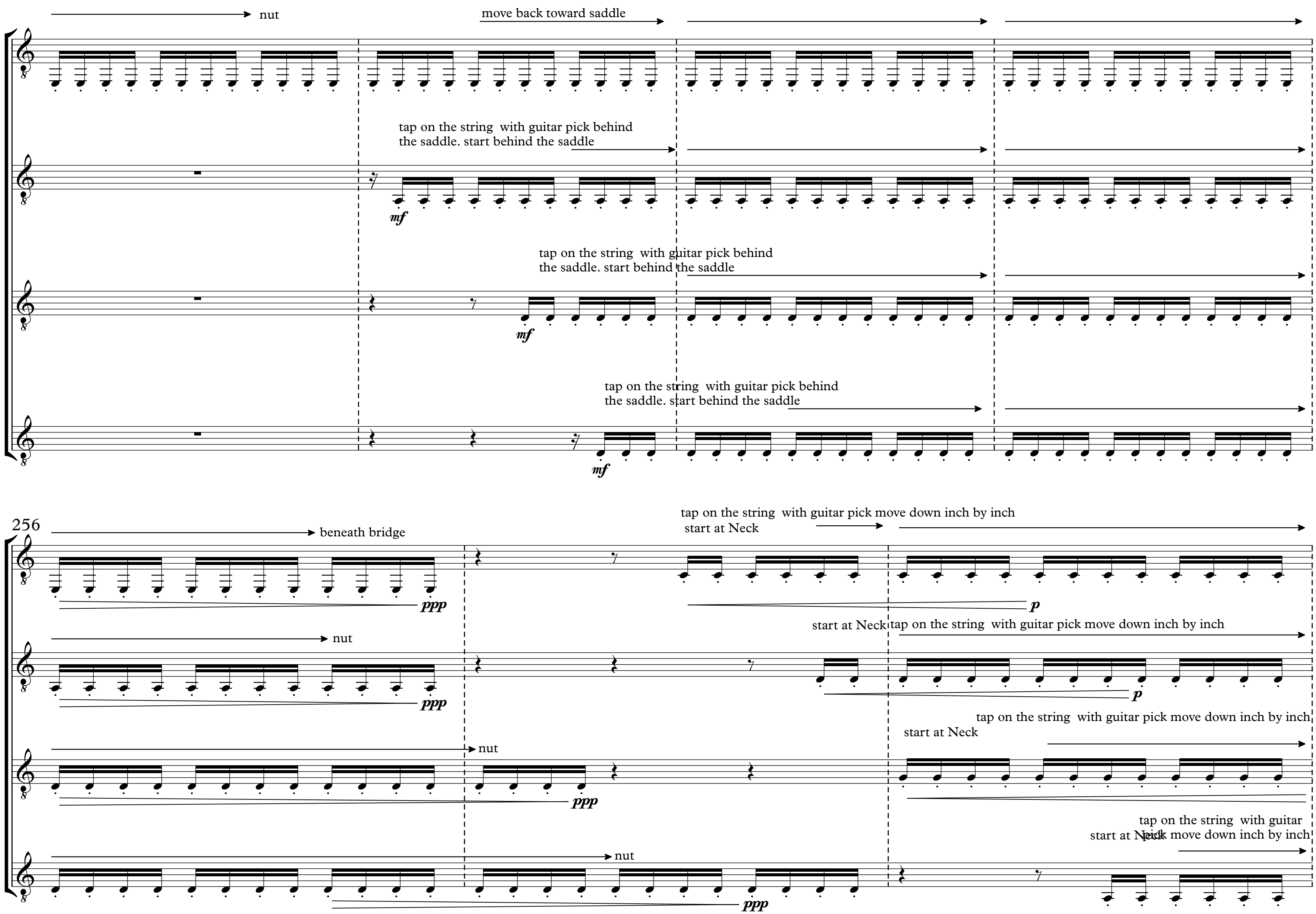

221
scratch sound
sim.
dead strum
i p i i p i
sim.
snap pizz
dead strum
i p i i p i
sim.
n.s
b.s.
b.s.
n.s
224
dead s.
i p i i p i i p i i p
tamb.
dead s.
i p i i p i
tamb.
dead s.
sim.
dead strum
i p i i p i i p i i p
tamb.
dead s.
i p i i p i
tamb.
dead s.
sim.
b.s.
dead s.
i p i i p i
tamb.
dead s.
sim.

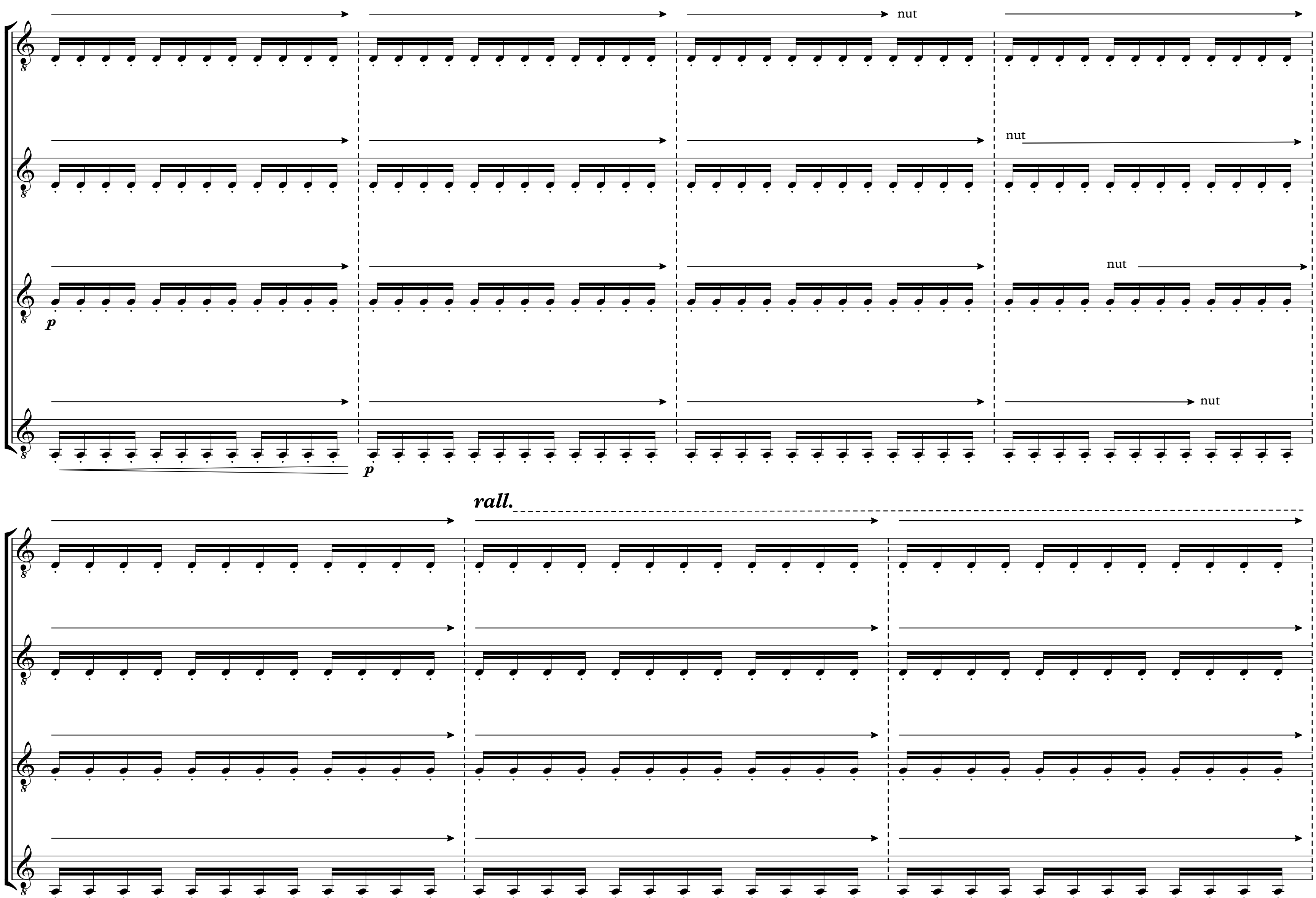

227
♩ = ca.88 - 96 erratic noise
scratch erratically in up and downward motion in large and small portions with guitar pick
f erratically
tamb.
dead s.
sim.
i p i
snap pizz
231
fff
sim.
dead strum
knock sound
ff
snap pizz.
f


233
not erratic anymore!
scratch tremolo
s.p.3
beneath bridge on the string
pp
ppp
scratch erraticaly up and downward motion in large and small portions with guitar pick
f erratically
not erratic anymore!
scratch tremolo
s.p.3
beneath bridge on the string
pp
ppp
scratch erraticaly up and downward motion
in large and small portions with guitar pick
f erratically
not erratic anymore!
scratch tremolo
s.p.3
beneath bridge on the string
pp
ppp
scratch erraticaly up and downward motion
in large and small portions with guitar pick
f erratically
not erratic anymore!
scratch tremolo
s.p.3
beneath bridge on the string
pp
ppp
color transformation of a dot
p
p
tap on the saddle with guitar pick
p
f
p
mp
tap on the saddle with guitar pick
p
f
p
scratch w/ pick slowly
scratch faster but softer
f
p


243
scratch slowly
scratch faster
scratch sound
tap on the saddle with guitar pick
scratch sound
tap on the saddle with guitar pick
tap on the saddle with guitar pick
sub.
tap on the bridge w/ guitar pick
tap with guitar pick on the strings beneath the saddle
tap with guitar pick on the strings beneath the saddle

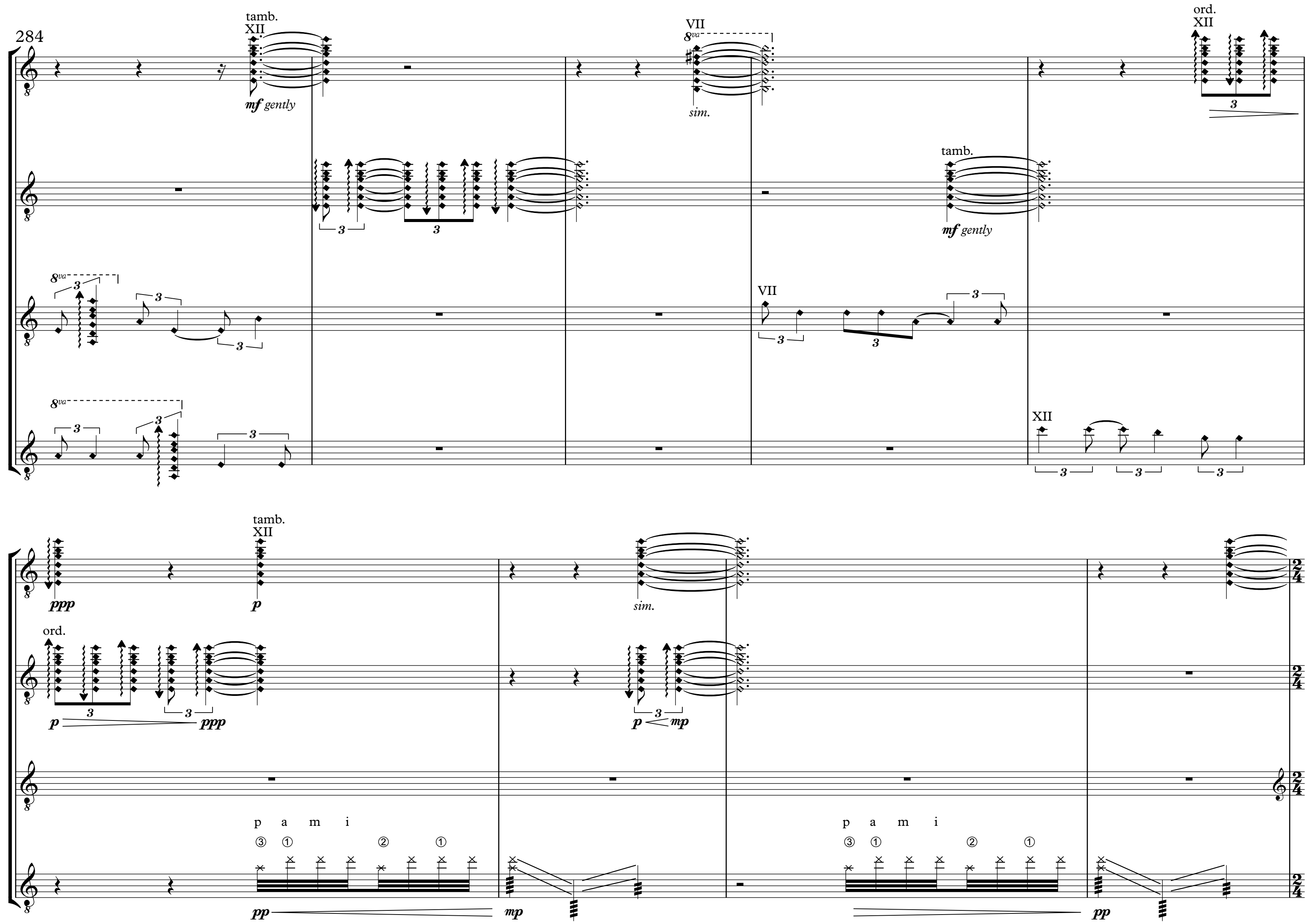

247
5
3"-4"
tap on the string with guitar pick behind
the saddle. start behind the saddle
mp
tap with guitar pick on the strings beneath the saddle
tap with guitar pick on the strings beneath the saddle
249
move toward nut in 1- inch increments for each beat

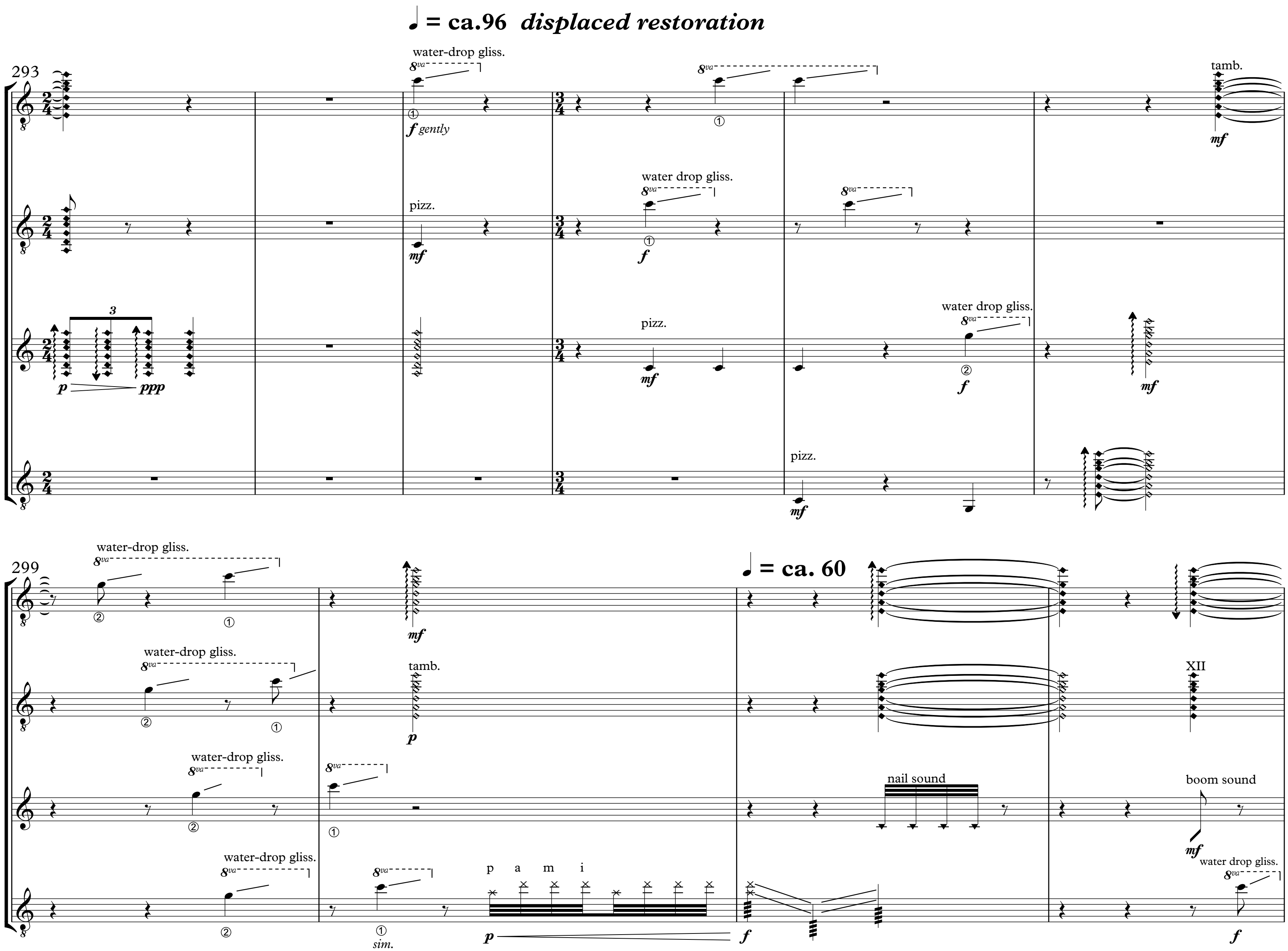

nut
move back toward saddle
tap on the string with guitar pick behind
the saddle. start behind the saddle
mf
tap on the string with guitar pick behind
the saddle. start behind the saddle
mf
tap on the string with guitar pick behind
the saddle. start behind the saddle
mf
256
beneath bridge
ppp
tap on the string with guitar pick move down inch by inch
start at Neck
p
nut
ppp
start at Neck
tap on the string with guitar pick move down inch by inch
p
nut
ppp
tap on the string with guitar pick move down inch by inch
start at Neck
nut
ppp
tap on the string with guitar
pick move down inch by inch
start at Neck


nut
nut
nut
p
nut
p
rall.

luscious atmospheres
♩ = ca. 48
synchronized
Neck
ppp
XII
mf
synchronized
Neck
ppp
XII
synchronized
Neck
synchronized
Neck
269
mf
f
p
f
nut
ppp
XII
mf
p
f
nut
ppp
XII
mf


274
VII
V
tamb.
ord.
mf gently

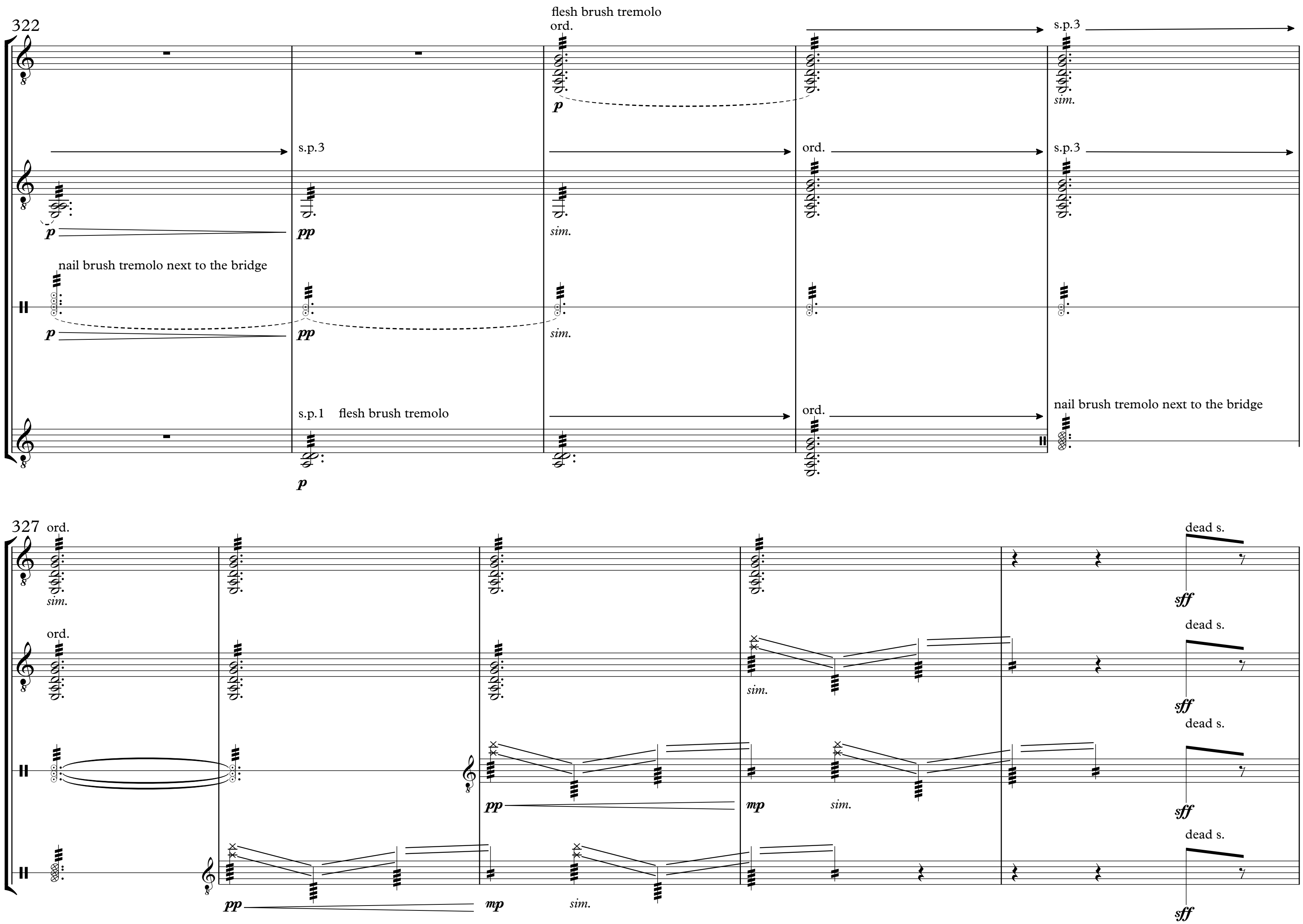

284
tamb.
XII
mf gently
VII
8va
sim.
ord.
tamb.
mf gently
VII
XII
ppp
p
ord.
ppp
mp
p a m i
③ ①
②
①
pp
mp
pp

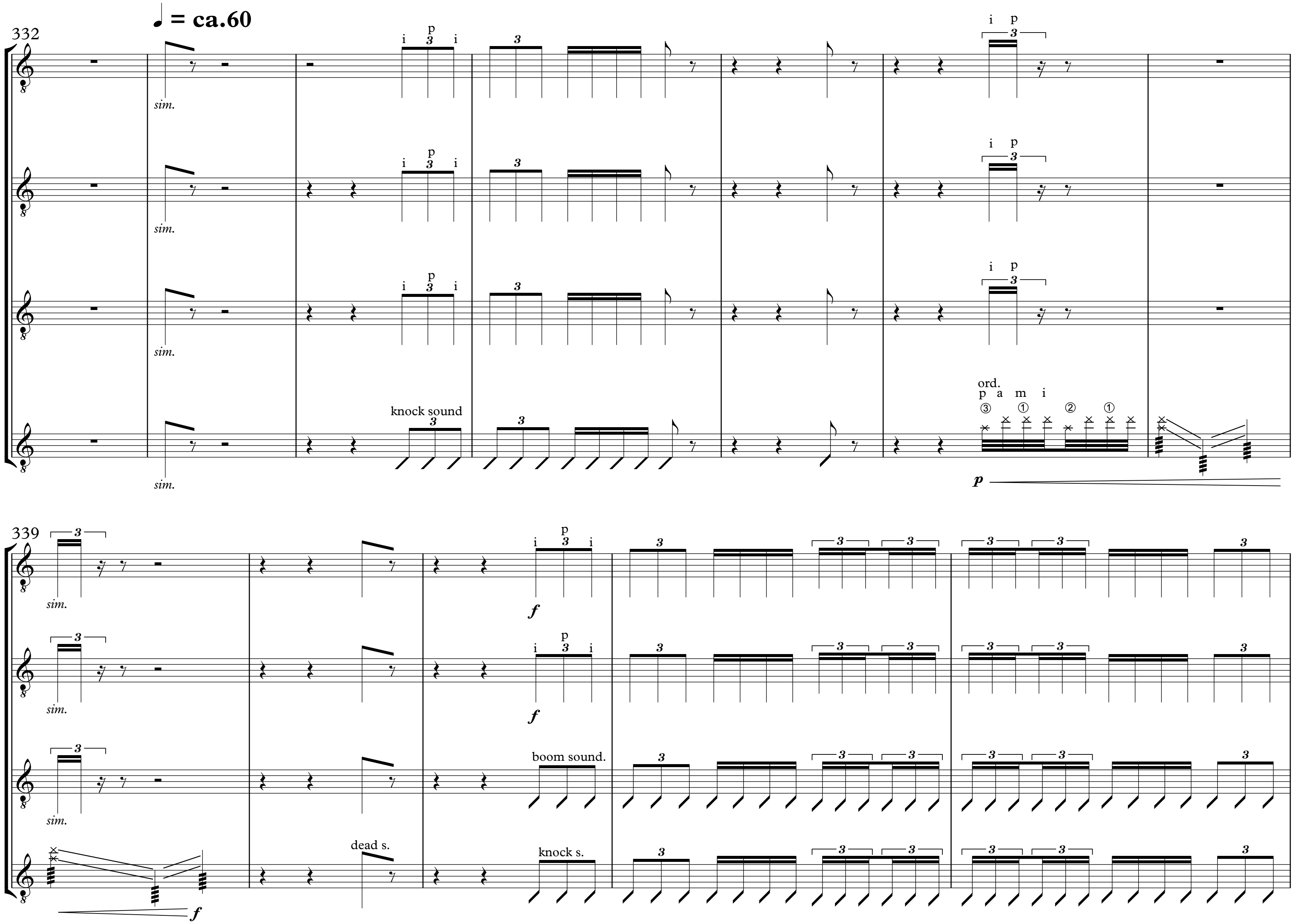


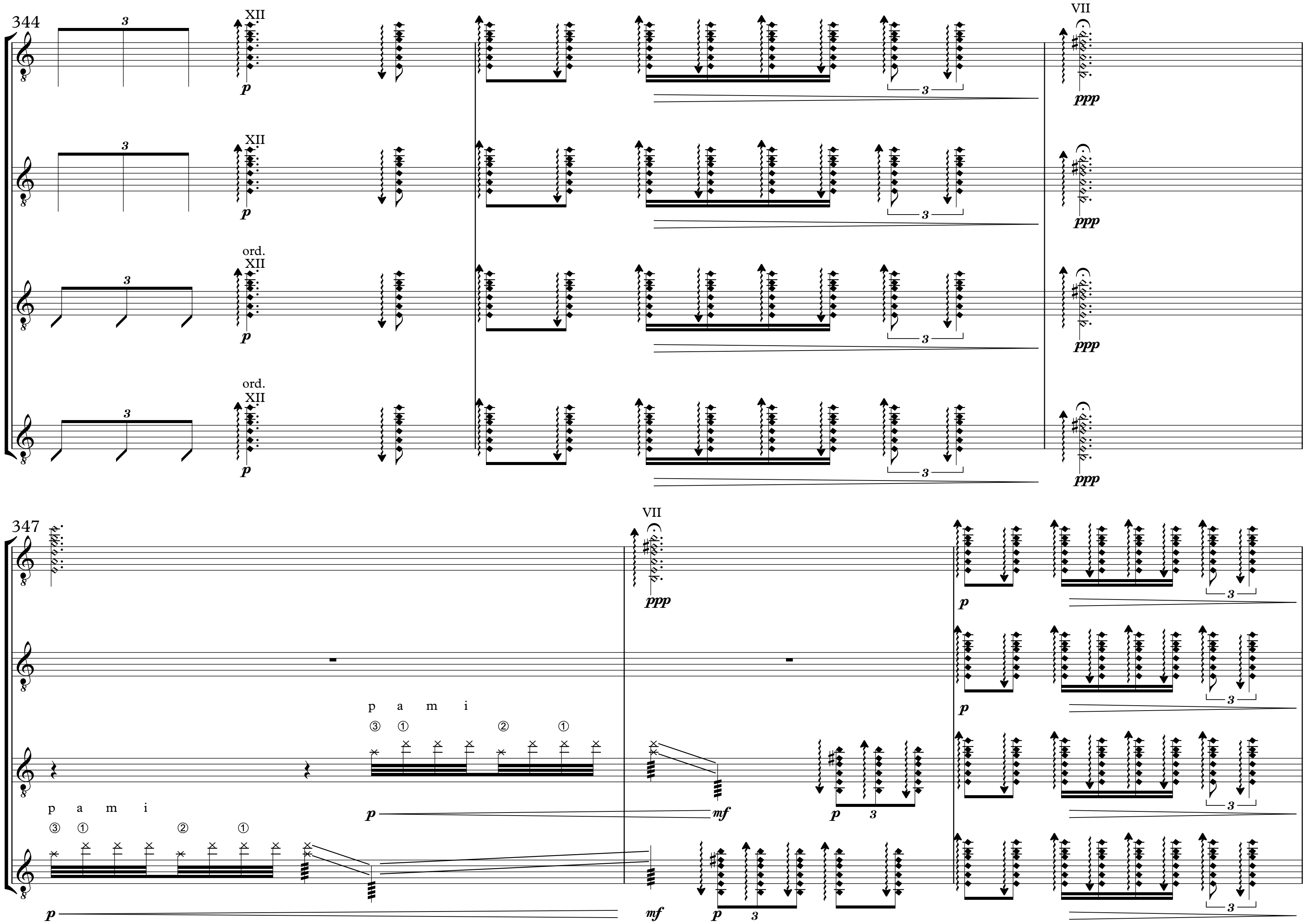
♩ = ca.96 displaced restoration
293
water-drop gliss.
8va
f gently
tamb.
mf
water drop gliss.
pizz.
mf
f
3
p
ppp
pizz.
water drop gliss.
pizz.
299
water-drop gliss.
♩ = ca. 60
tamb.
XII
nail sound
boom sound
p a m i
sim.
water drop gliss.

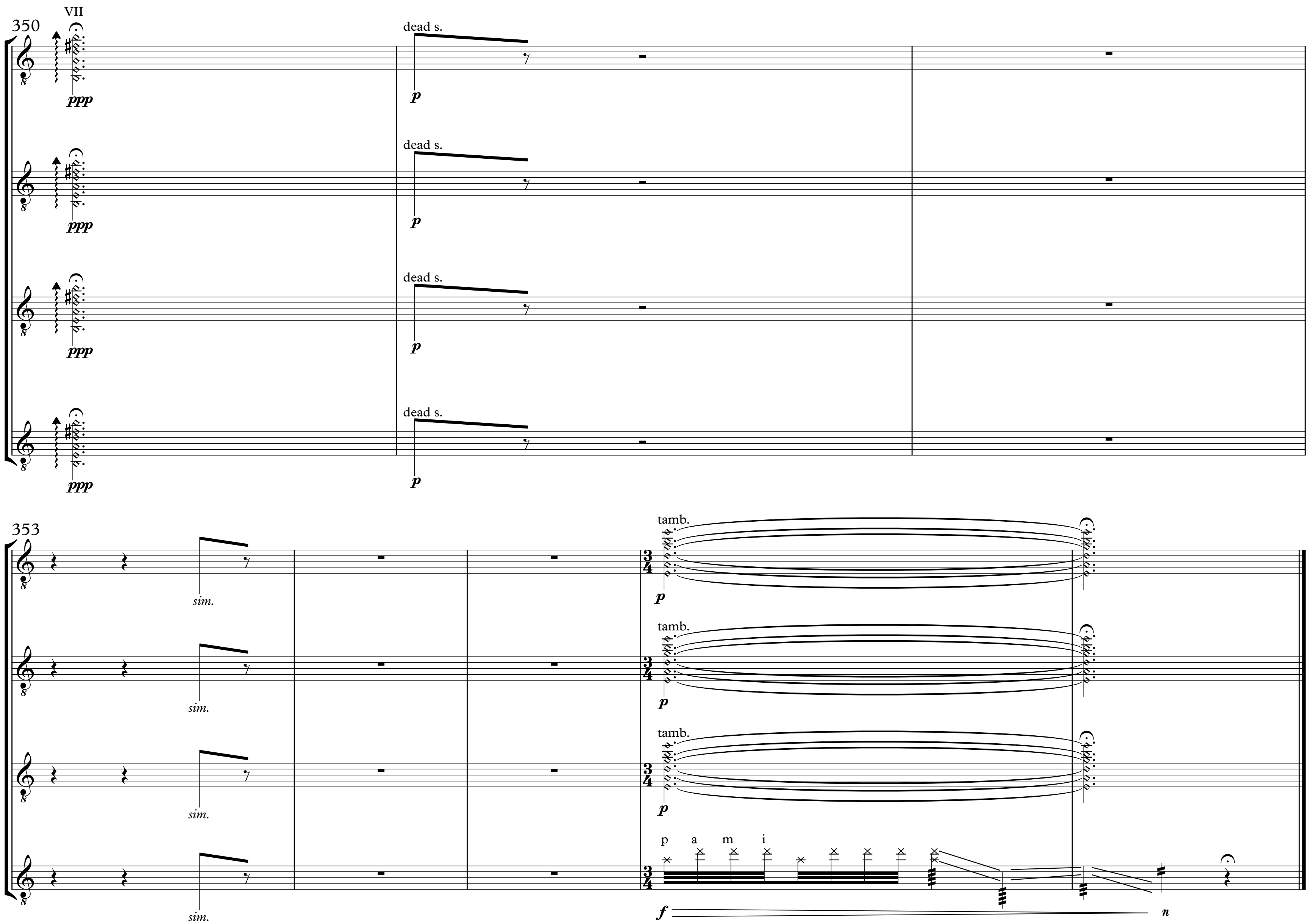

303
boom sound
nail sound
flesh brush tremolo on the sound box
water-drop gliss.
p a m i
sim.
307
dead s.
tamb.
water-drop gliss.
scratch sound
nail sound
flesh brush tremolo on the sound box
sim.


311
water drop gliss.
8va
sim.
scratch sound
dead s.
nail sound
p a m i
315
ord.
tamb.
dead s.
snap pizz.
knock s.
= ca.96
flesh brush tremolo


322
flesh brush tremolo
ord.
s.p.3
s.p.3
ord.
s.p.3
p
pp
sim.
sim.
nail brush tremolo next to the bridge
p
pp
sim.
s.p.1 flesh brush tremolo
ord.
nail brush tremolo next to the bridge
p
327
ord.
sim.
dead s.
sff
ord.
sim.
dead s.
sff
pp
mp
sim.
dead s.
sff
pp
mp
sim.
dead s.
sff


332
♩ = ca.60
sim.
i p 3 i
3
i p 3
knock sound
ord.
p a m i
③ ① ② ①
p
339
sim.
f
boom sound.
dead s.
knock s.


344
XII
ord.
p
ppp
VII
347
p a m i
③ ① ② ①
mf


350
VII
ppp
dead s.
p
353
sim.
tamb.
p
p a m i
f
n

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