A TRANSFORMATIONAL-NETWORK APPROACH TO STRAVINSKY'S *DOUBLE CANON 'RAOUL DUFY IN MEMORIAM'* (1959) AND *FEU D'ARTIFICE* (*FIREWORKS*), OP. 4 (1908)

by

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CHAPTER I

INTRODUCTION

Scholars have applied a variety of analytical methods to Stravinsky's music with regard to form, harmonic structure, row-forms, superimposition, and scalar analysis. These methods focus on specific relationships or compositional processes. For example, scalar analysis relates to octatonicism, while row-forms apply to serialism. I find that transformation theory, unlike other analytical methods, reveals relationships between a single pitch and motivic material in a work.

Roger Graybill has applied transformation theory to excerpts from *Symphony of Psalms* (1930), *Orpheus* (1947), and *The Rake's Progress* (1947-51).[1] In this thesis, I implement transformation theory with *Double Canon 'Raoul Dufy in Memoriam'* (1959), a work from Stravinsky's late serialistic period, as well as *Feu d'artifice* (*Fireworks*), op. 4 (1908) from his early nationalistic period. In *Double Canon*, I find that the first row statement initiates the other rows through two axes of symmetry. In *Fireworks*, a single pitch, D♯, generates thematic and accompanimental motives through the intervallic relationships ±3, ±6, and ±1. In this thesis, I deploy transformation theory to show that single pitches in both *Double Canon* and *Fireworks* initiate each work's thematic material.

In Chapter II I survey methods used by scholars to analyze Stravinsky's music. In Chapter III I discuss Stravinsky's *Double Canon*. In Chapter IV I focus on *Fireworks*.In Chapter V I discuss the relevance of transformation theory in my analyses of Stravinsky's music.

[1] See Roger Graybill, "Intervallic Transformation and Closure in the Music of Stravinsky," *Theory and Practice* 14/15 (1989/1990).

CHAPTER II

AN OVERVIEW OF ANALYTICAL APPROACHES TO STRAVINSKY'S MUSIC

When speaking of creativity, Howard Gardner quoted Stravinsky saying, "What fascinated me most of all . . . was that the different rhythmic episodes were dictated by the fingers themselves . . . they are great inspirers and in contact with a musical instrument, often give birth to unconscious ideas which might otherwise never come to life."[2] Stravinsky's unconscious ideas inspired compositions that separated themselves from existing musical styles. Fascinated by Stravinsky's compositions, music scholars Edward T. Cone, Richard Taruskin, Gretchen Horlacher, Joseph N. Straus, Pieter van den Toorn, and Dmitri Tymoczko utilize a variety of theoretical methods to analyze Stravinsky's music. Cone and Horlacher focus their articles on form and compositional techniques while Straus directs his analyses to several musical parameters and rotational arrays. In contrast, Taruskin discusses Stravinsky's historical influences and octatonic collections. Van den Torn and Tymoczko further evaluate octatonicism as they argue their own scalar interpretations, segmentation, and polytonality. I will present a summary of these scholars' analyses that address form, harmonic structure, pitch-class sets, twelve-tone rows, superimposition, diatonic modal scales, and octatonicism, as well as Stravinsky's compositional influences.

I will begin with a discussion of Stravinsky's structural process that Cone describes in his 1962 article "Stravinsky: The Progress of a Method."[3] Based on his analyses of *Serenade in A* (1925) and *Symphony of Psalms* (1930), Cone reveals that many of Stravinsky's works navigate three phases: *stratification*, *interlock*, and *synthesis*.[4]

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[2] Howard Gardner, *Creating Minds: An Anatomy of Creativity As Seen Through the Lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Ghandi* (New York: 2011), 203.
[3] Edward T. Cone, "Stravinsky: The Progress of a Method," *Perspectives of New Music* 1, no. 1 (1962), 19.
[4] The first appearances of analytical specific terms are italicized.

Stratification refers to the "separation in musical space of ideas."[5] Interlock delays fulfillment of expectations, whereas synthesis is the unification of an entire formal section.[6] Along with these three phases, Cone posits two techniques: *bridge* and *divergence*. The bridge is an "area with a life of its own," though not necessarily a transition, while divergence is the division of a single layer into two or more.

Cone identifies what is distinctive about Stravinsky's music in "The Uses of Convention: Stravinsky and His Models" by comparing Stravinsky's compositional practices to Haydn, Beethoven, and Schoenberg.[7] For example, Haydn uses contrasting dynamics to create surprise, whereas Stravinsky uses harmonic deception. An example of this is found in "Moderato alla breve" from *Symphony in C* (1938-40). Stravinsky follows the traditional sonata form just as Beethoven did in his 5th symphony; however, Stravinsky quotes Beethoven's famous motive on $\hat{7}$ rather than $\hat{5}$.

Stravinsky also modifies the twelve-tone system by using "three time-blocks" rather than twelve-tone aggregates.[8] In *Movements for Piano and Orchestra* (1958-59), Stravinsky disregards the convention of twelve unrepeated pitches within a row as Schoenberg practiced. Instead, Stravinsky clusters octave-voiced pitches into block chords and repeats pitch classes within a row.

Like Cone, Horlacher also addresses specific formal techniques that Stravinsky uses in his music. In "Running in Place: Sketches and Superimposition in Stravinsky's Music," Horlacher explores superimposition as a compositional process in addition to repetition.[9] She suggests that Stravinsky made carbon copies of his manuscripts and inserted thematic excerpts into his scores. Horlacher transcribed drafts from *Symphony of Psalms* (1930) and concludes that fragments were "cut and paste" into a "sequentially

[5] Cone, 19.
[6] Within the article, the process of unifying is referred to as "unification."
[7] Edward T. Cone, "The Uses of Convention: Stravinsky and His Models," *The Musical Quarterly* 48, no. 3 (1962).
[8] Ibid., 298.
[9] Gretchen Horlacher, "Running in Place: Sketches and Superimposition in Stravinsky's Music," *Music Theory Spectrum* 23, no. 2 (2001), 199.

ordered passage."[10] Repeated motives, or *episodes*, participate in *collisions* in which seemingly unrelated episodes sound against one another by the variation of their entrances. Rests in between these entrances become shorter and eventually superimpose, or all episodes play simultaneously. Horlacher applies the idea of collisions to four episodes in which bassoon, low strings, and trumpet each have their own repeating motive. In episode 1, bassoon states a three-beat motive, followed by a two-beat rest, and concludes with a low strings ostinato motive. In episode 2, the bassoon and low strings imitate episode 1, but are only separated by one beat. During the course of the ostinato, the bassoon repeats its motive and a trumpet motive is introduced. Bassoon and trumpet separately superimpose with the low strings, but not with each other. In episode 3, bassoon and low strings begin on the same beat, with the trumpet entering a beat after the bassoon finishes its statement. In episode 4, the low strings precede the bassoon by one rest and the trumpet enters during the last beat of the bassoon's motive. Because of what Horlacher describes as the "compact entrances," she indicates that all three instrument-groups have superimposed.[11]

Horlacher refers to Cone's idea of stratification as well as *interpolation*, meaning to interject, and discusses how superimposition of layers "interact in an ordered series of episodes." [12] The author offers an excerpt from *Symphony in Three Movements* (1942-45), which contains interpolations consisting of two repeated episodes, a collision, and a new motive.

Horlacher's analysis of Stravinsky's works in terms of repetition and sequences is an approach that Joseph Straus asserts would also assist in a better understanding of Stravinsky's works. In his article "Three Stravinsky Analyses: *Petrushka*, Scene 1 (to Rehearsal No. 8); *The Rake's Progress*, Act III, Scene 3 ("In a Foolish Dream"); *Requiem Canticles*, 'Exaudi,'" Straus focuses on David Lewin's supposition that the purpose of

[10] Horlacher, 200.
[11] Horlacher's book *Building Blocks: Repetition and Continuity in the Music of Stravinsky* (2011) further elaborates Stravinsky's use of "cutting and pasting" as well as superimposition.
[12] Ibid., 198.

analysis is to hear a piece better.[13] Straus begins by clarifying the relationship between theory and analysis. He argues that the field of music theory consists of "theory-based analysis and analysis-oriented theory."[14] The reason we analyze any piece of music is to understand and hear how it is constructed. He believes that most analysis, whether presented at conferences or published in journals, is not just "pursued for its own sake."[15]

Straus promotes "analysis [as] a central scholarly activity" in the three works listed in the article's title. He focuses on several passages, 4-10 measures in length, and comments from nine different analytical points of view.[16] The musical parameters that he discusses include motives, melodies, harmonies, melodic contours, rhythm, and meter. Straus also includes passages he recomposed to enable the reader's perception of the previous parameters. Additionally, he provides analyses of scalar collections and their symmetries, as well as briefly summarizing the meaning and expression of each passage.[17]

With respect to mm. 1-3 of *Petrouchka*, Straus identifies P4 (05) as a motive. Found within A-D-E-G, P4s possess "interior whole-tones" (025/035). With D^6 as the tonal center, the preceding A^5 soars to A^6 and then descends to D^6. Straus adds that the melody is an arpeggiation of D-E-G-A with E and G as neighbors to D and A, respectively. This collection of pitches from the harmony forms the tetrachord (0257). He attributes this specific tetrachord to a portion of the circle of fifths in the following order: G-D-A-E with D and A as two central fifths. This portion is then reorganized as D-E-G-A so that D and A are on the outside to form a P5 with E and G one step away from D and A, respectively. Both the central and outer fifths display the symmetry within (0257).

[13] Joseph N. Straus, "Three Stravinsky Analyses: *Petrushka*, Scene 1 (to Rehearsal No. 8); *The Rake's Progress*, Act III, Scene 3 ("In a foolish dream"); *Requiem Canticles*, 'Exaudi,'" *Music Theory Online* 18, no. 4 (2012), [1].
[14] Ibid., [1].
[15] Ibid., [2].
[16] Each topic from the textual download preceding Straus' interactive analysis will be cited with "[ ]".
[17] I will present one analytical passage per work.

Straus recognizes that Stravinsky's choice of triple meter causes the melodic leaps to appear on the weak beats. When Straus recomposes the excerpt in a duple meter, melodic leaps land on strong beats.[18] Finally, in his discussion of meaning and expression, Straus claims that Stravinsky's use of oscillating harmonies represents the "buzz and movement of the crowd" at the three-day celebration before Ash Wednesday called Shrovetide.[19]

In the duet "In a Foolish Dream" from *The Rake's Progress* (mm. 4-7), Straus identifies the motive as D-C-B♭-A. The melodic D, however, includes the upper and lower neighbors E♭ and C, respectively. The accompaniment, G-minor and D-major chords, indicates two structural fifths: G-D and D-A.

Straus argues that the vocal melody does not fit in the $\frac{3}{8}$ meter because the three thirty-second notes do not fall on strong beats. The text, however, falls correctly on the anacrusis. Straus reconstructs the passage to $\frac{2}{8}$ and moves the three thirty-second notes to a pick-up measure, even though this procedure displaces the text.

In the final excerpt, "Exaudi" from *Requiem Canticles*, Straus shows that a rotational array is present.[20] The array includes two aggregates, each from two different series, played adjacent to each other and transposed. Straus discusses the texture as a combination of three contrasting fragments: 1) an unaccompanied aggregate found mostly in the harp, 2) an open-spaced, six-note vertical harmony, and 3) a short choral excerpt repeating the vertical harmony. Though the harp's and chorus's aggregates differ, they both relate to whole-tone collections. Of six pitches, the harp contains four from the whole-tone scale that includes C (WT0) and two from the whole-tone scale that begins on C♯ (WT1). In contrast, the chorus sings four pitches from WT1 and two from WT0.

[18] Straus also reconstructed this excerpt as a piano reduction free of oscillation and simplified rhythms.
[19] Straus, [2].
[20] For a detailed explanation of rotational arrays, see Straus' article "Stravinsky's 'Construction of Twelve Verticals,'" *Music Theory Spectrum* 21, no. 1 (1999), 43-73.

Straus explains Stravinsky's use of structural P4 and P5s in relation to tonality and centricity. Like *Petrouchka*, "Exaudi" contains a P4, B-E, "and [is] further elaborated [with] chromatic passing and neighbor notes" D and C♯ to form the tetrachord (0235).[21] Straus also displays T_{+2} of (0235) from B-C♯-D-E to C♯-D♯-E-F♯. His next topic, motive, focuses on the transposition of pitches E-C♯-D♯ in the vertical harmony of the harp and the vertical harmony of the chorus. Straus also describes the symmetry of the excerpt through the identification of two row aggregates: A♯-B-C-C♯-D-E and C♯-D♯-E-F-F♯-G, in the harp and presented as a vertical harmony, respectively.[22] He concluded that both aggregates were inversions about C♯ and E ($I_E^{C\#}$). In "Exaudi," Stravinsky adapts an excerpt of text from the Latin requiem mass to include with his music. Straus notes that Stravinsky's attention to detail, as in his use of slow melodies and open chordal harmonies, provides the expected somber tone.

Straus next focuses on rotational arrays in "Stravinsky's 'Construction of Twelve Verticals'" (1999), here through the applications of serial and transformation theory. He claims that Stravinsky has three distinct ways of "writing serial harmony in chordal passages."[23] The first consists of three vertical tetrachords derived from one series (row). With block chords, Stravinsky hosts a complete series in one measure. The second way includes hexachordal arrays--each numerically labeled--that systematically rotate and transpose. For example, in *Requiem Canticles* he uses six arrays: one horizontal and five vertical. The third and final way Stravinsky writes serial harmony, according to Straus, is a four-block series that produces twelve vertical chords.[24]

Straus approaches Stravinsky's music theoretically; however, another important Stravinsky scholar, Richard Taruskin, in his article "Chez Petrouchka: Harmony and Tonality 'Chez' Stravinsky," also identifies historical influences for Stravinsky's

[21] Straus, "Tonality and Centricity."
[22] The harp melody is not scored in that pitch order, but Straus rearranged the pitches by octave displacement so that it may be compared with the vertical harmony.
[23] Joseph N. Straus, "Stravinsky's 'Construction of Twelve Verticals,'" *Music Theory Spectrum* 21, no. 1 (1999), 43.
[24] Ibid., 45.

compositional tendencies.[25] Taruskin discusses a "new branch of theory," this in reference to another scholar, Stephen Walsh, who credits this theory to van den Toorn, Berger, and others. Taruskin feels that to analyze Stravinsky's works, the new branch has to "deal with the nature of twentieth-century music," which is "not tonally functional."[26] Octatonicism has often been associated with Stravinsky's music, notably in writings by Taruskin and van den Toorn. Though both agree that octatonicism cannot consistently be applied to all works by Stravinsky, they have undertaken extensive analyses on select passages that use octatonic collections. Straus argued that, especially with regard to pitch content, these collections--Collection I beginning on C♯, Collection II on D, and Collection III on E♭--are "unordered, unregistered, [and] unrhythmicized."[27] Like Straus, Taruskin articulates that no one has incorporated chromaticism into their methodologies to explain pitches unrelated to the octatonic collections. Although he realizes that no octatonic scale can account for a work in its entirety, Taruskin praises van den Toorn's association with (0235) in the D-dorian scale and (037/047) with the C-major scale. Taruskin claims that both of van den Toorn's viewpoints highlights Stravinsky's progress from Nationalism to Neo-Classicism.

In his analysis, Taruskin approaches *Chez Petrouchka* (1910) within the context of common practice and "background theory," which draws on the legacy of Stravinsky's teacher, Rimsky-Korsakov.[28] Taruskin focuses on the Petrouchka chord, which Berger and van den Toorn view as octatonic. By labeling the chord octatonic, they refute polytonality because each pitch is accounted for in the scale. Taruskin supports van den Toorn's reference to Rimsky-Korsakov's works and teachings, which included octatonicism. Taruskin adds that Rimsky-Korsakov also used triadic octatonicism in his opera *Heaven and Earth* (1908). Because Stravinsky worked so closely with Rimsky-

[25]Richard Taruskin, "Chez Petrouchka: Harmony and Tonality 'Chez' Stravinsky," *19th-Century Music* 10, no. 3 (1987), 265.
[26] Ibid., 265.
[27] Ibid., 266.
[28] Ibid., 267.

Korsakov, it can be assumed that the student learned the octatonic system from the teacher and not from others, like Strauss or Ravel, who came from different periods and brought with them other cultural influences.[29] Taruskin concludes that *Chez Petrouchka* is based on a *complexe sonore* of (0369) from Collection III based on the compositional practice of Rimsky-Korsakov.[30]

Taruskin sheds light on another technique Stravinsky learned from his teacher: the simultaneous use of octatonic 1 and 2. Taruskin refers to Rimsky-Korsakov's opera *Sadko* (1896) in which the harmony follows octatonic 1 and the melody octatonic 2. Another Rimskian technique was the French sixth chord (048t) acting as a bridge between the octatonic collection and whole-tone scale, which contains symmetrical division of the octave (048).[31] Taruskin suggests that Stravinsky must have known the structure of *Sadko* well because the premiere of *Petrouchka* occurred around the same time Diaghilev performed *Sadko*.[32] Taruskin also stresses the impact that *Sheherazade* had on *Chez Petrouchka*, for Stravinsky had listened to it several times during his lessons as well as during the composition of it. *Sheherazade* contained several tritone relationships dispersed among different octaves; thereby he assumed that Stravinsky's tradition of octatonic symmetry (0369) reflects those lessons.[33] Taruskin further argues that Stravinsky's tritone relationships are not confined to vertical sonorities but to the "overall tonal coherence." The design of *Chez Petrouchka* outlines C-D-E-F♯, replicating *Sheherazade's* Shahriar *Leitmotif*.[34] The fanfare passage in *Sheherazade* contains a common-tone progression, or is "progressively redefined as root, third, seventh, and fifth." Taruskin indicates that this progression was "hammer[ed] away. . . [and] echoing in

[29] Taruskin, 268.
[30] *Complexe sonore* is an octatonic chord consisting of minor thirds.
[31] Ibid., 270.
[32] Serge Diaghilev (1872-1929) was a Russian impresario who developed the Ballets Russes in Paris.
[33] Ibid., 271.
[34] Ibid., 276.

Stravinsky's ear" when *Chez Petrouchka* was composed.[35] Taruskin points out that Stravinsky includes "three clarinet cadenzas. . . over a sustained harmony in the cellos."[36]

In conclusion, Taruskin states that Stravinsky used two keys simultaneously, both of which were not chosen at random, but carefully chosen to abide by the octatonic *complexe sonore*.[37] Pitches found in the Petrouchka chord, such as C and F♯, are meant to be heard as "competing centers, not merely as docile components of a single, static octatonically referable 'hyper-harmony.'"[38] Further, Taruskin agrees with the idea of superimposition, instead of the view that van den Toorn expressed of the "simultaneous unfolding of two keys." Taruskin reevaluates van den Toorn's notion that F♯-A♯-C♯ are triple leading-tones to G-major. Taruskin accepts this premise only if the triple leading-tones are associated with a C-major triad.[39]

Taruskin describes the key of *Chez Petrouchka* as collection III because it is the only collection containing both C and F♯, the competing tonal centers.[40] He makes clear that not every pitch in this piece is a part of collection III, but that there are plenty of "black keys" in Mozart's "Jupiter" Symphony, which fosters one idea that no single method can explain every distinct pitch in either work.

Although Berger, Tauruskin, and van den Toorn focus on octatonicism, Dmitri Tymoczko refutes it in his article "Stravinsky and the Octatonic: A Reconsideration."[41] According to Tymoczko, octatonicism has become the "single guiding idea" in analysis of *Petrouchka* (1910-11), *The Rite of Spring* (1911-13), and *Symphony of Psalms*.[42] Tymoczko claims that octatonicism results from modes within non-diatonic minor scales and from the superimposition of triads that belong to different scales. His evidence

[35] Taruskin, 274-5.
[36] Ibid., 276.
[37] Ibid., 278.
[38] Ibid., 283.
[39] Ibid., 284.
[40] Van den Toorn derived a specific octatonic scale from Collection III containing F♯ and C, in "Some Characteristics of Stravinsky's Diatonic Music" (1975). Collection I begins on E and Collection II on F.
[41] Dmitri Tymoczko, "Stravinsky and the Octatonic: A Reconsideration," *Music Theory Spectrum* 24, no. 1 (2002).
[42] Ibid., 69.

includes Stravinsky's "links . . . to the language of French Impressionism" and offers two contrasting views: to take notice of scales in analysis before their chordal superimpositions or to observe superimpositions before the scales they produce.[43] Tymoczko begins with the latter of the two views in Part I of his article.

According to Tymoczko, Stravinsky used four scales in his early works: diatonic, octatonic, whole-tone, and ascending melodic minor. Tymoczko claims that pc sets in Stravinsky's music are attributed to one or more of these scales. For example, what looks like a whole-tone scale in a passage of *Firebird*, Tymoczko interprets as an ascending melodic minor scale. The author also suggests that a C-melodic minor scale is present at rehearsal number 32 in *The Rite of Spring*.[44] He refers to this scale using the jazz theory label of "locrian ♯2" mode.

Tymoczko argues that the "Augurs of Spring" chord (E♭^{7}/F♭) is a "G♯-melodic minor scale and no others."[45] Though E♭^{7}/F♭ has been analyzed as E♭, G, B♭, D♭/F♭, A♭, C♭, enharmonically it becomes G♯, A♯, B, C♯, D♯, E, F×, the product of a G♯-melodic minor scale. He concludes that "any proper subset of the chromatic scale can be decomposed into octatonic and diatonic components."[46] Tymoczko further explains his reasons for attempting to assign scales to chords that seem polytonal in Part II of the article.

Tymoczko coins the term *polyscalarity* in an attempt to avoid polytonality, the controversial idea of the ability to hear two keys at once. Instead, he defines polyscalarity as "the simultaneous use of musical objects which clearly suggest different source-collections."[47] He claims that scholars either discuss polytonality or they avoid it and proceed toward a discussion of octatonicism. Tymoczko supports this claim by posing the

[43] Tymoczko suggests that Impressionists Debussy and Ravel were influential to Stravinsky. Both French composers commonly used whole-tone, octatonic, and melodic and harmonic scales in their music.
[44] Tymoczko refers to rehearsal numbers rather than measure numbers in this article.
[45] Tymoczko, 78.
[46] Ibid., 80.
[47] Ibid., 84.

question "is the Petrouchka chord polytonal or octatonic?"[48] Van den Toorn's idea that the Petrouchka chord is monoscalar yields two problems for Tymoczko: 1) Not all scales can conform to the octatonic scale, and 2) Stravinsky makes use of multiple scales at one time through superimposition. Tymoczko's opinion of the Petrouchka chord is a white-note/black-note superimposition. He claims that if the chord were octatonic, the G-major arpeggio, played simultaneously, would be unaccounted for. Also, through transformations of the polychord--CM/F♯M→GM/F♯M→Dm/F♯M→E♭M/Bm--not all would conform to the octatonic scale.[49] Both Dm/F♯M and E♭M/Bm produce hexatonic sonorities instead of octatonic because the scalar pattern "alternat[es] half-steps with minor thirds, instead of half-steps and major seconds."[50] Tymoczko concludes with the notion that superimposing any two major, minor, or diminished triads whose roots are separated by a minor third will yield a portion of the hexatonic or octatonic scale. He adds that superimposed triads--major, minor, diminished, or augmented--"will produce a subset of one of these seven scales:" diatonic, melodic minor, whole-tone, octatonic, harmonic minor, inversion of harmonic minor (harmonic major), and (014589) hexatonic.[51]

Tymoczko created a table of all of the scales used in the third movement of *Symphony of Psalms*. He concludes that of the 212 measures, 157 contain superimpositions, eighty-nine are diatonic, ninety-three are chromatic, twenty are possibly octatonic, and ten contain other types of scales. His evidence contradicts van den Toorn's argument that half of the movement (102 measures) makes use of octatonicism.[52]

Tymoczko summarizes that some of Stravinsky's major works are "less octatonic" than they are credited for being.[53] The author states: "we need to expand our ideas about

[48] Tymoczko, 85.
[49] In this context, "→" means the transposition from one polychord to another.
[50] Ibid., 86.
[51] Ibid., 89.
[52] Ibid., 96.
[53] Ibid., 96

Stravinsky's compositional methods" rather than describe Stravinsky's sense of unity as one "identifiable technique."[54]

In an attempt to defend his views, van den Toorn questions Tymoczko in their collaborative article "Colloquy: Stravinsky and the Octatonic 'The Sounds of Stravinsky.'"[55] In his portion of the article, van den Toorn expresses concern that Tymoczko rejects the method of octatonicism because he did not address certain details in his analysis--suggesting that he fails to elaborate on why he classified passages as octatonic or whole-tone. Van den Toorn implies that Tymoczko did not include the "messy details of priority, segmentation, and vocabulary" when he derived certain scales from selective passages.[56] Van den Toorn explains that Tymoczko's segmentation within these passages, based solely on rehearsal numbers in the score, are "not the endings and beginnings of different pieces, with the music organizing itself anew at each turn."[57] Van den Toorn asserts that "register, instrumentation, and chordal disposition are ignored as well" because there is no attention to the transposition of the octatonic scale in *The Rite of Spring*.[58] Van den Toorn highlights an example of transposition within the *Rite's* bassoon solo and disagrees with Tymoczko's view that it is a C-major scale. Van den Toorn argues that the fourth scale-degree, F, is missing from the passage, justifying the descending C-B-A motion, E-G-B triad, and the Dorian tetrachord (D-C-B-A).

Van den Toorn articulates a lack of referential evidence to allocate the "handful of rehearsal numbers" in the *Rite of Spring* and *Petrouchka* to French heritage or Debussy.[59] He also believes that such evidence would only coincide with select passages. Van den Toorn goes on to explain that the whole-tone scale has its roots in the early Russian

[54] Taruskin, 100-1.
[55] Pieter C van Den Toorn, and Dmitri Tymoczko, " Colloquy: Stravinsky and the Octatonic," *Music Theory Spectrum* 25, no. 1 (2003).
[56] Ibid., 167.
[57] Ibid., 169.
[58] Ibid., 168.
[59] Ibid., 178.

music of Glinka's opera *Russlan and Ludmilla* (1842). This work was composed before the French Impressionist composers began using the whole-tone scale.

Van den Toorn negates Tymoczko's use of "Locrian ♯2" in his argument that the term itself did not come into existence until the 1950s, after Stravinsky had composed the works Tymoczko described. His main criticism, though, is that Tymoczko did not elaborate on his choice of the term nor illustrate it with an example.

Van den Toorn accepts that *The Rite of Spring* may be unsystematic as a whole work, but that melodic and harmonic materials provide consistency throughout.[60] He agrees that he may have concentrated on octatonicism too much in Stravinsky's Neo-Classical works, but the method holds true to the works Stravinsky composed while he was in America in the 1940s.

In Tymoczko's response "Octatonicism Reconsidered Again," he addresses many of the criticisms raised by van den Toorn.[61] Tymoczko explains that Stravinsky derived modes from non-diatonic scales. In the "Infernal Dance" from *Firebird*, for example, the fourth mode that begins on A is included in the E-harmonic minor scale, instead of the octatonic scale with which van den Toorn identifies. Tymoczko further explains that harmonic-minor interpretation accounts for all pitches because the passage does not contain any notes that do not belong to the scale and that Stravinsky knew the harmonic-minor scale well and had examples from music by Debussy and Ravel that he could have studied.

In response to the discussion of Stravinsky's use of scales, Tymoczko proposes the phrase *scalar transposition*, more specific to non-diatonic modes, rather than speaking of limited diatonic transposition. Tymoczko considers passages of Stravinsky's music to be non-diatonic because Stravinsky commonly omits one or more pitches. Tymoczko refers to this omission as a "subtle musical pun."[62] Also characteristic of

[60] Van den Toorn, and Tymoczko, 185.
[61] Ibid., 185.
[62] Ibid., 191.

Stravinsky's music are his octave displacements, which make it difficult to hear clearly a scalar passage in a score. Tymoczko offers as an example a passage from *The Rite of Spring* in which the moving eighth and sixteenth-notes are in A-natural minor while the bass has a stepwise chromatic scale with octave displacement.

Tymoczko's second major point refers to polytonality and the superimposition of scales. He believes that van den Toorn accepts the fact that Stravinsky used "more than one scale at one time," but rejects the idea that Stravinsky used more than a select few from combinations of octatonicism and diatonicism. Tymoczko feels this idea is very limited and argues that Stravinsky used superimpositions of chromatic, whole-tone, pentatonic, and non-diatonic minor scales.[63]

Tymoczko's final point, which includes a *quasi-Schenkerian* approach, shows the "relative priority of scales and superimpositions." Forty-four measures from the third movement of *Symphony of Psalms* show C-natural minor superimposed with a "series of three major triads [ascending] by a whole step."[64]

In his conclusion Tymoczko addresses van den Toorn's claim that Stravinsky's use of the whole-tone scale derives from Glinka. He notes that Glinka used the scale melodically, while Debussy applied it harmonically, as does Stravinsky. Tymoczko also believes that polytonality should be a term attached to Stravinsky, as "many. . . believed Stravinsky to be the inventor of the technique."[65]

Tymoczko ends with a passage that stresses the differing viewpoints he and van den Toorn share in their approaches to Stravinsky's music:[66]

> But it is also possible to let the historical issues influence our choice of analytical procedures. Van den Toorn's Stravinsky is a composer largely concerned with his own idiosyncratic musical technique, engaged in a cryptic process of octatonic-diatonic synthesis, a process that remained almost completely misunderstood until van den Toorn decoded it. My Stravinsky is a much less complicated figure, a composer whose techniques are directly manifested on the surface of his music. This may mean that I am, in the end, a less original and sophisticated analyst than

[63] Van den Toorn, and Tymoczko, 196.
[64] Ibid., 196.
[65] Ibid., 199.
[66] Ibid., 200.

> van den Toorn. But it also means that my Stravinsky is much closer to the one that had such a profound influence on the history of twentieth-century music.

Several scholars have crafted methodologies in their analyses of Stravinsky's music. Major works, such as *Petrouchka*, *The Rite of Spring*, *Firebird*, and *Symphony of Psalms* have been and will continue to be analyzed. No single method can completely accommodate Stravinsky's repertoire because of his multifaceted compositional style. Scholars will continue to argue their own opinions based on their differing segmentations, how they perceive it aurally, and what techniques Stravinsky assimilated from his studies with Rimsky-Korsakov or from the friendships he had with other composers.

CHAPTER III

ANALYSIS OF *DOUBLE CANON 'RAOUL DUFY IN MEMORIAM'* (1959)

In 1959, Stravinsky received an inquiry from Marcelle Oury, editor of *Raoul Dufy: Lettre A Mon Peintre* (1965), asking Stravinsky's impression of Dufy.[67] To represent "Dufy's love of music," she wanted to commission a piece from Stravinsky to include in the book.[68] Around this time, Stravinsky sketched a duet for flute and clarinet "in response to a private request for an autograph," which he later expanded into a double canon for string quartet.[69] There is no evidence to suggest that Stravinsky ever replied to Oury, though the *Double Canon 'Raoul Dufy in Memoriam*,' published in November 1959, was his answer.[70]

The theme of Stravinsky's *Double Canon* is based on a twelve-tone row. Violins I and II enter canonically on two different row forms, P_6 and P_4, respectively. Viola and cello also enter canonically on yet another two respective row forms, R_6 and R_8. Thereby, the two pairs of instruments form a double canon. "The canon is also 'double' [because] Stravinsky's row choices are . . . related by ic2: both +2 and -2," which will be explained later in this chapter.[71] Douw (1998) identifies row forms based on circles of fifths and semitones, revealing relationships to a hypothetical source row.[72] While Douw discusses Stravinsky's choice of rows, I reveal relationships among those row forms and groups of

[67] Raoul Dufy (1887-1953) was a French Fauvist painter.
[68] Stephen Walsh, *The Second Exile: France and America, 1934-1971, Volume 2*. (California: University of California Press, 2008), p. 413.
[69] Eric Walter White, *Stravinsky: The Composer and His Works*. (California: University of California Press, 1979), pp. 509-10.
[70] Although Stravinsky wrote *Double Canon "In Memoriam of Raoul Dufy"* for a painter whom he had never met, he composed three other works to memorialize close friends: *In Memoriam Dylan Thomas* (1954), *Variations "Aldous Huxley in Memoriam"* (1963-64), and *Introitus "T.S. Eliot in Memoriam"* (1965).
[71] Andrew T. Kuster, "Stravinsky's Topology: An Examination of His Twelve-Tone Works Through Object-Oriented Analysis of Structural and Poetic-Expressive Relationships With Special Attention to his Choral Works and *Threni." (*D.M.A. diss. University of Colorado, 2000), p. 189.
[72] André Douw, "Sounds of Silence: Stravinsky's 'Double Canon,'" *Music Analysis* 17, no. 3 (1998), 314.

row forms though transformation theory. The application of transformation theory, as developed by Lewin (1982, 1987), reveals a network of relationships.

Figure 1 displays row forms from *Double Canon* as performed by each instrument; beat numbers appear across the top.[73] Violin I plays only two row forms: P_6 (starting at beats 1 and 20) and RI_2, (starting at beats 37 and 54). Violin II plays four row forms: P_4, P_6, RI_4, and RI_2 The viola states R_6 twice; the cello plays two different rows.

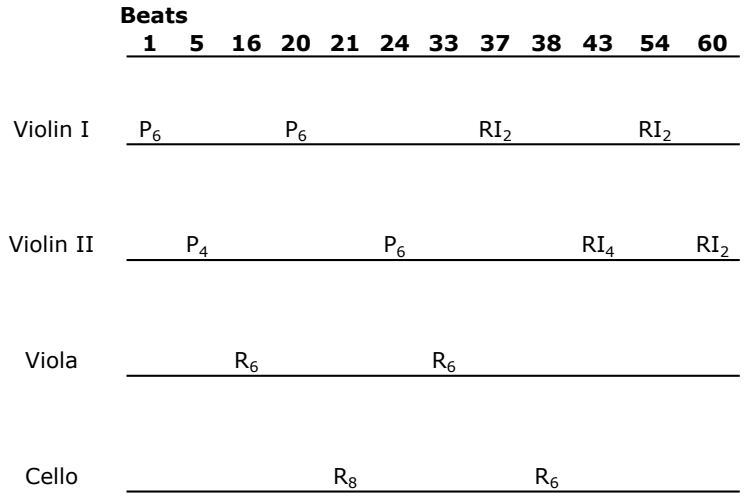


Figure 1. Row forms in *Double Canon*.

Figure 2 shows rows in *Double Canon* that form three sections labeled A_1, A_2, and A_3. A_1 includes only P-forms of the row; A_2 only R-forms; and A_3 only RI-forms.

[73] I reference beat numbers as opposed to measure numbers because different time signatures are used simultaneously. In order to know exactly which pitch sound with others, beat numbers are more accurate.

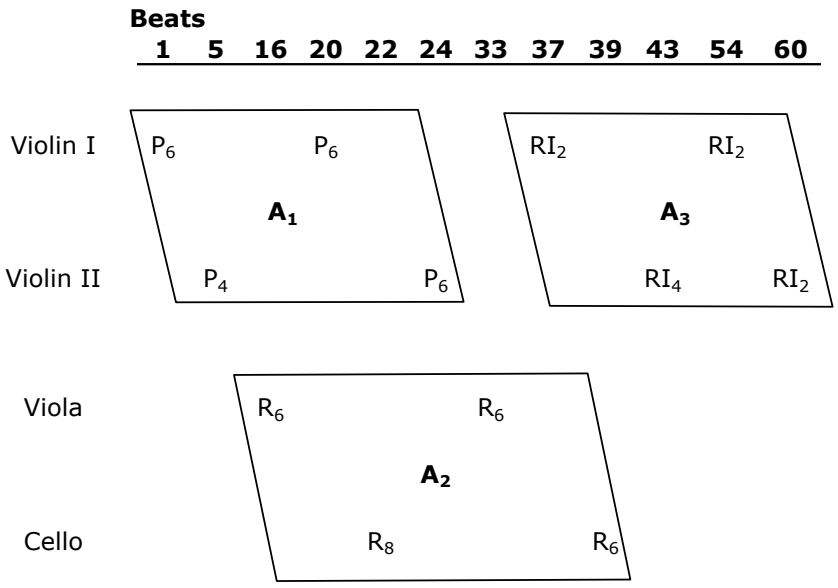


Figure 2. Row forms grouped into three sections.

Figure 3 specifies relationships among row forms in A_1, A_2, and A_3. In A_1, for example, the double arrow connecting the two statements of violin I's P_6 indicates an exact repetition. Double arrows occur in A_1, A_2, and A_3 at corresponding locations--the top and right side of each parallelogram, or what will be called a network.

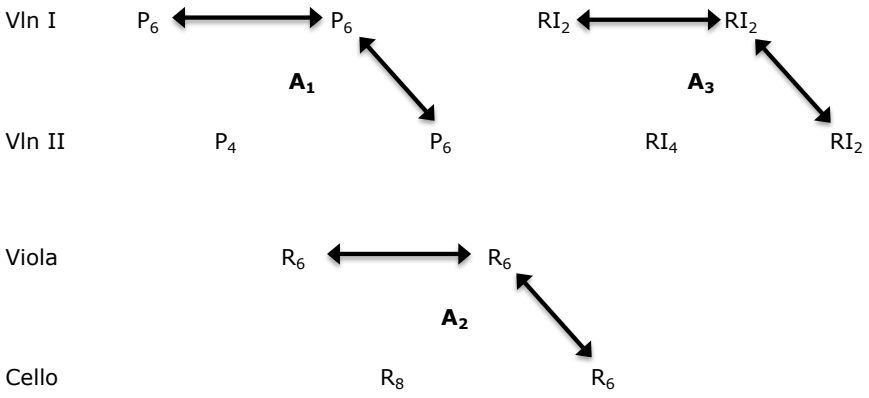


Figure 3. Similar relationships between networks.

Figure 4 clarifies specific relationships between the rows linked by arrows. Double arrows labeled "ID" (for identity) indicate exact repetition of a row form. Double arrows labeled "2" signify a non-directed relationship between two rows. For example, in

A_1, P_6 to P_4 and P_4 to P_6 are both two semitones apart. Because all of the arrows and transpositions connecting row forms are identical among A_1, A_2 and A_3, these networks are isographic. Isographies occur when row-form labels "and arrows are the same, and so are the transformations associated with corresponding arrows."[74]

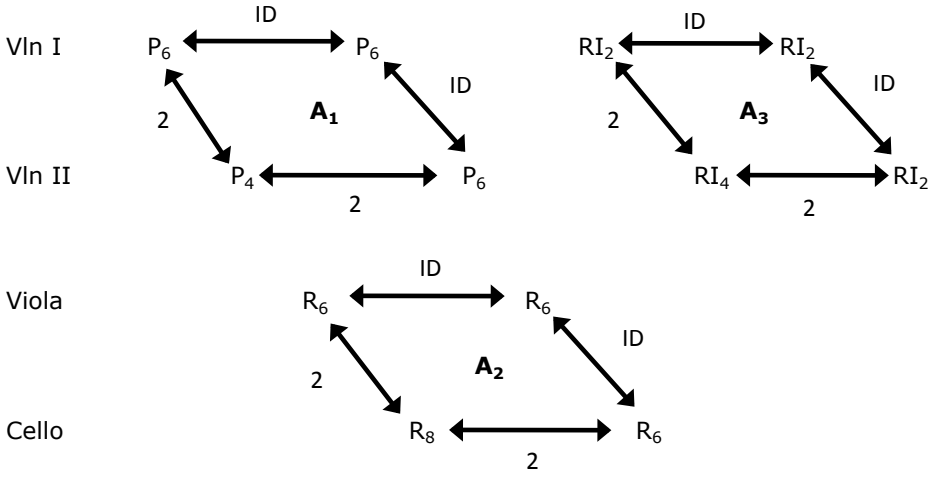


Figure 4. Repetitions and non-directed-arrow relationships.

Figure 5 shows the rows related by two semitones, replacing the double arrows in Figure 4 with single arrows that convey directed motion. As a result, A_1 is no longer isographic with both A_2 and A_3. Along the left side of A_1, violin I's first statement of P_6 precedes violin II's statement of P_4. The relationship from P_6 to P_4 is a transposition by two descending semitones (-2). Along the bottom of A_1, P_4 is a transposition by two ascending semitones (+2) to P_6. The A_2 network contains the same directed arrows as A_1, but their ascending and descending values change. In A_2, for example, R_6 is transposed by two ascending semitones to R_8. RI-forms in A_3 replicate the relationships among R-forms in A_2, confirming the isography between A_2 and A_3.

[74] David Lewin, "Some Klumpenhower Networks and Some Isographies That Involve Them," *Music Theory Spectrum* 12, no. 1 (1990), p. 84.

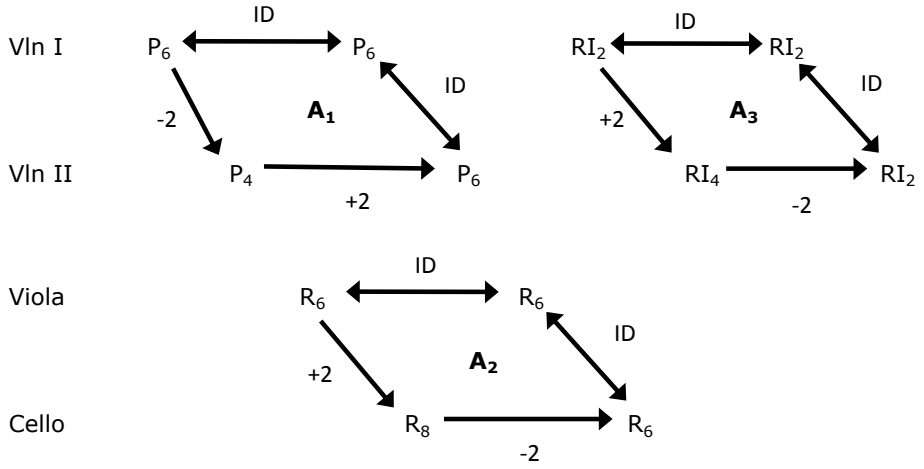


Figure 5. Directed-arrow relationships.

A_2 and A_3 are both inversions of A_1 because unlike A_1, they have ascending transpositions on the left and descending transpositions along the bottom of their networks. A_1 does the opposite by descending first on the left and ascending on the bottom. Because of these inversional relationships, A_1 is no longer isographic with A_2 and A_3. Figure 6 clarifies the relationships among A_1, A_2, and A_3.[75]

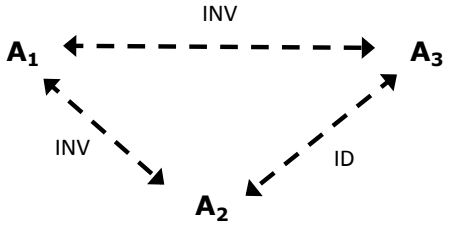


Figure 6. Relationships between networks.

I have identified twelve statements of the row in Stravinsky's *Double Canon*: two P-forms in A_1, two R-forms in A_2, and two RI-forms in A_3. Transformation theory reveals a network of relationships within A_1, A_2, and A_3. Furthermore, A_1, when inverted, generates A_2 and A_3, such that A_2 and A_3 are isographic. I will now explore additional

[75] Figure 6 uses dashed arrows to indicate relationships between networks.

relationships within these networks through an examination of the first pitch of each row.[76]

Figure 7 retains the relationships in A_1, A_2, and A_3 but replaces row-form labels with circles, which in transformation theory are called nodes. A node can contain the label for any musical event. Thus far, nodes have contained row-form labels. Figure 8 replaces row-form labels with the first pitch of each row. Even though the content of the nodes change, the network relationships remain constant. In A_1, for example, F♯ transposed down by two semitones becomes E, just as P_6 becomes P_4. Along the bottom of A_1, the pitch class E transposes up two semitones to arrive on F♯. A_2 and A_3 also fit this model. Both begin with pitch class A♯ transposed up by two semitones to B♯, as R_6 to R_8 in A_2 and RI_2 to RI_4 in A_3 were each transposed up by two semitones.

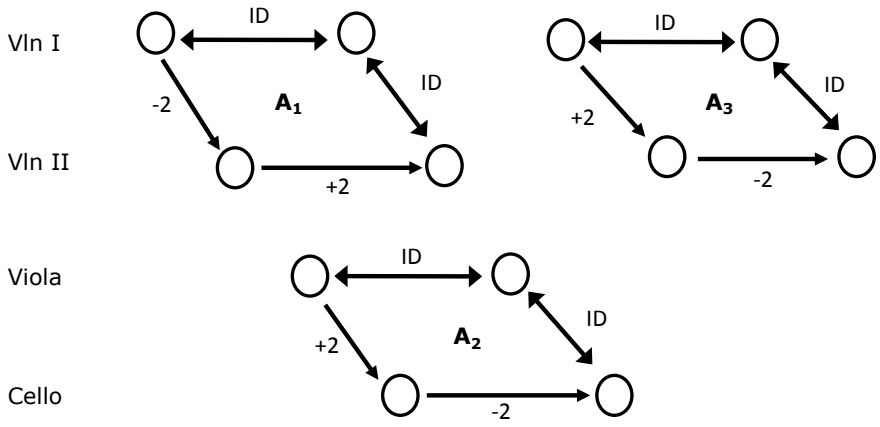


Figure 7. Nodes replacing row-form labels.

[76] Given that labels for P and I forms rely upon their initial first pitches, and R and RI forms on their last, it is to be expected that we can substitute those pitches for row forms in each network. It is remarkable that even though A_2 and A_3 use different row forms, their pitch content is the same.

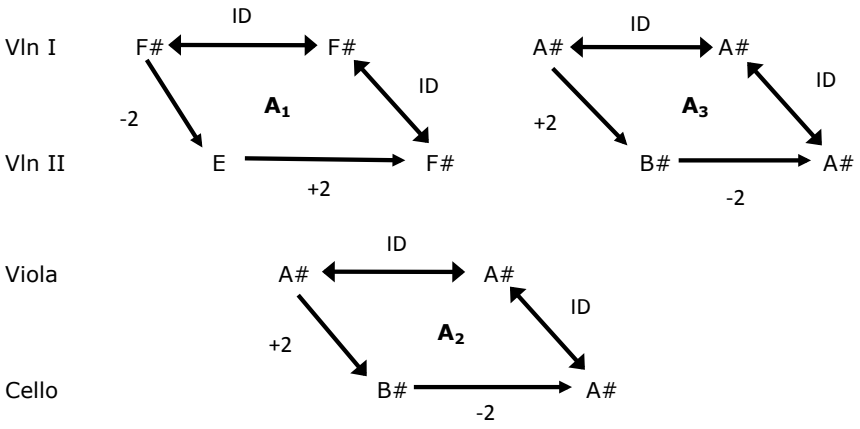


Figure 8. First pitches replace each row form.

The networks established thus far are consistent whether nodes contain row forms or first pitches of each row. Within and between networks, the relationships remain the same. A transformational analysis re-affirms the relationships between A_1, A_2, and A_3.

Axes of Symmetry

In the previous section, the relationships shown in the A_1, A_2, and A_3 networks were either by transposition or identity. In this section I will explore relationships created by inversion about an axis of symmetry. In *Double Canon*, pitches along the left side and bottom in A_1, A_2, and A_3 all invert about the B/F axis of symmetry (I_F^B), shown as the dotted line in Figure 9. The curved lines show relationships to this analysis and their inversions about the B/F axis: F♯ and E, A♯ and B♯. Along the B/F axis, F♯ and E are both one semitone from F, and A♯ and B♯ are both one semitone from B.

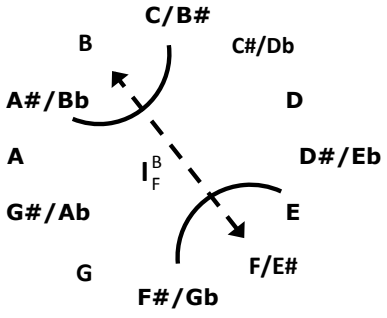


Figure 9. Axis of symmetry I_F^B.

Figure 10 reproduces networks A_1, A_2, and A_3 and makes clear the I^B_F relationship among them; these occur along the left and bottom. All three networks are again isographic. In A_1, violin I's first pitch F♯ generates E, the first pitch of violin II. The A♯s in the upper left-hand corner of A_2 and A_3, played by viola and violin I, respectively, generate the B♯s in cello and violin II, respectively.

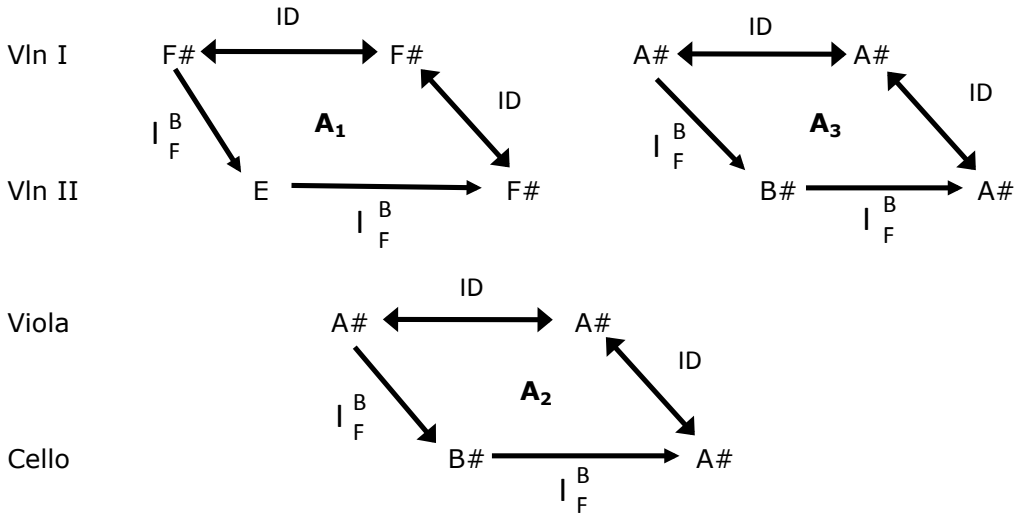


Figure 10. Axis of symmetry in place of transpositional values.

Transformational relationships are clear within A_1, A_2, and A_3 either by I^B_F or by identity. The new relationship that emerges between networks is $I^D_{G♯}$, shown in Figure 11. The dotted line indicates the axis, while curved lines connect pitches related by inversion about the axis: F♯ - A♯, and E - B♯. Between networks A_1 and A_3, violin I's F♯ in A_1 generates A♯ in A_3. Violin II's E generates B♯. Therefore A_1 generates A_3. Because A_2 and A_3 are identical, A_1 also generates A_2.

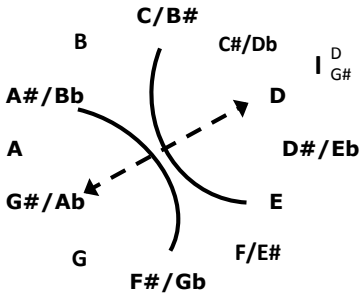


Figure 11. Axis of symmetry $I^{D}_{G\sharp}$.

Figure 12 shows the I^{B}_{F} relationships within each network, and the $I^{D}_{G\sharp}$ relationships between A_1 and A_2, and A_1 and A_3, as well as the identity relationship between A_2 and A_3.

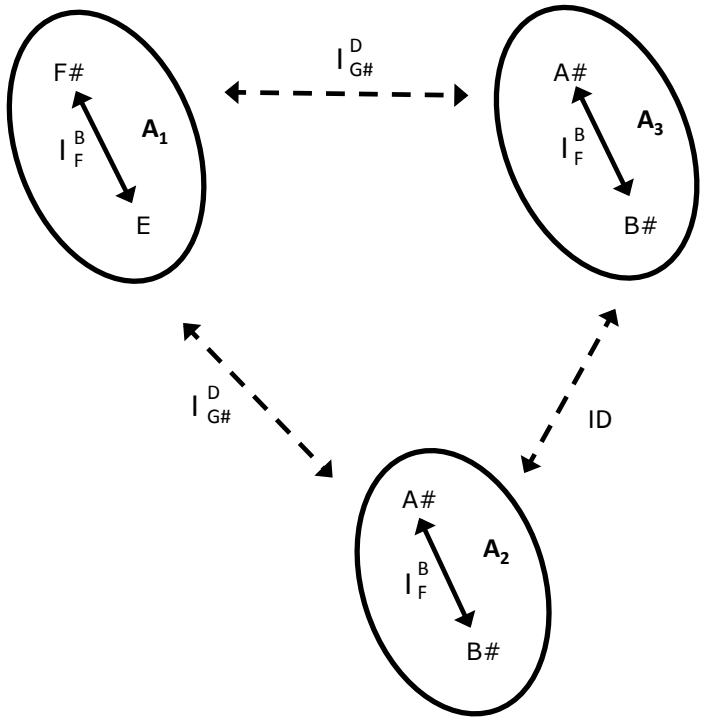


Figure 12. Inversions within and between networks.

Each of the four pitches in Figure 12--F♯, E, A♯, B♯--generate two different pitches through two axes of symmetry. Figure 13 superimposes I^{B}_{F} and $I^{D}_{G\sharp}$ onto one example. The axes are shown with dotted lines, while the curved lines indicate how each pitch connects

to two others. For example, F♯ generates E via I_F^B, as well as A♯ via $I_{G♯}^D$. E, in turn, generates not only F♯ via I_F^B, but B♯ via $I_{G♯}^D$.

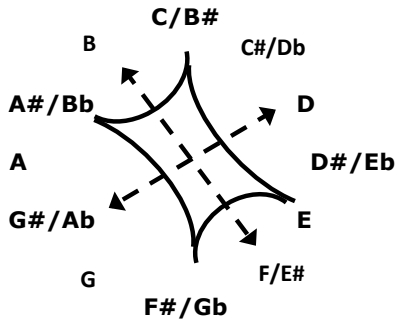


Figure 13. Axes of symmetries I_F^B and $I_{G♯}^D$.

In *Double Canon*, Stravinsky employed only six rows: two P-forms, two R-forms, and two RI-forms. While Douw's application of serial theory identifies row forms, the use of transformation theory reveals networks created by groups of row forms. These networks are either isographic or related by inversion. When the first pitch of each row replaces row-form labels, the relationships remain constant. When transpositional relationships are replaced with inversions about an axis of symmetry, pitch labels remain the same. Given only four pitches--F♯, E, A♯, B♯--each generated two of the remaining three pitches through axes of symmetry I_F^B or $I_{G♯}^D$.

CHAPTER IV

ANALYSIS OF *FEU D'ARTIFICE* (*FIREWORKS*), OP. 4

In 1903, Stravinsky composed *Piano Sonata in F-sharp minor* (without opus number, unpublished). Around this time, he and a group of friends began visiting Rimsky-Korsakov, who casually offered to help Stravinsky with his compositions. Stravinsky accepted this offer and asked advice from Rimsky-Korsakov on how to improve "formal problems" such as his use of sonata form.[77] Stravinsky studied with the elder Russian until Rimsky-Korsakov's death in June of 1908.[78] During this time, Stravinsky composed *The Mushrooms Going to War* (1904, unpublished), *Symphony in E flat,* op. 1 (1905-07, published 1914), *Faun and Shepherdess,* op. 2 (1906), *Pastorale* (1907), *Two Melodies of Gorodetzky* (1907-08), and *Scherzo Fantastique,* op. 3 (1907-08, published 1909). News of Rimsky-Korsakov's daughter Nadia's engagement motivated Stravinsky to compose his last piece during this period, also known as *Fireworks,* scored for large orchestra. After composing the piece in six weeks, Stravinsky sent the finished score to Rimsky-Korsakov as requested, but the score arrived after Rimsky-Korsakov's death and was returned.[79] Written just before Stravinsky's Nationalistic period (ca. 1909-18), op. 4 is a musical portrayal of fireworks launching and exploding in the air.[80] The formal design of the work is ternary: A (mm. 1-44), B (mm. 45-106), and A' (mm. 107-47). Though Taruskin views the beginning of the A section as an "octatonic/diatonic interaction," I will analyze the intervallic relationships found in the opening motive and

[77] Eric Walter White, *Stravinsky: The Composer and His Works*. (California: University of California Press,1979), 27.
[78] Ibid., 30.
[79] Ibid., 180.
[80] According to White, Stravinsky's nationalistic period began roughly around the time *The Firebird* (1909-10) was composed and "the national barriers began to fall" around *The Soldier's Tale* (1918). *Fireworks* was composed in 1908 and revised in 1909, at the beginning of this period.

accompaniment from the A section and compare those relationships to motives in the B section through use of transformational networks.[81] Each relationship, with regard to meter, rhythm, and vertical and linear motion, aids in what Edward T. Cone describes as "synthesis," or the unification of an entire work.[82] I will begin with an explanation of formal design in the A section. The initial A section is itself an asymmetrical ternary as indicated in the superscript letters: A^a (mm. 1-25), A^b (mm. 25-32), and $A^{a'}$ (mm. 33-44).

In section A^a, a solo horn presents a quarter-note motive, marked ***p*** (m. 2), which then repeats exactly (mm. 5 and 7). A solo trumpet echoes the horn's motive (m. 8) to initiate an imitative relationship between the two instruments. Now certain that the trumpet will respond, the horn expands its motive to four beats (m. 11) marked ***mp***. Not anticipating a four-beat motive, the trumpet enters on beat one of m. 12, overlapping with the last note of the horn; however, the trumpet plays the three-note motive as before without the added beat. Horn III, marked ***mf***, enters in m. 13 in unison with the solo horn, while the solo trumpet continues to imitate. The horns abandon the quarter notes for rhythmically active motives containing dotted figures and triplets (mm. 15, 17, and 19), which the trumpet echoes (mm. 16, 18, and 20). The four different one-measure horn motives (mm. 13, 15, 17, and 19) combine to create a four-measure theme (mm. 21-4). In m. 22, the solo trumpet and an additional unison trumpet begin a canonic imitation of the four-measure theme.

To contrast the brass thematic imitations, the A^a section contains two accompanimental gestures: one linear and one vertical. The former, which represents the initial sizzling discharge of fireworks, includes overlapping statements of a sixteenth-note motive exchanged between pairs of flutes and clarinets (mm. 1-25).[83] The latter, depicting small bursts of aerial fireworks, consists of three block chords played by the piccolo and upper strings (mm. 2, 5, 7-25). These offbeat block chords, all of which occur

[81] Richard Taruskin, *Stravinsky and the Russian Traditions: A Biography of the Works Through Mavra* (California: University of California Press, 1996), 336.
[82] In relation to this particular work, meter, rhythm, and motion are included in this process.
[83] Taruskin refers to this passage as a "turbulent ostinato accompaniment (336)."

simultaneously with the brass motives (mm. 2, 5, 7-25), sound as if they are on the beat because of their consistent repetition. A listener may also hear the woodwind's accompaniment on the beat instead of the brass' seemingly spontaneous motive because of the woodwind's high volume.

One can argue that Stravinsky's orchestration allows the woodwinds, initially marked *ppp*, to soar over the mellow tone of the solo horn, initially marked *p*. Orchestration, along with the metric ambiguity, provides an excellent example of what Edward T. Cone describes as interlock, or the delay of expectations.[84] Specifically, interlock aids in the aural explanation of the metric conflict between the woodwinds and brass.

As A^a comes to an end (m. 25), A^b presents new material based on ascending chromatic scales, first in the woodwinds, celesta, and harp. On beat two of m. 25, the last half of the trumpet's statement and both accompaniments overlap with this new material. The chromatic passages continue to alternate between groups of instruments until the four-measure theme in the brass returns (m. 33).

In $A^{a'}$, the imitation between horns and trumpets expands to include all of the brass (mm. 33-8) as listed in Figure 14. Measure numbers appear in bold across the top of the diagram with smaller numbers representing the beat. Each column displays the rhythm notated in the score.[85] Horns I-VI start in unison at m. 33 and Trumpets I-II enter in canon exactly one measure later. The remaining instruments enter on the second-half of the theme (horns, m. 35) with a dotted figure followed by two triplets. The horns', Trumpets I-II's, and Trombone II's dotted figures appear on the downbeat, but all of the remaining brass rhythmically displace their motives--shown separated by vertical dotted lines--to beat two or three in their respective measures.[86] While Trombone II enters on the second half of the theme, it is the only remaining instrument (besides the horns and

[84] Cone, 19.
[85] The rhythms represented across all instruments contain the same thematic pitches.
[86] Trombone II is the only brass instrument to enter with the second-half of the theme on the downbeat. All others either begin on quarter-note beats or on displaced second-half thematic material.

Trumpets I-II) to enter on the downbeat of a measure (m. 37). In the figure, dotted lines represent thematic displacement. Notice in m. 36, beat 3, that Horns I-II begin on the second-half of the theme along with Tuba I. Similarly, Horns III-IV and Trombone II on beat 1 of m. 37 and Horns V-VI with Tuba II on beat 2. This passage not only contains canonic imitation between the horns and trumpets, but also among all three horn-pairs separately and together with low brass.

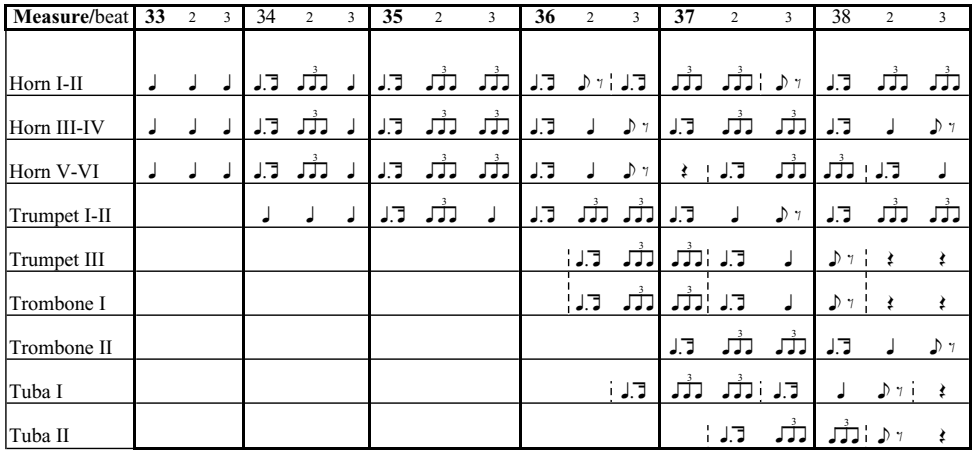


Figure 14. An excerpt of the brass thematic canon in mm. 33-8.

This six-measure passage contains six separate entrances by nine instruments, as if several fireworks were exploding in a small amount of time. From mm. 39-42, the linear gesture of constant sixteenth-notes (flutes, clarinets, bassoon, and trumpets), along with vertical offbeats (horns and strings), accompanies varied rhythmic patterns similar to that of the horn's original motive, but played by the piccolo, bells, trombone, and tuba. A crescendo in this passage (m. 39) leads to the end of the A$^{a'}$ section (m. 43), where the entire orchestra plays an eighth-note block-chord marked ***ff***. Momentum shifts to the next section as the dynamic level drops dramatically to ***pp*** with sustained pitches in horn II & III, tuba, and timpani.

In contrast to the A section (mm. 1-44), marked *con fuco*, the B section (mm. 45-106), marked *Lento* (♩=69), begins with upper woodwinds, upper strings, and low reeds.

While the A section repeated a small number of motives, the B section introduces new motives that repeat and vary.

As explosions from the A section dissipate, the piccolos and flutes introduce a neighbor-note figure, ♪.. 𝅘𝅥𝅯𝅘𝅥𝅯 (mm. 45-8). Upper strings play quarter notes simultaneously with the neighbor note figures. While *Lento* is the tempo for the beginning of the B section, mm. 50, 52-3 temporarily follow the Allegretto (♩=88) tempo. These interjections, consisting of a solo clarinet, present a two-beat quintuplet pattern that is passed to the piccolo (m. 54). Following the piccolo's short statement, along with a key change from E-major to C-major, the flute and celesta enter with a continuous quintuplet pattern (mm. 55-62). A new theme (mm. 63-76), accompanied by a gradual descending line in horns I-VI and a descending triplet sequence in the strings, emerges in the middle voices. Though this theme is marked ***p***, similar to the brass theme in the A section, it seems louder because of the high registers in the woodwinds and strings. Several triplet figures appear throughout the entire orchestra as the B section transitions to A' (mm. 77-106). During this transition, the key signature shifts back to E-major (m. 99).

In A' the whole orchestra presents an harmonized version (mm. 107-10) of the horn's original theme (mm. 21-24). Upper woodwinds and strings replicate the horn's rhythm exactly while transposing this linear theme T_{+5} to G♯, B, and F♯, from the original statement (m. 21, D♯, F♯, and C♯).[87] The remaining instruments play quarter notes, whose purpose is to vertically harmonize with the transposed theme. Unlike the theme in the A section, this section consists of block chords with no offbeat accompaniment. The block chords and homorhythmic thematic material in the following measures create tonic-tonic-dominant harmonies in the key of E-major (m 107). Though the A section indicated an E-major key signature, the brass motive and accompaniments did not imply the key as the A' section does with these harmonic relationships.

[87] These instruments include piccolo, flutes, Horns I and V, Trumpet I, and Violins Ia and IIb.

The expanded scoring of this theme suggests the finale of the fireworks show, in which several explosions illuminate the sky at once. A collection of rhythms that have been previously introduced--triplets, sixteenths, and sextuplets--appear to be chaotically pitted against one another (m. 118). Ascending sextuplets and descending sixteenths clash as fireworks are sent to the sky and disintegrate simultaneously. Two big crashes of ***ff*** eighth-note block chords (mm. 122 and 125) interrupt the show. As the end draws near, the tension in the orchestra, now marked ***p*** at m. 128, increases with repetitive triplets until a sudden cease in motion as a single chord sustains in m. 137-38. After this, two one-measure dotted-figure solos in the horn and trumpet (mm. 141-42) respectively remind the audience of the imitative relationship from the A section one final time. Momentum gathers through chromatic sixteenth-notes (m. 143) that lead to the last two eighth notes of the piece. The final fireworks burst in the air coinciding with a solid E-major chord (m. 147).

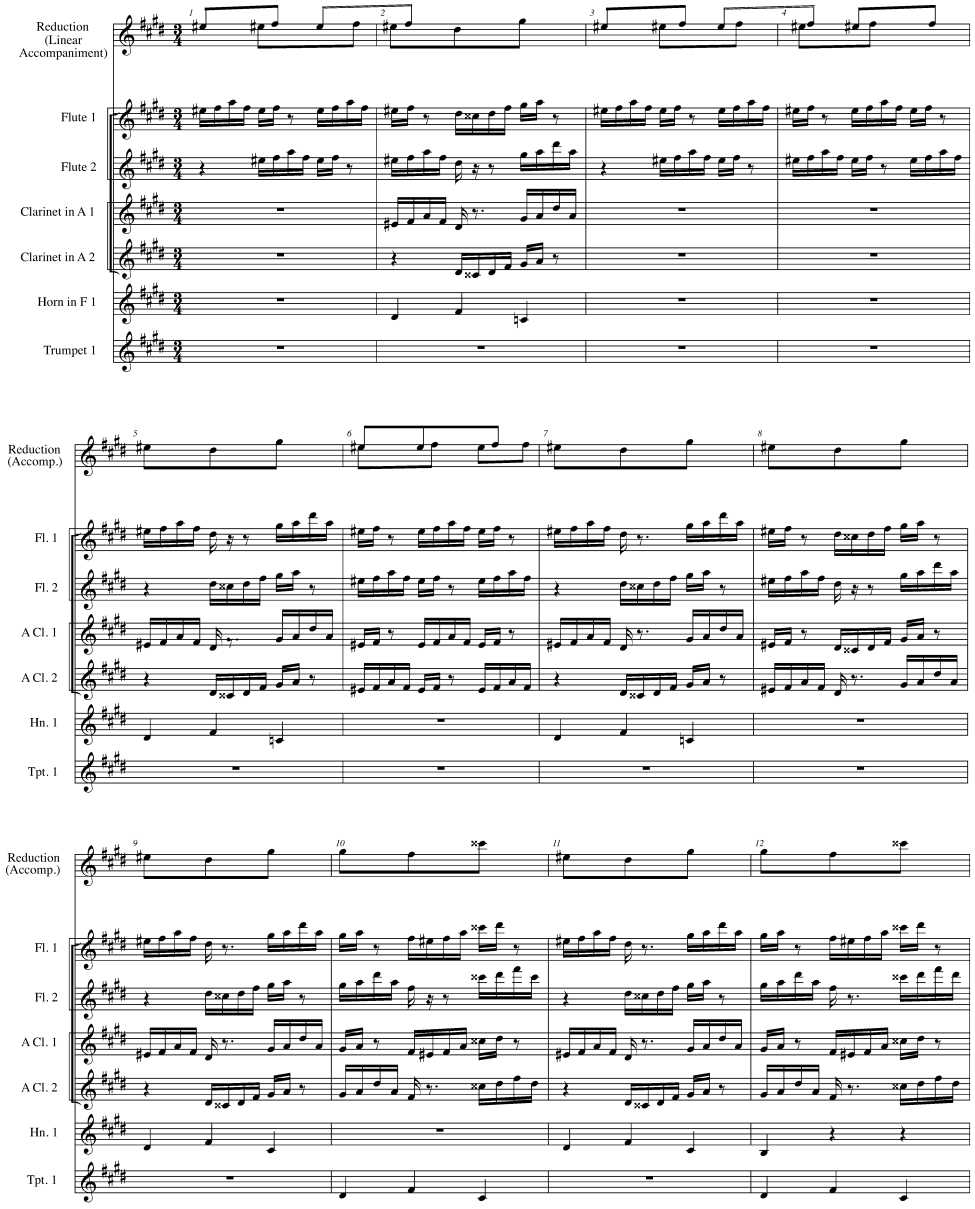
The A Section

Having discussed the work's form, motives, accompaniments, dynamics, and orchestration, I will proceed with an analysis of the A section's three motives: quarter-note motive, vertical accompaniment, and linear accompaniment.[88] In this section, I will focus on the intervallic relationships common among all three. I begin with an analysis of the linear accompaniment's overlapping statements of a two-beat motive in the flutes (m. 1).[89]

The overall contour of the sixteenth notes ascends from E♯ to F♯ as indicated by the beamed pitches on the top stave of Example 1. The texture in m. 2 remains the same, except it thickens with the addition of the clarinets. It also includes the initial statement of the horn motive, which will be discussed later in this section. The material in m. 1 repeats

[88] According to van den Toorn, Tymoczko focuses his analyses on passages based on rehearsal numbers, while van den Toorn prioritizes his analyses with the "beginnings and endings of different pieces (167)." In contrast to both, I focus on motivic passages and their accompanying material.
[89] Taruskin describes these statements as a "three-note octatonic fragment tossed back and forth between two flutes (335)."

exactly in m.3, while m. 4 maintains the rising E♯-F♯ contour. When the material of m. 1 returns in m. 6, the clarinets double the flutes.



Example 1. Overlapping sixteenth notes in mm. 1-12. Displayed in concert pitch.

Figure 15 shows the measures that pertain to each group of pitches. The numbers on the left side of the table refer to groups of measures that share pitches on the beat. The middle column lists the specific measures in a group. The last column displays the pitches per beat in each group. In mm. 2-8, group 1 accompanies the horn solo with a

trumpet echoing at m. 8. In mm. 9-12, groups 1 and 2 alternate as the trumpet imitates the horn. When the horn-trumpet exchange becomes rhythmically complex (m. 13-20), the linear accompaniment plays all four groups consecutively and is repeated. In Figure 15, dotted lines connect the last beat of a group to the downbeat of the next. For example, group 1 concludes with G♯ and initiates group 2. Group 2 ends with C𝄪 and initiates group 3. Groups 3 and 4 disrupt this pattern by sharing both A♯ and E♯.[90] As group 4 shares the last two pitches with group 3, group 1 shares the last two, E♯ and D♯, with group 4 in order to repeat the cycle.

Group	Measures	Pitches
1	2, 5, 7, 9, 11, 13, 17, 21	E# D# G#
2	10, 12, 14,18, 22	G# F# Cx
3	15, 19, 23	Cx A# E#
4	16, 20, 24	A# E# D#

Figure 15. The order of three-note patterns as they appear in the score (mm 1-25).

Figure 16 shows pitches with brackets around each group. For example, G♯ contains brackets on both sides to show its position in groups 1 and 2. Arrows indicate intervallic relationships between the first and last pitches in each group. In group 1, E♯ to G♯ ascends three semitones, labeled +3; G♯ to C𝄪 moves by a tritone, labeled ±6 (group 2); C𝄪 to E♯ ascends by three, labeled +3 (group 3); A♯ to D♯ ascends by five, labeled +5 (group 4). Groups 1 and 3 both ascend by 3; however, because groups 2 and 4 are not equivalent, this cycle is not symmetrical nor are the groups' transpositions of each other, though the far right-side bracket labeled group 1 demonstrates how the cycle repeats.

[90] Notice that both groups 3 and 4 were introduced for the first time during the first complete cycle. In contrast, groups 1 and 2 were each introduced separately.

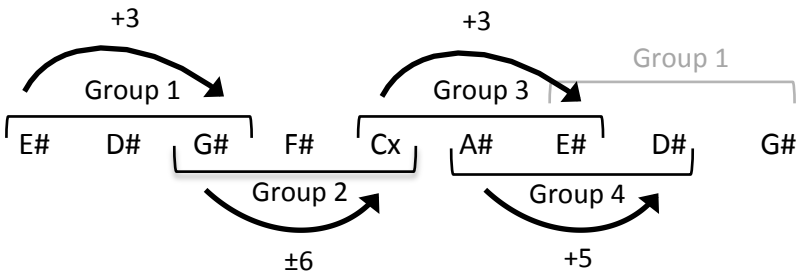


Figure 16. The linear accompaniment in bracketed groups with numerical values.

Similar to groups 1 and 2 in Figure 16, intervals in the initial horn motive--D♯ F♯ C--also span +3 and ±6 as shown in Figure 17. The intervallic relationships highlighted in the accompaniment occur between non-adjacent pitches, while those in the horn are adjacent.

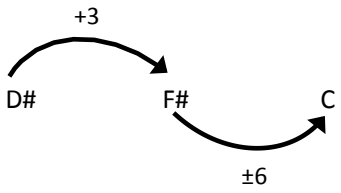


Figure 17. Intervallic relationships in the horn motive (mm. 2, 5, and 7).

A comparison of the linear accompaniment with the horn motive appears in Figure 18. The accompaniment's E♯, G♯, and C𝄪 relate to the horn's D♯, F♯, and C, respectively, by two descending semitones labeled -2. Letter names shown in gray, inserted between adjacent pitches in the horn motive, display the relationship -2 with the D♯ and F♯ from the linear accompaniment. Similar to the -2 relationship from the linear accompaniment (E♯ G♯ C𝄪) to the horn motive (D♯ F♯ C), the gray C♯ and E correspond with the linear accompaniment. Even though those pitches do not exist in the score, it seems that the linear accompaniment is an ornamented version of the horn.

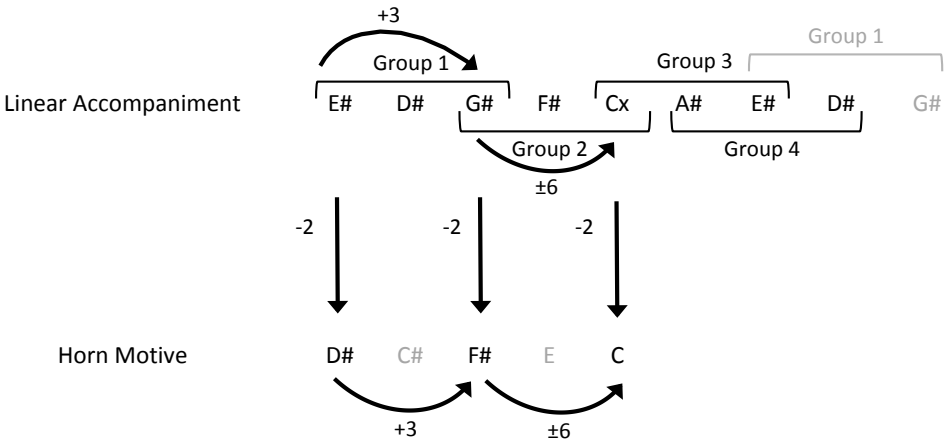
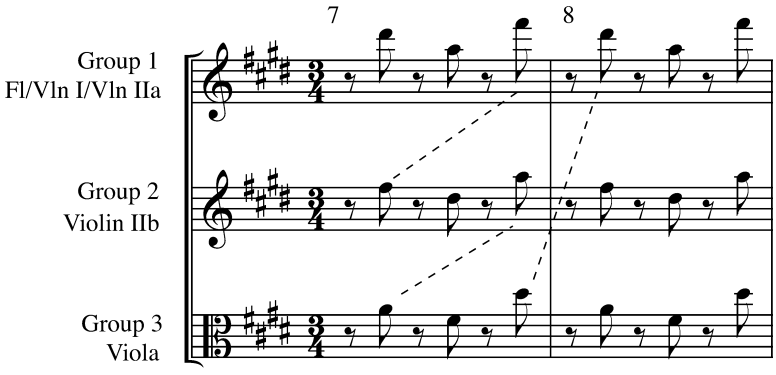


Figure 18. Transposition from linear accompaniment and the horn motive.

Having shown that the horn motive is a simplified version of the linear accompaniment in which both utilize +3, ±6, and share a -2 relationship, I will now examine the intervallic structure of the vertical accompaniment.[91] Simultaneously, three instrument groups, as labeled in Example 2, present diminished triad block-chords (mm. 2, 5, 7-25), while each group arpeggiates the same diminished harmonies; however, the block chord texture is more audible than the arpeggiated one.[92] The dotted lines show the correspondence between the last pitch of each arppegiation to the first pitch of the next group's first beat.



Example 2. Vertical accompaniment (mm. 7-8).

[91] The horn motive could also produce the accompaniments, but in this analysis, the accompaniment generating the horn motive explains its alterations (mm. 9, 11-2).
[92] The block-chord statements in mm. 7-8 are consecutive as mm. 2 and 5 occur separately during the horn motive.

All three groups participate in three inversions of the triad within one measure. Like the linear accompaniment and horn motive, the vertical accompaniment contains intervals of ±3 and ±6. Figure 19 shows a graphic representation of Example 2. In this figure, beat numbers appear across the top for the duration of one measure. On the far left, instrumental group numbers 1-3 correspond to group labels on Example 2. Across each row, pitches represent each instrumental group's arpeggiation within a measure. For example, instrumental group 1 performs D♯, A, F♯. As all three instrumental groups sound together in the score, block chords appear under each beat number. Arrows indicate intervallic relationships between the lowest and highest voices of each block chord.[93] Dotted lines, in contrast to those in Example 2, signify the common tone from the lowest pitch of one beat to the highest of the next. For example, group 3's A in beat 1 instigates group 1's A in beat two.

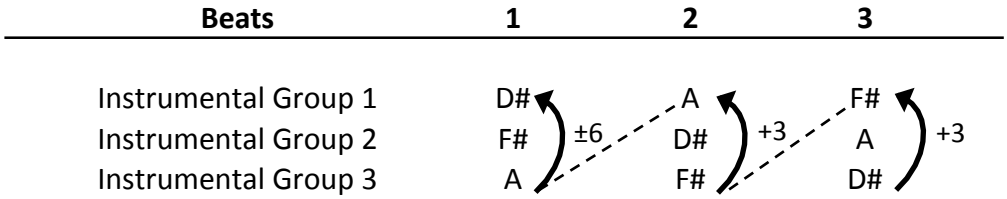


Figure 19. Vertical block chords with group labels.

Figure 20 vertically links all three beats by their common tones, A and F♯. Beats 1 and 2 share the pitch A, while beats 2 and 3 share F♯. As shown previously in Example 2, D♯ in beat 3 continues to beat 1 of the next measure. Therefore, to represent the continuation of this pattern, a gray beat 1 and its contents appear at the bottom of the figure.

[93] I analyze the triads from lowest to highest as one would analyze any chord by looking at the lowest voiced instrument first.

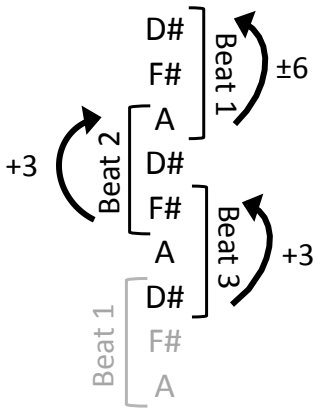


Figure 20. Intervallic relationships within the vertical accompaniment.

Figure 21 compares the linear accompaniment, the horn motive, and the vertical accompaniment.[94] Even though the horn motive and linear accompaniment share a transpositional relationship, the vertical accompaniment varies the intervallic patterns. The vertical accompaniment contains the same intervallic relationships (+3 and ±6), but reverses their order of intervals as well as direction. The linear accompaniment and horn motive contain arrows directing from left to right. In contrast, the vertical accompaniment arrows direct from lowest to highest because it contains block chords. This accompaniment, arranged horizontally, shifts the arrows to move from right to left, opposite of the horn motive and linear accompaniment.

[94] I analyze the vertical accompaniment horizontally in order to efficiently compare to horn motive and linear accompaniment.

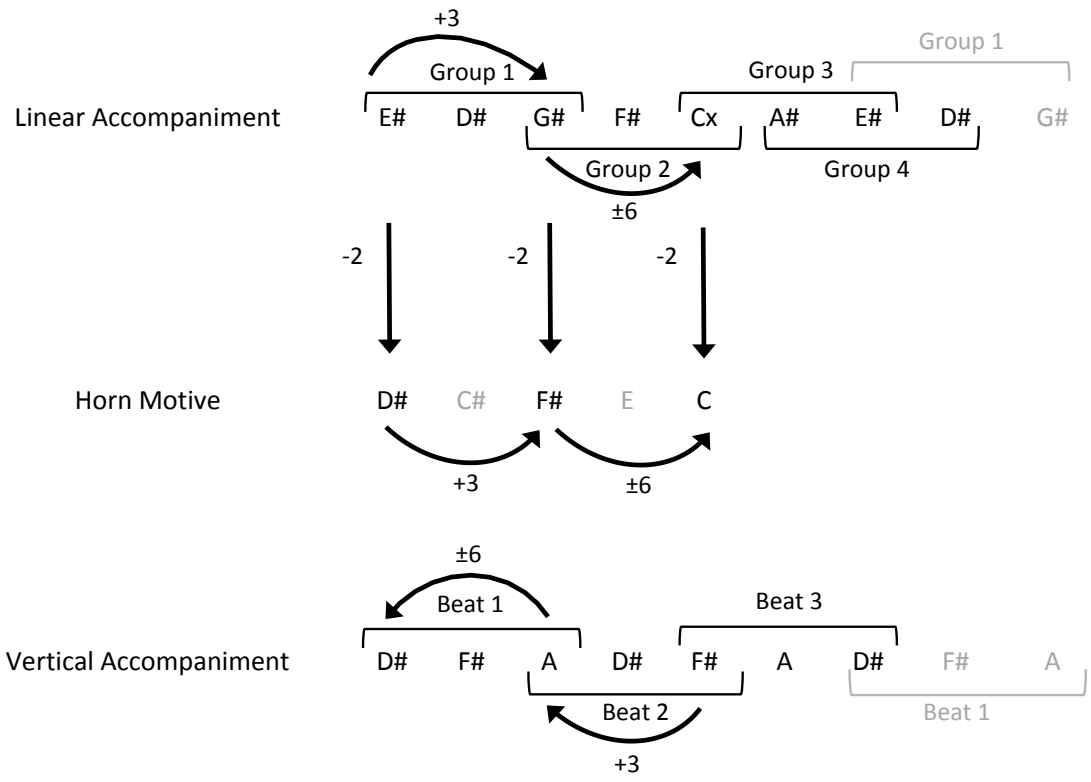


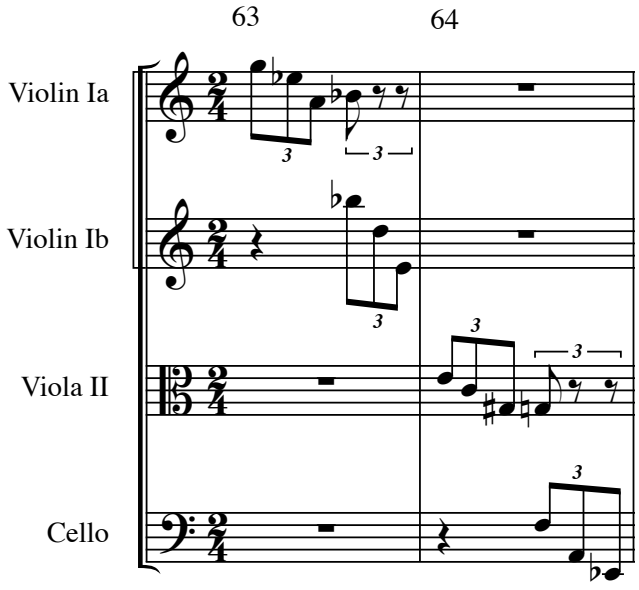
Figure 21. Horn motive and both accompanimental patterns' intervallic relationships.

Within the A section, the linear accompaniment plays three beats that relate to the quarter-note beats of the horn motive by -2. Both intervallic relationships share +3 and ±6. The vertical accompaniment, while on the offbeats, consists of a D♯° block-chord in three inversions through the course of a measure, both vertically by beat, and horizontally by group. This accompaniment shares the same intervallic relationship as the other accompaniment and motive, but in reverse order.

The B Section

The B section continues with the relationships of +3 and ±6, while adding ±1. In comparison to the horn motive and accompaniments from the A section, the B section contains descending accompanimental triplets in the strings (mm. 63-76). The descent from high to low strings extends over two measures as shown in Example 3. After the triplets finish their two-measure course, the material repeats, transposes, and begins again

in Violin Ia. Four instruments each play one triplet over a total of four beats, but Violin Ia and Viola II each double the next instrument's first pitch.



Example 3. Descending triplets in the strings (mm. 63-4).

Figure 22 organizes the pitches from mm. 63-4 into a horizontal line. Brackets represent each instrument's triplet. Arrows indicate intervallic distance between the first and last pitch. For example, in Violin Ia, G to B♭ ascends by three, labeled +3. Violin Ib replicates the relationship found in the A section. Viola II introduces +1, an intervallic relationship not yet encountered. Cello finishes the segment with -2, which imitates the -2 between the linear accompaniment and horn motive in section A.

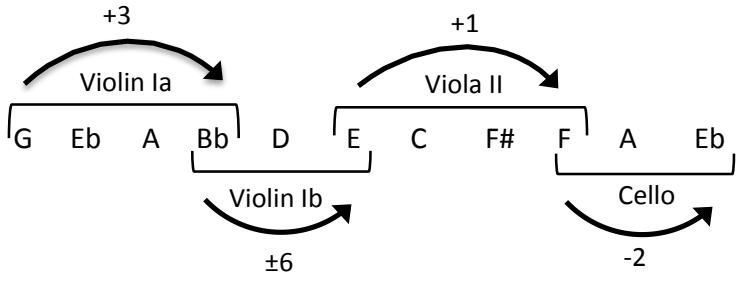
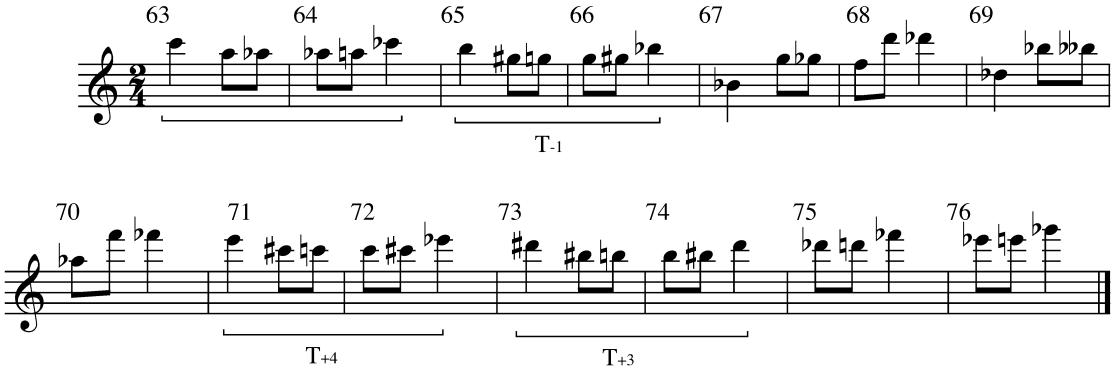


Figure 22. Descending triplets in the strings (mm. 63-4).

During this triplet accompaniment, a new theme, shown in Example 4, resonates in the oboe, English horn, violin II, and viola I (mm. 63-76). Brackets under the staff

highlight the two-measure motives that descend chromatically and ascend to arrive a semitone below the starting pitch. For example, m. 63 begins with C, descends to A♭, and ascends up to C♭, a semitone below C. Mm. 65-6 are T_{-1} from mm. 63-4; mm. 71-2 are T_{+4}; mm. 73-4 are T_{+3}.



Example 4. B section theme (mm. 63-76).

Because all four brackets are related by transposition, Figure 23 identifies the intervallic relationships within the first measure of each bracket (mm. 63, 65, 71, 73). Their first pitches can be substituted in place of the first node in a transformation network. For example, in m. 63, C descending by three semitones generates A; A descending by one semitone generates A♭. The first measure of each two-measure pattern represents a simplified version of the B section's triplets, similar to the linear accompaniment's ornamented version of the horn motive in section A.

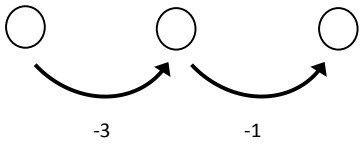


Figure 23. B section theme's intervallic relationships (mm. 63, 65, 71, and 73).

Figure 24 compares the triplets' and B section theme's intervallic relationships. In one beat, the triplets are +3 while the B section theme, also spanning one beat, is -3. Over

two beats, the triplets descend by 1, but the theme, containing eighth-notes, only uses half of a beat to descend by 1.

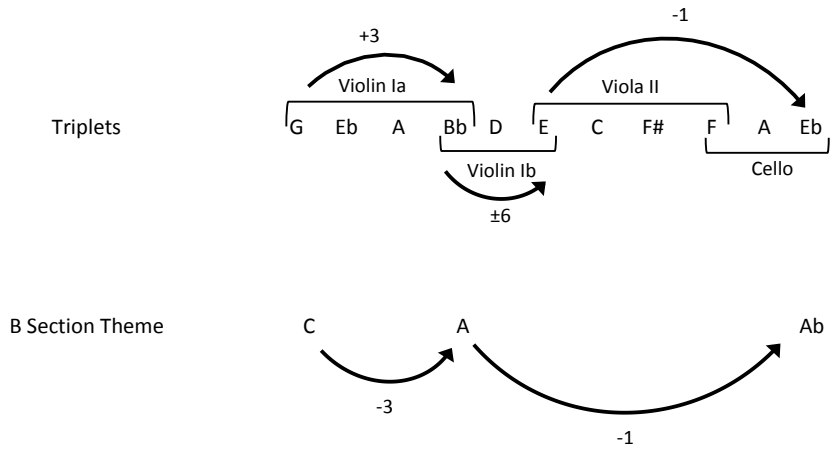


Figure 24. Intervallic comparison between the triplet line (m. 63-4) and the B section theme (m. 63).

Though there is a tritone in the midst of the triplet line, the triplets and B section theme end -4 from their beginning. Shown in Figure 25, the triplet's G to E descends by three (-3); E to E♭ descends by 1 (-1). This confirms their similar intervallic relationship from the first pitch to the end of their statements. Like the linear accompaniment and horn motive in the A section, the B section theme acts as a simplified version of the triplets. This theme presents three pitches within a measure, as the horn does in m. 2, while the triplets span two measures, like the linear accompaniment's groups 1 and 2.

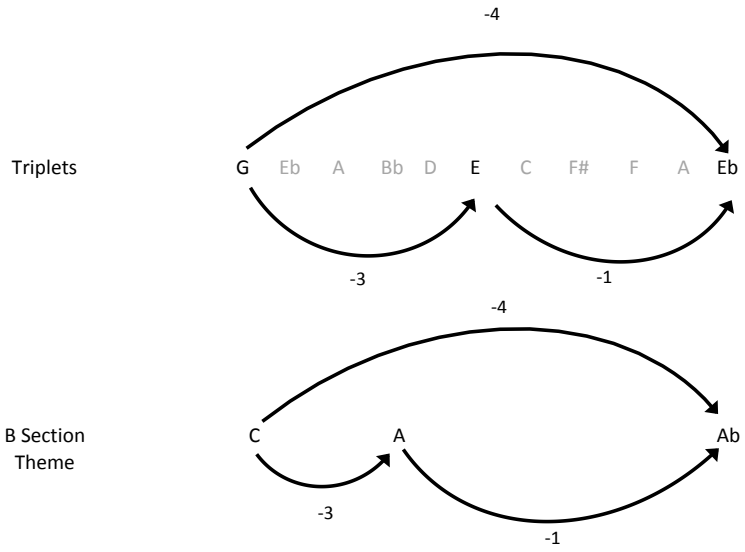
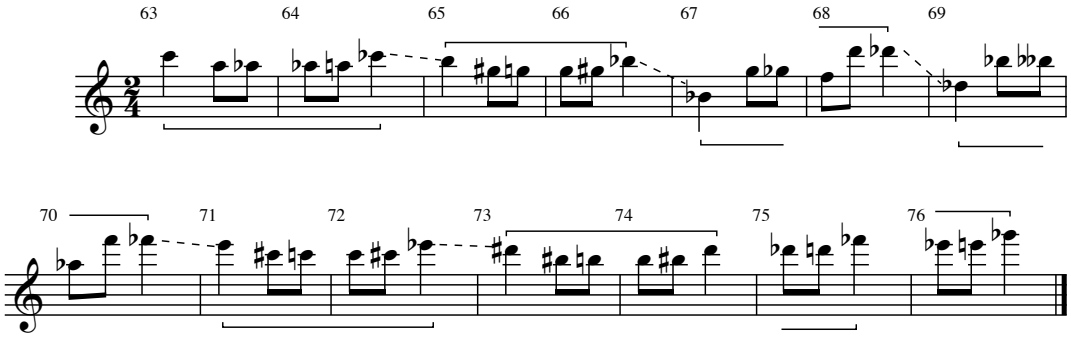


Figure 25. The triplet's and B section theme's descent by four.

The B section theme, a simplified version of the descending triplets, yields intervallic relationships of -3 and -1. Another similarity between the two occurs with an observation of the whole theme. This theme, shown in Example 5, contains complete and incomplete brackets. The complete brackets link the first and last pitches within a two-measure segment. The incomplete brackets show their one measure relationship to either the descending or ascending measures, depending on the association of the beginning or ending halves of the brackets. For example, mm. 67 and 69 share a similar intervallic relationship (-3, -1) with mm. 63, 65, 71, and 73, though material in the incomplete brackets extend an octave higher. Dotted lines between pitches represent the common tones between each complete and incomplete segment from mm. 63-73.



Example 5. B section theme's first to last pitches within a two-measure segment.

Figure 26 elaborates on these segments with labeled intervallic relationships. Measure numbers appear across the top. Because they are two-measure segments, odd measure-numbers represent the common tone from the last beat of a segment to the first beat of the next. For example, C♭ in beat two of m. 64 repeats on beat one of m. 65 as a B. The first and last pitches of each segment, with brackets around them, help to distinguish intervallic relationships. Intervals of -1 and +3 appear in a 2x2 pattern for the first six brackets (mm. 63-74). In mm. 75-6, the same two intervals alternate as the contour changes from descend/ascend for two-measure durations to ascend/ascend as shown in the score (Example 5).

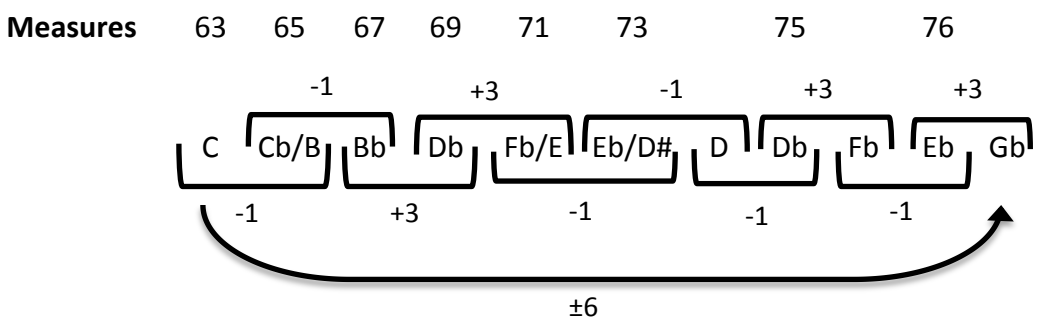


Figure 26. The B section theme's first and last pitches bracketed with intervallic relationships.

Similar to the intervallic structure of the triplets, the theme also uses +3 and -1. Additionally, the first to last pitch of the entire theme, C to G♭, is a tritone (±6). Within the B section, the theme and triplet accompaniment produce similar intervallic relationships among themselves as the horn motive and accompaniments do in the A section. In the remainder of this chapter I will focus on the similarities between both sections.

Similarities Between the A and B Sections

In both the A and B sections, a small number of intervals are used to generate the musical structure: ±3, ±6, and ±1. Figure 27 compares the linear accompaniment in the A section to the triplets from the B section. The first halves of these figures include +3 and ±6. The second halves each move by one semitone from the first pitches of their third bracket to the last pitches of their fourth bracket. In the A section's group 3, C𝄪 ascends to D♯ in group 4, while in the B section, Viola II's E descends to E♭ in the cello. As enharmonic equivalents, D♯ and E♭ are the resolutions of accompanimental material in both the A and B sections. Figure 28 reveals the structural significance of D♯/E♭ between both sections.

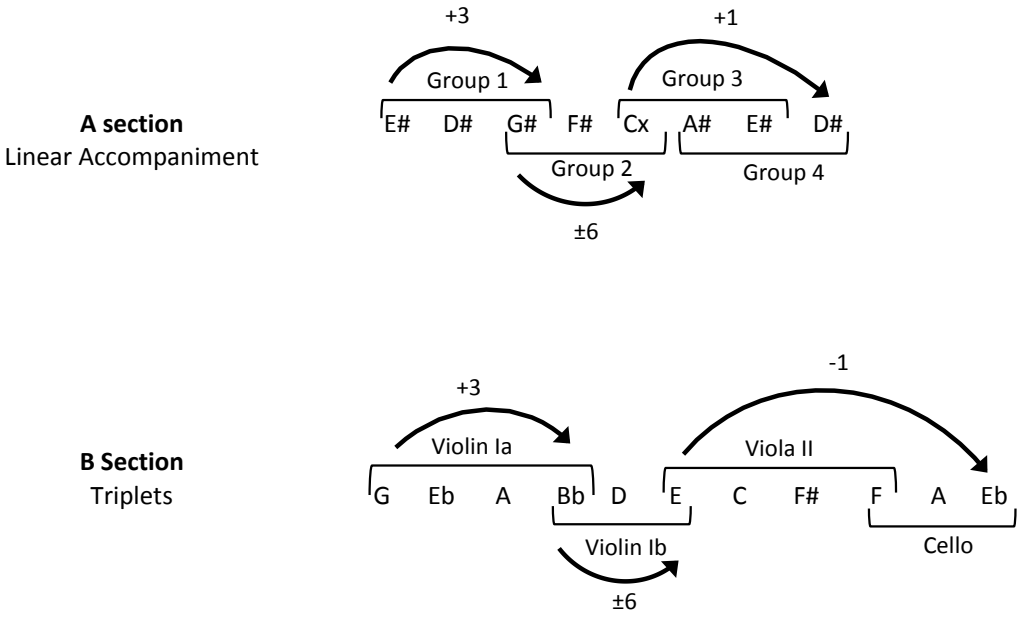


Figure 27. Comparison of accompanimental patterns from the A and B sections.

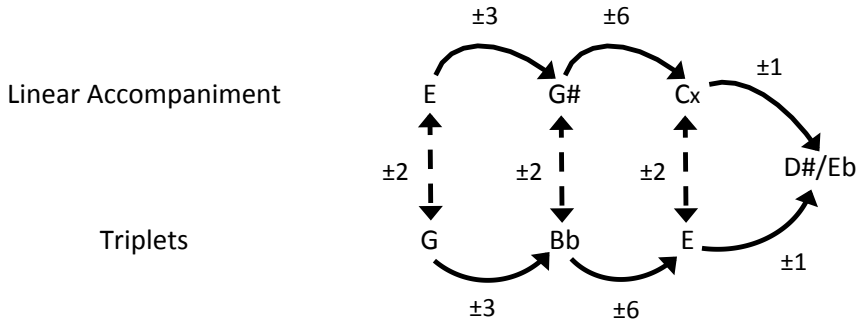


Figure 28. Intervallic relationships within and between the linear accompaniment and triplets.

Intervallic direction from one pitch to another exposes relationships between both sections. When ±3, ±6, and ±1 repeat from D♯ they generate the original horn motive, which also produces the B section theme, shown in Figure 29. This relationship describes the initial motive, D♯, F♯, C (mm. 2, 5, and 7), its transformation into D♯, F♯, C♯ (m. 9), and its extension to B (mm. 11-2) as well as the C to B from the beginning of the B section theme (mm. 63-4).

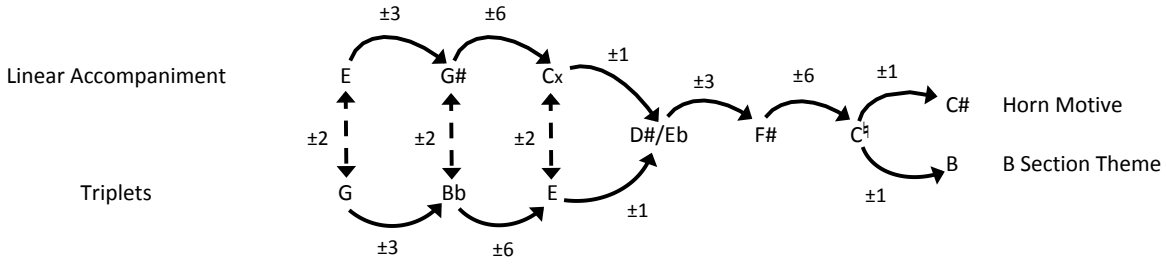


Figure 29. Intervallic relationships in the linear accompaniment and triplets generating the horn motive and B section theme.

The intervallic relationships ±3, ±6, and ±1 from the A and B sections of *Fireworks* generate the initial horn motive beginning with D♯/E♭. As the horn motive states its first pitch, D♯, the linear accompaniment begins a step higher on E♯ and completes its statement on D♯. The vertical accompaniment, which is continuously plucked throughout the course of the A section, rotates a D♯° triad among three groups of instruments within one measure's length. In the B section, triplets replicate the linear accompaniment's intervallic structure and end on E♭, as the key signature no longer contains D♯. The B section theme reflects the horn motive from the A section by acting as a simplified version of the triplets in section B. Both sections move by ±3, ±6, and ±1 to end at D♯, which in turn generates the original horn motive's initial three-note statement (mm. 2, 5, and 7; D♯, F♯, C), its alteration from C to C♯ (m. 9), and its expansion to B (m.11) as well as the B section theme's initial C descent to B (mm. 63-4).

CHAPTER V

CONCLUSION

Scholars such as Cone, Horlacher, Straus, Taruskin, van den Toorn, and Tymoczko approach Stravinsky's music with attention to form, harmonic structure, pitch-class sets, superimposition, and scalar analysis; some also focus on historical influences. Though these methods effectively aid in understanding passages in many of Stravinsky's works, they rarely clarify the processes that generate motivic material, though serial theory can explain a limited amount. My analysis of *Double Canon* and *Fireworks* reveal intervallic relationships that initiate motives from single pitches. Chapter II showed how scholars had applied methods to small passages within an entire work. I have shown that intervallic patterns can generate motivic material in an entire work, unifying the work itself.

In *Double Canon*, Stravinsky uses six rows--P_4, P_6, R_6, R_8, RI_4, and RI_2--that yield four different first pitches: F♯, E, A♯, and B♯. These pitches are symmetrical around two different axes: I^{B}_{F} and $I^{D}_{G♯}$. The initial pitch of the piece, F♯, generates E and A♯, both of which initiate B♯. In *Fireworks*, the enharmonic pair D♯/E♭ produce motives and accompaniments using the intervallic relationships of $\pm$3, $\pm$6, and $\pm$1, summarized by Figures 28 and 29,

Double Canon has been analyzed for its row forms and *Fireworks* for its octatonicism, but further study with other analytical methods is absent. I find that transformation theory reveals relationships between a single pitch and motivic material. Because I have revealed unifying relationships within two pieces composed fifty years apart, it is likely that transformation theory may uncover similar relationships within other works in Stravinsky's *oeuvre*.

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