SONATA FORM IN RAVEL'S PRE-WAR CHAMBER MUSIC

by

SIGRUN B. HEINZELMANN

VOLUME I: TEXT

A dissertation submitted to the Graduate Faculty in Music in partial fulfillment of the requirements for the Degree of Philosophy, The City University of New York.

2008

To Shasha

This manuscript has been read and accepted for the
Graduate Faculty in Music in satisfaction of the
dissertation requirement for the degree of Doctor of Philosophy

L. Poundie Burstein

______________________________ ______________________________

Date Chair of Examining Committee

David Olan

______________________________ ______________________________

Date Executive Officer

William N. Rothstein

Joseph N. Straus

J. Philip Lambert

Arbie Orenstein

Peter Kaminsky

Supervisory Committee

THE CITY UNIVERSITY OF NEW YORK

ABSTRACT

SONATA FORM IN RAVEL'S PRE-WAR CHAMBER MUSIC

by

SIGRUN B. HEINZELMANN

Advisor: Professor William N. Rothstein

Ravel was deeply concerned with the beauty and logic of musical form. To achieve formal clarity and perfection, he meticulously worked out every detail of a musical composition. This is especially true for sonata form, which is central to Ravel's instrumental work.

Although Ravel's works form an important part of the repertory of Western classical music, rigorous analytical studies are still scarce. This dissertation provides an in-depth study of the first movement of Ravel's String Quartet and the outer movements of his Piano Trio. It also presents analytical tools developed to analyze Ravel's complex and intricate music: an adaptation of Schenkerian analysis that takes into account dissonant prolongations at the fore- and middleground, and a set of step-based operations to describe motivic transformations within and across different referential collections. Both methodologies are applicable to a wider range of musical styles.

In addition to these tools, the analyses apply the concepts of Hepokoski and Darcy's Sonata Theory to demonstrate how Ravel invokes classical models only to distance himself ingeniously from them.

While harmonic analysis shows how Ravel's predilection for coupling third-related keys leads to a double-tonic complex in the Piano Trio's first movement, Schenkerian voice-leading graphs reveal that Ravel's sonata forms follow tonal background structures even where they do not adhere to Schenker's sonata-form paradigms. The Schenkerian approach also brings into relief the structural roles played by non-diatonic collections, which provide contrasting sonorities to delineate formal sections, and—as linear progressions—shape climax preparations at the surface level and transitional sections at the middleground.

Detailed motivic analysis brings to light how motives and their transformations help the listener track changes between referential collections. Since Ravel associates specific motive shapes with formal functions, motivic transformations also delineate the sections and subsections of a sonata's successive zones. Further, motivic analysis demonstrates how Ravel generates the thematic substance of an entire movement or sonata-cycle from motivic cells that appear in the first measure.

Taken together, these analyses provide concrete evidence that, striving for Mozartian perfection, Ravel created works of extraordinary craftsmanship and beauty.

ACKNOWLEDGMENTS

The roots of this dissertation go back to my Masters Studies at the University of Massachusetts, where I first began to analyze music by Ravel. I thank Gary Karpinski who mentored my first forays into music theory and provided a solid foundation on which I could build.

I am most grateful for the wonderful education I received from the outstanding faculty during my doctoral studies at CUNY; every seminar provided new insights, knowledge, and inspiration.

It is my great pleasure to thank the members of my committee for their invaluable contributions. My advisor, William Rothstein, guided the process with keen insight and impeccable scholarship. He carefully read and commented on multiple drafts, encouraged me to strengthen my arguments by challenging weak spots, and drew my attention to numerous articles that widened the scope of my discussion. My readers, Joseph Straus and Philip Lambert, provided prompt, thorough, and insightful feedback. The comments by committee members Arbie Orenstein, Peter Kaminsky, and Poundie Burstein helped me fine-tune the manuscript into its final shape.

I also thank my family, friends, colleagues, and students for their encouragement, patience, and support.

My deepest and heartfelt thanks go to Charlotte, without whom this dissertation would not have materialized for another few years. Her dedication, inspiration, and immeasurable support made everything possible.

TABLE OF CONTENTS
VOLUME I: TEXT

Conclusion

VOLUME II: EXAMPLES
LIST OF EXAMPLES

Chapter 2 Examples

Chapter 3 Examples

Chapter 4 Examples

Chapter 5 Examples

Chapter 6 Example

CHAPTER 1

Introduction

1.1. Background and Motivation

Maurice Ravel (1875–1937) was the preeminent French composer of his generation; no other French composer after Debussy gained as much recognition and stature.[1] His music has not lost any of its fascination to concert audiences worldwide and his works form an important part of the repertory of Western classical music; yet rigorous analytical studies of his music are still scarce.[2]

Ravel was deeply concerned with the beauty and logic of musical form. To achieve formal clarity and perfection, he meticulously worked out every detail of a musical composition. Although Ravel's superb craftsmanship invites theoretical inquiry and his deep concern with the beauty and logic of musical form has long been known,[3] very few scholarly works have pursued detailed studies of his musical forms.[4] My dissertation helps to fill this gap. In providing in-depth studies of selected movements from Ravel's pre-war chamber music, I contribute both to the much-needed analytical literature on the composer's music and to the history and theory of sonata form itself.

---

[1] Debussy (1862–1918), thirteen years Ravel's senior, belongs to the previous generation as do Vincent d'Indy (1851–1931) and Eric Satie (1866–1925).

[2] I provide a survey of the literature later in this chapter.

[3] In a 1932 interview, for example, Ravel links his love for Mozart to his own ideal of pure forms: "Mozart's great lesson for us today is that he is helping us to liberate ourselves from music, to listen only to ourselves and to our eternal heritage, to forget what immediately preceded us: this accounts for the present return to *pure forms*, this neoclassicism … which delights me, in a certain sense." See Nino Frank, "Maurice Ravel Between Two Trains," in Arbie Orenstein, *A Ravel Reader* (New York: Columbia University Press, 1990), 496–498; 497.

[4] See literature survey.

Moreover, to analyze Ravel's complex and intricate music, I have developed new analytical tools that are applicable to a wide variety of other musical styles.

Sonata-form pieces and movements make up an important part of Ravel's instrumental work, and he used the form throughout his composing life. Beginning with early sonata-form exercises at the conservatoire (ca. 1890s), Ravel wrote sonata forms in the *Sonate posthume pour piano et violon* (1897); the *Quatuor* (String Quartet, 1902–03); the *Sonatine* (1903–05); the *Trio pour piano, violon et violoncelle* (Piano Trio, 1914); the *Sonate pour violon et violoncelle* (1920–22); the *Sonate pour violon et piano* (1923–27); the *Concerto pour la main gauche* (Concerto for the left hand, 1929–30); and the *Concerto pour piano et orchestre* (Piano Concerto, 1929–31). In addition, we find modified sonata forms in *Jeux d'eau* (1901), the *Introduction et Allegro* (1905), and in "Ondine" and "Le Gibet" of *Gaspard de la nuit* (1908).[5]

Jankélévitch's assertion that "every composition by Ravel represents … a certain problem to be solved" applies especially to the way Ravel assimilates sonata form.[6] Each of the works mentioned above has a different formal design; in each, Ravel experiments with different aspects of the form. Since it plays such an important role within his oeuvre, a thorough study of sonata form in Ravel will provide a lens through which we can examine specific traits of his craftsmanship and compositional style. Rather than covering a larger number of works in less detail, this dissertation offers in-depth analyses of three sonata-form movements from Ravel's String Quartet and Piano Trio.

---

[5] For a brief discussion of these movement's sonata forms—"pushed to the verge of unidentifiability"—see pages 81–87 of Roy Howat's essay "Ravel and the Piano," *The Cambridge Companion to Ravel*, ed. Deborah Mawer (Cambridge: Cambridge University Press, 2002), 71–96; 82.

[6] Vladimir Jankélévitch, *Ravel* (New York: Grove Press, 1959), 69.

The focus on chamber works, where sonata form is specific to the genre, provides a window into the composer's discourse with the past. For Ravel, this discourse was as much a matter of learning his craft by studying works of past composers as it was a matter of communicating with his audience. During Ravel's time, chamber music was intimately linked to the culture of the *salon.* Thomas Kabisch argues convincingly that the environment of the Parisian salons before World War I influenced the aesthetic choices of Ravel:

> The task of composing for a specific audience with specific expectations—and one of the essential characteristics of the salon is that the composer knows the audience and its "background"—lets composers hold on to traditional aspects of the music (be they established forms or tone orders) so as to "astonish [the listener] without offending" (Barbey d'Aurevilly) through an artful nuance or a small deviation.[7]

Knowing the background of his educated audience, Ravel invokes and plays with historical models, setting into relief his own inventive designs. Sonata form thus becomes a vehicle through which Ravel invokes the past while at the same time distancing himself from it.

Since World War I interrupted Ravel's composing and subsequently led to significant changes in his style, this historical event forms a natural boundary for my study. After the war, Ravel began to experiment further with the limits of tonality—perhaps inspired by or even competing with the younger generation of *Les six*.[8]

---

[7] "Die Aufgabe, für ein bestimmtes Publikum mit bestimmten Erwartungen zu komponieren — und darin, daß man das Publikum und seinen Hintergrund kennt, besteht ein wesentliches Charakteristikum des Salons —, läßt Komponisten an tradierten Elementen der Musik — seien es überkommene Formen oder Tonordnungen — festhalten, um durch eine Kunst der Nuance und der kleinen Abweichung den Zuhörer 'zu erstaunen, ohne zu verletzen' (Barbey d'Aurevilly)." My translation, see Thomas Kabisch, "Oktatonik, Tonalität und Form in der Musik Maurice Ravels," *Musiktheorie* 5/2 (1990), 117–136; 119.

[8] *Les six* were the composers Georges Auric, Louis Durey, Arthur Honegger, Darius Milhaud, Francis Poulenc, and Germaine Tailleferre.

Especially in his post-war chamber works (the *Sonate pour violon et violoncelle* and the violin sonata), he pursued a more contrapuntal style.

In-depth analyses of the first movement of Ravel's String Quartet and the first and last movements of his Piano Trio as well as the Trio's four-movement cycle provide insights into Ravel's ingenious and inventive treatment of sonata form and into stylistic features not previously discussed in the scholarly literature.

Sonata form has been an important vehicle for composers throughout history. Since it continued to play a role in the repertoire of early twentieth-century music, studying Ravel's contributions to this form will also allow us to reassess its historical development and to draw comparisons to the sonata techniques of other early twentieth-century composers.

1.2. Brief Survey of Analytical Literature on Ravel

Until recently, the music of Ravel has been largely neglected by music-theoretical and analytical scholarship. The rate of analytical publications on Ravel has increased since the late '90s, yet their scope is still insufficient for a composer of his rank.[9] Moreover, rigorous analytical studies of Ravel's instrumental music have focused exclusively on post-war sonata works.[10]

French analytical literature on Ravel is surprisingly sparse; most French publications on the composer take biographical, historical, or musicological approaches.

---

[9] We need only compare the numbers of analytical publications on Ravel's music to those on Debussy's, for example, to become aware of the discrepancy.

[10] See Peter Kaminsky, "Ravel's Late Music and the Problem of 'Polytonality'," *Music Theory Spectrum*, 26/2 (2004), 237–264; Walter Pfann, *Zur Sonatengestaltung im Spätwerk Maurice Ravels* (Regensburg: Gustav Bosse, 1991); Gerd Sannemüller, "Die Sonate für Violine und Violoncello von Maurice Ravel," *Die Musikforschung* 28/4 (1975), 408–19.

Exceptions, such as Jean-Claude Teboul's volume *Ravel: Le langage musical dans l'oeuvre pour piano*, Olivier Messiaen and Yvonne Loriod Messiaen's recent book on Ravel's piano music, and Serge Gut's essay on Ravel's harmonizations of Greek melodies, discuss piano and vocal music.[11] While Ravel's chamber music has attracted studies by performers,[12] scholarly works on Ravel tend to bypass his chamber music.

Most German-language studies on Ravel, written in the tradition of *Musikwissenschaft*, focus primarily on musicological aspects of research, such as aestheticism, cultural environment, classicism, etc., and thus do not engage deeply with the music from a rigorously analytical and theoretical perspective.[13]

The recent surge in Ravel studies has brought forth approaches as varied as Ravel's music. By far the most detailed analytical response to Ravel's music in the English language has been the work of Peter Kaminsky. [14] His recent essays on Ravel's

---

[11] Jean-Claude Teboul, *Ravel: Le langage musical dans l'oeuvre pour piano - A la lumière des principes d'analyse de Schoenberg* (Paris: Léopard d'Or, 1987); Olivier Messiaen and Yvonne Loriod-Messiaen, *Ravel: Analyses des oeuvres pour piano de Maurice Ravel* (Paris: Durand, 2003); Serge Gut, "Permanence et transformation des structures mélodiques grecques antiques dans les Mélodies populaires grecques de Maurice Ravel" *Revue de musicologie* 84/2 (1998), 263–276.

[12] Richard William Dowling, "Maurice Ravel's *Trio pour piano, violon et violoncelle*: A preliminary study for a New Performing Edition," DMA diss., University of Texas at Austin, 1990; Sarina Saori Ohno, "The Piano Chamber Music of Maurice Ravel," DMA diss., City University of New York Graduate Center, 2005.

[13] See e.g., Jürgen Braun, *Die Thematik in den Kammermusikwerken von Maurice Ravel*, Kölner Beiträge zur Musikforschung, vol. 33 (Regensburg: Gustav Bosse, 1966); Ortrud Kuhn-Schließ, *Klassizistische Tendenzen im Klavierwerk von Maurice Ravel,* Kölner Beiträge zur Musikforschung, vol. 171 (Regensburg: Gustav Bosse, 1992); Cornelia Petersen, *Die Lieder von Maurice Ravel,* Europäische Hochschulschriften, Reihe Musikwissenschaft (Frankfurt am Main: Peter Lang, 1995); Walter Pfann, *Zur Sonatengestaltung im Spätwerk Maurice Ravels*; and Elisabeth Winnecke, *Ravel und die Modelle*: *Kulturhistorische Untersuchungen zum Gebrauch von Modellen und Beiträge zu einer Ästhetik Maurice Ravels*, Musik Kontext, vol. 1 (Frankfurt am Main: Peter Lang/Europäischer Verlag der Wissenschaften, 2001).

[14] Peter Kaminsky; "Of Children, Princesses, Dreams and Isomorphisms: Text-Music Transformation in Ravel's Vocal Works," *Music Analysis*, 19/1 (March 2000), 29–68; "Composers' Words, Theorists' Analyses, Ravel's Music (Sometimes the Twain Shall Meet)," *College Music Symposium* 43 (2003), 161–177; "Ravel's Late Music and the Problem of 'Polytonality'"; "Vocal Music and the Lures of Exoticism and Irony," *The Cambridge Companion to Ravel*, 162–187.

music contribute many valuable methodological approaches and a wealth of analytical insights into Ravel's compositional style. Kaminsky's analyses, which address text-music transformations and topics such as reharmonization and recontextualization, the role of collections, and polytonality, focus primarily on vocal music and piano works.

An excellent discussion of Ravel's use of the octatonic collection is Steven Baur's article on "Ravel's 'Russian' Period," which includes analyses of excerpts from Ravel's String Quartet and the *Introduction and Allegro*.[15] Also addressing the role of the octatonic collection in Ravel's works are earlier articles by Günter Weiss-Aigner and Thomas Kabisch.[16] While Weiss-Aigner's brief essay mainly lists various occurrences of the "diminished scale" from *Jeux d'eaux* to *L'Heure espagnole*, Kabisch places Ravel's octatonicism in the context of form and tonality.

The work of Deborah Mawer has contributed significantly to Ravel studies. As the editor of *The Cambridge Companion to Ravel*, Mawer draws together a group of scholarly essays, including two of her own, that provide cultural, aesthetic, and analytical approaches to Ravels music and discuss its performance and reception. She has also recently published a book on Ravel's ballets.[17]

A group of recent dissertations promises further growth of Ravel scholarship. Making the form of *La valse* the center of his inquiry, Volker Helbing examines aspects

---

[15] Steven Baur. "Ravel's 'Russian' Period: Octatonicism in His Early Works, 1893–1908." *Journal of the American Musicological Society* 52/3 (1999), 531–92.

[16] Kabisch, "Oktatonik, Tonalität und Form in der Musik Maurice Ravels"; Günter Weiss-Aigner, "Eine Sonderform der Skalenbildung in der Music Ravels," *Die Musikforschung* 25/3 (1972), 323–26.

[17] *The Cambridge Companion to Ravel*, ed. Deborah Mawer (Cambridge: Cambridge University Press, 2002); Deborah Mawer, "Musical Objects and Machines," *The Cambridge Companion to Ravel*, 47–67; "Ballet and the Apotheosis of Dance," ibid., 140–161; *The Ballets of Maurice Ravel: Creation and Interpretation* (Aldershot: Ashgate, May 2006).

of choreography and distance,[18] while Michael Puri's dissertation on *Daphnis et Chloé* analyzes the ballet's music in the light of Marcel Proust's *À la recherche du temps perdu*, incorporating Darcy and Hepokoski's concept of rotational form.[19] Gurminder Bhogal's dissertation studies the connections between the concept of *arabesque* and metrical dissonance.[20]

Examining prolongation and voice-leading, respectively, in Ravel's music, the dissertations by Philip Wade Russom and Eddy Kwong Mei Chong provide points of departure for further studies, but due to their focus on theoretical topics—respectively, pitch organization and Schenkerian principles—they include only short excerpts of works by Ravel.[21] While I reject Philip Wade Russom's premise that Ravel's early music is non-tonal, my research builds on his concepts of Ravel's referential collections and bass-line prolongations.

Peter Kaminsky's essays on Ravel are closest and most central to my own approach. My analyses of complete movements extend and complement Jürgen Braun's 1966 study on thematic aspects in Ravel's chamber music and Mark DeVoto's recent essay on harmony in Ravel's chamber music.[22]

---

[18] Volker Helbing, "Choreografie und Distanz. Studien zur Ravel-Analyse," PhD diss., Technische Universität Berlin, 2005.
[19] Michael Puri,"Theorizing Memory in Maurice Ravel's *Daphnis et Chloé,*" PhD diss., Yale University, 2004.
[20] Gurminder Bhogal "Arabesque and Metric Dissonance in the Music of Maurice Ravel," PhD diss., University of Chicago, 2004.
[21] Philip Wade Russom, "A Theory of Pitch Organization for the Early Works of Maurice Ravel," PhD diss., Yale University, 1985; Eddy Kwong Mei Chong, "Extending Schenker's *Neue musikalischen Theorien und Phantasien:* Towards a Schenkerian Model for the Analysis of Ravel's Music," PhD diss., Eastman School of Music, University of Rochester, 2002. In some dissertations on aspects of early twentieth-century music, a few examples engage the music of Ravel. See for example, Kip Douglas Wile, "Collection in Neocentric Music: A Study in Theory and Analysis of the Music of Debussy, Stravinsky, Bartók, and Ravel," PhD diss., University of Chicago, 1995, which includes two examples from the first movement of Ravel's *Sonatine*.
[22] Mark DeVoto, "Harmony in the Chamber Music," *The Cambridge Companion to Ravel*, 97–117.

1.3. The Problem of Methodology

The challenge in analyzing Ravel's music is to find analytical tools that adequately address the great variety of compositional resources he uses. Ravel based his pitch material on referential collections such as the pentatonic, diatonic, octatonic, enneatonic, and whole-tone collections.[23] His harmonic language, though overall tonal at least in his early works, combines non-tonal elements—such as symmetrical chords drawn from non-diatonic collections—with complex dissonant diatonic harmonies. While his forms are creative adaptations of earlier models from the Baroque and Classical periods, his sophisticated motivic and thematic ideas and their transformations owe much to the spirit of the early twentieth century. Ravel's music is inspired both by that of his contemporaries and by such diverse influences as gamelan music, Russian octatonicism, Basque folk music, orientalism, jazz, and the writings of Edgar Allan Poe.[24]

Ravel's integration of all these influences requires a variety of analytical approaches to address motivic-thematic transformation, the role of diatonic and non-diatonic collections, harmony and voice-leading, and last, but not least, form.

We perceive form as a confluence of vertical and horizontal forces. Our perception of sonata form in real time operates at two or more levels: where we perceive contrast, we tend to place boundaries (vertical); where we hear gradual change, we perceive continuity and transformation of related elements (horizontal). In Ravel's music, the complexity of interaction between these forces and the musical elements that shape them makes analytical discourse difficult. Rather than attempting to relate every detail to

---

[23] See Philip Wade Russom, "A Theory of Pitch Organization."
[24] See Barbara Kelly, "History and Homage," *The Cambridge Companion to Ravel*, 7–26; Robert Orledge, "Evocations of Exoticism," ibid., 27–46.

everything else, I explore each analytical approach separately and present the insights it yields, leaving their ultimate integration to the music itself.

My discussion of formal designs also addresses issues of harmony and tonality. In the String Quartet, the first movement's F-major/D-minor ambiguity provides the framework for a sonata-form process based on the dialectic opposition of referential diatonic and octatonic collections rather than on an opposition of harmonic relationships. The concept of the "double-tonic complex" is central to my analysis of the Piano Trio's first movement.[25] In both the Quartet and the Trio, Ravel explores third-relationships; specifically, he combines a minor key with its relative major key.[26]

1.3.1. Sonata Theory

Recent models and sonata-form paradigms introduced by William Caplin, James Hepokoski and Warren Darcy provide the basis for my discussion of formal aspects of Ravel's music.[27] I use the analytical approaches and vocabulary of these authors to describe sections and their functions within sonata form, and I discuss the ways Ravel follows "classical" models, deviates from them and creates a different combination of formal elements for each individual sonata form.

---

[25] For extensive references on the double-tonic complex see chapter 5, footnotes 46–53.

[26] A similar F#-minor/A-major/C#-minor ambiguity characterizes the harmonic and formal design of the *Sonatine's* outer movements.

[27] William E. Caplin, *Classical Form: A Theory of Formal Functions for the Instrumental Music of Haydn, Mozart, and Beethoven* (Oxford/New York: Oxford University Press, 1998); James Hepokoski, "Beyond the Sonata Principle," *Journal of the American Musicological Society* 55/1 (2002), 91–154; James Hepokoski and Warren Darcy, "The Medial Caesura and Its Role in the Eighteenth-Century Sonata Exposition," *Music Theory Spectrum* 19 (1997), 115–54; *Elements of Sonata Theory: Norms, Types, and Deformations in the Late-Eighteenth Century Sonata* (New York: Oxford University Press, 2006).

William Caplin's most thorough discussion of formal functions in the works of Haydn, Mozart, and Beethoven provides a clear and precise vocabulary, especially for phrase structure, which can be adapted easily to describe Ravel's music.

Hepokoski and Darcy's Sonata Theory allows us to compare formal processes in Ravel's sonata forms to those of classical composers, and their concept of "rotational form" seems especially well suited to understanding and describing Ravel's creative adaptation of earlier sonata-form models. I provide a brief introduction to their concepts and a short explanation of their most important terms later in this chapter.

1.3.2. Schenkerian Analysis

To successfully analyze Ravel's pre-war music, I have also built on and extended analytical tools from two major areas of modern American music theory: Schenkerian analysis and transformational analysis.[28] Schenkerian analysis is still unsurpassed in its capacity to uncover the deeper tonal structures of a composition and their interaction with foreground features. I introduce a modified Schenkerian methodology to study Ravel's tonal processes in detail, elucidate his complex harmonic designs, and compare his background structures with Schenker's *Ursatz* paradigms. Such a prolongational approach yields crucial insights into Ravel's melodic and motivic elements, his harmonic language, and the contrapuntal structures and rhetorical devices that shape his formal designs. Diatonic and non-diatonic referential collections interact to create complex layers of structural hierarchies; pedal tones often control large-scale harmonic motion;

[28] I will discuss the literature pertaining to each area in chapters 2 and 3, which introduce my adaptations of existing methodologies.

ascending linear progressions prepare climaxes; larger-scale descending whole-tone progressions shape transitions. Ultimately, however, even the most dissonant features of Ravel's pre-war music are subordinate to consonant, tonal paradigms.

1.3.3. Motivic Analysis and Transformation

In discussing thematic and motivic relationships, I take Deborah Mawer's idea of Ravel's "musical objects" as a point of departure and show (a) how the characteristics of individual motivic and thematic "objects" influence the overall structure and harmonic design of each sonata form, and (b) how these motives and themes participate in creating form by earmarking formal sections for the listener.[29]

To address motivic transformations and to elucidate motivic-thematic connections between movements in the Piano Trio, I develop my methodology from set-theoretic and transformational analysis. Building on Matthew Santa's "Modular Transformations," I introduce (a) new analytical tools based on step(-class) theory to describe precisely motivic transformations across varying referential contexts, and (b) demonstrate how Ravel employs different transformational paths to create intra- and inter-movement connections.

As Ravel's music draws from different referential collections, I first explain the properties of these collections and how they shape Ravel's melodic materials. I then present the theoretical framework of "modular transformation" and adapt Santa's concepts to the music of Ravel. Modular transformation mathematically describes transformations of chords or motives that are brought about by changes in their

---

[29] See Mawer, "Musical Objects and Machines."

referential contexts. We can see such a transformation in the first movement of Ravel's String Quartet, where a diatonic passage from the exposition returns in the recapitulation in an octatonic context. I extend Santa's theoretical framework to include the possibility of inversion within and across different referential collections. This allows description of the inversional relationship between the P- and S-themes in Ravel's Piano Trio, for example.

1.4. A Brief Introduction to Hepokoski and Darcy's *Sonata Theory*

"The essence of Sonata Theory lies in uncovering and interpreting the dialogue of an individual piece with the background set of norms."[30] Since Ravel was a composer very much in dialogue with the set of norms that originated in the classical period, Hepokoski and Darcy's Sonata Theory provides an ideal vehicle with which to analyze Ravel's sonata forms. The following paragraphs provide a summary of those concepts of Hepokoski and Darcy's theory that inform my analyses in chapters 4 and 5; I provide more detailed explanations of the individual concepts and terms in the context of the analyses themselves.

1.4.1. The Zones of Sonata Form

Hepokoski and Darcy divide each of the sonata form's three main sections (exposition, development, and recapitulation) into "zones." These zones largely correspond with the "subject areas" or "theme groups" of earlier sonata theories.[31] The

---

[30] Hepokoski and Darcy, *Elements of Sonata Theory*, 11.
[31] See, e.g.Wallace Berry, *Form in Music*, 2nd ed. (Englewood Cliffs, NJ: Prentice Hall, 1986); Charles Rosen, *Sonata Forms*, rev. ed. (New York: Norton, 1988); Peter Spencer and Peter M. Temko, *A Practical*

term "zone" has two advantages: (1) unlike previous labels, it incorporates both thematic and harmonic aspects; and (2) its definition neither depends on nor implies a specific type of melodic organization such as a "theme." The term "zone" also implies both space and time—metaphors we invoke when describing our experience of form.

The exposition typically has four zones: the primary-theme zone (P-zone or P), the transition zone (TR-zone or TR), the secondary-theme zone (S-zone or S), and the closing zone (C-zone or C). Each zone can often be subdivided into smaller units, so-called modules, which are delineated by their phrase- and harmonic structure.

The P-zone's function is to launch the sonata and introduce its principal idea (*Hauptgedanke*). "At the same time, P establishes its rhetorical function as the initiator of rotations."[32] The TR-zone's function is to gather energy and to drive toward the MC. As Hepokoski and Darcy point out, this rhetorical function is often, but not always, accompanied by a modulation. The S-zone's task is to establish the new key and to achieve *essential expositional closure* (EEC), the definitive PAC in the new key. The EEC marks the boundary between S and C.[33] From the harmonic perspective, the EEC completes the exposition's tonal trajectory. Following the EEC, the C-zone's "[post-cadential] complex of C-ideas reaffirms and reinforces the new key."[34]

Approach to the Study of Form in Music (Englewood Cliffs, NJ: Prentice Hall, 1988); William S. Newman, *A History of the Sonata Idea*, 3 vols., paperback ed. (New York: W.W. Norton 1972.

[32] Hepokoski and Darcy, *Elements of Sonata Theory*, 65. I explain the principle of rotation in the next section (1.5.2).

[33] Ibid., 117.

[34] Ibid., 180.

In most sonata forms, a "medial caesura" (MC) divides the exposition into two large halves: P and TR form the first half, S and C the second.[35] The medial caesura articulates the point of arrival that harmonically and rhetorically prepares for the onset of the S-theme. The most common cadences that mark the MC in major-mode sonatas are: a half cadence in the tonic key (I:HC MC), a half cadence in the dominant (V:HC MC), or a perfect authentic cadence in the dominant (V:PAC MC). Typical MC cadences in minor-mode sonatas are III:HC MC, v:HC MC, and, less often, i:HC MC.

For these and other concepts, Hepokoski and Darcy establish levels of "defaults" to describe how common or normative certain conventions are. (First-level defaults always refer to the most normative use of a convention.) The more a composer distances himself or herself from the first-level default, the more "special" we have to consider his or her choice.

Most often, a medial caesura features a clearly audible caesura. A typical MC gesture in the classical period is the "triple hammer-blow,"[36] three *forte* chords that "ostentatiously reiterate the final dominant chord" and are often followed by a rest.[37] In some cases, medial caesuras do not immediately lead to the onset of the S-theme. The caesura-gap is widened to three, four, or more measures and filled with "connective caesura-fill" (CF).[38]

[35] "The medial caesura has two functions: it marks the end of the first part of the exposition (hence our adjective 'medial'), and is simultaneously the highlighted gesture that makes available the second part." Ibid., 25.
[36] Ibid., 34. Two such "hammer-blows" are also frequent.
[37] "The silence of the caesura-gap is a watershed moment relinquishing the preceding drive and energy-gain: it articulates and represents *energy-loss*, thus initiating, usually, the subsequent drop to *piano* for S." Ibid., 34.
[38] Ibid.

In addition to the regular MC, Hepokoski and Darcy discuss two additional MC scenarios. (1) An exposition without a clearly articulated MC is a "continuous exposition."[39] Without an MC, no S-theme can be launched; thus this type of exposition features a succession of *Fortspinnung* modules (FS) or a thematic chain. In the listener's perception, there comes a point when an assumed TR must be reinterpreted as FS.[40] (2) Some movements feature two MC gestures. In that case, Hepokoski and Darcy refer to the S-zone as a "trimodular block" (TMB).[41]

1.4.2. The Principle of Rotation

Hepokoski and Darcy base their concept of rotation on our experience of form as a series of recurring patterns:

> Sonata movements are engaged in a dialogue with a more basic architectural principle of large-scale recurrence that we call *rotation*. Rotational structures are those that extend through musical space by recycling one or more times—with appropriate alterations and adjustments—a referential thematic pattern established as an ordered succession at the piece's outset. In each case the implication is that once we have arrived at the end of the thematic pattern, the next step will bring us back to its opening, or to a variant thereof, in order to initiate another (often modified) move through the configuration.

Hepokoski and Darcy thus call the recurring pattern P–TR–S–C a rotation. The succession and content of rotations become matrices against which we can compare and interpret the ordered events in individual pieces. While the content of rotation—the order, presence or absence of the various zones—shapes the discussion of each movement's

---

[39] Ibid., 51–64.
[40] Ibid., 52–53.
[41] Ibid., 170–177. The TMB is the typical procedure Schubert applies for his three-key expositions. In chapter 4, I explain the concept of the TMB in detail in my analysis of the String Quartet's first movement.

individual identity, the order and number of the rotations themselves become the basis for Hepokoski and Darcy's classification of sonata-form types.

1.4.3. The Sonata-Form Types

Hepokoski and Darcy distinguish five types of sonata form:

> *Type 1 sonatas* are those that contain only an exposition and a recapitulation, with no link or only a minimal link between themes. These have been referred to as "sonatas without development" (or instances of "exposition-recapitulation form," "slow-movement sonata form," or the "sonatina"). …
>
> *Type 2 sonatas* are … those "binary" (or "binary variant") structures in which what others have called the recapitulation begins not with the onset of the primary theme (P) but substantially after that point, most commonly at or around the secondary theme (S). …
>
> *Type 3 sonatas* are the standard "textbook" structures, with expositions, developments, and recapitulations that normally begin with P in the tonic. …
>
> *Type 4 sonatas* are the differing types of sonata-rondos. …
>
> *Type 5 sonatas* encompass concerto-sonata adaptations.[42]

Types 1 and 2 are characterized by two rotations each; Types 3–5 have three or more rotations. The three movements I analyze from Ravel's String Quartet and Piano Trio feature only Type 2 and Type 3 sonatas.

1.5. Labels and Abbreviations

My sonata-form labels and terminology generally follow Hepokoski and Darcy's. Where I use terms and concepts by other authors, I indicate so in a footnote. However,

---

[42] Ibid., 344–45.

the labeling of themes causes some difficulties. Hepokoski and Darcy's abbreviations P, TR, S, and C may refer equally to a zone or a theme. To distinguish between these two uses of "P" in the form tables, I label the "P-zone" with an upper-case "P" and the "P-theme" with a lower-case "p." When referring to a specific theme in the text, I use the lower-case "p-theme" or "theme p," to match the label in the form table; but when referring to the primary theme in a generic sense, I use Hepokoski and Darcy's upper-case "P-theme." In both tables and text, lower-case labels also denote motives associated with specific themes; for example, "motive p" is the main motive that characterizes "theme p." The same principle applies to the remaining zones.

I assume the reader's knowledge of Schenkerian concepts and terminology. In chapter 2, I explain only where I adapt them.

In chapter 3, I explain my labels for motivic transformation and provide a glossary.

1.6. Outline of Chapters

The theoretical and methodological framework I develop from Schenkerian analysis and set- and transformation-theory form the first part of the dissertation. In the second, I combine these two approaches with concepts and terminology from recent sonata theories to analyze the String Quartet and Piano Trio.

Chapter 1 introduces the aim and purpose of my dissertation and places it in the context of existing research on Ravel.

Chapter 2, the first of two chapters on methodology and analytical approaches, discusses the challenges of adapting Schenkerian prolongational analysis to Ravel's pre-war music, develops solutions to meet these challenges, and demonstrates their analytical application with examples drawn from Ravel's pre-war music.

Chapter 3 develops a methodology to analyze Ravel's motivic and thematic transformations by extending Matthew Santa's concept of "Modular Transformation" to include inversion and other kinds of motivic transformations.[43]

Chapters 4 and 5 form the analytical core of my dissertation, presenting in-depth analyses of the sonata-form movements of Ravel's two major pre-war chamber works: the first movement of the String Quartet (chapter 4) and the outer movements of the Piano Trio (chapter 5). Voice-leading graphs of selected passages and complete movements support the analytical discourse. Figures and tables showing each movement's formal design serve as a background for the analysis of form.

Chapter 6 summarizes the analytical findings of the previous chapters and places them in a larger context. First, taking a comparison between the Quartet and Trio's first movements as my point of departure, I look at both earlier and later pieces to uncover significant trends in Ravel's treatment of sonata form. Second, I evaluate Ravel's use of historical models as an inspiration for his own forms. Third, I show how my observations open up further avenues for research.

---

[43] Matthew Santa, "Defining Modular Transformations," *Music Theory Spectrum* 21/2 (1999), 200–229.

CHAPTER 2

Analytical Approaches and Methodologies I:

Adapting Schenkerian Analysis to Ravel's Music

2.1. The Problem(s) of Prolongation in Ravel

Schenker did not think highly of French composers, and Ravel's music certainly lies outside Schenker's favored canon of native or honorary "German" masters. I will demonstrate, however, that we can adapt Schenkerian tools and in the process uncover many of the characteristics of Ravel's style. A prolongational approach reveals the multi-layered interactions between diatonic and non-diatonic collections, which shape Ravel's melodic and harmonic language. It clarifies the role of pedal tones and non-diatonic linear progressions and shows how these significant elements function within Ravel's formal designs. Finally, it enables us to hear how in his pre-war music Ravel anchors even the most dissonant features to tonal paradigms.

I use the term "prolongation" in the sense of *Auskomponierung*, the "composing-out" of a melodic tone, an interval or a harmony by embellishment or elaboration through additional notes of lower structural significance. In addition, prolongation can be brought about by temporal or registral displacement. The latter two are separate categories for Väisälä, but are included as types of embellishment by Larson.[1]

---

[1] See Olli Väisälä, *Prolongation in Early Post-Tonal Music*, Studia Musica 23, Sibelius Academy (Helsinki: Hakapaino Oy, 2004), 30; and Steve Larson, "The Problem of Prolongation in 'Tonal' Music: Terminology, Perception, and Expressive Meaning," *Journal of Music Theory* 41/1 (1997), 119–20. Two chapters of Väisälä's book have been published as independent essays; see "Concepts of Harmony and Prolongation in Schoenberg's Op. 19/2," *Music Theory Spectrum* 21/2 (1999), 230–59, and "Prolongation of Harmonies Related to the Harmonic Series in Early Post-Tonal Music," *Journal of Music Theory* 46/1&2 (2002), 207–83.

In this chapter, I address the challenges Ravel's music poses to the Schenkerian method, re(de)fine the distinctions necessary to formulate a coherent approach to prolongation for Ravel's *tonal* compositions, and illustrate their analytical application. I also offer general observations on Ravel's pre-war *oeuvre*. In contrast to Eddy Kwong Mei Chong, whose dissertation discusses the philosophical-theoretical foundations for applying Schenkerian analysis to Ravel,[2] I aim here to provide a methodological foundation for the kinds of analytical decisions one encounters when graphing Ravel's tonal works. Joseph Straus' four "conditions for prolongation" will serve as a background for my discussion.[3]

In adapting Schenkerian principles to analyzing Ravel, I have drawn on historical sources such as Ravel's own writings and René Lenormand's *Study of Contemporary Harmony*,[4] to which Ravel provided some analytical excerpts of his own work. I have also drawn on recent scholarship such as Olli Väisälä's work on prolongations of the harmonic series, Matthew Santa's modular transformations," Matthew Brown's *Explaining Tonality*, and Peter Kaminsky's analytical essays on Ravel's music.[5] In

---

[2] Chong, "Extending Schenker's *Neue musikalischen Theorien und Phantasien*."
[3] Joseph N. Straus, "The Problem of Prolongation in Post-Tonal Music," *Journal of Music Theory* 31/1 (1987), 1–21.
[4] In *A Study of Twentieth-Century Harmony*, René Lenormand, a French composer and contemporary of Ravel, comments on the French harmonic practice of his time, presenting musical examples solicited from his contemporaries (such as Caplet, Chabrier, Chausson, Debussy, Dukas, Fauré, Franck, Gounod, d'Indy, Koechlin, Ravel, Roussel, Satie, and Schmitt) as well as contributing some of his own. See René Lenormand, *Twentieth-Century Harmony: A Treatise and Guide for the Student Composer of Today*, trans. Herbert Antcliffe, vol. 1, *Harmony in France to 1914* (London: Joseph Williams, 1915; rept. New York: Da Capo Press, 1976). French original published 1913.
[5] Matthew Brown, *Explaining Tonality* (Rochester: University of Rochester Press, 2005); Väisälä, *Prolongation in Early Post-Tonal Music*, and "Prolongation of Harmonies Related to the Harmonic Series in Early Post-Tonal Music"; Peter Kaminsky, "Of Children, Princesses, Dreams and Isomorphisms"; "Composers' Words, Theorists' Analyses, Ravel's Music"; "Ravel's Late Music and the Problem of 'Polytonality'."

addition, my approach is informed by the extensive literature on the topic of prolongation.[6]

After establishing the basic premises for my methodology and interpreting Straus' four conditions for prolongation in relation to Ravel's music (sections 2.1.2 and 2.1.3), I treat the specific challenges in detail in sections 2.2 to 2.7, offering a flexible, context-derived approach to determine the hierarchical distinctions for prolongation. In conclusion, I summarize how and where Ravel uses the different means of prolongation and propose a flexible system of correspondences between these prolongational structures and the levels at which they tend to function.

2.1.1. Challenges posed by Ravel's Pre-war Music

Ravel's harmonic language is rich in complex dissonant sonorities, chord structures based on stacked thirds, "unresolved appoggiaturas,"[7] and chords based on non-diatonic, cyclic referential collections (collections whose scalar step-sequence is governed by interval cycles). Prolongations of such dissonant harmonies occur at the fore- and middleground. Cyclic collections may also govern linear progressions; among these, Ravel was especially fond of large-scale whole-tone progressions in the bass. At

---

[6] To name just a few: James Baker, "Schenkerian Analysis and Post-Tonal Music," *Aspects of Schenkerian Theory*, ed. David Beach (New Haven: Yale University Press, 1983), 153–86; William Clark, "Heinrich Schenker and the Nature of the Seventh Chord," *Journal of Music Theory* 26/2 (1982), 221–59; Larson, "The Problem of Prolongation in 'Tonal' Music"; Robert Morgan, "Dissonant Prolongations: Theoretical and Compositional Precedents," *Journal of Music Theory* 20/1 (1976), 49–91; Felix Salzer, *Structural Hearing: Tonal Coherence in Music* (New York: Charles Boni, 1952); Paul Wilson, "Concepts of Prolongation and Bartók's Opus 20," *Music Theory Spectrum* 6 (1984), 79–89.

[7] "Appoggiature sans resolution," Ravel's own term; see his self-analysis for Réne Lenormand's *Twentieth-Century Harmony*, 62–63. Ravel's original French text is published in Arbie Orenstein, comp. and ed., *Maurice Ravel:Lettres, Ecrits, Entretiens*.(Paris: Flammarion, 1989). The analysis is also presented in Orenstein, *A Ravel Reader*, 519–520.

times, the juxtapositions and interactions of different referential collections create simultaneous prolongations of seemingly incompatible harmonies. Ravel's practice of subposition further complicates the identification of harmonic structures.[8] To untangle the complex web created by the interaction of all these elements, the analyst must determine structural priority contextually, layer by layer.

2.1.2. Basic Premises

If we accept, as Matthew Brown and William Rothstein suggest, that even in Schenker's view different prolongational levels are governed by somewhat different constraints of voice leading (generally, the closer to the background, the stricter the rules), we can extend the principles of prolongation to Ravel's music—and to other repertoires outside Schenker's favored canon—by applying additional context-derived criteria at the foreground and middleground. In other words, to analyze Ravel's early music in Schenkerian terms, we need additional prolongational distinctions to accommodate the increased complexity of fore- and middleground phenomena without changing Schenker's paradigms for the deep middleground and background. I base my proposed extensions for Ravel's tonal music on the following premises:

1. The background structures of Ravel's tonal, pre-war pieces largely conform to Schenker's *Ursatzformen*.[9] Thus, the closer Ravel's prolongations are to the background, the more they tend to follow "orthodox" Schenkerian tenets.

[8] For a definition of subposition in this context, see section 2.5.
[9] With the exception of the first movement of the Piano Trio, all pre-war pieces and movements are in a single key, prolonging a single tonic triad. Chapter 4 presents an analysis of the Piano Trio's first-movement "double-tonic complex."

2. Dissonant prolongations characterize the foreground and shallow middleground but reduce out in the deeper middleground and the background.
3. Non-diatonic structures based on cyclic collections are ultimately subordinate to diatonic tonal structures.
4. Two of Ravel's favored referential cyclic collections (the octatonic and the enneatonic) are capable of supporting three of Straus' four conditions for prolongation (all except the scale-degree condition, which is provided by the structurally superior diatonic framework).
5. As Ravel's chord spacing reflects perceptual structures uncovered in recent research in perception and cognition, I maintain Kaminsky's assumption of the "structural priority of the bass as a normative tendency."[10]

To develop solutions and a methodology for analyzing Ravel's music according to Schenkerian principles, I begin by interpreting Joseph Straus' four conditions for prolongation in the context of Ravel's music.[11]

---

[10] Kaminsky, "Ravel's Late Music and the Problem of 'Polytonality'," 240; David Huron, "Tone and Voice: A Derivation of the Rules of Voice-leading from Perceptual Principles," *Music Perception* 19/1 (2001), 1–64. Väisälä's approach based on the harmonic series incorporates the same psychoacoustical research as Kaminsky's and Huron's relating bass function and chord spacing to our perception of harmony.

[11] Straus' four conditions for prolongation have served as a point of departure for subsequent studies and discussions of prolongation, among them Larson, "The Problem of Prolongation in 'Tonal' Music," and Straus' response to Larson, ibid., 137–39. Since Straus establishes criteria for exploring the possibilities of prolongation outside a strict tonal context, it is no coincidence that prolongational approaches to early post-tonal music, such as Väisälä's *Prolongation in Early Post-Tonal Music* and my own here, build on Straus' conditions. I compare Väisälä's and my approaches in section 2.3.

1. ***Consonance-Dissonance: A consistent, pitch-defined basis for determining relative structural weight***

Ravel's harmonic vocabulary shows a predilection for dissonant chords: chord structures of stacked major and minor thirds (7th, 9th, less often 11th and 13th chords),[12] the added-sixth chord (*sixte ajoutée)*, chords with unresolved appoggiaturas or chord-tone substitutions, and tertian structures based on cyclic collections, such as augmented triads and diminished seventh chords. Adapting the consonance-dissonance condition to Ravel's harmonic language, I reinterpret the binary distinction between consonance and dissonance as a context-dependent scale of the relative stability of harmonies.[13] Thus, certain dissonant chords can be prolonged *locally* if they fulfill at least the embellishment and harmony/voice-leading conditions. I will describe Ravel's most typical dissonant prolongations in section 2.3.

2. ***Scale-Degree Condition: A consistent hierarchy of consonant harmonies***

For those works of Ravel that can be considered tonal (most of his works prior to World War I) this condition poses no problem. In so far as the background structures

---

[12] Aldwell and Schachter distinguish between 11ths and 13ths that "originate in melodic motion" and such that are "chordal in origin." They illustrate the latter with a passage from the first of Ravel's *Valses nobles et sentimentales*. See Aldwell and Schachter, *Harmony and Voice Leading*, 3rd ed. (Belmont: Thompson and Schirmer, 2003), 483–84. Pointing to this distinction, Steve Larson argues that, "although these dissonances may receive greater emphasis and may be treated more freely in modern jazz than in classical music, their basic meaning remains the same: a dissonance derives its meaning from more stable pitches at deeper structural levels." Steve Larson, "Schenkerian Analysis of Modern Jazz: Questions about Method," *Music Theory Spectrum* 20/2 (Fall 1998), 209–41; 213.

[13] A similar approach has been proposed by Felix Salzer: "The distinction between consonance and dissonance appears replaced by a distinction between dissonances of lesser and greater intensity." Salzer, *Structural Hearing*, 192; see citation in Baker, "Schenkerian Analysis and Post-Tonal Music," 155. However, unlike Salzer, I contend that, at least in Ravel's prewar compositions, dissonant prolongations do not function beyond the middleground and are always embedded in a larger context of consonant prolongations.

tend to represent Schenker's *Ursatzformen*, dissonant or non-diatonic prolongations even within the middleground are ultimately subordinate to and controlled by diatonic *Stufen*. These superimpose their hierarchical and functional relationships onto the lower-level dissonant prolongations.

3. ***Embellishment Condition: A consistent set of relationships between tones of lesser and greater structural weight***

The three types of embellishment (passing, neighboring, and arpeggiating) are defined in relation to an intervallic system of steps and skips. In tonal music, the properties of the diatonic scale define these steps and skips. The relative structural weight of single tones depends on their intervallic or harmonic context, that is, whether a given tone belongs to the underlying harmony or not. By analogy, we can distinguish between steps and skips in certain cyclic collections and so define their characteristic harmonic structures (e.g., augmented triads for the whole-tone collection and diminished seventh chords for the octatonic collection). In doing so, we can determine neighbor notes, passing tones, and arpeggiations.

4. ***Harmony-Voice leading Condition: A clear distinction between the vertical and horizontal dimensions***

As in the embellishment condition, the distinction between the vertical and horizontal dimensions is based on two principles: the distinction between step and skip and the underlying chord-formations of a referential collection. The main types of cyclic collection found in Ravel's music (the whole-tone, enneatonic, and octatonic collections) fulfill this condition. The distinction becomes difficult in the pentatonic and hexatonic collections,[14] where we find "steps" of a minor third that we tend to perceive as skips, and the enneatonic collection, where we find "skips" of a major second that we tend to perceive as steps because they are within the critical bandwidth.[15] In both cases, we must rely on context to interpret this interval as a step or skip. Occasionally, Ravel imposes harmonic structures from one type of collection onto melodic structures from another. For example, an octatonic melody may be harmonized by diatonic harmonies (especially as the octatonic collection contains many diatonic chords), or a pentatonic melody might be harmonized by whole-tone harmonies.

2.2. Prolongation in the Context of Referential Collections

Ravel employs a variety of referential collections as pitch resources to shape many aspects of composition.[16] He uses sonorities based on different collections to delineate formal sections, non-diatonic linear progressions to lead to climaxes, long-range whole-tone progressions in the bass to shape transitions, changing referential collections

[14] Philip Wade Russom refers to the hexatonic collection or set class 6-20 as the "augmented scalar collection" because alternates half steps with augmented seconds (the successive interval array is [1-3-1-3-1-3].) See Russom, "A Theory of Pitch Organization for the Early Works of Maurice Ravel," 17–61. The hexatonic collection, a 6-note subset of the enneatonic collection, can also be parsed into two augmented triads a half step apart (ibid., 45). As examples for this collection in Ravel's music, Russom shows the beginnings of "Manteau de Fleurs" and the second of the *Valses nobles et sentimentales* (ibid., 47). Recent studies of hexatonic systems include Richard Cohn, "Maximally Smooth Cycles, Hexatonic Systems, and the Analysis of Late-Romantic Triadic Progressions," *Music Analysis* 15/1 (1996), 9–40, and Michael Siciliano, "Toggling Cycles, Hexatonic Systems, and Some Analysis of Early Atonal Music," *Music Theory Spectrum* 27/2 (2005), 221–247. An interesting discussion of the properties of various scales is Dmitri Tymoczko's "The Consecutive-Semitone Constraint on Scalar Structure: A Link Between Impressionism and Jazz," *Intégral* 11, 135–79.
[15] See Huron, "Tone and Voice."
[16] In *A Study of Twentieth-Century Harmony*, Lenormand devotes two chapters to scales and tonality. Chapter IX introduces a wide variety of scales used by composers of that time, and Chapter X is devoted to the whole-tone scale.

to transform motives, and, especially in his songs and two operas, octatonic passages to represent the odd, scary, or unfamiliar.[17] As the individual collections influence the kinds of prolongations possible within their respective contexts, we have to begin any Schenkerian interpretation by determining the referential collections of each passage.

The most typical collections in Ravel's music are the diatonic, including all modes as rotations of the diatonic's successive-interval array; the pentatonic and all its possible rotations; the whole-tone; the hexatonic; the enneatonic, which in Ravel's music tends to function as an embellished whole-tone collection; and the octatonic. **Example 2.1** lists the intervallic structures of these collections and the discrete instances of chord types (triads and four-note chords such as seventh chords) within each collection. **Example 2.2** presents the six collections' triads in musical notation.[18] Once we have determined the referential collection of a given passage, we can distinguish between

---

[17] Some of the early writings that point to this use of referential collections are Russom, "A Theory of Pitch Organization," and Günter Weiss-Aigner, "Eine Sonderform der Skalenbildung in der Musik Ravels." The use of the octatonic collection to symbolize the unusual has also been discussed by Kabisch in "Oktatonik, Tonalität und Form in der Musik Maurice Ravels." An excellent study on octatonicism in Ravel is Baur's essay, "Ravel's 'Russian' Period," which demonstrates how Ravel builds on Rimsky-Korsakov's octatonicism and develops it further, providing in turn the inspiration for Stravinsky's octatonic techniques. Although a recent study by Sylvia Kahan, "'Rien de la tonalité usuelle': Edmond de Polignac and the Octatonic Scale in Nineteenth-Century France," *19th-Century Music* 29/2 (2005), 97–120, uncovers earlier French sources of the octatonic scale in the work and writings of Edmond de Polignac, Baur argues convincingly that Ravel's use of the octatonic was more likely inspired by the music of Mussorgsky, Rimsky-Korsakov, and other Russian composers, which he had studied intimately since his teenage years. Baur's assessment of Ravel's octatonicism builds on Taruskin's research, which traces the origins of Russian octatonicism back to Liszt. See Taruskin, *Stravinsky and the Russian Traditions* (Berkeley, Los Angeles: The University of California Press, 1996), 275. Taruskin observes how the use of the whole-tone and octatonic is intimately connected demons and otherworldly characters. Similarly, Elliott Antokoletz's study, *Musical Symbolism in the Operas of Debussy and Bartók* (Oxford: Oxford University Press, 2004) relates non-diatonic collections to dramatic elements outside the human sphere. In my M.M. thesis, "Cyclic Pitch-Class Collections in the Music of Maurice Ravel" (University of Massachusetts Amherst, 1998), I show how in the song cycle *Histoires naturelles* Ravel associates the octatonic collection with illusion and disorientation in "Le cygne" and with mockery in "La pintade."

[18] In the context of this chapter, I refer to the collections mainly based on their intervallic identity. In Chapter 3, I provide a more detailed discussion of the various collections' orderings (rotations) and their resulting intervallic properties.

harmonic and non-harmonic tones and identify embellishing tones and underlying harmonies. Within diatonic contexts, the basic chord structures are built by stacking thirds—the smallest possible interval beyond a step. Within non-diatonic contexts, we can build our basic chords analogously, transferring the step-skip condition onto the scalar structures of the cyclical collections.

2.2.1. Diatonic and Pentatonic Collections

In the *diatonic collection*, the major triad is the most basic prolonged structure.[19] As a variant of the major triad, Schenkerian analysis accepts the minor triad as capable of sustaining large-scale prolongation as well. Any other chord structures based on stacked thirds are dissonant and thus considered incapable of providing the harmonic stability that enables prolongation. However, if we accept, at least at the foreground and shallow middleground, a concept of relative rather than absolute stability, some dissonant harmonies can temporarily assume structural priority over less stable tones or chords and thus be prolonged by them. Section 2.3 explores the relative stability of specific dissonant chords and the contexts in which they function.

In the *pentatonic collection*, prolongations of major and minor triads are also common, since the collection is a subset of the diatonic. However, if we define “triads” or “consonant chords” as originating from successive “skips” in a given ordered collection, the situation is more complicated. Due to the uneven cardinality of the pentatonic collection, we have to consider the possibility that somewhere in the collection the distance between two “chord tones” might be *two* steps (as between scale degrees 5 and 8

[19] See Carl Schachter, “The Triad as Place and Action,” *Music Theory Spectrum* 17/2 (1995), 149–69.

in the major and minor scales). The exact location of these two "passing tones" in the collection depends on its specific rotation and context.[20] While we can easily conceive the pentatonic collection as a scale of alternating steps of major seconds and minor thirds (see **example 2.2**), it is difficult for our diatonically conditioned ear actually to perceive the minor thirds as steps. For example, in measures 90–91 of the first movement of Ravel's Piano Trio (**example 2.3**) the violin prolongs an A-minor triad descending through a pentatonic collection. In this pentatonic context, we must understand the G as a "passing" tone between A and E! Even stranger is C–A, which can function as an arpeggiation *and* a "step."

2.2.2. Non-Diatonic, Cyclic Collections

Ravel uses a variety of referential cyclic collections.[21] To establish a context for prolongation, we must distinguish between harmony and voice leading, that is, between steps and skips (Straus' condition 4).

---

[20] In example 2.3, we might thus interpret both C and D as "passing" between the more structural E and A.

[21] Example 2.1 lists the intervallic properties of these collections and the chord structures they can support. Although the origin of the diatonic and pentatonic collections is cyclic as well (segments of the 5/7 cycle), I do not treat them as "cyclic" collections, since I focus on the collections' *scalar*, i.e., ordered arrangement within the span of an octave. According to Taruskin, non-diatonic collections originated from the sequential treatment of familiar triadic harmonies (triads and seventh chords); see Chapter 4 of Taruskin, *Stravinsky and the Russian Traditions*, 255–306. For example, when the sequential interval is a minor third (or a succession of alternating half and whole steps), the resulting collection is octatonic. When the sequential interval is a major third, the resulting collection is hexatonic. In this way, the collections can be understood as the result of subjecting a harmony to cyclic transposition. Another explanation, espoused by Elliott Antokoletz, is that composers conceived of scales with symmetrical divisions of the octave as alternatives to diatonic and modal scales; see Chapter 2 of Antokoletz, *Musical Symbolism in the Operas of Debussy and Bartók*, 14–29. Ravel's employment of non-diatonic collections suggests that he was aware of both harmonic and scalar derivations. Depending on the individual context, he used melodic as well as harmonic partitionings of non-diatonic collections while exploiting shared subsets with diatonic collections melodically and harmonically as well.

In the *whole-tone collection*, the harmony analogous to the major or minor triad is the augmented triad, since all steps are whole steps and the smallest possible skips are major thirds.

In the *octatonic collection*, the harmony analogous to the major or minor triad is the diminished triad or the fully diminished seventh chord, because steps alternate between whole and half steps and the smallest possible skips are minor thirds.

In the *enneatonic collection* (see **examples 2.1** and **2.2**), which alternates two half steps with one whole step, thus yielding nine different pitch classes, we must derive the characteristic triadic sonority indirectly. The collection features elements from both the whole-tone and the octatonic collections, supporting harmonies of augmented triads and voice leading by whole and half steps. If the collection is parsed into three augmented triads a half step apart, the central augmented triad can be prolonged by its neighboring augmented triads or by "contrapuntal chords."[22] The latter result from voice leading and include passing and neighboring motion (as in mm. 90–91 of the Piano Trio's first movement; **example 2.13**).

In a Schenkerian context, we must understand the basic, dissonant chord structures expressed by cyclic collections as *analogues* and not *equivalents* of consonant diatonic chord structures because they do not fulfill the consonance/dissonance or scale-degree conditions.[23] In Ravel's pre-war music, their prolongation never reaches beyond the shallow middleground because they are always subordinate to consonant triads, which

[22] Salzer's term; *Structural Hearing,* 15.
[23] James Baker makes this distinction between "analogue" and "equivalent" harmonic structures in his 1983 essay "Schenkerian Analysis and Post-Tonal Music," 157, while Matthew Santa's article "Defining Modular Transformations" uses the idea of constructing non-diatonic analogues of steps and skips.

in turn provide the tonal context that fulfills the consonance/dissonance and scale-degree conditions. In other words, Ravel's non-diatonic prolongations do not challenge but rather embellish tonal structures, serving expressive, rhetorical, structural, and formal purposes.[24]

2.3. Dissonant Prolongations at the Fore- and Middleground

In Ravel's music we encounter dissonant chord types prolonged locally by embellishing tones or harmonies closer to the musical surface. Where the distinction between chord tones and non-chord tones is challenging, we need to consider larger contexts such as linear progressions or pedal points to determine higher-level harmonies.

Dissonant chord structures occur in a variety of contexts and functions. In Ravel's pre-war music, we can discern roughly four different contexts for dissonant chord types:

1. Dissonant chords within diatonic contexts, most often seventh and ninth chords and their inversions[25]
2. Dissonant chords as the result of unresolved or added appoggiaturas
3. Dissonant chords within non-diatonic contexts, including fully diminished seventh chords and augmented triads
4. Dissonant chords resulting from subposition (a bass note is "sub-posed" below a consonant or dissonant harmony)

---

[24] A significant fact supporting this interpretation is that Ravel leaves non-diatonic collections or progressions to create a strong, diatonic cadence. See, e.g., examples 2.7, 2.8, 2.10, 2.11, 2.12, and 2.17. This suggests that many of Ravel's non-diatonic passages function as pre-cadential expansions.
[25] As 11^{th} and 13^{th} chords function as mere extensions of ninth chords, I will not discuss them separately.

Ravel's sonorities do not consist of tightly stacked thirds; rather, their spacings closely resemble certain chord structures and spacings of the harmonic series discussed by Olli Väisälä.[26] Though Schenker himself "vehemently rejected Schoenberg's conception of dissonances as 'more remote overtones',"[27] Väisälä's approach provides an elegant extension of Schenker's "chord of nature" and creates a very useful framework for analyzing dissonant prolongations in early post-tonal music. To illustrate my own approach, I will briefly summarize Väisälä's concepts and highlight where they differ from mine.[28]

Väisälä builds on Straus' four conditions of prolongation. However, taking into account psychoacoustic principles, he departs from Straus' premises in two regards. (1) While Straus' conditions clearly presuppose "full octave equivalence or unrestricted registral freedom," in Väisälä's approach, "registral disposition is regarded as essential for the identity of harmony and intervals."[29] (2) Based on psychoacoustical research on critical bandwidth and the concept of *virtual pitch*, Väisälä derives the aspect of *rootedness* from the correspondence between intervals of a harmony and those of the harmonic series.[30] Both concepts, registral disposition and rootedness, apply well to the analysis of Ravel's pre-war music.

---

[26] Väisälä, "Prolongations of Harmonies related to the Harmonic Series."
[27] Clark, "Heinrich Schenker on the Nature of Seventh Chords," 222.
[28] I base the summary of Väisälä's concepts on his published dissertation, *Prolongation in Early Post-Tonal Music*.
[29] Väisälä, *Prolongation in Early Post-Tonal Music*, 3.
[30] Ibid., 4. In total, Väisälä justifies four theoretical principles by psychoacoustical factors: (1) "the significance of registration for the identification of harmonies and intervals"; (2) "the proximity principle of voice leading" linked to auditory streaming; (3) rootedness based on the concept of virtual pitch; and (4) "the *proximity principle of spacing*, the avoidance of small intervals in consonant chords," related to the "phenomenon of critical band." Ibid., 26.

In his chapter on ninth chords, Lenormand notes that "the best arrangement of the parts [of a ninth chord of the first species] is that of the harmonics," which suggests that Ravel and his contemporaries might actually have related chord spacings to the harmonic series.[31] **Example 2.4** compares some of Ravel's favorite sonorities with Väisälä's chords derived from the overtone series.[32] Based on Lenormand and Väisälä, I propose two preference rules for hearing and interpreting Ravel's complex sonorities.

1. The more closely a chord's tones and spacing resemble those of the harmonic series, the less dissonant we may consider the chord.
2. The more closely a chord's tones and spacing resemble those of the harmonic series, the greater the tendency of the bass note to absorb the upper voices within its functional identity (rootedness).

Where my approach differs from Väisälä's is in the overall status of these dissonant prolongations. Väisälä stipulates that in "post-tonal circumstances… the highest hierarchical level [that is, the composed-out tonic triad in conventional Schenkerian analysis]" can be "replaced by some other referential harmony."[33] For the repertoire included in his study—Debussy, Scriabin, Schoenberg, Berg, and Webern—[34]

---

[31] The two chords following Lenormand's remark show in treble clef: (1) C4, G4, E5, B♭5, D6, and (2) C4, E4, B♭4 (smaller notehead), D5, G5. Lenormand's "Explanatory Notes" at the very beginning of his treatise imply that the overtone series may have played an even bigger role in conceptualizing chords and voice leading. The caption to a representation of the harmonic series in musical notation reads: "In order to reckon with some of the processes of the modern school it will be well to refer to the harmonic series. Here will be found, we believe, the origin of a certain number of progressions reproved by classical teaching." Lenormand, *A Study of Twentieth-Century Harmony*, xii.
[32] Among others, David Huron has related chord spacing to perceptual characteristics such as the effects of critical bandwidth. See "Tone and Voice," 1–64.
[33] Väisälä, *Prolongation in Early Post-Tonal Music*, 30.
[34] Debussy's *Voiles* and *Ce qu'a vu le vent de l'ouest* from the first book of *Préludes* (1909 and 1910); Schoenberg's piano pieces op. 11/2 (1909) and 19/2 (1911); Berg's song "Schlafend trägt man mich," op. 2/2 (1909–10); Anton Webern's song "Dies ist ein Lied," op. 3/3 (1909–10), and Scriabin's *Vers la flamme*, op. 72 (1914).

this is a necessary and, judging by his analyses, highly productive extension of Schenkerian principles. For the repertoire included in my dissertation, this extension is unnecessary. The backgrounds of Ravel's pre-war sonata forms still adhere to the single tonic triad of Schenker's *Ursatz*; in these movements, the dissonant prolongations of harmonies based on the harmonic series do not reach deeper than the (shallow) middleground.[35] The only exception is the first movement of the Piano Trio, where the background structure outlines a double-tonic complex (A minor/C major; see Chapter 5).

2.3.1. Dissonant Prolongations Within Diatonic Contexts

Diatonic dissonant prolongations are, of course, not new to Schenkerian analysis. Schenker himself presented analyses where dominant-seventh chords are prolonged locally; the best-known example perhaps is the "composing out of a seventh-chord" in mm. 24ff. of the C-major prelude from Bach's *Well-Tempered Clavier* (vol. I). Robert Morgan calls this prolongation of a dissonance by consonant harmonies "a prolonging function relative to a conceptually prior dissonance."[36] While the dominant seventh chord is the only seventh chord that can be derived from the overtone series (although Schenker

---

[35] That Ravel embeds even the most dissonant, at times non-diatonic harmonies in an overall diatonic context might be due to his interpretation of a quintessential historical form (sonata form) and may not necessarily hold true for other pre-war works. Only further analysis of complete, non-sonata movements from a Schenkerian-derived, prolongational perspective will (1) show how much less "conservative" forms by Ravel, such as the rather "impressionist" movements of *Miroirs,* will require adaptation (following Väisälä's or other extensions), or (2) uncover new prolongational paradigms in his post-war compositions.
[36] See Morgan, "Dissonant Prolongations," 54. Schenker's analysis is presented as Figure 62 in the Supplement to Heinrich Schenker, *Free Composition*, trans. Ernst Oster (New York: Longman, 1979), and in Schenker's *Five Graphic Music Analyses* (New York: David Mannes School of Music, 1933; repr. New York: Dover, 1969).

did not accept this derivation), the idea that certain dissonant chords can be prolonged opens the door to extending the principle beyond the major-minor seventh chord.[37]

2.3.1.1. Seventh Chords

Among the various species of seventh chords (see **example 2.4**), Ravel seems to have been especially fond of the minor seventh and half-diminished seventh chords, perhaps because of the sonorities' ability to function within many contexts. Ravel rarely prolongs simple V7 chords; he prefers V9/7 chords for dominant prolongations. Many of these dominant ninth chords place a locally prolonged diminished triad a perfect fifth above a pedal tone, or a fully diminished seventh chord a perfect fifth or major tenth above a pedal tone (as in **examples 2.8 and 2.9**). In many instances, prolongations of a diminished seventh chord control an octatonic melodic line.

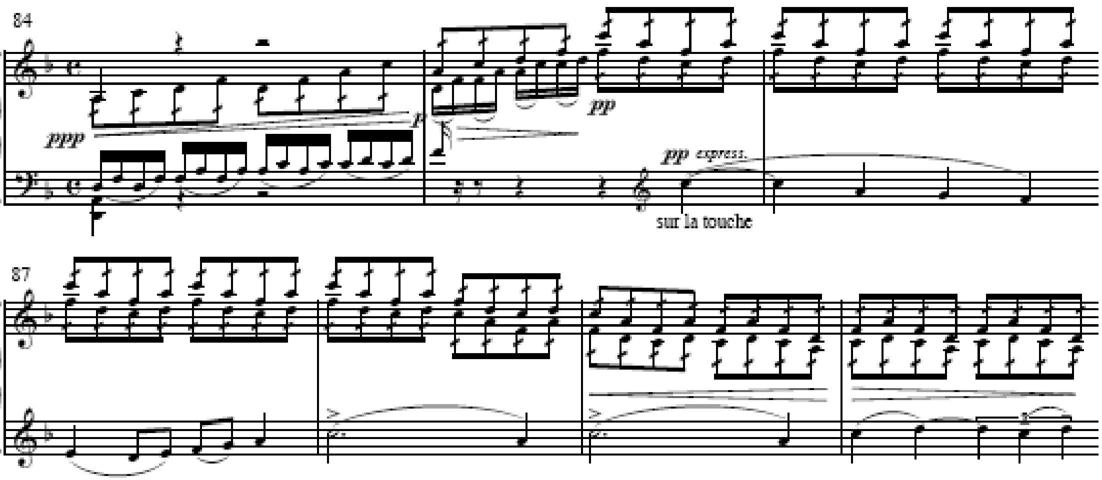
Some of Ravel's pieces feature prolongations of chords with major sevenths close to the foreground.[38] The majority of seventh-chord prolongations in the repertoire of this dissertation, however, involve chords with minor sevenths (Reber-Dubois' second and third species seventh chords; see **example 2.4**). I can see three possible reasons for this: (1) The major seventh produces a harsher dissonance; (2) Ravel wanted to avoid the major seventh's tendency to sound like a leading tone, especially since he loved cadences with a lowered seventh; and (3) the minor seventh is part of the harmonic series and thus

---

[37] An in-depth discussion of the problem of the seventh chord in Schenker's writings and analyses is Clark's "Heinrich Schenker and the Nature of the Seventh Chord." There, Clark refers to both Schenker's analysis and Morgan's commentary cited above.
[38] Example 3 of Peter Kaminsky's excellent discussion of the second of Ravel's *Valses nobles et sentimentales* shows a G minor-major seventh chord (G–B♭–D–F#) prolonged by a neighboring F minor-major seventh chord (mm. 1–3). These chords result from combining an augmented triad with a bass note a minor third below it. See "Composer's Words, Theorists' Analyses," 165–66.

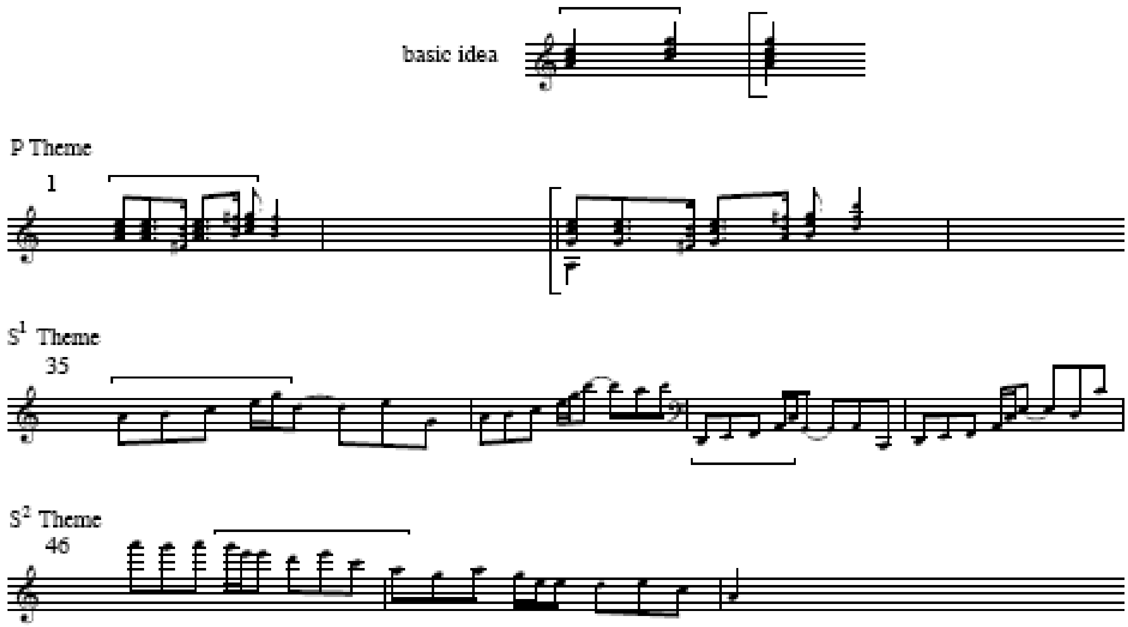
closer to consonance—if my assumption of the conceptual role of the harmonic series is correct.

The first movement of Ravel's String Quartet prolongs the *minor seventh chord* D–F–A–C in measures 84–90.[39]



Ravel explored the minor seventh chord and its melodic and harmonic possibilities also in the Piano Trio, where A–C–E–G and C–E–G–A serve as a basic idea, providing the pitches for the primary and secondary themes and forming the basis of the double-tonic complex A minor/C major.

[39] A glimpse at the score easily reveals the prolongation of D–F–A–C (mostly by simple arpeggiation) in mm. 84–90. Chapter 4.1 shows how the F major/D minor ambiguity plays an important structural role in the movement's sonata design.



Transposed to D–F–A–C or F–A–C–D, the sonority also functions as a simultaneous subdominant to both keys.

A prolongation of a *half-diminished seventh chord* in mm. 68–71 of the Piano Trio's first movement is shown in **example 2.5**. In mm. 68 and 70, the violin's octave E5–E6 functions as a cover tone, while the cello's tremolo figuration outlines an E-minor triad (with passing tone F# and lower neighbors A and D). The subposed bass C#, itself a passing tone within a larger-scale bass-line progression from the D# pedal of mm. 60–67 to the B in m. 72 (ultimately leading to the A at the climax in m. 77 via B and B♭) combines with the upper voices' E minor to form the half-diminished seventh chord C#–E–G–B. This chord, prolonged by the passing third D–F (from E–G to C#–E), briefly moves to a neighboring F#-major 6/4 chord. Then rearticulated, the half-diminished seventh chord passes through an F#-major 6/4 chord to a G-major sixth chord in m. 72.[40] In the ensuing circle-of-fifth progression (mm. 72–75, shown in the top staff; see also the graph of the complete movement in Chapter 5.1), the G-major sixth chord substitutes for an E-minor seventh chord that would otherwise initiate the sequence paralleling the corresponding section in the exposition.

2.3.1.2. Added-Sixth Chords

A French favorite since Rameau, the chord of the added sixth (*sixte ajoutée*) can in some contexts also be explained as an inversion of a minor seventh chord, a conflation of II and IV, or an appoggiatura added to the fifth of a major triad.[41] **Example 2.6**, based on Ravel's own analysis of the seventh of his *Valses nobles et sentimentales,* shows a prolongation of an added-sixth chord (for more details, refer to section 2.3.1.4 on unresolved and added appoggiaturas). As Ravel was very fond of this sonority, we find many more examples of added-sixth chords in a variety of contexts. Rather than listing them here, I will discuss them in their respective contexts.

---

[40] Although the progression follows tonal syntax at its surface, Roman numerals do not make much sense in this transitional section: The half-diminished seventh chord originates from a dissonant C# passing tone in the bass below E minor. This local prolongation hovers in harmonic limbo until the circle-of-fifth sequence (mm. 72–75) propels the music toward B♭ minor, which serves as a chromatic neighbor to the A-minor climax in m. 77.

[41] "The chord formed by adding a sixth to the perfect chord is called the chord of the large sixth. Although this chord may be derived naturally from the seventh chord, here it should be regarded as original. On all other occasions, however, it should follow the nature and properties of the chord from which it was first derived." Jean Philippe Rameau, *Treatise on Harmony*, trans. Philip Gossett (New York: Dover, 1971), 75. If the sixth is added to a perfect chord, the chord fulfills subdominant function and has to resolve up to the third of the tonic; if the chord is understood as a 6/5 inversion of a seventh chord such as II^7, the sixth forms the root, and the other three voices must move to the dominant. In his later writings , Rameau uses the two explanations of the harmony, IV 6/5 and II^7 for his concept of *double emploi*. Later composers such as Ravel use the sonority on other scale degrees as well.

2.3.1.3. Ninth Chords

Since ninth chords usually appear in conjunction with special voice-leading situations such as pedal tones, subposition, or the combined voice leading of voices belonging to different referential collections, I will discuss them in these contexts.

2.3.1.4. Unresolved and Added Appoggiaturas

Ravel likes to add dissonant seconds to triads or other tertian harmonies (as in the opening of the *Sérénade grotesque*; see **example 2.10**).[42] The most famous example of unresolved appoggiaturas is, of course, the self-analysis that Ravel prepared for Lenormand's study; it is reproduced as **example 2.6a**.[43] To judge by the example and comments Ravel provided, unresolved appoggiaturas played an important role in his harmonic thinking. Orenstein even suggests that Ravel's analysis "indicates an awareness of a larger structural prolongation."[44] Ravel's explanations strongly resonate with the Schenkerian idea of "implied tones."[45] For our purposes, then, the implied resolution of an appoggiatura may serve as part of the underlying harmonic structure at the next deeper level. **Example 2.6b** realizes Ravel's analysis in Schenkerian notation: level *a* represents Ravel's analysis with implied resolutions shown in parentheses; levels *b* and *c* represent a Schenkerian reading of the passage.

Where dissonant chords arise as a result of unresolved appoggiaturas, we can thus invoke the Schenkerian concept of implied tones to reinstate their resolutions as chord

---

[42] The added-sixth chord can, of course, also be understood as the result of an added appoggiatura as discussed above.
[43] See Lenormand, *Contemporary Harmony,* 62–63; Orenstein, *A Ravel Reader*, 519–20; the example is also discussed in Kaminsky, "Composers' Words," 169–72.
[44] Orenstein, *A Ravel Reader*, 517.
[45] William Rothstein, "On Implied Tones," *Music Analysis* 10/3 (1991), 289–328.

tones belonging to a higher level. To recognize unresolved appoggiaturas as such, we have to consult the voice leading of the larger context. Ravel's analysis shows that he thought of appoggiaturas in relation to their resolutions, even if the latter are not actually sounding. It further shows that he thought of dissonances—at least in his pre-war compositions—as essentially operating within the boundaries of tonality, perhaps stretching those boundaries but never severing them.

2.3.2. Dissonant Prolongations Within Non-Diatonic Contexts

As the examples demonstrate, dissonant prolongations governed by non-diatonic collections are always embedded in larger diatonic contexts and occupy a relatively short time span—a few measures or a small section at the most. Examples of the whole-tone collection serving as an unordered referential collection (as opposed to an ordered collection sounding in scalar form; see section 2.4) tend to appear earlier in Ravel's *oeuvre*, whereas the octatonic collection's role as referential collection seems to gain importance with the String Quartet (1902). The enneatonic collection makes a late but intriguing appearance in the Piano Trio (1914; see **examples 2.21a** and **b**).

The octatonic collection is capable of supporting a great variety of harmonic structures (as shown in **example 2.1**) and of prolonging diatonic as well as non-diatonic harmonies. In all examples provided here, Ravel embeds octatonic prolongations, such as diminished seventh chords, in larger diatonic contexts.

Measures 17–24 of the fourth movement of the Piano Trio (**example 2.7**) feature an octatonic passage within a larger diatonic context. The cello's melody, introducing the second theme of this sonata form, draws its pitches from octatonic collection $OCT_{1,2}$, B–

C–D–(E)–F–G–(G#)–B♭. The piano accompaniment features a stepwise descending progression of minor thirds from the same collection above a pedal tone E. Together, the cello's melody and piano's thirds briefly prolong the diminished seventh chord G#–B–D–F above the E pedal. The cello's tune abandons the octatonic collection for a melodic cadence on C. In the larger context, the resolution is temporary; C functions as an upper neighbor to the B of m. 20, its supporting harmony E–G–C as a Neapolitan to the bass voice's cadence F#–B. The violin's transposition of the second theme up a minor third (m. 21) returns to $OCT_{1,2}$, again leaving the collection for a melodic cadence, this time on E♭, in m. 22. Melodically and harmonically, the octatonic passages function as dissonances embedded in a larger tonal context to which they resolve.

In the first movement of Ravel's String Quartet, the primary group's middle section[46] returns in the recapitulation as an octatonic transformation of the passage's earlier diatonic manifestations from the exposition and development (**example 2.8**). The first violin's melody clearly outlines the diminished seventh chord A–C–E♭–G♭; the second violin's accompaniment prolongs the same harmony. Though the cello outlines a conflicting diminished triad, the outer voices (the bass note F plus the melody) combine to create a dominant (minor) ninth chord.[47] The bass's arpeggiation creates two embellishing V ♭9/7 chords on A♭ and B. These non-functional ninth chords, formed by the combination of the fully diminished seventh chord A–C–E♭–G♭ and the chord roots F, A♭ and B of the complementary 0369 tetrachord of collection $OCT_{2,3}$, foreshadow a similar use of these chords in the *Introduction and Allegro* (mm. 131–45; see example

---

[46] For an overview of the movement's form, refer to example 4.1.
[47] See the second of Gevaert's first-species ninth chords in example 2.4.

2.9). Ravel abandons the octatonic collection in m. 144 to prepare for the cadence, returning to the primary theme in m. 145. In the context of the recapitulation's primary-theme area, the non-functional chords of this octatonic passage create a moment of surprise and disorientation; we are only able to anchor ourselves again to the F-major tonality with the arrival of the clearly functional V 9/7 chord in m. 144.[48]

A cadenza-like harp solo, mm. 137–45 of the *Introduction and Allegro* (1905), provides my third and final example of prolongation within an octatonic context (**example 2.9**).[49] The melodic line, an octatonic transformation of the secondary subject from mm. 78–91, prolongs the diminished triad A–C–E♭, which the accompanying chords complete to a fully diminished seventh chord A–C–E♭–G♭. The bass D and the inner-voice arpeggiation through A and G♭ combine with the diminished seventh chord to form a V 9/7 chord, which resolves deceptively to E♭ major in m. 151. The box in the upper right corner of **example 2.9** shows how Ravel uses the pitch classes of $OCT_{2,3}$, combining the fully diminished seventh chord E♭–G♭–A–C with major triads whose roots are taken from the complementary tetrachord of the collection. Note how the spacing of the chords again resembles that of the harmonic series with an open fifth at the bottom, the chords' major third a tenth above the root, and the minor thirds of the diminished seventh chord in a higher octave.

---

[48] Chapter 4.3 addresses the motivic-thematic transformations of the movement.
[49] This work for harp, string quartet, flute,, and clarinet was commissioned by the piano and harp manufacturer Erard; see Orenstein, *Ravel: Man and Musician* (New York: Dover, 1991), 45.

2.3.2.2. Prolongations in Whole-Tone and Enneatonic Contexts

In whole-tone and enneatonic contexts, Ravel most often prolongs augmented triads. Many of these augmented triads occur above a pedal tone that renders them part of a dominant harmony whose spacing resembles Väisälä's chord type "U." [50] Peter Kaminsky has discussed the multiple "dominant potential" of the augmented triad for the seventh of Ravel's *Valses nobles et sentimentales* (1911).[51] The augmented triad's relationship to the bass determines as which dominant it functions in each given context.

In at least two instances, Ravel utilizes the interval structure of the whole-tone collection to prolong a French augmented sixth chord, which subsequently resolves to the tonic. To discuss the examples in chronological order, I will begin with prolongations of the French augmented sixth chord (**examples 2.10** and **2.11**) and continue with prolongations of augmented triads (**examples 2.12** and **2.13**).

The opening ten bars of the *Sérénade grotesque* (see **example 2.10**), which "foreshadow the guitar-like beginning of 'Alborada del gracioso',"[52] are entirely governed by the whole-tone collection B–C#–D#–E#–G–A.

The main harmony prolonged by these measures forms the French augmented sixth chord G–B–C#–E#. If A and E in the right hand's arpeggiation in mm. 11 and 12 are understood as appoggiaturas to G and D respectively, the Fr+6 chord moves through a ♭II chord (from beat 2 of m. 12 to m. 14), resolving to the F# tonic on the downbeat of m. 15. Since the tension of the leading tone E#5 has not been resolved, we can hear the ♭II$^{(7)}$

---

[50] See chord T_0U of Väisälä's example 1 in "Prolongations of the Harmonic Series," 212; shown as chord "U" in my example 2.4.
[51] Kaminsky, "Composers' Words," 167–69.
[52] Arbie Orenstein, Introduction to Ravel, *Sérénade grotesque* (Paris: Salabert, 1975).

chord as a transformation of the French augmented sixth chord into a German augmented sixth chord. The cadential melodic gesture of the double neighbor in the upper voice suggests that we hear the Fr+6/Gr+6 as an altered dominant.[53, 54]

In measures 119–25 of the String Quartet's first movement (see **example 2.11**), the pedal-tone F#2 alternately supports the octatonic collection $OCT_{0,1}$ in the first half of each measure and the whole-tone collection WT_0 in the second half. At the movement's climax in m. 119, the upper-voice A6, which had been prolonged throughout measures 110–18, becomes a suspension above the ninth chord F#–A#–C#–E–G. Similarly, the D in the second half of each measure functions as an appoggiatura to the inner-voice C natural. The shifts from C# to C natural suggest that Ravel alternates between German and French augmented sixth chords, both with an added ninth. On beat 2 of measure 125, the whole-tone collection decides in favor of the French augmented sixth chord, with D as an upper neighbor to C.

Ravel employs enharmonic relationships to reinterpret the voice leading, gradually shifting the underlying harmonies' functions. At the climax in m. 119, the harmony appears to outline a V 9/7 chord on F#. In mm. 122 and 124, the cello's C2 appears structurally superior to the previously prolonged F# 2 and thus seems to announce the arrival on the dominant. When it yields again to the F#2 at the last moment (mm. 126 to 128), we literally witness—to use the modern term—a "tritone-

---

[53] For a discussion of ♭II$^{(7)}$ as dominant substitution, see the following paragraphs and footnotes 57 and 58.
[54] In the left-hand melody of mm. 15–16 (see the original score; not provided in example 2.10), note the transformation of the opening's voice leading E#–E–D (in the top voice) and B–A#–F# (in the inner voice) to E–D#–D and A#–C#–F#. The bass's F# in mm. 11–14, a "rude" appoggiatura against the G, anticipates the tonic F# of m. 15 without functioning as such.

substitution."[55] The French augmented sixth chord functions as (enharmonically spelled) ♭II #9/♭7/4 chord, which substitutes for the dominant (a V4/3 chord with simultaneously raised and lowered fifth). The bass's F# resolves enharmonically to the tonic F (Phrygian cadence G♭–F); the upper voice's E4 passes through F# and G# to regain the first theme's initial tone, A, in m. 129. Oscillating between diatonic and chromatic dominant-preparations, Ravel seems to play with the listener's expectations. The tug-of-war between diatonic and non-diatonic collections is one of the defining principles of the movement (as I will demonstrate in chapter 4).

These few measures show in a nutshell how Ravel exploits common subsets among three types of referential collection (diatonic, octatonic, and whole-tone) that shape this movement.

1. As the only subset common to both $OCT_{0,1}$ and WT_0, the French augmented sixth chord F#–A#–C–E forms the perfect intersection between these collections. Its subset A#–E, sustained through measures 119–28, forms an audible link between the two collections. Although measures 119–25 are governed by $OCT_{1,2}$, Ravel's motivic preparation for the recapitulation substitutes D for D# in the melodic line. That the melodic line in the violins, A–G–D–C, forms a four-note subset of the pentatonic is a further indication of Ravel's skill in combining and shifting between the different types of collection.

[55] The principle of tritone-substitution is a familiar procedure in popular music and jazz, where a Neapolitan seventh or ninth chord may substitute for a dominant. See, e.g., Miguel Roig-Francolí, *Harmony in Context* (New York: McGraw Hill, 2003), 671–72.

2. Ravel associates both the octatonic and the whole-tone collections with the specific formal functions they previously assumed in the movement. While the octatonic refers to previous developmental aspects of the movement, the whole-tone recalls previous preparatory passages.

In both examples, 2.10 and 2.11, the augmented sixth chords resolve to a root-position tonic and not to a cadential 6/4 chord. Based on the repertoire of the so-called Common Practice period, American textbooks identify augmented sixth chords as pre-dominant chords that result from the chromatic intensification of scale degrees 6 (lowered) and 4 (raised). Ravel's way of resolving augmented sixth chords directly to the tonic, however, seems to have been the standard for Tchaikovsky. In chapter 27 of Tchaikovsky's harmony treatise, first published in 1871, we read: "[Chords of the augmented sixth] are nothing more than the inversions of certain chords resolving into the tonic triad, and having the 2nd degree of the scale chromatically lowered."[56]

In the first movement of the String Quartet, the whole-tone collection's role in shaping preparatory passages first becomes apparent in mm. 21–23 (**example 2.12**). After the primary theme recurs as the third segment of the primary group's small ternary form, we hear three measures governed by the whole-tone collection G–A–B–C#–(D#)–E#/F. Together, the pitches of violins I and II form the augmented triad C#–F–A (the second

---

[56] Peter Ilyitch Tchaikovsky, *Guide to the Practical Study of Harmony*, trans. Emil Krall and James Liebling (Leipzig: P. Jurgenson, 1900; repr. Mineola: Dover, 2005; Russian original published 1871), 106. Tchaikovsky lists three such chords: (a) the "augmented chord of the sixth" (derived from vii^{O6}), D♭–F–B in C major; (b) the "augmented chord of the fourth and third" (derived from V4/3), D♭–F–G–B; and (c) "the augmented chord of the sixth and fifth" (derived from vii^{O} 6/5), D♭–F–A♭–B (106). In their interval structure, these three types are equivalent to the Italian, French, and German augmented sixth chords, but for Tchaikovsky they function as pre-tonic chords. He introduces a "fourth chord of the augmented sixth," derived from ii 4/3, "with doubly augmented fourth," e.g., A♭–C–D#–F# in C. This chord resolves to the "tonic six-four chord" (our cadential six-four chord), but "is often confused with its enharmonic equivalent [type (c)], the chord of the sixth and fifth" (108–9).

violin’s B4 is a lower neighbor toC#5), the viola sustains the tritone B3–F4, and the cello provides G2 as the bass. The prolonged harmony functions as V#11/9/7 (without the fifth, D) of the dominant, C, which enters in m. 24. The spacing and pitch content of this V#11/9/7 chord are nearly identical to Väisälä’s chord “U.” I would like to mention here Ravel’s predilection for repeated melodic thirds (such as the upper-voice F–A) within such preparatory passages. Alternating between two tones of the same harmony, these thirds provide a sense of biding time until the music is ready to move on. Wherever Ravel uses them in this manner, I shall refer to them as “waiting thirds.”

A prolongation of an augmented triad within an enneatonic collection occurs at the end of the second-theme group of the first movement of Ravel’s Piano Trio, where a *denouement* descends to the closing group. In measures 90–94 (**example 2.13**), the piano’s left hand (mostly doubled by the right hand) moves through a succession of augmented triads. With the exception of the pedal tone G, all pitches in the piano belong to the enneatonic collection E–**F**–F#–G#–**A**–B♭–C–**C#**–D. The central augmented triad is F–A–C#, which receives prominence through its placement on three successive downbeats, through its frequency, and through its presence both as verticality and as an arpeggiation. The remaining augmented triads, E–G#–B# and B♭–D–F#, function as upper and lower neighbors to this central triad. Sounding above the pedal tone G, the augmented triad F–A–C# again forms the upper voices of a V#11/9/7 chord which resolves to C at the movement’s structural close in measure 94. I will discuss the rather complex interactions of the violin and piano parts of this passage in section 2.6.2 (**examples 2.21a** and **b**).

2.4. Non-Diatonic Linear Progressions

Though different in their intervallic structure and aural impact, Ravel's non-diatonic linear progressions function structurally much the same way as diatonic progressions. Ravel's linear progressions will unfold either a consonant interval, directly connecting the harmonies at the beginning and end of the progression (see ex. 2.16), or a dissonant interval, using neighboring motion to connect to the next harmony (see ex. 2.17). At the end of the Quartet's first movement, the whole-tone progression C#–B–A–G–F–E♭ stops one step short of completing the octave to unfold an augmented sixth. Even though the descending progression overshoots its linear goal F by one step (E♭) to create Ravel's "favorite" cadence—approaching the tonic from a whole-step below—the underlying voice results ultimately in a stepwise ascent: C#–E♭–F.[57]

In Ravel's pre-war compositions, non-diatonic linear progressions serve two main formal purposes:

1. At surface levels, they shape climactic ascents or wedges, serving as rhetorical signals and formal markers. These climax preparations are so abundant in Ravel's music (pre- and post-war) that I consider them a hallmark of his style. For ascending progressions, Ravel tends to prefer the octatonic collection, where the alternation of whole and half steps creates a tension between goal-driven forward motion (half step) and resistance to it (whole step). For descending progressions, he tends to prefer whole-tone progressions.[58] In quite

[57] For a detailed analysis of the complete movement, see chapter 4.
[58] These preferences find their parallels in the examples Taruskin provides as early instances of the use of whole-tone and octatonic progressions: The excerpts from Schubert's Mass in E♭ major and Octet, Glinka's Overture to *Ruslan and Lyudmila*, Liszt's E♭-major Piano Concerto, the etude *Un sospiro*, the *Mountain Symphony*, the *Dante Symphony*, and Rimsky-Korsakov's *Antar* all feature descending whole-tone progressions. Only two excerpts, from Liszt's *Mountain Symphony* and Korsakov's *Skazka* features

a few cases, Ravel combines ascending and descending linear progressions to create a pre-climactic wedge.

2. At deeper levels, whole-tone progressions are often a result of circle-of-fifth progressions (see example below). To shape transitional passages, Ravel seems to prefer ascending progressions to *depart* from stable formal sections (e.g., the bridge in the exposition of the Piano Trio's first movement, mm. 13–17, discussed in Chapter 5.1) and descending progressions to *return* to stable sections of larger forms.

2.4.1. Octatonic Linear Progressions

Ravel's octatonic linear progressions always appear close to the musical surface, shaping intense climactic ascents. We find octatonic climax preparations in many variations and combinations:

1. A single-line ascent (String Quartet, I, mm. 37–39, cello)[59]

descending octatonic progression in the bass, while Taruskin's quintessential example for the "melodic octatonic scale" (the rotation of OT that begins with the whole-step) from Korsakov's opera *Sadko* is ascending. Drawing on Korsakov's sketches, Taruskin argues that both, whole-tone and octatonic scales, originated from passing motions connecting root-motion by major and minor, respectively, thirds. See Taruskin, *Stravinsky*, 255–281. His historically based explanation of usage resonates with my own observations on the psychological impact of the progressions, the half-step's tendency to provide tension when moving upward and the whole-step's tendency to provide a sensation of "dropping" or "sinking" into empty space (see also my examples 2.16 and 2.17 discussed in sections 2.4.2 and 2.4.3, respectively).

[59] The ascending octatonic scale ($OCT_{0,1}$) in the cello reaches its climax after only two measures (37–39), rising from C#4 to C#5. With the exception of the viola part, $OCT_{0,1}$ also governs the other voices

2. A primary linear ascent with accompanying secondary line in parallel motion (String Quartet, I, mm. 110–19; see **example 2.14**)
3. Two octatonic lines forming a wedge or an X-shaped double wedge (Piano Trio, IV, mm. 26–31; see **example 2.15**)
4. An ascending octatonic progression in the upper voice combined with a descending whole-tone progression in the bass, forming a wedge (Piano Trio, II, mm. 99–105)
5. Combinations of octatonic and diatonic progressions forming a wedge (*Gaspard de la nuit*, "Scarbo," mm. 556–63)[60]
6. Combinations of three or more lines (Piano Trio, III, 41–49; see **example 2.17**)

I will limit my discussion here to situations 2 and 3 and treat situation 6 in section 2.4.3.

In the first movement of the String Quartet, an ascending and accelerating octatonic scale in the cello (mm. 110–19) leads to the movement's main climax at the end of the development (**example 2.14**). Based on $OCT_{2,3}$ (D#–E#–F#–G#–A–B–C–D), this linear ascent is accompanied in parallel minor sevenths by a secondary octatonic line ($OCT_{0,1}$, C#–D#–E–F#–G–A–A#–B#) in the upper notes of the upper strings' tremolo figure, up to and including the downbeat of m. 114. The main melodic voice, a transformation of the movement's second theme, outlines the diminished seventh chord A–C–E♭–F#, that is, the four-note subset common to $OCT_{2,3}$ and $OCT_{0,1}$. The cello's

(including the previous two measures). The octatonic progression propels a climactic ascent which releases its tension in the transition to the second-theme group of this sonata-form movement.

60 The lower voice of mm. 556–63 of "Scarbo" descends through a complete octatonic scale, $OCT_{2,3}$ (A, G#, F#, F, E♭, D, C, B). Two modulating diatonic scale fragments in the upper voice (based on the 4#-diatonic collection centered on A and the 2♭ -diatonic collection centered on B♭) form a wedge with the descending octatonic scale.

progression transfers D#2 to E♭4, which resolves as an inner voice through a passing D to C#3 at the climax in m. 119. The bass note D#2 (m. 110) moves by a minor third to F#2 (m. 119), which becomes the pivot tone for the return to the tonic in m. 127 (as discussed above in **example 2.11**).

An X-shaped octatonic double wedge prepares the exposition's climax (mm. 26–31, **example 2.15**; see also the parallel section in the recapitulation, mm. 97–101) in the fourth movement of the Piano Trio, culminating in this movement's brilliant and triumphant closing group. The violin ascends from G#3 to B5 through $OCT_{1,2}$ (G#–A#–B–C#–D–E–F–G); the top voice of the piano's accompanying tremolo chords descends from F5 to D4 through the same collection. The combined boundary pitches of the intervals unfolded by these two progressions, F5 to D4 and G#3 to B5, form the diminished seventh chord G#–B–D–F; the double wedge flips the chord's thirds G#-B and F–D (see the box labeled as "Simplified Voice Leading" in **example 2.15**). To intensify the tension of the voice leading, Ravel inserts the chromatic passing tone C6 in the top voice (m. 30). Similarly to **example 2.11**, the pedal tone D seems to function as an appoggiatura to the E♭/D# that participates in the circle-of-fifth progression to the cadence G#-C#. C# functions as the dominant of F# minor/major, in which key the development begins.

2.4.2. Whole-Tone Linear Progressions

Ravel's linear whole-tone progressions also shape a variety of situations. Close to the surface, they appear—like the octatonic progressions described above—at climactic passages as:

1. A single-line ascent
2. A primary linear ascent with accompanying secondary line in parallel motion (*Concerto pour la main gauche*, reh. 43–45)
3. Two whole-tone lines in contrary motion forming a wedge or an X-shaped double wedge (*Miroirs*, "Une barque sur l'ocean," mm. 28–35)
4. Combinations of three or more lines (*Valses nobles et sentimentales*, I, mm. 57–61; *L'Enfant et les sortilèges*, scene "Arithmetic," 5th measure after reh. 91)

In the sonata-form movements at the center of this dissertation, whole-tone progressions tend to function at deeper levels, shaping transitional sections or preparing for new formal sections (see **example 2.16**) or for the return to a formally stable section such as the recapitulation (see the analysis of the Piano Trio's fourth movement in Chapter 5).

Ravel's descending whole-tone progressions often create the sensation of sinking, giving in to gravity, or waiting to reach the ground. In the transitional section of the Quartet at the beginning of the development (mm. 69–84; see **example 2.16**) and in the coda (mm. 201–13), the sinking motion of the lower strings is counteracted by the ascending register transfer of the first violin's soaring melody.

The descending whole-tone progression in the cello (B♭–A♭–G♭–E–D) is accompanied by parallel fifths (F–E♭–D♭–B–A) in the viola and, from m. 77 on, in the cello itself. Each harmony's third sounds a tenth above the root (violin 2, mm. 69–79; viola, mm. 80–84), investing the chords with the *rootedness* discussed in section 2.3.

The headtone A (scale degree 3), prolonged throughout the exposition, turns into a dissonant major seventh above the cello's B♭2 in m. 69. The first violin's 7–8 suspension resolves on the last note of m. 73, continuing to C5 above the cello's A♭2 in m. 74. The upper voice's (harmonically) delayed motion to E♭ in m. 77 renders the E♭ a 6–5 suspension above the G♭-major harmony of mm. 77–79. Despite the first violin's ascending motion to a higher register (C#6 in m. 80), the voice leading amounts to another descending 6–5 suspension, C#–B above E. In mm. 81–83, the C#–B is transferred down by two octaves, arriving on A3.

The polarization of texture throughout measures 69–80 builds tension until the first violin yields to the gravitational forces of the descending progression, dropping an octave below the obligatory register and thus preparing the next section of the development.[61] Tonally and formally, the section's linear progression functions like a transition,[62] within which Ravel creatively juxtaposes static and dynamic musical elements. The relative stability of the extended pedal tones supporting root-position harmonies and the repetitive neighbor-tone motions of the first- and second-theme fragments contribute to the sense of stasis. The descending whole-tone trajectory and the upper-voice dissonances that force resolution contribute to the sense of transition. Interestingly, the upper-voice melodic lines interact with the whole-tone progression in such a way that the downbeats, outlining the diminished triad A–C–E♭ in mm. 69–79,

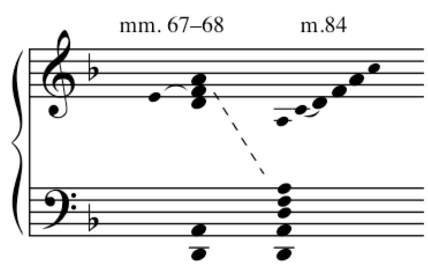
---

[61] Measures 69–83 form what Caplin would call the "pre-core" of the development section. The "core," then, begins in m. 84. See William E. Caplin, *Classical Form*, 147–55.

[62] Caplin states that "A pre-core can be formed in a way that resembles a transition." Ibid., 153. Since this transitional pre-core sounds in lieu of the closing section (C), its thematic material begins with "reverberations of ideas from the end of" S (instead of C)—to paraphrase Hepokoski and Darcy's description of "C-Based Openings" of the developmental space. See Hepokoski and Darcy, *Elements of Sonata Theory*, 215.

alternately function as dissonance and consonance above their respective pedal tones B♭, A♭ and G♭.

The symmetry of the slow whole-tone descent contributes elements of stasis as well as motion: though we are clearly moving, we are moving (1) downwards, (2) slowly, and (3) without any sense of a goal. In the end, we arrive exactly where we were before the whole-tone passage: in D minor, with the headtone A as upper voice. In fact, the spacings of the two D-minor harmonies before and at the end of the whole-tone progression are quite similar:



Thus, the non-diatonic syntax of the whole-tone progression formally delineates the passage as a separate musical event, while its linear motion creates a sense of transition between nearly identical points of departure and arrival.

2.4.3. Combined Whole-Tone and Octatonic Progressions

In the third movement of the Piano Trio, the deeper-level whole-tone progression combines with foreground-level octatonic progressions to shape the climactic return to the A' section of a large ternary form (**example 2.17**, level a). As the foreground graph shows, the strings ascend first through $OCT_{2,3}$ (D#, E#, F#, etc.; mm. 41–42)—minimally embellished by the thematic diatonic lower neighbor on every downbeat—then through $OCT_{1,2}$ (E, F, G, G# etc.; mm. 43–45).[63] At the same time, the upper voice of the piano's right-hand chords first descends through the same collection for two measures, then continues through $OCT_{1,2}$ (G, F, E, etc.). Meanwhile, $OCT_{2,3}$ continues in an inner voice, beginning with C4 in m. 42. The rather complicated voice leading resulting from the combination of these non-diatonic linear progressions creates a succession of chords that do not follow common-practice tonal syntax. If one simplifies the metrically emphasized harmonies to root-position chords, the voice leading emerges as shown in **example 2.17**, level b.

The octave transfer of the melodically and metrically emphasized upper-voice D# suggests a direct connection between the two supporting harmonies, G# minor and G augmented, related by parsimonious voice leading. The bass's E (m. 43) must be considered passing since it does not belong to either chord or combine with the upper voices into a syntactically meaningful harmony. The upper-voice G#5 of m. 44 connects with G#6 (and G#3) of m. 46 to form another octave transfer, giving G# structural prominence. In m. 44, the bass's whole-tone progression has arrived on D2. The upper voice's changes of diminution and register at mm. 46–47 articulate a division of the whole-tone progression at the octave span from G#2 to G#1 (mm. 41–47); the D2 of m. 44 functions as the whole-tone equivalent of a fifth-divider. From mm. 47 to 49, the progression unfolds the augmented fourth G#1–D1. D1, the goal of the progression, serves as a pedal tone from mm. 49 to 56. Measures 53–57 prolong A♭ in the upper voice,

---

[63] The change of collections is indicated in the foreground graph by the beaming, which in this case does not reflect voice leading!

which connects enharmonically with the prolonged G# of mm. 44–46. Ravel's octave doublings suggest that the passage begins and ends in the same register. This might well be due to the limitations of the keyboard; my interpretation, however, reflects the descending nature of the circle-of-fifth progression from which the two whole-tone progressions originate.

The middleground voice leading of the whole-tone progression thus unfolds G# to D in the bass (mm. 41–49) while the upper voice's octatonic progression first spans D#4 to G#6 (mm. 41–46) and resumes the high register in m. 48 to arpeggiate via B6 to E7. The harmony at the end of this prolongation in m. 56—D1 (plus octave doubling D2), C4, E4, and A♭4 (G#4)—again resembles the spacing of Väisälä's chord T_0U (or V#11/9/7, though functioning here rather like a French augmented sixth chord) and resolves chromatically to an F#-minor chord above a C# pedal in m. 57. The return here of the passacaglia theme in C# Phrygian signals the return of the A part of the movement's ternary form.[64]

2.5. Subposition

I use the term *subposition* to describe a *compositional practice* by Ravel that may have been inspired by Rameau. In Rameau's use, the term *supposition* refers to a

---

[64] An interpretation of the movement as in C# Phrygian has the advantage of linking its conclusion to the final movement in A major by similar parsimonious voice leading (C#–E–G#, C#–E–A) as the transition between the first and second movements (C–E–G, C–E–A). On the other hand, an interpretation of the movement in a plagal F# minor seems better to reflect Ravel's harmonization of the theme and to relate the F# minor/A major connection of movements III and IV to the A minor/C major double-tonic complex of movements I and II. Only further analysis (outside the scope of this dissertation) will show which of the two interpretations is superior.

theoretical construct to explain voice leading and chord progressions.[65] Rameau modeled the resolution of dissonant chord tones after the dominant seventh chord (the most basic dissonant chord structure and one of his fundamental chord types) to explain any descending stepwise resolution of a dissonance.[66] The sounding bass "supposes" the true fundamental tone, which is a seventh below the dissonant chord-tone. For example, the fundamental of the minor ninth chord F–A–C–E–G is A; the F is added below. Turning dissonant tones we interpret as suspensions (such as 9–8, 4–3) into sevenths, Rameau thus creates a single and efficient explanation for their stepwise descending resolution.[67] Peter Kaminsky defines subposition in Ravel's music as "the placement of a root, interval, or chord below a previously stated sonority, generally either defining or altering its functional implication."[68] To distinguish between the two situations—defining or altering the function of a chord—I shall borrow terms from company takeovers in business and call a subposition that defines the function of the previous harmony a

---

[65] While the term originated in the seventeenth century, modern music theorists mostly associate it with Rameau. In *Rameau and Musical Thought in the Enlightenment* (Cambridge: Cambridge University Press, 1993), 65 ff., Thomas Christensen explains how "supposition was initially defined in the seventeenth century as a melodic dissonance caused by passing tones and ornamentation."

[66] "The octave should … serve as the limit for all chords. … A ninth and an eleventh would always represent a second and a fourth. If a fifth sound can be added to the seventh chord at all, it can be added only below and not above. This added sound will suppose the fundamental, which will be found immediately above it. As a result, we shall not treat the octave of this added sound as the source, but shall use as the source the fundamental sound which has been supposed." See Jean-Philippe Rameau, *Treatise on Harmony*, 88. For a short account of Rameau's *supposition*, see Joel Lester, "Rameau and eighteenth-century harmonic theory," *Cambridge History of Western Music Theory* (2002), 764. For a detailed study of Rameau's theories, see Thomas Christensen, *Rameau and Musical Thought in the Enlightenment.*

[67] "We are purposely stressing that all chords by supposition, such as [the ninth] chord, the chord of the augmented fifth, the eleventh chord, and the chord of the augmented seventh … are derived from the seventh chord of a dominant. In this way, we immediately know how to prepare and resolve these chords, so that by using the fundamental bass we shall see how everything relates to our rules concerning sevenths. See Jean-Philippe Rameau, *Treatise on Harmony*, 294; and Christensen, *Rameau*, 124.

[68] Peter Kaminsky, "Of Children, Princesses, Dreams and Isomorphisms," 35. In the corresponding footnote to this definition, Kaminsky writes: "Evidently, Ravel was interested very early on in sub-position as a means of generating complex chords … As the similarity in name would suggest, my *sub-position* has as its conceptual forebear Rameau's *supposition*." Ibid., 65.

"friendly" subposition, and a subposition that alters the function of the previous harmony a "hostile" subposition.[69]

2.5.1. "Friendly" Subposition

In measure 149 of the first movement of the String Quartet, the combined pitches of the viola and violins form the chord B–C#–F–A (**example 2.18**). The spacing suggests that the chord be conceived as the augmented triad C#5–F5–A5 with F doubled an octave below and B3 a diminished fifth below the F4. While the B below the augmented triad is not enough to convey the chord's tonal function, the entrance of the cello's G2 in m. 150 renders the harmony a V9/7 chord with #4 (C#) replacing the chord's fifth, D. As in the identical passage from mm. 21–23 (**example 2.12**), the chord tones and spacing closely resemble the arrangement of the harmonic series in Väisälä's chord "U." Unlike Rameau's concept of supposition, where the subposed tone is placed below the chord's true fundamental (or root, in the modern sense), Ravel's subposed G here identifies the harmony's function as dominant.

2.5.2. "Hostile" Subposition

At m. 77, the climax of the Piano Trio's first movement (**example 2.19**; see also **example 2.20**), the movement's primary theme sounds *fortissimo* in the tonic key, A minor. However, at the end of the measure, Ravel subposes the bass D below the locally prolonged triad A–C–E, turning the upper voices into fifth, seventh and ninth above the

---

[69] Though not music-theoretical, these terms are shorter than, for example, "function-defining" or "function-altering subpositions" and easier to remember than abbreviations ("FDS" or "FAS").

bass and thus changing the harmonic function of the chord to a subdominant. Above the subdominant pedal D, E in the inner voice eventually moves to F in m. 80, forming the third of the subdominant chord, whereas E in the upper voice functions as a 9–8 suspension.[70] The ambiguity of the subdominant ninth chord, D–F–A–C–E, allows Ravel to reinterpret the chord from iv of A minor to ii of C major; at this juncture the chord thus fulfills a critical role in the recapitulation's shift to C, the second tonic of the movement's double-tonic complex.

2.6. Conflicting Prolongations

Conflicting prolongations present one of the greatest challenges when we approach Ravel's music with Schenkerian tools. The harmony outlined by a melody often does not match the harmony prolonged in the accompanying chords; two different voices might draw pitch material from incompatible collections; or the upper voices may seem o move independently of the bass line. To solve these problems, the analyst must establish an order of structural priority, evaluating and determining the hierarchical relationships among all voice-leading components within the individual context of the passage in question. The more the various voice-leading components differ, the more complex their interaction.

[70] To my ears, the suspension's melodic trajectory E-D already points towards a resolution on C, even if Ravel successfully delays the resolution until the structural cadence in m. 94.

2.6.1. Bass/Upper-Voice Conflicts

Conflicts between bass and upper voices arise when the underlying prolongation formed by the melodic line alone is dissonant to the bass tone or bass progression underneath. In some cases, the upper voices form dissonances above the bass that are subsumed by and subordinate to the bass's harmonic function. As Ravel's pedal tones most often act as the roots of the structural harmonies they support, this usually occurs when the intervals of the upper voices form stacked thirds (fifths, sevenths, ninths) above the pedal tone. For example, the upper voices might prolong a triad a fifth above a bass, thus forming a ninth chord. In other cases, the upper voices might form temporary dissonances above a pedal tone until their intervals can be subsumed under the bass's harmonic function.

Example 2.20, mm. 77–86 of the Piano Trio's first movement, illustrates these various situations. (1) The subposed D in m. 78 renders the A-minor triad dissonant, changing the previous tonic function to a subdominant. (2) The G-augmented triad prolonged in m. 79 is a neighboring harmony.[71] Still more locally, E and G# of the E augmented triad on the last quarter of m. 79 are lower neighbors to F and A in m. 80. (3) The third, F (coming from the inner-voice E) above the D, confirms the re-articulated A–C–E as part of the subdominant harmony. This dissonant subdominant ninth chord is prolonged throughout the return of the secondary subject area (mm. 83–85). (4) The dissonant E reveals its identity as a suspension with the D pedal's motion to G, which

---

[71] As shown in example 2.1, in the melodic context of the pentatonic motive A–G–E the upper-voice G itself is "passing" from A to E.

functions as a dominant pedal (mm. 86–93) and eventually leads into the "essential sonata closure" (ESC) at measures 93–94.[72]

2.6.2. Simultaneous Prolongations of Different Referential Contexts

The following discussion of mm. 90–94 of the Piano Trio's first movement relates both to **examples 2.21a** and **2.21b.**

(a) In the piano, the enneatonic collection prolongs the central augmented triad F–A–C#. F–A–C#, embellished by its neighboring augmented triads, E–G#–B# and B♭–D–F#, is present both as a vertical sonority (successive downbeats in mm. 90–93) and as an arpeggiation..

(b) The violin's descending line is governed by a pentatonic collection. At the surface level (bottom system), the stemmed notes show the descent through the pentatonic scale. If we interpret G as a passing tone, the pentatonic collection outlines an A-minor triad and thus also supports hierarchical relationships (square note heads).

(c) Interpreted independently, the two parts seem to prolong incompatible harmonies: an A-minor triad in the violin and an A-augmented triad in the piano. However, Ravel coordinates the two instruments' interaction in such a way that the piano's neighboring augmented triad E–G#–B# coincides with the violin's E and C—two of the four pitch classes the two collections have in common.

---

[72] Hepokoski and Darcy's term for the structural cadence at the end of a sonata-form recapitulation, introduced in "The medial caesura and its role in the eighteenth-century sonata exposition," *Music Theory Spectrum* 19/2 (1997), 115–54. See also Hepokoski and Darcy, *Elements of Sonata Theory*, 23–50.

(d) Interpreted enharmonically, both E and C "belong" to the neighboring augmented triad E–G#–B#. Thus the apparent incompatibility of harmonies can, at the next level, be resolved in favor of the augmented triad A–C#–F, which is prolonged throughout mm. 90–92. In this context, the violin's A-minor arpeggiation simply prolongs the single pitch A, transferring it down by two octaves to arrive at the ESC in the movement's obligatory register. This interpretation does not contradict the simultaneous perception of both harmonies, A minor and A augmented.

2.7. Interaction of Prolongational Structures at Multiple Levels

The different prolongational structures described above can interact in multiple combinations across many structural levels. The following brief example demonstrates how a Schenkerian approach reveals Ravel's brilliant treatment of complex interactions between bass, harmony, and melody. Within the span of four measures, we find (1) hierarchical relationships within two different types of collections (one a cyclic collection, the other pentatonic); (2) their interaction, creating two additional structural levels (A-minor and A-augmented triads); (3) the subordination of a dissonant prolongation (augmented triad) to a pedal tone (G); and (4) the resolution of the dissonance by parsimonious voice leading to the structural dominant, which effects the completion of the *Urlinie's* final descent at the ESC.

The excerpt shown in **example 2.21b,** the denouement to the closing group of the first movement of Ravel's Piano Trio (mm. 90–94), represents this sonata movement's approach to the ESC. Building on **example 2.21a**, **example 2.21b** takes the larger context of the passage into account. The letters below correspond to the circled letters in both examples. As I have already discussed the interaction of the pentatonic and enneatonic collections, I shall continue with the role of the pedal tone G (letter e).

(e) The bass pedal G1 does not belong to this enneatonic collection and functions only as a subordinate pitch in the pentatonic collection. As the G1 does not participate in either of the local prolongations, the larger context must determine its role. In much of Ravel's pre-war music, the bass line's pedal tones move at a much slower pace than the upper voices. Assuming a normative structural priority of the bass, I interpret the upper-voice prolongations as lower-level dissonant voice leading above the higher-level pedal tone G. The augmented triad (now C#–A–F) ultimately progresses parsimoniously to D–F–A, forming a V9/7 chord on G, which supports the structural cadence's scale degree 2 at the ESC.

(f) Interpreting the violin's E4 in m. 93 as an escape tone and the G3 as a motion into an inner voice, the violin's structural scale degree 2 (D4) is carried over as a suspension into m. 94 by the piano's top voice. The structural voice leading is shown more clearly in the top system **(g).**

This example demonstrates the complexity of possible interactions; in-depth analyses follow in chapters 4 and 5.

2.8. Summary and Conclusion

The Schenker-derived methodology introduced in this chapter sheds light on many traits of Ravel's style. We find prolongations of dissonant diatonic chords, such as seventh and ninth chords and chords based on unresolved appoggiaturas at the foreground and shallow middleground. Prolongations within whole-tone and octatonic environments serve as contrasting sonorities but are always subordinate to diatonic prolongations. Ravel’s octatonic prolongations often function as upper voices combining with a diatonic bass line to create dominant harmonies. Also, Ravel usually leaves a governing octatonic or whole-tone collection to approach a cadence. Octatonic linear progressions mostly serve as rhetorical devices, creating tension in preparation for climaxes. Whole-tone linear progressions tend to function at a larger level and govern transitional passages: in ascending forms, they signal a departure from stable formal sections; in descending forms they signal a return to a stable formal section. The complex interactions of all these elements require a context-sensitive interpretation of structural priorities.

The methodology introduced in this chapter can be extended to pre-war works of Ravel not included in my dissertation. **Example 2.22** summarizes the most typical prolongational features of Ravel’s pre-war music and the structural levels at which they characteristically function.

Though the complexity of prolongational interaction between diatonic and non-diatonic collections provides considerable challenges to the analyst, Ravel’s ways of employing these collections actually guide the listener’s perception toward tonal and formal processes. If we think of tonality as a grounding force comparable to our experience of gravity, we can perceive prolonged dissonances as temporarily suspending gravity. Where dissonant harmonies are prolonged by non-diatonic collections, the symmetries of these collections create a degree of disorientation, further suspending “gravity.” We are led to perceive formal processes as a succession of musical spaces with varying degrees of tonal grounding, at times experiencing a delightful sense of weightlessness, at other times a return to gravity. Ravel's registral distributions and the kinetic forces of rhythmic and melodic shapes that characterize his musical language further enhance our sense of musical gravity and motion. Within this ebb and flow of gravitational fields, Ravel's clear bass lines, with their extended pedal points, serve as aural anchors. Our sense of grounding depends much on the "rootedness" of the prolonged harmonies: the more we perceive a bass tone as the root of the harmony above, the more easily we relate it to its tonal framework. Where these rooted harmonies fulfill the basic syntactical functions of tonality (such as pre-dominant, dominant, and tonic), they anchor our perception, providing a sense of key and form. Thus, notwithstanding the complexity of Ravel's harmonic language, these "most-rooted" syntactic harmonies allow us to track the progression of the tonal background. In the analytical chapters 4 and 5, I explore in detail the relationships between prolongational structures, motivic processes, and formal design.

CHAPTER 3

Analytical Approaches and Methodologies II:

Step-Based Transformations

3.1. The Importance of Motives in Ravel's Music

3.1.1. Motivic Transformation

Motivic transformation is an essential feature of Ravel's music, where motives and their transformations form networks of motivic-thematic relationships that weave a rich fabric of individual textures.[1] Ravel's motivic techniques involve intervallic changes, repetition of motivic segments, and, most of all, transformations brought about by changes in the collections (such as the whole-tone or octatonic collections) that govern the sections within which the motives reside. Especially in Ravel's sonata forms, motives and their transformations become landmarks amid these changing collections and so play an important role in the delineation and characterization of formal sections. Because Ravel draws his pitch material from diatonic as well as non-diatonic collections, set-theoretical tools are not well suited to describe the intervallic alterations that characterize these transformations, whether they occur within a single collection or result from a shift between collections.[2] To describe motivic transformations brought about by such shifts, we need to establish appropriate analytical tools and terms.

---

[1] The most thorough treatment of Ravel's masterful motivic and thematic transformations to date is Braun, *Die Thematik in den Kammermusikwerken von Maurice Ravel.*

[2] To relate motivic procedures to the style or compositional technique of a specific composer is not a new idea. For example, Schoenberg's idea of "developing variation" grew out of his study of the music of Brahms. As in my own approach, transformational analysis is central to Lora L. Gingerich's study "A Technique for Melodic Motivic Analysis in the Music of Charles Ives," *Music Theory Spectrum* 8 (1986), 76–93. While the majority of Gingerich's Ives-inspired definitions of specific transformations focus on temporal aspects of motivic transformations (such as insertions, expansions, contractions, and reorderings),

Consider **example 3.1**. When the flute introduces this theme—the second theme of the *Introduction and Allegro's* modified sonata form—we hear it in the diatonic context of E♭ minor. When the theme returns as part of a harp solo, its steps have been mapped onto the octatonic collection $OCT_{2,3}$. The intervallic transformations of the theme result simply from the change of collection.

In both tonal and post-tonal music, we categorize simple transformations of motivic units, such as transposition, inversion, retrogression, retrograde inversion, diminution, and augmentation. However, we apply different systems of analysis to tonal and post-tonal music. Neither the language and terms of traditional tonal analysis (in all its different methodological incarnations) nor those of post-tonal set theory sufficiently address motivic analysis of music that spans both categories, such as Ravel's.[3] In this chapter, I provide new tools for analyzing motivic relationships that work for both tonal and post-tonal repertoire. Building on the idea of "step" and "step class," these tools are extremely flexible and can thus be applied to many musical styles. Moreover, the methodological foundations I offer provide a framework capable of broader application and further development.

My approach combines transformational analysis with aspects of set theory by applying the latter to ordered referential collections. Though this approach itself is not

---

my Ravel-inspired definitions of motivic transformations focus on changes in motives' pitch structures brought about by changes in the referential contexts through which the motives progress.

[3] An exception is David Lewin's work in transformational analysis, which embraces tonal as well as post-tonal music and offers dynamic analytical models capable of describing all kinds of musical transformation, including those of motivic entities. See, for example, David Lewin, *Generalized Musical Intervals and Transformations* (New Haven: Yale University Press, 1987), *Musical Form and Transformation: 4 Analytic Essays* (New Haven: Yale University Press, 1993)..

new,[4] I discuss several types of motivic transformation not previously addressed in the scholarly literature.[5] While David Lewin's writings on transformation form the theoretical background for my approach, my methodology builds on the analytical tool of "modular transformation" which Matthew Santa developed to describe transformational processes in the context of changing referential collections.[6]

After briefly relating Ravel's music to some ideas posed by other authors on general motivic relationships, I elucidate the concept of *referential collections as modular spaces*, present the chapter's basic terminology and a graphic tool for motivic transformations, and discuss in detail the different collections we find in Ravel's music. I then introduce eight types of step-based intervals (parallel to the four types of intervals we use in pitch-based set theory) as a foundation for the eight types of step-based motivic transformations I define in the main body of the text. I illustrate each type of transformation with one or more musical examples from works by Ravel and other composers, from Bach to Bartók.[7] In conclusion, I apply the transformational tools I have

---

[4] A recent work that combines set theory with the idea of collections is Matthew Santa, "Studies in Post-Tonal Diatonicism: A Mod7 Perspective" (PhD diss., City University of New York, 1999).

[5] My research for this chapter originates from 1999 and its concepts were formulated by 2000; that is, before similar research by Michael Berry, Julian Hook, and Dmitry Tymoczko was published. See Michael Berry, "An Exploration of Some Non-Tonal Pitch-Class Spaces with Implications for a Theory of Voice-Leading," PhD diss., City University of New York, 2007; Julian Hook, "Cross-Type Transformation and the Path Consistency Condition," *Music Theory Spectrum* 29/1 (2007), 1–39; Dmitri Tymoczko, "Scale Theory, Serial Theory, and Voice Leading," unpublished article under review at Music Analysis; see http://www.music.princeton.edu/~dmitri/. Despite of some overlap among the issues themselves, my approach differs significantly in the way I conceptualize (1) specific motivic transformations, (2) interval consistency under inversion, (3) transformation labels, and (4) visual representation of transformations. Throughout this chapter, I shall point out the specific differences at the appropriate junctures of my discussion.

[6] Matthew Santa, "Defining Modular Transformations." I will build on Santa's approach and discuss it in detail in the following paragraphs.

[7] The inclusion of examples from music by composers other than Ravel serves to illustrate the broad applicability of the analytical tools developed in this chapter. In the remainder of the dissertation, however, I apply each of the eight types of transformations to music of Ravel.

developed to two complex examples by Ravel, intra-movement motivic transformations in the first movement of the String Quartet, and inter-movement motivic connections among the primary themes of the Piano Trio's four movements.

3.1.2. Motivic Relationships

Leonard B. Meyer distinguishes between "synchronic" and "diachronic" interpretations of motivic similarity relationships.[8] The motivic relationships in Ravel's music I address in this dissertation are both synchronic and diachronic. My conceptualization of Ravel's motivic techniques views his motives as musical objects that undergo a variety of transformations, related to but not dependent on each other in their temporal succession.[9] Where I relate motivic variants with perfectly or nearly identical rhythmic shapes to their roles in the sonata-form *process*, I focus mostly on their *diachronic* relationships.[10] Where I compare more abstract, primarily pitch-based motivic relationships such as those that form inter-movement connections, I draw attention to a network of *synchronic* motivic relationships.

In discussing Ravel, Deborah Mawer's distinction between a "musical object" as a "fixed, passive entity" and "a motive, which engenders organic growth and

---

[8] Leonard B. Meyer, "A Pride of Prejudices; Or, Delight in Diversity," *Music Theory Spectrum* 13/2 (1991), 241–51. Meyer defines *synchronic* as "a relationship of similarity without regard to temporal ordering" and *diachronic* as "a process of successive development or change over time." Meyer claims that "most theorists who have been concerned with motivic unity have adopted a synchronic position; that is, they have explained how the variants of a motive or theme are related to one another—or to some abstracted imaginary pattern from which all the variants are presumably derived--by arguing for their classlike similarity." Meyer, "A Pride of Prejudices," 244–45.

[9] Deborah Mawer relates Ravel's "musical objects" to his musical aesthetic of neoclassical objectivity and his fascination with mechanical objects. Deborah Mawer, "Musical Objects and Machines."

[10] Due to their brevity, many of my examples in this chapter highlight synchronic aspects of motivic transformation. Nevertheless, Lewin's dynamic model of transformational analysis is capable of constructing diachronic transformational paths as well. These diachronic paths are especially important in Ravel's sonata forms, where they guide our perception of the sonata process in real time.

development"[11] is reminiscent of Lewin's opposition of a Cartesian, intervallic approach and a dynamic, transformational approach to musical space.[12] Viewed as musical objects in Mawer's sense, Ravel's motives are indeed "passive entities" that undergo transformations imposed on them by the changing referential collections that govern them. On the other hand, as the various forms of a motive represent the respective referential collection that governs them, they actively shape our perception of the transformational, tonal, and formal processes within a movement.

My discussion here focuses on transformations that involve relatively small changes in the intervallic structure of motives.[13] In this regard they resemble transformations that Schoenberg calls "exact" and "modified repetitions":

> *Exact repetitions* preserve all features and relationships. Transpositions to a different degree, inversions, retrograde, diminutions and augmentations are exact repetitions if they preserve strictly the features and note relations. *Modified repetitions* are created through variation. They provide variety and produce new material (motive-forms) for subsequent use. Some variations, however, are merely local 'variants' and have little or no influence on the continuation.[14]

In principle, the kinds of transformation I discuss fall mostly under Schoenberg's first category. But insofar as their application within the various collections produces intervallic changes, they also belong to the second category.

---

[11] Deborah Mawer, "Musical Objects and Machines," 48.

[12] In a recent essay, Henry Klumpenhouwer shows Lewin's work as aiming for a shift from "Cartesian thinking" —which, for example, conceives of "transposition as affecting Gestalts built up from individual objects," (Lewin, *GMIT*, 159)—to an "Anti-Cartesian" transformational perspective, where "activity, rather than measurement, mediates the object at hand." See Henry Klumpenhouwer, "Anti-Cartesianism in Lewin's *Generalized Musical Intervals and Transformations*," *Music Theory Spectrum* 28/2 (2006), 277–89; 280.

[13] The specific rhythmic shape in which a given motive and its transformations appear will, of course, influence whether we perceive the various motive forms as related or accept them as transformations of each other.

[14] Arnold Schoenberg, *Fundamentals of Musical Composition* (London: Faber and Faber, 1967), 9.

3.2. Referential Collections as Modular Spaces

A collection is the same as a set, but when we speak of the whole-tone collection, we might visualize the collection as a scale, which is an *ordered* collection.[15] This aspect of ordering is crucial to the labeling of steps and step classes later in this chapter. I use the term *referential collection* as an abbreviation of Philip Wade Russom's term "Referential Scale Collection" or RSC:

> A scale is regarded as a collection of notes (or pitch classes) that can be composed out in a multitude of vertical or horizontal formations. It is convenient to reduce this multitude to some stepwise arrangement of notes. The former [i.e., collection] is an unordered collection, the latter [i.e., stepwise arrangement] is a true scale, but both are 'referential' in their pitch-class content. Combining all three notions, we call the many scales with which Ravel composes *referential scale collections* (RSCs).[16]

Since most of the referential collections Ravel uses can be arranged—that is, ordered—as scales, we think of the intervals between adjacent members of these scales as "steps." In some collections, we apply the concept of "step" even where, owing to the pitch proximity principle,[17] our perception of intervals larger than a major second tells us that we are, in fact, hearing skips. For example, we treat the interval between scale degrees 6 and 7 in harmonic minor as a step, but the fact that many of our students need to practice singing the interval of the augmented second suggests a cognitive disjunction

---

[15] I prefer the term "collection" to "set" because it is more closely associated with the idea that—in the music of Ravel—different types of scales serve as varied pitch-class repertoires.

[16] Philip Wade Russom, "A Theory of Pitch Organization," i. Russom's language is not quite clear. I assume that by "all three notions" he means (1) an unordered collection; (2) an ordered collection, arranged as a scale; and (3) the referential aspect of the scalar collections which provide defined reservoirs of pitch classes from which Ravel draws his pitch materials.

[17] David Huron discusses the "pitch proximity principle" in "Tone and Voice." Summarizing empirical evidence on auditory streaming, he concludes: "The coherence of an auditory stream is maintained by close pitch proximity in successive tones within the stream. Pitch-based streaming is assured when pitch movement is within van Noorden's 'fission boundary' (normally *two semitones or less* for tones less than 700 ms in duration). When pitch distances are large, it may be possible to maintain the perception of a single stream by reducing the tempo." Ibid., 18; the emphasis is mine.

between the conceptualization and practical execution of this "step." Because of our cultural conditioning toward diatonicism we might find it even more challenging to perceive the minor third between adjacent scale degrees in two locations of the pentatonic collection as a step.[18]

3.2.1. Terminology and Definitions[19]

In order to apply set-theoretic operations to steps, we can conceptualize referential collections as modular spaces, where the *modular space* (mod) is defined by its cardinality (M), and the *modulus* (M^n) is defined by the particular ordering (n) of pitch-class intervals within that specific modular space.[20] For example, mod7 represents the modular space of the seven-note diatonic collection class, 7^1 the modulus defined by the pc-interval sequence [2-2-1-2-2-2-1], our "major scale."[21] For the diatonic modular space mod7, Santa's orderings of the rotations begin analogously to the white-key sequence of

[18] Viewing our repertoire of scales from an historical perspective, Robert Gauldin suggests that pentatonic pitch sets resulted from the "filling-in of the two empty tetrachords with an additive note or *infix*, which partitioned the fourths [of the cyclic string tuning of Greek antiquity] asymmetrically." Robert Gauldin, "The Cycle-7 Complex," *Music Theory Spectrum* 5 (1983), 39–55; 42. Gauldin espouses Joseph Yasser's theory that "tonal evolution witnessed an expansion from pentatonic toward the heptatonic collection 7–35, with *structural gaps of the five-tone set bridged by secundal motion*. In the case of 5–35, the m3 was cleft *with a whole and half-step*, thereby continuing the asymmetrical process noted earlier in the division of the fourth." Ibid., 46–47. The emphases are mine. See also Joseph Yasser, *A Theory of Evolving Tonality* (New York: American Library of Musicology, 1932). Dmitri Tymoczko observes that most of the scales used in Western music " do not contain consecutive semitones." The scales that follow that constraint include the major, melodic and harmonic minor, octatonic, and whole-tone scales. See Dmitri Tymoczko, "The Consecutive-Semitone Constraint on Scalar Structure: A Link Between Impressionism and Jazz." *Intégral* 11 (1997), 135–79; 136.

[19] For a summary with definitions of all technical terms of this chapter, see example 3.21.

[20] Here I am deviating from Santa's labeling. Santa's labeling for *modular space* (*mod*) also serves to label specific moduli if combined with an integer for the modular space's cardinality and an order number for the specific modulus. Substituting M^n for Santa's *mod* when talking about a specific modulus allows us to distinguish between the *modular space* itself (mod) and its cardinality (M). With M serving as an abstract symbol for the cardinality, formulas and the labeling of transformational paths become more concise.

[21] What I call "interval sequence" is Chrisman's "successive interval array," or SIA. Richard Chrisman, "Describing Structural Aspects of Pitch-Sets Using Successive-Interval Arrays," *Journal of Music Theory* 21 (1977), 1–28.

the keyboard starting on C, so that 7^1 has the interval sequence of the major (Ionian) mode, 7^2 that of Dorian, and so forth.[22] The orderings of the pentatonic moduli follow the same convention, beginning with the interval sequence of the "major" pentatonic, so that 5^1 has the interval sequence [2-2-3-2-3]. The orderings of non-diatonic moduli, on the other hand, follow the conventions of set theory and start with the collection's "normal form." 9^1, for example, has the interval sequence [1-1-2-1-1-2-1-1-2], 9^2 [1-2-1-1-2-1-1-2-1], and 9^3 [2-1-1-2-1-1-2-1-1].[23] Mod6 contains two different modular spaces with the same cardinality: mod6W stands for the whole-tone collection, mod6H for the hexatonic collection.

Conceptualizing referential collections as modular spaces allows us to apply set-theoretical operations to the members of each ordered collection by assigning a number to each ordered position. In his article on modular transformations, Santa uses Stephen Dembski's term "step class" as an analogue to "scale degree" to avoid the diatonic and tonal connotations of the latter term.[24] Santa and Dembski define "step-class" as "a numbered position within a modular system; octave equivalence is assumed."[25] To parallel the set-theoretical conventions of pitch class, Santa labels the first step class of a given collection 0.

I make a further distinction between the numbered position within a *specific* collection—e.g., the sixth step of a given octatonic collection—and a numbered position

[22] Santa, "Defining Modular Transformations," 203.
[23] Though it would be more consistent to order all collections according to the "normal form" principle, Santa's approach conveniently reflects our custom of placing diatonic collections mostly in a tonal context, non-diatonic in a post-tonal one.
[24] Santa, "Defining Modular Transformations," 202 and footnote 4.
[25] Ibid.

in *any* collection—e.g., the third step of *all* collections.[26] According to set-theoretical conventions, only the latter situation really constitutes a "class," namely, the class of all steps that share the same ordered position within all collections.[27] I will use the term "step class" only for the latter situation and refer to ordered positions within specific collections simply as "steps."[28]

To clearly distinguish pitch classes, steps, and step classes, I will use the following symbols: simple integers represent pitch classes; a ~ above a number, e.g., $\tilde{6}$, indicates a *step* within a given collection; and a ≈ above a number refers to a *step class*, e.g., $\overset{\approx}{3}$.[29] Unless indicated otherwise, octave and enharmonic equivalence apply to both.[30]

3.2.2. Common Referential Collections and Their Modular Spaces

Before introducing and applying transformational operations based on steps and step classes, I will discuss the collections we find in Ravel's music.[31] **Example 3.2** builds on Matthew Santa's example 5, which presents the collections as modular spaces and

---

[26] Though Santa does not explicitly make this distinction, his application of "step class" is consistent with my definition.

[27] By the same token, Santa's "modular space" is the equivalent of a "collection class," that is, the class of all collections equivalent under transposition and/or inversion, whereas the specific modulus is the equivalent of a specific ordered collection.

[28] Unlike a "scale step," which usually refers to diatonic systems where the first note of a scale is labeled 1, my "step" follows the designation of pc set theory by labeling the first step 0. When we talk about scale steps, 1 is not really a "step" but an ordered position; thus "scale degree" is a much better term. The term "step" implies a motion or the distance from one ordered position to the next. A more precise terminology might therefore use "scalar position" and "position class," but since the concept of steps has been around for centuries, I see no advantage in trying to change that tradition. One could potentially extend the methodology laid out in chapter 2 to construct non-diatonic parallels to *Stufentheorie* using the term "*scalar* degree."

[29] For visual clarity, the ~ and ≈ symbols are omitted in the single-spaced boxed definitions.

[30] In some musical contexts, octave equivalence is not desirable or possible and we need further distinctions. I discuss this in detail on pages 76–77 and 94–106.

[31] See also table 2.1.

shows their possible rotations (moduli) and interval successions mod12.[32] In addition to the modular spaces listed by Santa, I include the hexatonic and enneatonic because they appear in Ravel's music.[33] The chromatic modular space has only one rotation and is represented as mod12. The octatonic has two possible rotations; the one starting with the half step is labeled 8^1, the one starting with the whole step 8^2. The seven rotations of the diatonic modular space correspond to the diatonic modes: 7^1 is Ionian or major, 7^2 Dorian, 7^3 Phrygian, and so forth. To distinguish between the two kinds of mod6 spaces, I label the whole-tone modular space 6W and the hexatonic's two rotations $6H^1$ and $6H^2$. To remember the five rotations of the pentatonic modular space, we might imagine the series of black keys on a keyboard: 5^1 starts on G♭, 5^2 on A♭, 5^3 on B♭, 5^4 on D♭, and 5^5 on E♭.[34] In practice, of course, any of the moduli can start on any pitch class. I will refer to this flexibility of designation as the "relative" or "moveable-do" approach to labeling our moduli, where step $\tilde{0}$ represents the pitch class we choose as the first of a given modulus. My approach thus adds to Santa's nomenclature a letter-name pitch-class designation (L) to specify which pitch class of a given modulus receives the step designation $\tilde{0}$. Because of the overall tonal nature of Ravel's pre-war compositions, I provide the L designation *prior* to the modular designation M^n.

---

[32] Santa," Defining Modular Transformations," 203. With the exception of my example 3.4, which shows the harmonic and melodic minor scales as derivations of mod7^6, I limit my list to the collections introduced in chapter 2. However, it is possible to extend the idea of modular systems of ordered step classes to any other scale, such as variants of the so-called Gypsy scale, as shown in Benjamin Suchoff, *Concerto for Orchestra—Understanding Bartók's World* (New York: Schirmer, 1995), 61.

[33] For example, Russom shows that the hexatonic collection governs the beginnings of "Manteau de fleurs" and the second of the *Valses nobles et sentimentales* (Russom, "A Theory of Pitch Organization," 47), while I discuss in great detail the role of the enneatonic collection in the first movement of Ravel's Piano Trio (see chapter 2, pp. 61–63). For an extensive discussion of the scales' intervallic properties and shared subsets among them, see also Tymoczko, "The Consecutive-Semitone Constraint."

[34] Suchoff refers to 5^1 as "Chinese pentatonic," and the symmetrical 5^3 as "Hungarian pentatonic." Benjamin Suchoff, *Concerto for Orchestra*, 64 and 43–44.

It is important not to confuse the moduli with transpositions of scalar collections; for example, the octatonic modular space has two moduli (8^1 and 8^2), but the octatonic collection has three distinct transpositions ($OCT_{0,1}$, $OCT_{1,2}$, and $OCT_{2,3}$). Thus, the modular spaces and moduli given in examples 3.4 and 3.5 do not specify actual pc collections but only the interval sequence of a modulus whose step $\tilde{0}$ could be mapped onto any pitch class of the equally tempered aggregate. For non-diatonic collections, the choice of $\tilde{0}$ is not necessarily based on "centricity" and might appear somewhat arbitrary. As a systematic treatment of the difficult subject of "centricity" is beyond the scope of my dissertation, I suggest an empirical approach; namely that the designation of $\tilde{0}$ be based on context-sensitive interpretation of each individual musical example.[35]

3.2.3. Types of Intervals in Modular Spaces

In modular spaces, we can measure intervals between steps in two basic ways:

1. As ***pitch-based intervals*** measured in the manner of pitch-class intervals; that is, counting the number of half steps from any given step or step class to another;
2. As ***step-based intervals***, counting the number of steps from any given step or step class to another within a given modular space.[36]

Since our concept of step is inherently modular, the term "step" implies octave equivalence. However, in some contexts we will encounter motivic transformations where octave equivalence is not desirable or possible. The problem of octave equivalence

---

[35] See also my suggestions on p. 84.
[36] The term *step-based interval* shall serve as an umbrella for all intervals based on steps and step classes.

requires that we expand our definitions of interval types.[37] For example, when an interval of six steps is mapped from the chromatic modulus onto the whole-tone modulus, the pitch-class interval traversed by the six steps changes from a tritone (i_6) into an octave (i_{12})—not a unison.[38] To describe motivic transformations precisely, we thus need to distinguish between intervals *with* and *without* octave equivalence.

When we speak of *pitch intervals*, we think of concrete intervals in *pitch space* without octave equivalence. Extending this concept, I shall refer to intervals between steps without octave equivalence as *step-space intervals*. We may visualize a *modular space* as a series of intervals mapped onto a circle or clock face.[39] To visualize *step space*, we can imagine the same series of intervals mapped onto a spiral in pitch space from low to high. Unwound, the spiral would map a modulus's recurring interval sequence onto an infinite line through pitch space. I shall call such an "unwound" modulus a *step space*. The same distinction is possible for step-class intervals, but much more abstractly: *step-class space* has to be visualized as the space that encompasses all possible interval sequences of all modular spaces. Going beyond the four levels of abstraction we use for pitch-based intervals,[40] I thus propose eight levels of abstraction for step-based intervals:

---

[37] I discuss the octave-equivalence problem and possible solutions in more detail on pp. 94–106.
[38] See, for example, my discussion on p. of the differences between Santa's MODCOMP and my INTMAP.
[39] See also example 3.5.
[40] Ordered and unordered pitch intervals, ordered and unordered pitch-class intervals. See Joseph Straus, *Introduction to Post-Tonal Theory*, 3rd ed. (Upper Saddle River, NJ: Pearson/Prentice Hall, 2005), 11, exs. 1–6.

1. *ordered step-space interval* (ordered ss-i): the ascending or descending interval between two steps in a given step space (without octave equivalence);
2. *unordered step-space interval* (unordered ss-i): the distance between two steps in a given step space (without octave equivalence);
3. *ordered step interval* (ordered st-i): the ascending or descending interval between two steps within a single modulus (with octave equivalence);
4. *unordered step interval* (unordered st-i): the distance between two steps within a single modulus (with octave equivalence);
5. *ordered step-class-space interval* (ordered scs-i): the ascending or descending interval between two step classes in step-class space (without octave equivalence);
6. *unordered step-class-space interval* (unordered scs-i): the distance between two step classes in step-class space (without octave equivalence);
7. *ordered step-class interval* (ordered sc-i): the ascending or descending interval between two step classes in any modulus (with octave equivalence);
8. *unordered step-class interval* (unordered sc-i): the distance between two step classes in any modulus (with octave equivalence).[41]

To understand better the distinctions among these eight types of step-based intervals, let us realize the interval between E5 and D3 (in the diatonic modular space) at the various degrees of abstraction:[42]

---

[41] Since step-class intervals are only relevant in such generalizing contexts, categories 5–8 will rarely play a role in specific analytical examples. Nevertheless, they complete the conceptualization of step space and step-class space.

ordered step-space interval	–15	
unordered step-space interval	15	
ordered step interval	–1	(= 6 in mod7)
unordered step interval	1	
ordered step-class-space interval	–15 modM	
unordered step-class-space interval	15 modM	
ordered step-class interval	M–1 modM	
unordered step-class interval	1 modM	

Note that for the last four categories I have translated the step and step-class intervals that E and D form in the *diatonic space* into the same-size step and step-class interval in any modular space. This means that the *unordered step-class interval 1 in modM* is a more abstract representation of the *unordered step interval 1 in mod7*. It does *not* mean that the distance between E and D always represents the unordered step-class interval 1 in any modular space (which would not be true for collections with steps smaller than a whole step). **Example 3.3** provides a summary of step-based intervals in the form of a table.

As shown in example 3.3, the various types of intervals can be grouped into further categories of abstraction. A *step-interval class* is the class of all ordered and unordered step-space and step intervals (grouping categories 1–4 into one class).[43] A *step-*

---

[42] This list is modeled after Joseph Straus' four categories of pitch-based intervals. Ibid.

[43] Andrew Mead's concept of "scale-degree difference classes" is essentially the same as my step interval class without s-ic_0. For example, "the diatonic scale contains three scale-degree difference classes;" (1) minor and major seconds (s-i_1); (2) minor and major thirds (s-i_2), and (3) perfect and augmented fourths (s-i_3). "The eight elements of the eponymic octatonic scale create four [scale-degree difference classes]," that is, step interval classes 1–4 in the octatonic column of my table 3.3b. Andrew Mead, "Shedding Scales: Understanding Intervals in Different Musical Contexts," *Theory and Practice* 22–23 (1997–98), 73–94; 75.

class interval class is the class of all ordered and unordered step-class-space and step-class intervals (grouping categories 5–8 into one class).

Example 3.4 features a series of tables to further illustrate step-based intervals. **Example 3.4a** lists the intervals at their most abstract level, as *step-class interval classes*. Each step-class interval class (sc-ic) includes all *step-interval class* (s-ic) members of the same cardinality for all modular spaces. For example, sc-ic_1 includes every single s-ic_1 of each collection. Sc-ic_1 encompasses all the pitch-class interval classes we get when we move by one step in any direction within any given modulus.[44] The table also shows that the size of any given s-ic cannot exceed half the cardinality M of its modular space. For example, sc-ic_4 does not exist in modular spaces with fewer than eight members. Any odd-numbered modulus has the same number n of step-interval classes as the next lowest even-numbered modulus because the inversional complement n^i of the highest step-interval class s-ic_n within an odd-numbered modulus is s-ic_{n+1}, which, as an inversion, belongs to the same interval class as s-ic_n. For example: in mod7, s-i_3 becomes s-i_4 under inversion, so that for both n=3 and n^i=4, the step interval class is s-ic_3.

Example 3.4b shows how the actual interval size (measured as pc interval) of any step interval depends on the specific modulus in which it resides. The table also compares the step-interval classes within each modular space to the pc intervals they can represent, showing the latter in mod12. It is interesting that the diatonic (mod7) collection is one of only two collections where different step intervals can have the same pc-interval size. In the diatonic modulus, that pc interval is i_6, the tritone, which in the major scale appears both as an augmented fourth between steps 3 and 6 (s-i_3) *and* as a diminished fifth

---

[44] See also table 3.4c.

between steps 6 and 3 ($s\text{-}i_4$).[45] Both belong to the same step-interval class, $s\text{-}ic_3$—the highest possible step interval class in the diatonic collection. The other collection that includes different step-intervals that share the same pc-interval size is the enneatonic collection, where the alternation between two successive half steps and a whole step produces three s-i pairs that share the same pc-i values: $s\text{-}i_1$ and $s\text{-}i_2$ can measure $pc\text{-}i_2$, $s\text{-}i_4$ and $s\text{-}i_5$ can measure $pc\text{-}i_6$, and $s\text{-}i_7$ and $s\text{-}i_8$ can measure $pc\text{-}i_{10}$.[46] As in the diatonic collection, the central pair, namely $s\text{-}i_4$ and $s\text{-}i_5$, share the highest step-interval class, here $sc\text{-}i_4$.

Example 3.4c extracts information from the preceding two tables to further illustrate the high degree of abstraction of the notion of step-class interval class. For example, $sc\text{-}ic_2$ can be represented by eight different pc intervals within our group of five modular spaces (excluding harmonic and melodic minor). Spelled out, $sc\text{-}ic_2$ means: "Move two steps in any direction within any of the given modular spaces, and you will have moved by any of these eight intervals: a whole step, a minor third, a major third, a perfect fourth, and their inverse intervals, a perfect fifth, a minor sixth, a major sixth, a minor seventh." This high variability makes step-class operations more flexible than comparable pitch-class operations. The degrees of variability depend on the collections that are compared. Composers such as Debussy, Bartók, and Ravel might have chosen collections relatively similar to each other (such as the diatonic and octatonic) precisely to minimize intervallic variability. For my motivic comparisons, I will label the

[45] In tonal contexts, the two different intervallic identities of the tritone influence voice leading: the augmented fourth expands in order to resolve, whereas the diminished fifth contracts toward its resolution.
[46] As I have pointed out in chapter 2, this particular interval succession contributes to the difficulty in distinguishing between a step and a skip when hearing $pc\text{-}i_2$ because theoretically it could be either!

transformations described below according to changes in the *ordered* step or step-class interval content of motives, which represents the least abstract interval designation for step-based operations. Finally, **example 3.4d** shows the various step-interval representations for each pc interval. For example, pc-i_5 spans five steps in mod12; four steps in mod9; three steps in mods8, 7, and 6H; two steps in mod5; and cannot be represented as a step interval in mod6W.

Example 3.5 depicts the modular spaces of the collections mapped in circular fashion on a clock face. Interval successions between steps are reflected in lengths of segments that connect them. The lines through the center depict axes of symmetry around which an inversion will reproduce the modulus. Dashed lines show axes that intersect with at least one step of the modulus; dotted lines show axes that fall between scalar steps of the modulus. The number of distinct rotations (moduli) of a given modular space is a function of the mutual relationship between its interval structure and axes of symmetry: The number of moduli (n) for a given modular space modM equals its cardinality M divided by the number of axes of symmetry (a); thus: n=M/a. For example, the diatonic collection has the cardinality 7 and only one axis of symmetry, thus seven distinct moduli. The octatonic collection, on the other hand, has four axes of symmetry and thus only two distinct moduli. At the same time, the number of axes (a) equals the number of distinct moduli (n) divided by the number of interval components (p) of each collection's recurring intervallic pattern: a=n/p. For example, the enneatonic collection's recurring intervallic pattern [1-1-2] has three components, thus a=9/3=3.[47] The diatonic collection,

[47] These "recurring intervallic patterns" are somewhat related to George Perle's "interval cycles." See, for example, George Perle, "Berg's Master Array of Interval Cycles," *The Musical Quarterly* 58/1 (1977), 1–30. I purposefully avoid using Perle's terminology so I can include incomplete cyclical collections, such as

on the other hand, has only one intervallic pattern with seven components [2-2-1-2-2-2-1], thus only one axis: a=7/7=1.[48]

Example 3.6 expresses in numbers some of the geometrical characteristics of the modular spaces depicted in example 3.5. The table gives an index of all step inversions for each modulus that render the pc content of that particular modulus invariant; that is, under this kind of step inversion the pc collection of the modulus maps onto itself. The first column indicates the modulus, the fifth column the step index number for all inversions that reproduce the pc-content of a given modulus, and the sixth column the step axis/axes of that inversion. Just as with pitch-class inversions, the axis of an inversion may fall between two adjacent steps. In that case, these steps are given as a pair. As in mod12 set theory, where each inversion through a pitch class or a pair of pitch classes has an equivalent inversion a tritone apart, in other modular spaces each axis also intersects at two points. The step interval between these two opposing axis points a^1 and a^2 is half the cardinality M of the modulus: **s-i (a^2–a^1) = c/2.** Whereas in even-numbered modular spaces the axes will either go through two single step classes or through two step pairs, in odd numbered collections each axis is represented by a single step at one end and a pair of steps at the other. Columns one to four show the mutual relationships between a modulus' cardinality, recurring interval pattern, number of rotations, and number of axes that I discussed under example 3.5.

---

the diatonic and pentatonic (both subsets of the interval cycle 5/7), and stay free of the connotations of his system, which would unnecessarily complicate my discussion.

48 These two formulas break down in the case of the harmonic minor scale, which has no axis of symmetry. For an axis of symmetry to exist, each pc interval that forms a "step" in a collection must exist at least twice. The harmonic minor has only one instance of i_3. To be precise, then, both formulas are true only *if* the number of occurrences (o) for each pc-i of a step in a given modular space is at least 2. Thus n=M/a ε M ⊂ o ≥ 2; and a=n/p ε M ⊂ o ≥ 2.

The greater the symmetry within a collection, the less we are able to make functional distinctions between its various steps. To orient oneself in any given space, the human mind takes its clues from differences within a given pattern and not from likenesses.[49] To illustrate this, **Example 3.7** offers a visual analog to the aural intervallic patterns for each modular space (collection) by translating them into keyboard designs. You can easily see that orientation is hardest where the pc distances between successive steps remain the same throughout a collection, as in the chromatic and whole-tone. The more varied the patterns of interval succession, the easier it becomes to orient oneself within the collection.[50] Ravel employs the different intervallic properties of the various modular spaces to shape motivic and formal processes in his works.

Since these collections do not exist in a vacuum but live in the context of a composed work, the musical environment will strongly influence how we interpret and label steps and step-classes within an analysis. As my examples below show, we can label a given pitch class as step $\tilde{0}$ based on a variety of musical features. We may assign $\tilde{0}$ to a tonal center; to the lowest note of a motive or passage; to a pitch class that functions as an axis of symmetry; or to a pitch class that asserts itself contextually—for example, by repetition—over the other members of the collection. To determine how these features justify the designation is an important and valuable part of the analytical process. In Ravel's pre-war music, the designation of $\tilde{0}$ will most often follow either motivic criteria or the tonal implications of the larger diatonic framework.

[49] For example, the regular grid of streets and avenues in Manhattan relies on a numerical system to provide orientation. Only after time might one distinguish one block from another by remembering buildings or landmarks.

[50] Mead talks about this kind of contextual orientation in terms of distinct scale degrees, of which the diatonic scale possesses seven, the octatonic two, and the whole-tone scale only one. Mead, "Shedding Scales," 77–78.

Deborah Rifkin has introduced useful distinctions between "systemic motives," "non-functional" and "functional pitch-class motives."[51] Adhering to Rifkin's definition of *systemic motives* as "diminutions of first-level middleground progressions,"[52] I have found that systemic motives are relatively rare in Ravel's music. Because of Ravel's idiosyncratic melodic language, his motives often only imply linear descents typical for first-level middleground motives rather than expressing them directly.[53] *Pitch-class motives*, on the other hand, defined by Rifkin as "ordered progressions of pitch classes" with or without "scale-degree functions" occur more frequently in Ravel's music.[54] Quite often, Ravel will alter the scale-degree functions of identical pitch-class motives by changing their harmonic contexts.[55] We find examples of such scale-degree reinterpretations in the first movements of the String Quartet and the Piano Trio. In both movements, these reinterpretations are part of the overall formal and tonal design of the respective sonata forms (for detailed analyses, see chapters 4 and 5). In addition to Rifkin's systemic, non-functional and functional pitch-class motives, my methodology adds the concept of "step-class motives." I define step-class motives as motives whose ordered step-class progression remains identical through varying modular contexts.[56] Unlike functional pitch-class motives, step-class motives may or may not imply tonal

---

[51] Deborah Rifkin, "A Theory of Motives for Prokofiev's Music," *Music Theory Spectrum* 26/2 (2004), 265–89.
[52] Ibid., 278.
[53] The fifth-descent of the primary theme of the Piano Trio's first movement, discussed in chapter 5, may serve as an example: instead of arriving at scale degree 1 (the goal of the melodic trajectory), the theme's cadence skips from the minor scale degree 7 into an inner voice to scale degree 5.
[54] Rifkin, "A Theory of Motives," 278.
[55] Depending on the context, these transformations might be interpreted as S-T, MODROT or MODTRANS transformations, which I will define shortly.
[56] Since a step-class motive by definition exists in more than one given modulus, I will use that term only for situations where I wish to generalize a motive's step-class identity independently of its actual manifestations in specific moduli.

functions—depending on the properties of the modular spaces by which they are governed. Like systemic motives, however, step-class motives may occur at different pitch-class transpositions, since they are defined in relation to scalar structures rather than specific pitch classes.

3.3. Motivic Transformations based on Step-Based Operations

When viewing motives as residing in different moduli, the properties of moduli as self-contained systems allow us to interpret common pitch-class based motivic transformations in the light of step-class operations as well. The types of transformational tools I suggest can thus be applied to a great variety of musical repertoires. Moreover, we can easily conceive of further adaptations of the same principles to all kinds of musical transformations. In the following paragraphs, I define eight different step-based operations grouped into four categories.

- Motivic Transformations within a single modular space:
    1. *step transposition* (S-T, analog to pitch-class transposition)
    2. *modular rotation* (MODROT, rotating from one modulus to another by changing the location of step $\tilde{0}$)
    3. *modular shift* (MODSHIFT, changing the modulus while maintaining $\tilde{0}$ at the same pitch level)
- Motivic transformations across different modular spaces:
    4. *modular transformation* (MODTRANS based on Matthew Santa’s work)
    5. *interval mapping* (INTMAP) as an alternative to MODTRANS

- Inversions within and across modular spaces:
    6. *step inversion* (S-I) as an analog and alternative to pc inversion
    7. *interval-mapping inversion* (INTMAP-I) across different modular spaces
- "Internal" motivic transformations (transformations not brought about by an "external" change in the referential pitch-class environment):
    8. *interval transformation* (INTTRANS, changes of single intervals)

I also discuss possibilities of specific time- and order-based transformations (without introducing such transformations formally). After defining each type of transformation, I illustrate its application with examples from music by Ravel and other composers.[57]

3.3.1. Notational Conventions

My definitions and analyses follow these notational conventions:

1. Arrows indicate transformational paths.
2. Upper-case letters and their abbreviations denote operation labels.
3. Lower-case letters and their abbreviations are identifiers, such as step-class motive (sc motive) or pitch-class content (pc content).
4. Superscript numbers are order numbers, while subscript numbers denote specific values such as the interval of transposition or inversion.
5. Step and step-class motives are given in angled brackets, < >.
6. Transpositions and inversions use the familiar T and I abbreviations from set theory.
7. Definitions of transformations are presented as single-spaced, framed text.[58]

---

[57] **Example 3.21** provides a summary of all transformations and their definitions.

3.3.2. A Graphic Tool to Depict Motivic Transformations

Our diatonic-based musical notation does not visually reflect the precise pc intervals between steps of the various referential collections. To represent graphically the intervallic changes that motives undergo—be it through regional changes of referential collections and moduli or through local intervallic changes—we can arrange the intervallic grid of a modulus like staff notation as a set of horizontal pitch-lines from low to high (see **example 3.8**). The distances between lines are measured in half steps. In the examples, each line is labeled with a letter-name pc designation. Bold lines show the steps of the collections in which a musical entity resides. Onto this grid we map the exact intervallic relationships of a musical entity, e.g., a motive. The motive's steps are labeled with integers to the right of the motive or between two motives of the same collection. For visual clarity, the step numbers do not have the ~ symbol in the graphs. A grid of vertical lines from left to right represents the beat and measure units for the temporal dimension of each motive.[59] The graphical tool thus is able to account for changes in rhythm, metric structure, grouping, and ordering in addition to pitch-based transformations.

3.4. Motivic Transformations Within a Single Modular Space

3.4.1. Step Transposition (S-T)

In tonal as well as non-tonal music, transposing a motive to a different location within the same collection or modulus will often change its intervallic structure (implying

[58] For a summary of all analytical symbols and their abbreviations, see the glossary in **example 3.20.**
[59] This metric grid builds on the "protonotation" Gary Karpinski developed for Aural Skills students; see Gary Karpinski, *Aural Skills Acquisition* (Oxford/New York: Oxford University Press, 2000), 19–28.

harmonic as well as melodic changes). Good examples of this procedure are sequences, especially in Baroque and Classical music, such as the well-known passage shown in **example 3.9**. To account for this type of transformation, I will use the term s*tep transposition* (S-T).

Given motive m^1 as an ordered group of steps s^1, s^2, s^3, ... s^n within the modulus M^n, and motive m^2 as an ordered group of steps u^1,u^2, u^3, ... u^n within the same modulus, then S-T_n transposes the entire motive by the ordered step interval n, so that u^1=s^1+n, u^2=s^2+n,… u^n=s^n+n.

S-T_{-1}, for example, means that a motive is transposed one step downward within the same referential collection (or modulus). Unlike pc transposition, step transpositions do not require that the pc interval content of a motive remain identical. To define the modulus within which the transposition is performed, I give step transpositions an additional label M^n in parentheses following the T number's subscript:

$$\mathbf{m^1 \xrightarrow{\quad \text{S-T}_n\ (M^n) \quad} m^2}$$

For the Mozart example above, the chain of step transpositions would thus be:

$$\mathbf{m^1 \xrightarrow{\text{S-T}_{-1}\ (7^1)} m^2 \xrightarrow{\text{S-T}_{-1}\ (7^1)} m^3 \xrightarrow{\text{S-T}_{-1}\ (7^1)} m^4}$$

To specify the exact pc-collection of the modulus, a letter-name designation precedes the modulus identification: S-T_n (LM^n). Our Mozart example thus reads more precisely:

$$\mathbf{m^1 \xrightarrow{\text{S-T}_{-1}\ (C7^1)} m^2 \xrightarrow{\text{S-T}_{-1}\ (C7^1)} m^3 \xrightarrow{\text{S-T}_{-1}\ (C7^1)} m^4}$$

The sequence's harmonic grounding in C major clarifies that this transformation chain is *not* one of modular rotation (discussed in section 3.4.2), which would assign $\tilde{0}$ to each new pattern, changing from A to G to F to E and interpreting each scale as governed by a different mode.[60] For diatonic (tonal) music as well as music based on other collections, step transposition poses a valid alternative to pc transposition in that it provides a precise description of transposition within a single modulus.[61] Like pc transposition, S-T easily combines with other pc or step-based operations and thus adds flexibility to the repertoire of transformational operations.

3.4.2. Modular Rotation (MODROT)

In tonal music, a change of "mode" more often than not will transform a motive's pc intervals. When comparing major and minor modes, we conceptualize two different relationships: while we construct the "relative" mode by maintaining the collection and changing the tonic (permutation), we construct the "parallel" mode by maintaining the tonic but changing the collection (modal shift). Let us generalize both procedures for all modular spaces. Since the first (relative) approach is based on permutation, that is, a rotation of ordered positions within the modular space, I call this operation "modular rotation" (MODROT). The second (parallel) approach, which shifts from one mode or modulus to another based on the same starting point (tonic or step $\tilde{0}$), I call Modular Shift (MODSHIFT). I discuss the latter in section 3.4.3.

Though modular rotation is closely related to step-class transposition, the two operations must not be confused: S-T is a local event where the transposition does not

[60] The next pattern of the motive in m. 9, not shown in example 3.13, does briefly tonicize 1 and D minor, despite the global key of C major.

[61] I do not claim to have "invented" step (-class) transposition. While the term as such is mine, Matthew Santa has used this type of transposition in "Studies in Post-Tonal Diatonicism: A Mod7 Perspective."

change the modulus of the passage (as in example 3.9), whereas MODROT changes the modulus by rotating referential step $\tilde{0}$ to a new location within the modular space (in diatonic or pentatonic music this will most likely be accompanied by a change of the tonal center).

Let us define MODROT as the operation that changes a modular space's modulus M^x to modulus M^{x+n} of the same modular space by rotating step $\tilde{0}$ by n positions (with n being expressed as an ordered step interval). At the same time, the L designation for step $\tilde{0}$ moves by n positions within the modular space. The equal sign indicates that the modular space's pc collection remains identical.

The labeling of MODROT uses M to indicate the modular space's cardinality and x the modulus' rotation:

$$\mathbf{m^1} \xrightarrow{\mathbf{MODROT\ (LM^x=[L+n]M^{x+n})}} \mathbf{m^2}$$

For example,

$$\mathbf{m^1} \xrightarrow{\mathbf{MODROT\ (A7^6= C7^1)}} \mathbf{m^2}$$

means that motive 1 in A minor has been transformed into motive 2 in C major (with no changes in the step content of the motive or the pitch-class content of the collection). The graph above describes **example 3.10**, the primary theme's transformational path of from exposition to development in the first movement of Mozart's Piano Sonata in A minor, K 310.[62] For this particular transformation, n = 2; that is, if we rotate two positions to the right, modulus 7^6 (A minor) changes into modulus 7^1 (C major), because in mod7, 6+2=1. Based on the tonal context of this passage, we can conceptualize the transformation also

[62] Though this process resembles tonal transposition, it is not exactly transposing the motive to a new pc level. Based on the interval structure of the moduli involved, a motive's pc-i structure is likely to change under MODROT, whereas under pc-T it would remain the same.

in terms of a harmonic progression within a key K (the *Stufen* being expressed by Roman numerals):

$$m^1 \xrightarrow{\textbf{MODROT (K: } \textbf{\textit{Stufe}} \textbf{ x, } \textbf{\textit{Stufe}} \textbf{ y)}} m^2$$

This particular way of labeling draws attention to the change of the motive's governing *Stufe*. The transformation shown in example 3.10 can thus also be represented as:

$$m^1 \xrightarrow{\textbf{MODROT (a: I, III)}} m^2$$

Again, the difference between the two *Stufen*, I and III, is n=2.

3.4.3. Modular Shift (MODSHIFT)

A modular shift indicates a change of modulus within the same modular space when both moduli have the same pc designated as step $\tilde{0}$. In other words, a modular shift brings about a change in "mode", such as shifting a motive's intervallic structure from D major to D Phrygian.

Let us define MODSHIFT as the operation that shifts from modulus M^x to modulus M^y of the same cardinality with pc level L as the point of synchronization. If L^y of M^y is transposed, the difference between L^x and L^y is shown as transposition T_n by the pc interval n, or by providing separate L labels for each M.

For a transformation from D major ($D7^1$) to D Phrygian ($D7^3$), for example, we thus write:

$$m^1 \xrightarrow{\textbf{MODSHIFT } (\mathbf{D7^{1,3}})} m^2$$

Read: To transform motive m^1 into motive m^2,
map the motive's steps
from the diatonic modulus 1 on D to modulus 3 on D.

Combined with transposition, either type of operation can be applied, as shown for the following example by Ravel. The transformational path of the second theme of Ravel's piano piece "Ondine" from *Gaspard de la nuit*, given in **example 3.11**, can either be expressed as:

$$m^1 \xrightarrow{\textbf{MODSHIFT }(\mathrm{D\#7}^{3,6})\ \mathrm{T}_{11}} m^2$$

Read: To transform motive m^1 into motive m^2,
shift the motive's steps from D# Phrygian to D# Minor,
then transpose the motive (up) by eleven half steps.

or as

$$m^1 \xrightarrow{\textbf{MODROT }(\mathrm{D\#7}^{3}=\mathrm{G\#7}^{6})\mathrm{T}_{6}} m^2$$

Read: To transform motive m^1 into motive m^2,
rotate the motive's steps from D# Phrygian to G# Minor,
then transpose the motive (up) by six half steps.

MODSHIFT first shifts the modulus, then transposes the collection down by a half step (T_{11}). MODROT rotates step $\tilde{0}$ by three positions within the modular space, thus changing the modulus, then transposes the result by six half steps (T_6). Since the distance between D# and G# (pc3 and pc8) is five half steps, the transposition has to add another six half steps to arrive at the same pitch level as the MODSHIFT operation followed by T_{11}.

When comparing the two operations MODSHIFT and MODROT combined with transposition, the MODSHIFT process is more intuitive, thus preferable. Following the conventions established earlier, I further simplify the notation for MODSHIFT by indicating the transposition as a change of step $\tilde{0}$ designation:

$$m^1 \xrightarrow{\textbf{MODSHIFT }(\mathrm{D\#7}^{3},\ \mathrm{D7}^{6})} m^2$$

Read: To transform motive m^1 into motive m^2,
map the motive's steps from D# Phrygian to D Minor.

This example seems to suggest that combined with transposition, MODROT and MODSHIFT are alternative, interchangeable operations, but this is not always the case. MODROT only works within a single modular space (whose overall interval sequence remains consistent), within which $\tilde{0}$ is rotated to different locations. MODSHIFT, however, is possible between different modular spaces with the same cardinality. For example, MODSHIFT can transform a motive by mapping its steps from 6W to $6H^1$ or from 7^2 to 7H.[63] Thus, MODROT and MODSHIFT combined with transposition are only alternatives when applied within a single modular space and its transpositions and permutations.

3.5. Motivic Transformations Across Different Modular Spaces

Moving between collections of different cardinalities presents two essential problems: (1) The *cardinality problem*: the differing number of members in each collection prohibits one-to-one mappings, and (2) the *octave equivalence problem*: due to the their different cardinalities, mappings from one collection to another do not, in the words of Julian Hook, "respect octave equivalence."[64] As long as a motive's largest interval span stays within the boundaries of the smaller modulus, MODTRANS poses no problem. However, when the motive involves steps not represented in the smaller modulus, MODTRANS cannot overcome the obstacle of the cardinality problem: a one-to-one mapping of steps becomes impossible. This chapter does not offer a *theoretical*

[63] In my tables 3.2, 3.4, and 3.6 I have not listed 7H and 7M because we think of them as alterations of the minor mode 7^6. Example 3.5 lists them as such but does not show all their possible rotations. My aim is not to list all possible referential collections and their rotations but to provide a summary and methodology for the most common types, to which we can add other types when necessary.
[64] Hook, "Cross-Type Transformation and the Path Consistency Condition," 17.

solution to these two problems. Instead, it presents a *practical* solution for negotiating both when describing motivic transformations.

3.5.1. Modular Transformation (MODTRANS)[65]

Modular transformation describes a motive's journey from one modular space to another of a different cardinality by mapping the corresponding step classes from the first modulus to those of the second modulus. Santa defines MODTRANS as follows:

> Let us define MODTRANS (x, y, z) as a transformation that maps each step class of a musical entity in modular system *x* onto a corresponding step class in modular system *y*, where *z* represents the "point of synchronization," the pitch class in the starting modulus that is interpreted as step-class $\tilde{0}$.[66]

For analyses of MODTRANS operations that aim to show a change of $\tilde{0}$ designation for the given modulus, as in **example 3.12**, I suggest an alternative way of labeling. Rather than giving the point of synchronization (considered to be transposed if it is not the same "step class" in the second modulus), I indicate the $\tilde{0}$ designation for each modulus separately. Because of my focus on motivic transformation, I represent Santa's "musical entity" as a motive (m), its consecutive forms indicated by superscript.

Let us define MODTRANS (L^xM^x, L^yM^y) as a transformation that maps each step of a motive m in modulus M^x onto a corresponding step in the modulus M^y, where L represents the pitch class of each modulus that is interpreted as step 0.

Instead of

$$\mathbf{m^1} \xrightarrow{\textbf{MODTRANS } (\mathbf{7^6, 8^2, E\flat})\ \mathbf{T_6}} \mathbf{m^2}$$

Read: Motive 1 changes into motive 2
through modular transformation

---

[65] Matthew Santa, "Defining Modular Transformations" and "Studies in Post-Tonal Diatonicism." In the latter, MODTRANS is introduced in chapter 5, "Beyond Mod7: Relating Diatonic and Non-Diatonic Materials." Note that Santa's "*step class* in modular system x" means the same as my *step* in L^xM^x.

[66] Santa, "Defining Modular Transformations," 202.

from the diatonic modulus 6 on E♭
into the octatonic modulus 2
and transposed [up] by 6 semitones.

I write

$$\mathbf{m^1} \xrightarrow{\textbf{MODTRANS } (\mathbf{E\flat 7^6, A8^2})} \mathbf{m^2}$$

Read: Motive 1 changes into motive 2
through modular transformation
from the diatonic modulus 6 on E♭
into the octatonic modulus 2 on A.

When comparing modular spaces of different cardinalities, we will find one or more steps in the modular space of the higher cardinality not represented in the "smaller" modulus. Santa presents two strategies for mapping higher-numbered steps when moving from a larger to a smaller modulus that has no equivalents for these steps: "modular wrap-around" (MODWRAP)[67] and "module completion mapping" (MODCOMP).[68]

---

[67] "Under MODWRAP, if step class x in the starting modulus is equal to or greater than the cardinality of the destination modulus, y, it maps onto step class (x-y) in the destination modulus. For instance, modular wrap-around maps step-class 7 in a mod12 space onto step-class 0 in a mod7 space." Santa, "Defining Modular Transformations," 206. This solution poses two problems: (1) Different pcs in the starting modulus map onto the same pcs in the destination modulus; and (2) the intervallic spacing of the mapping becomes inconsistent. For example, when mod-wrapping the octatonic modulus 2 around the diatonic modulus 1, we get the following mapping:

octatonic 8^2	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
maps onto	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
diatonic 7^1	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**0**	**1**

(1) As the mapping table shows, the octatonic step 0 is first mapped onto the diatonic step 0, then the diatonic step 1. Vice versa, the diatonic step 1 may result from mappings of three different octatonic steps, 1, 0, or 7. (2) Because of the shift by one step each time the octatonic is wrapped around the diatonic, the step intervals of corresponding mappings change with every wrap-around. For example, the pc interval between step 2 and step 5 in 8^2 is 5. In 7^1, the pc interval transforms into 5 between steps 2 and 5 in the first mapping, but into 6 between steps 3 and 6 in the second mapping. If we "modwrapped" the octatonic modulus around a pentatonic modulus the discrepancies would be even larger.

[68] Santa calls his second strategy "module completion mapping" or MODCOMP: "If the number of step classes used in the entity to be transformed is equal to or less than the cardinality of the destination modulus, another solution is available; let us call this strategy 'module completion mapping' or MODCOMP. Under MODCOMP, step classes in the source are placed in ascending numerical order and mapped to the numerically ordered step classes of the destination. Suppose we wish to map the mod12 segment X = <G C# D E C A>, mod12 step classes <7 1 2 4 0 9>, to the segment Y = <G# D E F# C A#>, mod6 step classes <4 1 2 3 0 5>. The step-class segments are reordered as X' = <0 1 2 4 7 9> and Y' = <0 1 2 3 4 5>, in preparation for mappings between corresponding locations." Santa, "Defining Modular Transformations," 207–208. I show and discuss the resulting mappings on pp. 98–100.

3.5.2. Interval Mapping (INTMAP)

When using MODTRANS to compare motivic forms whose identity depends on the structure of ordered step-class intervals, MODTRANS will occasionally pose another problem. If we base the mapping on matching step numbers, skips that cross the octave boundary of step-class $\overset{\approx}{0}$ will measure a different step interval for each different modular space. For example, from $\tilde{5}$ to $\tilde{1}$ in mod7 we move three steps, whereas in mod8 we have to move four steps for the same skip. We can avoid these problems by mapping motives from one modular space onto another by a different method: instead of mapping the step *numbers*, we can map the step-space *intervals* onto the new modulus.[69] If the intervals are defined as step-space intervals, INTMAP provides an interval-preserving operation from one modular space to another of a different cardinality. It is this interval consistency that distinguishes Hook's and my approach from other types of mappings proposed by Callender and Berry.[70] The consistency of interval mappings based on scalar collections further distinguishes the INTMAP function from contour relationships or Tymoczko's arrangement of chord structures into "scales,"[71] because each step is assigned an ordered position within a *consistent* and *pre-determined* sequence of intervals.[72] The focus on

---

[69] This approach is similar to Santa's MODWRAP.

[70] See Hook, "Cross-Type Transformation"; Berry, "An Exploration of Some Non-Tonal Pitch-Class Spaces"; Clifton Callender, "Voice-Leading Parsimony in the Music of Alexander Scriabin," *Journal of Music Theory* 42/2 (1998), 219–33. Berry applies Callender's "split transformation" to move between collections of different cardinalities (Berry, 107–9). Although a rather elegant solution for transformations at the collection level (enabling "one-to-many and many-to-one mappings," see Berry, 107), split transformation does not work well for transformations between motives with a fixed number of pitches.

[71] Tymoczko writes: "*any possible chord* can be considered a scale; the term carries no special implications or ontological import, beyond signifying that the chord's notes have been assigned scale-degree numbers." See "Scale Theory," 12. I strongly disagree with this nomenclature because (1) it blurs the distinction between harmony and voice leading, and (2) it contradicts centuries of usage based on perceptual reality.

[72] For a theory of contour relationships, see Elisabeth West Marvin, "A generalized theory of musical contour: Its application to melodic and rhythmic analysis of non-tonal music and its perceptual and pedagogical implications," PhD diss., University of Rochester, 1989. A contour segment is self-referential in distinguishing "steps" from "skips," since the size of each step depends solely on the placement of the

intervallic relationships between steps rather than on fixed step positions is crucial for negotiating the cardinality and octave equivalence problems when dealing with inversion. (see section 3.6.2).

> Given the interval content of a motive m^1 as an ordered group of ordered step-space intervals $x^1, x^2, x^3, \ldots x^n$ within the modulus M^x, and the interval content of a motive m^2 as an ordered group of ordered step-space intervals $y^1, y^2, y^3, \ldots y^n$ within the modulus M^y, then INTMAP maps each ordered interval (expressed as ordered step-space interval) from m^1 in M^x onto the same ordered interval (expressed as ordered step-space interval) of m^2 in M^y, with step-class 0 as the point of synchronization of the mapping. Where the point of synchronization is not 0, we shall think of the operation as a transposition (by a step or pitch-class interval) of the INTMAP function.

$$\mathbf{m^1} \xrightarrow{\textbf{INTMAP }(\mathbf{M^x}, (\mathbf{M^y})} \mathbf{m^2}$$

To illustrate an application of INTMAP, let us compare the INTMAP operation to Santa's MODCOMP. Santa maps the "mod12 segment X = <G C# D E C A>, mod12 step classes <7 1 2 4 0 9>, to the segment Y = <G# D E F# C A#>, mod6 step classes <4 1 2 3 0 5>" by reordering the "segments as X' = <0 1 2 4 7 9> and Y' = <0 1 2 3 4 5>,[73] in preparation for mappings between corresponding locations."[74] The resulting MODCOMP mappings are:

mod12	**0**	**1**	**2**		**4**			**7**		**9**
pc	**C**	**C#**	**D**	**?**	**E**	**?**	**?**	**G**	**?**	**A**
maps onto	↓	↓	↓		↓			↓		↓
mod6	**0**	**1**	**2**		**3**			**4**		**5**
pc	**C**	**D**	**E**		**F#**			**G#**		**A#**

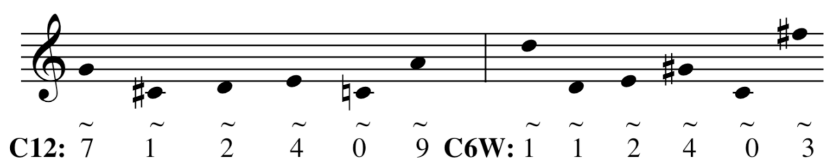
segment's members in pitch space. While the resulting flexibility is certainly useful for certain atonal repertoire, the INTMAP function is more precise in describing the transformations of the collection-based repertoire of the early twentieth century.

[73] To avoid having to use different symbols for steps 10 and 11, I separate the integers of step segments by a comma.

[74] Santa, "Defining Modular Transformations," 207–208. Here, Santa's "step classes" correspond to my "steps."

While these MODCOMP mappings of the segment preserve its overall contour, they clearly distort the intervallic integrity of the mod12 collection.

Let us now use Santa's hypothetical segment X as our point of departure for our INTMAP operation. The step designations of the ordered segment X <G C# D E C A> in mod12 are $<\tilde{7}, \tilde{1}, \tilde{2}, \tilde{4}, \tilde{0}, \tilde{9}>$. The ordered step-space interval sequence of the ordered segment is sc-i [–6, +1, +2, –4, +9]. If we take $\tilde{\tilde{0}}$ as the point of synchronization, our new segment mod6 has the steps $<\tilde{1}, \tilde{1}, \tilde{2}, \tilde{4}, \tilde{0}, \tilde{3}>$. Since the ordered step-space intervals indicate the direction as well as the step size of the interval, the first interval, sc-i_6, turns into an octave in mod6, and the fifth interval, sc-i_9, spans a tritone plus an octave. Santa's hypothetical mod12 segment X <G C# D E C A> becomes our new mod6 segment <D, D, E, G#, C, F#>:



The step mappings now read:

mod12	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
pc	**C**	**C#**	**D**		**E**			**G**		**A**		
maps onto	↓	↓	↓		↓			↓		↓		
mod6	**0**	**1**	**2**	**3**	**4**	**5**	**0**	**1**	**2**	**3**	**4**	**6**
pc	**C**	**D**	**E**	**F#**	**G#**	**A#**	**C**	**D**	**E**	**F#**	**G#**	**A#**

Though we face the problem of mapping two different step numbers from mod12, $\tilde{7}$ and $\tilde{1}$, to a single step number, $\tilde{1}$, INTMAP preserves both the integrity of the modular spaces and the contour of the segment. In principle, any of the steps can function as the point of synchronization; the resulting transformation is then a combination of INTMAP plus transposition.

3.6. Inversions Within and Across Modular Spaces

In the context of modular spaces, we can conceptualize two kinds of inversional operations. The first kind concerns inversions within a single modular space. Consider **example 3.13.** Though we recognize these two themes of Bach's *Art of the Fugue* as inversions of each other, pitch-class inversion (as shown in **example 3.13a**) cannot mathematically describe this inversion: the difference between the major and minor third prevents a consistent pc index number. Unlike pitch-class inversions, inversions based on the concept of step-classes work with the intervallic patterns of each individual modulus. Inverting around steps rather than pitch classes, however, we can mathematically express diatonic and other modular inversions (as shown in **example 3.13b).** The step numbers of the corresponding pairs add up to 4. Following the conventions for pitch-class inversion, 4 is the index number of this inversion.

The second kind of inversion deals with inversions across different modular spaces. While rare in the music of Ravel, these inversions occur in the music of his contemporaries Debussy and Bartók. Two passages from the beginning of Debussy's first prelude from Book 1, "Danseuses de Delphes," shall serve as a preliminary illustration of this kind of motivic transformation (**example 3.14**). The motive indicated by the bracket sounds first as an ascending chromatic pattern, centered on B♭ through the accompanying chords. A few measures later, the same motive is mapped onto a descending pentatonic pattern. Sounding above a pedal on V, the pentatonic sequence still has B♭ as $\tilde{0}$. The continuation of the dotted rhythm yields a second four-note pattern that we can also interpret as an inversion of the original motive (even if the rhythm has changed).[75] When we add the step numbers of corresponding notes, the index number of the first inverted pattern is 4 and that of the second pattern 0. Though the cardinalities of the chromatic and pentatonic moduli differ by 7, this difference causes no problem here since the motive itself spans only four steps. The following paragraphs define and describe in detail both kinds of modular inversion.

3.6.1. Step Inversion (S-I)

Step inversion (S-I) functions analogously to pitch-class inversion.[76]

Let us define S-I as the inversion that maps each ordered step $s^1, s^2, s^3, \dots s^n$ of motive m^1 within modulus M^x onto its ordered, modM-complement, step $u^1, u^2, u^3, \dots u^n$ of motive m^2 within modulus M^y of the same cardinality (M). When the inversion is not S-I_0, the interval of transposition shall be defined as the unordered step interval n and written as index number S-I_n.

When inverting step-class motives from moduli with the same cardinality, an inversion's index number x can be obtained by simply adding the mirroring step numbers:

$$\mathbf{m^1} \xrightarrow{\textbf{S-I}_x\ (\mathbf{M^n})} \mathbf{m^2}$$

In some examples, the inversion comes with a change of key or collection. Consider, for example, the G-major inversion of the A♭-major fugue subject (labeled f)

[75] Another possible parsing of the sequence would be to overlap the beginning of the second pattern on C with an index number of 1 instead of 0, but then the pattern would end on the sixteenth-note F rather than on the half-note D.

[76] Following the conventions established earlier for step transposition, I label step inversions "S-I" followed by the modular designation(s) in parentheses.

from Beethoven's Piano Sonata op. 110, given in **example 3.15**. The step index number of this inversion is 4. Thus the transformation is

$$\mathbf{f^1} \xrightarrow{\mathbf{S\text{-}I_4\,(A\flat 7^1,\ G7^1)}} \mathbf{f^2}$$

or, if one wanted to express the change of key as a transposition,

$$\mathbf{f^1} \xrightarrow{\mathbf{S\text{-}I_4\,(A\flat 7^1)\ T_{11}}} \mathbf{f^2}\ .$$

3.6.2. Inversion by Interval Mapping (INTMAP-I)

When inverting a motive (or another musical entity) across modular spaces of different cardinalities, the cardinality problem causes two related inconsistencies; (1) interval inconsistency, and (2) index number inconsistency.

(1) Due to the varying numbers of steps per modulus (= number of steps within an octave), a MODTRANS-derived inversion would not always preserve the step-interval content of a given motive. Santa's "example 7" demonstrates that the combination of MODTRANS and pc inversion is not commutative.[77] If we first apply MODTRANS:

$$\mathbf{m^1}\langle\tilde{1}, \tilde{2}, \tilde{3}, \tilde{0}\rangle \xrightarrow{\mathbf{MODTRANS\ (C6,\ 8^2)}} \langle\tilde{1}, \tilde{2}, \tilde{3}, \tilde{0}\rangle$$

thus:

$$\mathbf{m^1}\langle \text{D E F\# C}\rangle \xrightarrow{\mathbf{MODTRANS\ (C6,\ 8^2)}} \langle \text{D E}\flat\text{ F C}\rangle$$

[77] Santa, "Modular Transformation," 203–205. I have slightly changed Santa's nomenclature to be consistent with my own.

then invert:

$$\langle \text{D E}\flat\text{ F C} \rangle \xrightarrow{\quad\mathbf{I_4}\quad} \mathbf{m^2}\langle \text{D C\# B E} \rangle$$

motive 1 <D E F# C> transforms into motive 2 <D C# B E>.

However, if we reverse the two operations, invert first:

$$\mathbf{m^1}\langle \text{D E F\# C} \rangle \xrightarrow{\quad\mathbf{I_4}\quad} \langle \text{D C B}\flat\text{ E} \rangle$$

then apply MODTRANS:

$$\langle \text{D C B}\flat\text{ E} \rangle \xrightarrow{\mathbf{MODTRANS\ (C6,\ 8^2)}} \mathbf{m^2}\langle \text{D C A}\flat\text{ E}\flat \rangle$$

motive 1 <D E F# C> transforms into motive 2 <D C A♭ E♭>.

The problem lies in the inconsistency of applying transformations from two different intervallic systems: pitch-class space and step (-class) space. I_4 is an inversion in pc space around the pc axis D. Because pitch class inversion takes steps out of their modular context, the step interval structure of the motive gets distorted. For example, if we take the 8^1 step segment $<\tilde{0}, \tilde{1}, \tilde{2}>$ on C, that is, pc set 0, 1, 3 and invert it around pc 0, we get pc set 0, 11 , 9 (or 0, 2, 3). We cannot map these pitch classes onto 8^1 without transposing them, thus effectively moving them to a different step location.[78] The solution is to treat the steps *as steps* under inversion; in other words, to invert within a modulus around a given step axis. To do so, we combine INTMAP with S-I.

(2) For the inversion at step-class $\tilde{\tilde{0}}$*(SC-*I_0*), the sum of mirroring step numbers equals a different kind of 0 for each modular space, as each* $\tilde{0}$ *equals the cardinality of*

[78] Unlike inversion, pc transposition does not present the same problem for modular intervals because it preserves the intervallic integrity of each modulus.

its particular modular space. For example, S-I_0 mod12 has the index number 12, whereas S-I_0 mod5 has the index number 5. To resolve this, I define all inversions at step-class $\overset{\approx}{0}$ as the inversion class I_M, where M equals the cardinality of the modulus in which a given motive is inverted. As with pitch-class inversions, the index number reflects the sum of mirroring step numbers. Building on this definition of the inversion class I_M, for any index number x of I_X within any modulus, its corresponding inversion class becomes I_{M+X}.

I shall therefore derive inversion across modular spaces of different cardinalities from the INTMAP operation, which preserves a motive's ordered step-space interval content. Instead of mapping the steps themselves onto the new modulus, we map the ordered step (-space) *intervals* onto the new modulus before inverting the motive's steps within that new modulus. I call the combined operation "interval-mapping inversion", or INTMAP-I.

Let us define INTMAP-I as the inversion within the destination modulus of an ordered segment of ordered step(-space) intervals that has been interval-mapped from its original modulus. Step class 0 shall serve as the point of synchronization; transpositions shall be indicated by the inversion's index number. Let us define all inversions at step-class 0 as the inversion class I_M, where M equals the cardinality of the modulus in which a given motive is inverted. For any index number n of I_n within any modulus, its corresponding inversion class is I_{M+n}.

Unlike Santa's MODTRANS/pc-I combination, INTMAP inversions are commutative.[79] **Example 3.16** shows an inversional motivic relationship in Bartók's

[79] To show the commutativity of INTMAP-I, I have chosen an actual musical example rather than Santa's hypothetical example. However, it is easy enough to show that commutativity holds true for his example as well: The MODTRANS (C, 6, 8^2) of <D, E, F#, C> is <D, E♭, F, C>. Inverted around s-axis D, this step inversion has the index number 2. S-I_2 of <1, 2, 3, 0> in mod8^2 yields <1, 0, 7, 2>, thus <D, C, B, E♭>. To reverse the order of operations: If we apply ST-I_2 to <D, E, F#, C> in mod6, we get <1, 0, 5, 2>. If we INTMAP this sc set onto mod8^2 (beginning with the sc axis and moving by the same ordered step-class intervals), we get <1, 0, 7, 2>. Thus the result is the same: <D, C, B, E♭>.

Second String Quartet. With $\tilde{0}$ as the axis of inversion, the ascending steps (s-i_{+1}) of the chromatic motive are mapped onto the descending steps of the melodic-minor motive (s-i_{-1}). The INTMAP or MODTRANS transformation of <B♭ B♮ C C# D>— B♭12 steps $\langle \tilde{0}, \tilde{1}, \tilde{2}, \tilde{3}, \tilde{4} \rangle$—from the chromatic onto the diatonic modulus B♭7^{M} (B♭ melodic minor) gives us <B♭ C D♭ E♭ F>.

$$\mathbf{m^1}\langle \tilde{0}, \tilde{1}, \tilde{2}, \tilde{3}, \tilde{4} \rangle \xrightarrow{\textbf{INTMAP (B}\flat\textbf{12, B}\flat\mathbf{7^{M}}\textbf{)}} \langle \tilde{0}, \tilde{1}, \tilde{2}, \tilde{3}, \tilde{4} \rangle$$

When we invert these steps within the destination modulus (B♭7^{M}), we get <B♭ A G F E♭ F>:

$$\langle \tilde{0}, \tilde{1}, \tilde{2}, \tilde{3}, \tilde{4} \rangle \xrightarrow{\mathbf{I_0}\textbf{ (B}\flat\mathbf{7^{M}}\textbf{)}} \mathbf{m^2}\langle \tilde{0}, \tilde{6}, \tilde{5}, \tilde{4}, \tilde{3} \rangle$$

Taking the cardinality of the second modulus as our index number (0=7), the complete interval-mapping inversion reads:

$$\mathbf{m^1} \xrightarrow{\textbf{INTMAP-}\mathbf{I_0}\textbf{ (B}\flat\textbf{12, B}\flat\mathbf{7^{M}}\textbf{)}} \mathbf{m^2}$$

That is, motive 1 maps onto motive 2 through the interval-mapping inversion I_0 with B♭ as point of synchronization (defining B♭ as $\tilde{0}$ for both the chromatic modulus and B♭ melodic minor, the index number of the inversion is 0).[80]

To reverse the order of operations, we first invert the motive, $\langle \tilde{0}, \tilde{1}, \tilde{2}, \tilde{3}, \tilde{4} \rangle$ in its original modulus, mod12:

$$\mathbf{m^1}\langle \tilde{0}, \tilde{1}, \tilde{2}, \tilde{3}, \tilde{4} \rangle \xrightarrow{\mathbf{I_0}\textbf{ (B}\flat\textbf{12)}} \langle \tilde{0}, \tilde{11}, \tilde{10}, \tilde{9}, \tilde{8} \rangle >$$

[80] Though the first violin's passage in mm. 120–21 does not provide a D♭, the preceding cadential arrival on a B♭ minor harmony (with an embellishing dissonant appoggiatura A in the cello) in mm. 116/117 and the reiteration of that harmony in the first half of m. 119 imply B♭ minor.

The index number is 0 (=12). Now, to interval-map these descending steps onto the diatonic modulus, mod7, we simply begin on $\tilde{0}$ in the destination modulus and find the remaining steps by traversing through the ordered step intervals of the motive; here [–1, –1, –1, –1].[81] That is,

$$\langle\tilde{0}(=12), \tilde{11}, \tilde{10}, \tilde{9}, \tilde{8}\rangle \xrightarrow{\textbf{INTMAP }(\mathbf{B\flat 12, B\flat 7^M})} \mathbf{m^2}\,\langle\tilde{0}(=7), \tilde{6}, \tilde{5}, \tilde{4}, \tilde{3}\rangle$$

As a convention, I suggest that the interval mapping precede the inversion so that we always invert within the destination modulus.

3.7. Internal Motivic Transformations

3.7.1. Interval Transformation (INTTRANS)

Interval transformations are characterized by internal changes in the intervallic content of a motive not caused by any of the contextual transformations discussed so far.

> Given the interval content of a motive m^1 as an ordered group of ordered step-space intervals $x^1, x^2, x^3, \ldots x^n$ within the modulus M^x, and the interval content of a motive m^2 as an ordered group of ordered step-space intervals $y^1, y^2, y^3, \ldots y^n$ within the modulus M^y, let us define INTRANS as the interval transformation that changes an ordered step-space interval x^n of motive m^1 into the ordered step-space interval y^n of motive m^2 by the ordered step-space interval n ($y^n–x^n$).[82]

$$\mathbf{m^1} \xrightarrow{\textbf{INTTRANS } \mathbf{i^n}\,(\mathbf{y^n–x^n})} \mathbf{m^2}$$

[81] Alternatively, we can subtract the difference of the modular cardinalities, in this case 12–7, i.e., 5, from each step whose number is larger than the cardinality of the destination modulus.

[82] Because INTTRANS is already defined as a step-based operation, the simple number n rather than s-i_n suffices as a label for the interval of transposition. Should it occur that the transformation of an ordered interval i^n of a motive employs an interval outside the governing collection, we would have to redefine the INTTRANS operation in relation to pc space.

The difference $y^n–x^n$ expressed as an *ordered step-space interval* n thus precisely describes the intervallic transformation of the numbered interval i^n from motive m^1 to motive m^2. **Example 3.17** shows an instance of interval transformation in the first movement of Ravel's String Quartet. The exposition's motive p^2 (the second motive of the primary theme group, see also ex. 5.1.x) returns at the beginning of the development, the first note now extended over the barline by one beat. As the first interval (i^1) is reduced by one step, the motivic transformation between $p^{2\,[\text{EXPOSITION}]}$ and $p^{2\,[\text{DEVELOPMENT}]}$ can be expressed as

$$\mathbf{p^{2\,(EXP)}} \xrightarrow{\textbf{INTTRANS } \mathbf{i^1} \textbf{ -1 } \mathbf{(D7^6)}} \mathbf{p^{2\,(DEV)}}$$

Because of the harmonic ambiguity of the passage, one could interpret $p^{2\,[\text{DEVELOPMENT}]}$ also in terms of F major ($F7^1$). In that case, the motivic transformation reads

$$\mathbf{p^{2(EXP)}} \xrightarrow{\textbf{INTTRANS } \mathbf{i^1} \textbf{ -1 } \mathbf{(D7^6, F7^1)}} \mathbf{p^{2(DEV)}}$$

However, the first solution is more intuitive and elegant: Not only is the transformation simpler, it better illustrates the harmonic change from $p^{2\,(\text{EXP})}$, outlining a stable D-minor chord, to $p^{2\,(\text{DEV})}$**,** outlining a less stable minor seventh chord on D, and thus allows one to draw a connection between the motivic and formal design of this sonata form.[83]

3.7.2. Transformations Based on Temporal Aspects

In her study "A Technique for Melodic Motivic Analysis in the music of Charles Ives," Gingerich's definitions of specific transformations focus on temporal aspects of

[83] Example 3.18 gives a more detailed account of the chain of p^2 transformations.

motivic transformations such as insertions, expansions, contractions, and reorderings.[84] While her INSERT function inserts a *pitch* between two others,[85] one can easily adapt this transformation to insert *motive segments*. See, for example, the primary theme of the second movement of Ravel's Piano Trio (example 3.19).[86] We can interpret the second segment (beats 2 and 3 of m. 2) as an insertion that shifts the initial motive p^S two beats to the "left." While the more normative structure of p^S begins on downbeats in mm. 3 and 4, the shifted p^S begins on beat 2 of m. 1. Though I do not formally introduce transformations brought about by temporal aspects, my graphic tool lets us compare note values, beat units, metric units, and reorderings. Wherever these types of transformations play a role, I will discuss them in the context of each individual example.

Example 3.19b provides a brief preview of such transformations. For this particular graph, I chose to align the themes according to their beat units so that—regardless of the tempo of each movement—we can compare the pitch structures in relation to their metric distribution. For example, eight eighth notes of the first movement's 8/8 meter take up as much horizontal space as four beats of the second movement's 3/4 meter. At the same time, the dotted vertical lines show how the related motivic segments group each theme into four sections, following the same basic pattern of a^1b^1, a^2b^2.

[84] Gingerich, "A Technique for Melodic Motivic Analysis in the Music of Charles Ives."
[85] Ibid., 77.
[86] I discuss this example in more detail in section 3.8.2 and chapter 5.

3.8. Application of Step-Based Transformations to Ravel's Music

3.8.1. Motivic Transformations as Markers of Form

Motive p^2 of **example 3.18** first outlines a D-minor triad (mm. 9-10); therefore, I assign $\tilde{0}$ to D. Motive p^2 is thus represented by the step segment $D7^6\langle\tilde{0}, \tilde{4}, \tilde{3}, \tilde{2}, \tilde{1}, \tilde{0}, \tilde{1}, \tilde{2}, \tilde{3}, \tilde{4}\rangle$. At the corresponding location in the recapitulation (mm. 137–138), however, p^2 outlines a diminished-seventh chord on A. With A now representing $\tilde{0}$, p^2 has been mapped onto an octatonic grid through MODTRANS. This MODTRANS ($D\ 7^6$, $A\ 8^2$) is accompanied by a change in step content that replaces the initial $\tilde{0}$ (=7) of D minor by $\tilde{6}$ of A octatonic.[87] The interval transformation of the motive's first interval from s-i_3 to s-i_2 (INTRANS i^1-1) changes the underlying chord structure from a triad into a seventh chord. The combined operations yield the step segment $A8^2\ \langle\tilde{6}, \tilde{4}, \tilde{3}, \tilde{2}, \tilde{1}, \tilde{0}, \tilde{1}, \tilde{2}, \tilde{3}, \tilde{4}\rangle$. This octatonic form of p^2, outlining a diminished seventh chord, is a result of a larger transformational trajectory from the exposition through the p^2-transformations of the development. In mm. 86–87, INTTRANS changes motive p^2 from its expositional triadic shape into a minor-seventh chord outline (D–F–A–C). In mm. 93–94, MODSHIFT/MODROT then transforms this manifestation of p^2 to outline a half-diminished minor seventh chord (F-A♭–C♭–E♭) in mm. 93–94. MODSHIFT changes the governing collection from D minor to A♭ melodic minor. The motive's step-class identity requires that we place $\tilde{0}$ on F; MODROT accounts for this placement. Short of a proper definition of rotations of the melodic minor modulus,[88] I call the resulting modulus $F7^{6[\flat 4]}$.

[87] If the MODTRANS operation had mapped all step classes of p^2 exactly onto the octatonic grid, the hypothetical p^2 of the recapitulation would have outlined a diminished *triad* rather than a seventh chord (descending A–E♭–C–A instead of G♭–E♭–C–A.) However, it is seventh-chord forms of p^2 that shape the first part of the development section.

[88] See also footnote 59 of this chapter.

Finally, MODTRANS changes the half-diminished seventh-chord form of p^2 into the recapitulation's fully-diminished seventh-chord form G♭–E♭–C–A.

The development's p^2 outline, D–F–A–C, contains as overlapping trichordal subsets the pair of related major/minor triads that characterize the tonal ambiguity upon which Ravel plays throughout the whole movement. Creating a perceptible path from exposition through development to recapitulation, the transformations of p^2 participate in a larger network of transformational paths that help us track the movement's sonata-form process. Transformations of the p^2 head (shown in the second horizontal section on each page of example 3.18) reveal a close connection to the movement's primary theme p^1 (last horizontal section). The ordered step interval sequence of motive p^2 in m. 17 [-2, -3, -1] is related to the [-1, -2, -1] of the initial head motive p^1 (without the upper-neighbor eighth note) of the movement's primary theme by INTTRANS (i^1, i^2)-1. Along with this transformation, we hear the return of the primary theme in its original form: Measure 17 splits the primary theme's head motive between the viola, which plays the upper-neighbor figure A–G–A (first two beats of m. 17), and the violins, which double the descending second E–D (beats three and four).

The chain of p^2 heads that prepares for the return of p^1 after p^2's octatonic episode in the recapitulation features an elegant motivic parallelism that bridges across the modular transformation from the octatonic to diatonic collections. The overall transformation from $p^{2(EXP)}$ to $p^{2(REC)}$ is a combination of the INTTRANS and MODTRANS transformations. With the help of step-based operations, we can link local motivic appearances to the overall formal process as well as to the main harmonic characteristics of the movement.

3.8.2. Motivic Transformations between Movements

In addition to tracing intra-movement motivic processes, step-based transformations also clarify inter-movement connections in many of Ravel's pre-war works with multiple movements (such as the *Sonatine*, the String Quartet, and the Piano Trio). My final example for step-based transformations describes thematic relationships in Ravel's Piano Trio among the beginning themes of all four movements (see **example 3.19**). The components of the slightly abstracted motivic forms of p—a neighbor figure, a skip, a descending step, are shown with bigger note heads in ex. 3.18). Their metamorphoses are related through the following transformational path from movement to movement:

$$\mathbf{I} \xrightarrow{\textbf{INTTRANS } \mathbf{i}^{3}\textbf{-2}} \mathbf{II} \xrightarrow{[\textbf{INTTRANS } \mathbf{i}^{3}\textbf{-1}]\ \mathbf{T}_{-3}} \mathbf{III} \xrightarrow{[\textbf{S-I}_{6}\textbf{, INTTRANS } \mathbf{i}^{3}\textbf{-1, } \mathbf{i}^{4}\textbf{-2}]\ \mathbf{T}_{-2}} \mathbf{IV}$$

$A7^{2}\langle\tilde{4}, \tilde{3}, \tilde{4}, \tilde{6}, \tilde{5}\rangle$	$A7^{6}\langle\tilde{4}, \tilde{3}, \tilde{4}, \tilde{1}, \tilde{0}\rangle$	$C\#5^{5}\langle\tilde{0}, \tilde{4}, \tilde{0}, \tilde{2}, \tilde{1}\rangle$	$A7^{1}\langle\tilde{1}, \tilde{2}, \tilde{1}, \tilde{6}, \tilde{5}\rangle$
<E5, D5, E5, G5, F#5>	**< E5, D5, E5, B5, A5>**	**<C#3, B2, C#3, F#3, E3>**	**<B5, C#6, B5, G#5, F#5>**

This transformational analysis of inter-movement connections demonstrates cyclic aspects of a multi-movement work. In the same way, we can apply step-based operations to reveal stylistic features of a particular composer's style or even the formal concerns of a generation of composers. Example 3.19's graph shows additional relationships, which I will discuss in Chapter 5.

The eight types of step-based transformations I have discussed here can be combined in many ways. Moreover, we can easily expand the list of transformational procedures by other suitable kinds of operations. The transformational tools I present here are a response to the analytical challenges that the fascinating music of Ravel poses.

CHAPTER 4

Sonata Form in the First Movement of the String Quartet

Composed in 1902–03, Ravel's String Quartet is among his earliest compositions in sonata form.[1] This chapter focuses entirely on the first movement even though the fourth movement might be considered a modified sonata form as well.

Ravel shapes the movement's "classical" design, a "Type 3" sonata form,[2] by creating tension not only between keys but also between diatonic and non-diatonic collections. He integrates octatonic and whole-tone passages into the movement's tonal framework,[3] itself characterized by the interplay of the F-major tonic and its submediant, D minor. From the first phrase, these two keys engage in a play of rivalry, in which D-minor sonorities try to gain the upper hand over the F-major tonic in controlling the shared collection. The tug of war between the two rival keys creates a tonal ambiguity that permeates the sonata structure throughout.[4] In addition to the fascinating interaction of collections, the movement features interesting formal articulations: (1) two caesura

---

[1] The sonata forms that precede the Quartet are unpublished exercises from Ravel's studies at the Conservatoire and the posthumously published *Sonata posthume pour piano et violon*, composed in 1897 (Paris: Editions Salabert, 1975).

[2] In Hepokoski and Darcy's classification, a "Type 3" or "textbook" sonata form has three rotations, one for the exposition, one for the development, and one for the recapitulation. The development's rotation is the most likely to show alterations (incomplete rotations or new materials in place of one of the segments). See Hepokoski and Darcy, *Elements*, 16–22.

[3] Thomas Kabisch was the first author to point to the structural role of non-diatonic collections in the first movement of Ravel's String Quartet. See Thomas Kabisch, "Oktatonik, Tonalität und Form in der Musik Maurice Ravels," see especially the subsection "'Une construction musicale plus nette'—Oktatonik, Tonalität und Sonatenform im Kopfsatz des Streichquartetts," 121–122. Although I disagree with some details of Kabisch's analysis, I share his overall assessment that in the string quartet (as well as in other works by Ravel), the "octatonic-tonal integration aims to enrich tonality to make it appear new and revitalized." [Die oktatonisch-tonale Verflechtung … zielt auf eine Belebung der Tonalität, darauf, diese neu und unverbraucht erscheinen zu lassen]. Kabisch, 119; my translation.

[4] At the end of this chapter, I construct a narrative that relates the F-major/D-minor tug of war to the zones of the sonata form.

gestures in the exposition and recapitulation present a three-part exposition that seems to offer two “candidates” for a secondary theme; and (2) descending whole-tone progressions at the end of the exposition and recapitulation obfuscate the formal functions of the sections they control. Moreover, the recontextualization of the s-theme from D minor to F major foreshadows that of the Piano Trio’s P-theme from A minor to C major, positing the F-major/D-minor ambiguity as a precursor of the Trio’s double-tonic complex.

Each of the chapter’s five sections provides a different analytical focus: The first (**4.1**) discusses the movement’s sonata form in the light of Hepokoski and Darcy’s *Elements of Sonata Theory*,[5] while the second (**4.2**) offers a Schenkerian interpretation of the movement, relating its voice leading to the articulation of sonata form. The third (**4.3**) analyzes the motivic relationships that shape the movement’s sonata form, and the fourth (**4.4**) considers the thematic transformations in the sonata-form context. The fifth (**4.5**) integrates the previous analyses by shedding light on how the diatonic and non-diatonic collections interact to shape the movement’s sonata design. This multi-pronged approach causes some analytical findings to overlap; however, this only bears witness to Ravel’s perfect integration of formal, tonal, motivic, and collectional forces.

4.1. Formal Considerations: The First Movement as a Type 3 Sonata Form

The first movement’s formal subdivisions allow alternative readings: (1) a form in which the early medial caesura (mm. 21–23) is “declined” so that only the second medial caesura (mm. 50–54) opens the S-space (from m. 55 on); and (2) a form whose

[5] Hepokoski and Darcy, *Elements*.

"trimodular block" begins in m. 24.[6] . The difference between these two interpretations is subtle; it hinges on the analyst's perception of mm. 24–32: do they present a continuation of the transitional activity begun in m. 17, or do they introduce a new theme that attempts to open S-space?[7]

Example 4.1 shows the movement's subdivisions. The sections and segments are approximately proportional to the number of measures they occupy**. Example 4.2** supports example 4.1 by providing an overview of the movement's themes and their labels. It also allows us to compare the themes' expositional, developmental, and recapitulatory forms.

4.1.1. Exposition

The exposition confronts the analyst with three of the movement's main questions: (1) What formal interpretation best describes the consequences of the "double medial caesura"?[8] (2) What is the significance of the s-theme's motion to VI? (3) Does Ravel's double bar in m. 69 signal the beginning of the development?

4.1.1.1. The Primary-Theme Zone

The P-Zone forms a small rounded—although tonally open—binary (see **example 4.3**), whose dissolving reprise (mm. 17–20) transitions to the first MC The P-theme itself

---

[6] I explain and apply these two concepts by Hepokoski and Darcy in the following paragraphs.
[7] I would like to thank Poundie Burstein and Warren Darcy, whose valuable input contributed to my discussion here. Burstein kindly provided the manuscript of his paper "The Trimodular Block, the Three-Part Exposition, and the Classical Transition Section," presented at the Annual AMS/SMT Conference in Los Angeles on November 3, 2006; while Darcy generously provided his insights in a personal conversation on January 14, 2008.
[8] Hepokoski and Darcy, *Elements*, 170–177.

forms a parallel period (p^1): antecedent mm. 1–4, modulating consequent mm. 5–8. Ravel contrasts it with a second thematic unit (p^2), a P-derived sentence. The partial return of p^1 brings the music to a first moment of repose: mm. 17–19 restate mm. 1–3 an octave higher, m. 20 forms a sequence to m. 19 leading into a three-measure standstill, the first MC gesture on V/V (mm. 21–23).[9]

These three measures provide a formal articulation announcing that a new thematic unit is to follow. Because of their rhetorical impact and harmonic function, I perceive the three measures as a first medial caesura (MC) gesture (MC^1 in **example 4.4**). However, the theme that follows this "MC" is not really new but a rhythmically altered derivation of p^1. Moreover, instead of moving to the dominant, the theme remains in the tonic (albeit on a I 6/4 chord). Hepokoski and Darcy offer two alternative interpretations to describe expositions that feature apparent double MCs. (1) The medial caesura, which really comes "too soon"—that is, long before the exposition's midpoint— is "declined," and the music continues to build transitional momentum toward a second caesura that successfully launches the S-zone,[10] or (2) The medial caesura is accepted as such and launches a new theme. Since this theme really comes proportionally too soon, the music once more dissolves into an energy-gathering transitional section that prepares for a "post-medial" caesura, which subsequently introduces the "true" S-theme. Hepokoski and Darcy refer to the three phases that shape this process—(1) the first new theme after the MC, (2) the first theme's dissolution and the preparation of the second MC, and (3), the

[9] The V/V at this point is rather unusual, far more common MCs, especially that early in the form, are I:HC or V:PAC. That V/V leads not to V but back to I 6/4 perhaps foreshadows the movement's unusual final cadence, V/V 9/7 to I (mm. 212–13).
[10] Hepokoski and Darcy, *Elements*, 45–47.

second new theme “starting its own, renewed journey toward the EEC”[11]—as a “trimodular block (TMB).”[12]

4.1.1.2. MC declined versus Trimodular Block

MC declined. The dissolving reprise of p^1 initiates the TR process (mm. 17–20), albeit without energy gain (in examples 4.1 and 4.7, this initial TR does not receive its own module number). Following the premature first MC, TR resumes in 24. From here on, TR divides into two modules: a p^1-based TR^1 (mm. 24–34), and TR^2, whose first submodule (the climactic passage mm. 35–44), elides with its second submodule (the dominant-lock followed by the single MC m. 50 and CF mm. 50–54). The two modules present two stages in the energy-gain associated with TR: the increased rhythmic activity of the sixteenth-notes in TR^1 and the dynamic increase from *pp* to *ff* in the first submodule of TR^2. The successful launch of the S-zone in m. 55 leads to the exposition’s EEC in m. 63. In this interpretation, we hear the music in beginning in m. 24 not as a “new” theme, but as continuing within “pre-MC space.”[13] The ways in which the music following the “proposed MC” may decline it, includes returning to the primary theme in the tonic, or remaining in the tonic while introducing a new theme.[14] Here, it does both, albeit with a twist: (1) Not quite the P-theme itself, the “new” theme is a derivation of the p^1-theme (and, at the same time, an embellishment of the “waiting third,” A–F, see p. 47); and (2) although it does return to the tonic, it sounds over an unstable I 6/4 harmony and

[11] Hepokoski and Darcy, *Elements*, 170.
[12] Ibid.
[13] Ibid., 45.
[14] Ibid.

is further destabilized by the octatonic undercurrents in violin II and viola. Presenting a "new" theme not quite in the tonic, the section is at least in dialogue with the principle of the trimodular block.

Trimodular Block. Featuring not one but two MCs, a "trimodular block" is characterized by "two separate launches of new themes (pre-EEC themes) following those MCs. … The first new theme, following the first MC, will prove 'unable' to move to the EEC and will instead be converted into the preparation for a new MC, possibly including the establishment of a dominant-lock and other features of MC-preparation."[15] Since the presence of two MCs opens up a variety of TR- and S-theme implications, Hepokoski and Darcy suggest labeling the successive modules of the TMB as TM^1, TM^2, and TM^3. **Example 4.7** follows this labeling convention.

Hepokoski and Darcy distinguish among different types of TMBs. The first and simplest

> occurs entirely within an unequivocal S-space, so that TM^1 is unproblematically equivalent to $S^{1.1}$. This type of TMB might be regarded as a variant of the multi-modular or trimodular S, one in which an additional MC effect and "second" MC have been planted somewhere in the middle. … This type of TMB begins with an initial caesura (usually a I:HC) that could serve as an MC, followed by a TM^1 that appears with acceptable S-rhetoric, characteristic, lyrical, or *cantabile*, in the expected new key. In this situation TM^1 accepts the proposed MC and launches S-space, although it might also strike us as weak or flawed in some way (minor-mode? thematically problematic? too eager to accept a premature or insufficient MC? drifting back to the original tonic?)[16]

The TM^1 theme of mm. 24 ff. in Ravel's String Quartet (**example 4.4**) resonates with at least three of the elements listed above: (1) TM^1 is thematically problematic since it is a

---

[15] Ibid.
[16] Ibid., 171.

transformation of p[1];[17] (2) the MC seems premature after only four measures of TR without energy gain; (3) TM[1] does indeed “drift back” to the original tonic (albeit in the guise of a 6/4 chord). To move toward a new MC, the second module, TM[2] often has a TR-like texture and function. If the MC setting up TM[1] is considered the “real” MC, the second MC “may be considered one type of post-medial caesura.” The function of the second MC is to “prepare for a more ‘successful’ S-theme, which, in this case, receives the label TM[3].”[18]

In the first movement of Ravel’s Quartet, the first MC (V:HC; mm. 21–23) leads to the new theme beginning in m. 24, which forms TM[1] (see **example 4.4**). The theme’s transformation (p[3]) of the original P-theme divides into two hemiolic segments of three quarter notes each (or 1 1/2 mm. each) and is followed by a one-measure link that prepares for the theme’s sequence two steps higher (the bass moves up a major third from C to E, while the upper voice moves up by a minor third from A to C). This time, a four-bar link that combines elements of the TM[1] accompaniment (ascending octatonic tetrachords)[19] and p[1]-fragments follows the two hemiolic statements of the TM[1] theme.

The new texture in m. 35 and the repeated and modified p[1]-fragments move toward a climax in m. 39 (see **example 4.5**). An ascending octatonic progression (played by the cello) that foreshadows a larger octatonic progression in the development propels the last two measures (mm. 37–38) toward the passage’s melodic and dynamic goal at the downbeat of m. 39. Its denouement (mm. 39–43) prepares the arrival of a dominant lock (V/vi; mm. 44–50), which eventually produces the second MC in m. 50 (with

---

[17] For a detailed discussion of motivic and thematic transformation, refer to section 4.3.
[18] Hepokoski and Darcy, *Elements*, 172.
[19] In section 4.3, I show how Ravel derives this figure from the opening scales in the cello and violin II.

caesura fill, CF, in mm. 50–54; see **example 4.6**). All elements of this section correspond with the role Hepokoski and Darcy assign to TM^2: a TR-texture followed by a dominant lock that leads to a second MC (upon which TM^3 initiates a new theme).

When we compare the two MC candidates in the exposition of Ravel's Quartet, the question arises which of the two is the more "successful" and thus the stronger: the first, which prepares for the "correct" key, or the second, which prepares for the theme that successfully completes the journey to the EEC?[20] If we opt for the second, then TM^1 does not truly represent S-space. Hepokoski and Darcy describe TMB situations in which "TM^1 is not a satisfactory S-candidate" as follows:[21]

> TM^1 may strike us as unacceptable for any number of reasons, and we are then obliged to conclude that S-space has not been genuinely opened by the first apparent MC (which must thus be regarded as a "false MC"). … One might suppose that the "real" S-function is consequently shifted over to TM^3, following the "real" MC.[22]

Considering the "P-ness" of TM^1 and the fact that the preceding TR (mm. 17–20) has not been satisfactory, this second scenario better describes the Quartet's expositional divisions than the simpler TMB type. In this case, the exposition's second MC is the "true" one. **Example 4.7** illustrates the interpretation of the movement's three-part exposition with a TMB.

The alternative interpretations reflect the tension between thematic content and tonal expectations. On the one hand, the close p^1-based thematic relationship between P

---

[20] Note that both MCs feature a triple statement of similar motivic gestures: MC^1 repeats a descending third in the first violin with intervening rising seconds in the second violin, while MC^2 repeats a descending diminished fifth in the viola and cello, separated by two ascending *pizzicato* fourths in the first violin. In both cases, the triple gesture might be a gentler transformation of the "triple-hammer-blow effect" Hepokoski and Darcy describe as a convention for classical-style MCs. See *Elements*, 34.
[21] Ibid., 172.
[22] Ibid., 172–175.

and TM^{1} suggests that we interpret TM^{1} as the first full module of a continued and expansive TR, whose second phase would take the place of TM^{2}. On the other hand, the concept of the TMB expresses the tonal scheme Ravel chose for the MCs and the succession of themes, where the "false" MC produces a half cadence in the "correct" key that does not lead to a successful launch of an S-theme, and the "true" MC a half cadence that does lead to the S-theme, but in the "wrong" key. Because it highlights the similar gestures of the two MCs and illuminates how Ravel plays with the listener's expectations rooted in classical paradigms, I lean slightly toward the latter interpretation. However, since the exposition really lives in a continuum between the two interpretations, I will provide both labels (TM^{1}/TR^{1}, TM^{2}/TR^{2}, and TM^{3}/S) for the remainder of the chapter.

4.1.1.3. The C-Zone

Although Ravel obscures the EEC by slurring the melodic arrival on scale degree 1 of D-minor (at the end of m. 63) to the melody's continuation in the following measures, the II-V-i PAC outlined by bass and harmonic motion in mm. 61–63 clearly indicates the arrival at the exposition's tonal goal, prolonged by a post-cadential expansion through m. 68. In m. 69, the D-minor chord is literally "undermined" by the subposition of B♭, which turns the consonant D-minor triad into a dissonant B♭-major chord. As I have shown in chapter 2, this harmony is the first in a progression based on a descending whole-tone pattern in the bass (mm. 69–84, see **example 4.8**).

The whole-tone progression is one of the elements that make it difficult to determine the formal function of this section. Ravel's double bar at the beginning of m. 69 might indicate that he thought of the passage as launching the development section. If we read the passage in this way, the best functional label is Caplin's "pre-core."[23] According to Caplin, "the pre-core typically begins with the tonic of the subordinate key, thus retaining the harmony from the end of the exposition." If the pre-core begins in a different key, "the opening harmony is often dominant, and the music takes on the character of an upbeat unit to the resolving tonic of the new key."[24] Because Ravel's whole-tone progression does not constitute a key, we have to look to other pre-core characteristics to determine if mm. 69–84 qualify as such.

> The formal function of this upbeat gesture is rather complex and thus presents a terminological dilemma. On the one hand, it gives the impression of appearing "before-the-beginning" and therefore seems to function as an introduction. On the other hand, its underlying dominant harmony makes a transition from the subordinate key to the new development key. The rather clumsy expression *transitional introduction* perhaps describes what happens.
>
> Unlike the core's character of ongoing restlessness, the pre-core is generally more relaxed yet also somewhat hesitant and anticipatory. The dynamic level tends to be soft, and the rhythmic motion is frequently discontinuous (or at least less active than the subsequent core). …
>
> Whereas the core [of the development] may draw on any ideas from the prior exposition, the opening of the pre-core is usually restricted to material derived from the basic idea of the main theme or from the closing section of the exposition.[25]

In terms of their harmonic structure, it is clear that mm. 69–84 do not qualify as "pre-core." The whole-tone motion neither works as dominant harmony nor prepares a new key—but perhaps Ravel intended it to sound as *if* it were.[26] However, the passage

---

[23] For simplicity's sake, this is the explanation I offer in the Schenkerian discussion of the passage in chapter 2. In the context of the current chapter, which focuses on the formal aspects of the movement, I prefer to interpret the passage as a kind of "closing" zone or coda to highlight the parallelism between exposition and recapitulation.
[24] Caplin, *Classical Form*, 147.
[25] Ibid., 147–151.
[26] Thomas Kabisch, who interprets mm. 69–83 as an introduction to the development (*Durchführungs-Einleitung*), suggests that Ravel employs the whole-tone progression to "neutralize" the tonic function of the D minor in order to enable its octatonic use in mm. 84 ff. "Die Durchführungs-Einleitung beruht auf

does possess the quiet dynamics and the less active rhythm Caplin describes as characteristic of the pre-core.

On the other hand, the corresponding whole-tone progression at the end of the movement suggests that the passage fulfills some kind of concluding function. As I have pointed out in my detailed discussion of the passage in chapter 2, enough musical elements support that function. In addition, my Schenkerian analysis shows that in spite of its non-diatonic provenance, the passage connects the two D-minor harmonies at either end—so that we can interpret the whole-tone progression as prolonging D minor. A post-EEC passage fulfilling a "closing function" could either be a C-zone or a coda/codetta. In either case, this interpretation highlights the parallel placement of the whole-tone progressions in exposition and recapitulation. An interpretation of these measures as "pre-core" would imply that Ravel assigns different formal functions to what is essentially the same passage.

Hepokoski and Darcy's definition of C-space rests to a great extent on thematic considerations.[27] The continuation of the s-theme suggests that the s-space is still open, whereas the presence of p^1 could signal either a p-based closing or the beginning of a new rotation. While p-based closings are very common, the developmental rotation usually features the initial p module (and not p^2).

As I will show also in chapter 5, Ravel likes to blur formal boundaries, even as the music's aural surface offers clear segmentation. By overlapping s- and p-based

---

einer Ganzton-Progression des Basses, die offenkundig dazu dient, die Quinte D-A, die im Seitensatz über 13 Takte Tonika-Funktion hatte, zu 'neutralisieren' und dadurch ihre oktatonische Verwendung in Takt 84 ff. möglich zu machen." Kabisch, "Oktatonik," 124.

[27] In their view, the continuation of the s-theme past m. 63 may even prevent the movement from truly achieving an EEC and thus result in a "failed exposition." See *Elements*, 177–79. Based on my Schenkerian reading of the movement, I will not pursue this option at this time.

motives, the formal function of mm. 69 to 83—which are so clearly delineated by the descending whole-tone progression—is ambiguous. No interpretation of the boundary between exposition and development seems capable of entirely capturing the whole-tone passage's role in a single formal term. In its own way, each of the interpretations I have presented contains only part of the "truth."

Both **examples 4.1 and 4.7** favor the symmetrical alignment of the whole-tone progression, showing it as belonging respectively to the expositional and recapitulatory rotations. Although in this symmetrical distribution both sections could also function as codas (especially since both prolong the harmony of the preceding EEC/ESC), I prefer to interpret them as the C-zone for two reasons. (1) Since in the exposition the whole-tone progression's goal tone, D, elides with the first downbeat of the development, the term "coda" seems inappropriate. (2) In Hepokoski and Darcy's definition, the coda-space does not belong to the sonata-space proper, a post-EEC coda space would be highly unusual. Interpreting the whole-tone progression as shaping both the exposition's and the recapitulation's C-zone not only creates the most symmetrical interpretation of the movement's overall form, it also shows the development as a trimodular space, clearly divided by changes in texture, thematic material, and governing collections. In comparison, an interpretation of the first whole-tone progression as belonging to the developmental space and the second as belonging to a post-ESC coda (see **example 4.9**), distorts the thematic, sectional and formal symmetry so clearly outlined by Ravel.

4.1.2. Development

In the development, p^1 is conspicuous by its absence.[28] It is only in the retransition that a chain of p^1 fragments foreshadows the theme's impending return in the recapitulation. Beginning in m. 84, the development's first module is characterized by a transformation of theme p^2; later modules feature transformations of the s-theme. Since p^2 at least partially represents the P-zone, Hepokoski and Darcy's concept of "writing over" does not quite apply[29]: p^1 is not replaced by a new theme, and the P-module is not missing. Instead, it falls to p^2 to initiate the developmental action. Leaving p^1 "out of it"—that is, out of the developmental space—Ravel ultimately strengthens its role as the recapitulation's herald when it returns after a "long" absence.[30]

In chapter 3 I have described how the various transformations of p^2 help the listener to track the progress of the sonata form. The first instance of p^2 in the development (viola, mm. 86–90, preceded by a two-measure accompanimental prefix, mm. 84–85),[31] elongates the theme's first note by a quarter note to begin "early" on the fourth beat of m. 85 (see **example 4.10**). Outlining the same minor seventh chord on D as the arpeggiating accompaniment, p^2 joins in the prolongation of the D-minor seventh chord. Combining the overlapping D-minor and F-major triads, the D-minor seventh chord at development's outset encapsulates the F-major/D-minor ambiguity that characterizes the entire movement. A passing tone, D, at the end of m. 90 serves as a link

---

[28] Proponents of the "pre-core" interpretation might point out that if mm. 69–83 are considered part of the development, vestiges of p^1 do indeed appear at the development's outset.

[29] This elegant concept of Hepokoski and Darcy's Sonata Theory allows us to relate new or different material to the more normative material we expected instead. The different material is said to "write over" the expected segment of the rotation. See *Elements*, 212–215.

[30] I examine the roles of the themes and their transformations more closely in section 4.3.4.

[31] William Rothstein, *Phrase Rhythm in Tonal Music* (New York: Schirmer, 1989), 68–70.

to the second instance of p^2, preceded again by the two-measure prefix. Now outlining a half-diminished seventh chord on F, the theme combines the sonorities of an F-diminished and an A♭–minor triad. Accompanied by a shift in collection to A♭ melodic minor, this transformation of p^2 provides a perfect link between the diatonic and octatonic phases of the development. Although A♭ melodic minor is a transformation of the diatonic collection A♭7^6, it shares six of its seven pitches with $OCT_{1,2}$. The passing tone F6 at the end of m. 97 leads to the development's first melodic peak. With it, the first module of the development reaches its final four measures. Together, the gesture of the "waiting thirds" and the triple reiteration of the bass note F—whose "friendly supposition" turns the diminished seventh chord of m. 98 (E♭–G♭–A–C) into a major minor ninth chord—identify this four-measure group as a close relative of the first MC. Sharing its rhetorical function, they signal the end of the first module and prepare the listener for the second. Reinterpreted enharmonically as D#–F#, the thirds undergo a functional transformation in beginning in m. 102, actively propelling the development toward the climax in m. 119.[32] With the second module, the development enters its first octatonic phase. Beginning with an open-ended s/p^2 hybrid theme in the viola (mm. 102–105), this module is almost entirely governed by collection $OCT_{2,3}$—the single exception being the pitch C# in the second violin which belongs to this instrument's accompanying chromatic wedge (B–C–C#–D and back). Followed by a one-bar interjection, the theme's repetition (cello mm. 107–109) is stripped of its internal motivic repetition and thus reduced to two-and-a-half measures. Riding the intensifying momentum of the cello's

---

[32] The "waiting thirds" originate from mm. 13–15, where the cello alternates the open fifths, G–D and B♭–F. As I have pointed out earlier, they underlie theme p^1 in mm. 24–30 and play a central role in the first module of TM^2 in mm. 35–43.

subsequent ascending $OCT_{2,3}$ progression (mm. 110–118),[33] the hybrid theme's fragmentation ends up alternating the eighth-note lower-neighbor figure of theme p^1 with the eighth-note-triplet double-neighbor figure of theme s. The development's second melodic—and now also dynamic—climax in m. 119 shifts to $OCT_{0,1}$. The collectional shift at the point of climax signals the second octatonic phase and final module of the development, the p^1-based denouement which provides the retransition to the recapitulation.[34]

4.1.3. Recapitulation

In essence, the recapitulation reiterates the same modules and thematic units as the exposition (see **examples 4.1 and 4.7).** Perhaps the three most interesting moments occur where Ravel defies our expectations by changing melodic or harmonic features where we expect them to be the same, and *not* changing them where we expect them to be different. The recapitulatory rotation holds three such surprises. The first occurs in the P-zone, when p^2—which for recapitulatory purposes could remain identical to its expositional form—sounds in an octatonic transformation.[35] The subsequent p^1 nonetheless returns unchanged.

The second surprise comes after the TMB's first ("false") MC and the subsequent TM^1. We might expect the MC to behave like a "true" MC and sound at a different pitch level to prepare for the return of TM^1 in a different key. However, remembering that in

[33] In chapter 2, page 47 and example 2.14, I have provided a detailed discussion of the harmonic role of this octatonic progression. In section 4.3 of the current chapter, I will also highlight its motivic relationship to the movement's opening measures.
[34] As the reader will recall, I have described the harmonic details of this retransition in chapter 2.
[35] For an exact description of this transformation and its place in the overall sonata process, see chapter 3, pp. 107, 109–110, and examples 3.17 and 18.

the exposition MC^1 prepared for a TM^1 that remained in the F-major tonic, we quickly realize that the tonic key would also be appropriate now. Indeed, the recapitulation's MC^1 (mm. 149–151) is identical to that of the exposition (see **example 4.11**). Consequently, TM^1 also sets out as in the exposition (mm. 152 –154 are identical to mm. 24–26, m. 155 changes the accompanying harmonies while keeping the first violin's melodic line identical). Just when we settle into this realization, both melody and harmony undergo an unexpected change. Instead of hearing the second instance of theme s in the same key as before, the bass returns a half step "too low" at E♭ and the melodic outline of the arpeggiation (resolving the appoggiatura, m. 29/m. 157) that formerly outlined F major above an A-minor 6/4 chord now outlines f-minor above an A♭-major 6/4 chord.

The next four measures (mm. 159–162) sound a half step lower than their corresponding measures in the exposition (mm. 31–34)—except for the first violin's last sixteenth-note in m. 162, which skips from E5 to G5 rather than completing the stepwise octatonic ascent to F#5.[36]

The four-measure group that follows (mm. 163–166) presents an interesting transformation of the corresponding group in the exposition (mm. 35–38): the first bass tone, formerly C#2, is respelled enharmonically to D♭2 (see **example 4.12**). It now alternates with its upper fifth, A♭ (rather than the previous minor third). The upper voice, formerly beginning its p^1 motive at E6, now begins a half step lower at E♭6. While in the exposition the upper voice began on a consonant chord tone, it now begins with a

[36] The G5 is somewhat puzzling. If Ravel intended the passage to be octatonic, the G5 might be an error; perhaps a flat is missing. On the other hand, Ravel spells the same pitch class as F# at the beginning of m. 162—so why would he not spell it the same way? Perhaps in m. 162, Ravel decided to match the violin's final sixteenth note to the underlying diminished seventh chord B♭–D♭–E♭–G—but why would he not have done so in m. 34?

dissonant ninth. Skipping down the characteristic fourth of p^1 against the bass's rising fifth, p^1's descending second now forms a 9–8 appoggiatura, whereas in the exposition, the first note of p^1's descending second (beat 3 of m. 35) was the consonant chord tone. The cello's rising octatonic scale of mm. 37–38 is transformed into two rising chromatic tetrachords[37] in mm. 165–166 whose dove-tailing two-pitch overlap shrinks the span of the overall linear progression from an octave in the exposition to a fifth in the recapitulation (**example 4.12**). The changes in the harmonic progression and the interval transformations of the upper voice between the exposition's TM^2/TR^2 and that of the recapitulation reflect a change in the governing collections: while in the exposition, TM^2/TR^2 was entirely octatonic, alternating $OCT_{1,2}$ with $OCT_{0,1}$ (see **example 4.7)**, the recapitulation's TM^2/TR^2 uses the six-flat collection with additional chromatic pitches.

As a result of the changed first half of TM^2/TR^2, the climax and denouement lead to a dominant lock on C (mm. 172–179). Although the cello's harmonic-minor scales in mm. 173 and 175 imply F *minor* (to parallel the exposition's move to D minor), the music is at least heading toward the correct *tonic* to fulfill the recapitulation's harmonic task.

The return of the upper voices' (violin I and II) to their pitches from the exposition (mm. 180–183) announces the recapitulation's third surprise: the reharmonization of theme s (at TM^3/S) at the identical pitch level (see **example 4.13**). MC^2 (the "true" MC) in mm. 180–183 seems to split the preparation for the return of theme s (TM^2/S) between the upper and lower voices: the violins prolong A in preparation for a D-minor theme s as they did in the exposition; the viola and cello, on

---

[37] To be precise, the first tetrachord begins with a whole step, D♭–E♭.

the other hand, prolong a ninth chord on C (C–G–B♭–D) in preparation for a return to the F-major tonic. Both preparations are successful as Ravel reharmonizes the "D-minor" theme in F major. Here again we perceive the F-major/D-minor ambiguity that characterizes the movement's tonal structure. The ESC ultimately decides in favor of the F-major tonic.

Ravel changes only three pitches of the melody to achieve the movement's ESC: the EEC ending A–F–E–D (E is an accented passing tone) becomes A–E–G–F (G is an appoggiatura). The reharmonization provides the ii-V-I PAC in F in mm. 190–192. As in the exposition, a small post-cadential expansion functions as a link to the closing group (201–209).[38] Parallel to the exposition's closing, the whole-tone progression reaches its goal, F, with the fifth whole step in m. 209. Thus I interpret the remaining measures, 209–213, as a codetta. Following the whole-tone progression's trajectory and stepwise motion, the bass line uses ♭VI and II♮^{7} to confirm the tonic arrival at F major.

4.2. Tonal Structure: A Schenkerian Interpretation at the Deep Middleground

While the background structure (see **example 4.14**) of the String Quartet's first movement lies safely within the paradigm of a $\hat{3}$–$\hat{2}$–$\hat{1}$/I–V–I fundamental structure, much of its middleground voice leading does not adhere to either of Schenker's major- or minor-mode sonata-form models. In fact, the prolongation of the headtone $\hat{3}$ throughout most of the development space is closer to Schenker's minor-mode paradigm than to the major-mode paradigm we might expect given the movement's F-major tonic. In contrast

[38] I discuss the intricate voice leading of the link's transition to the whole-tone progression in the Schenkerian section of this chapter, section 4.3.

to the Piano Trio's background structure, however, we can interpret the Quartet's background structure as an interruption form, whose first branch breaks off with the arrival of $\hat{2}$ over V in m. 122. The prolongation of $\hat{3}$ throughout the exposition is a function of Ravel's choice to deploy the S-theme in vi. In the development, $\hat{3}$ is supported first by a D-minor minor seventh chord, then by the large-scale unfolding of the diminished seventh chord A–C–E♭–G♭.

The recapitulation provides the second branch, relaunching the *Kopfton* $\hat{3}$ with P in m. 129 and prolonging it past the ♭iii inflections of $TM^{1/2}$/$TR^{1/2}$ into TM^{3}/S, where the turn of the S-theme's last three notes complete the structural descent (and the ESC) above a clear (II–)V–I *Bassbrechung* (arpeggiation). In the Schenkerian sense, the C-zone functions as a coda. While the C-zone's whole-tone progression traverses the span of an augmented fifth to return to the tonic, the upper voice alternates fifths and thirds above the changing roots of the non-diatonic progression to reach for the coupling an octave above the final scale degree 1. That the *Kopfton* A remains active for most of the exposition, development and recapitulation is the result of the movement's harmonic design. The "true" S-theme's motion to VI easily integrates the headtone, which simply turns into $\hat{5}$ above D.[39] The bass arpeggiation moves in the opposite direction from that in Schenker's minor-mode sonata model, where $\hat{3}$ above the minor tonic turns into an octave when S moves to the relative major. To show the overall correlation between voice-leading and sonata form, **example 4.15** aligns the Schenkerian graph with the form table.

---

[39] This scale-degree reinterpretation is the opposite of the Piano Trio's double tonic complex, where $\hat{5}$ above the initial A-minor tonic becomes $\hat{3}$ above the new C-major tonic.

4.2.1. Voice Leading in the Exposition

Because of the 3-line, the movement lacks fifth progressions. Instead, the p[1]-theme's reaching-over to 1 an octave above the obligatory register, returns to $\hat{3}$, albeit in disguise of $\flat\hat{3}$ by way of a descending sixth progression, to come to a halt on $\hat{2}$. In mirroring the movement's large-scale interruption, this miniature interruption strongly resonates with Schenker's *Übertragung der Ursatzformen*, the "transference (to lower levels) of the fundamental structure's forms."[40] As in the large sonata structure, the miniature interruption's second branch begins with the return of p[1] an octave above the obligatory register in m. 17. At the deep middleground, the contrasting p[2] theme reduces to a motion from an inner voice, providing a registral connection to the second p[1] while the bass line completes the motion from ii/II to V^7 (m. 16). This time, the sixth-progression of p[1] (mm. 17–21) returns to $\hat{3}$ proper, which extends as a ninth above V/V through MC[1] (mm. 21–23). Turning into a suspended sixth with the arrival of p[3] in m. 24, the ninth's resolution to G above the $V^{\flat 9}$ chord triggers the descent of the second miniature branch, completed by the F5 in m. 25. The dominant ninth chord's ♭9 is actually spelled as a C#4 ("#1") because it functions locally as a leading tone to the D-minor harmony that enriches the more structural F major with an added sixth. Again, Ravel seems to pursue simultaneous progressions in both keys, F major and D minor. At this stage, F major is structurally still superior. The sequential return of p[3] imitates the third progression a sixth lower, C5-B♮4-A4 above E-a^{add6}. Its goal tone A4 brings the return of the *Kopfton* in the obligatory register (m. 29; the coupling to the octave below

---

[40] For description of this special type and other types of motivic parallelism, see Charles Burkhart, "Schenker's 'Motivic Parallelisms'," *Journal of Music Theory* 22/2 (1978), 145–175; 153.

by the second violin's repetition of p^3 is not shown in the middleground graph). Measures 32–34 prolong the A-minor dominant, E. (I understand the E# as an unresolved appoggiatura that highlights the octatonic collection of $OCT_{1/2}$ that governs all but the p^{1tra} motives.) In m. 35, the p^1 motive (now $p^{1\ chr}$) adapts to its octatonic environment to help prolong a half-diminished seventh chord on C#. Parsimonious voice-leading provides the $ii^{ø7}$ chord on E in m. 43 that through a half cadence opens the dominant space for the D-minor S-theme.

The S-theme (mm. 55 ff.) first descends through a fourth progression to recapture the *Kopfton*, A5, in m. 61 (supported more strongly by the dominant in m. 62). Below it, the movement's EEC completes the D-minor $\hat{3}$–$\hat{2}$–$\hat{1}$ descent in m. 63. The post-cadential expansion continues to prolong D minor through measures 68, until in m. 69 the subposition of B♭3 by the cello renders the upper-voice A dissonant.

The A's resolution to B♭5 (the last eighth note of the triplet) begins a chromaticized voice exchange in the upper voices from m. 69 to m. 79 (B♭5 to D♭5 in violin I, D4 to B♭3 in violin II) while the bass progresses through the first three whole steps from B♭2 to G♭2. From m. 79 to m. 84, the upper voice moves in parallel fifths to the bass to return to the *Kopfton* A3 above D minor at the beginning of the development.

4.2.2. Voice Leading in the Development

From the *Kopfton,* now the fifth of D minor, the development arpeggiates a diminished seventh chord through an octave and a diminished fifth. The arpeggiation is brought about by a sequence of collection changes. The initial skip from A to C still belongs to the diatonic realm of the prolonged D-minor seventh chord (mm. 84–90). With the transposed reiteration of theme p^2 in A♭ minor (mm. 91–98), the arpeggiation reaches E♭. From E♭ it moves to G♭. The octatonic collection $OCT_{2/3}$, which controls the next module of the development (mm. 98–118), supplies G♭ over F and A over D#. Having reached the octave above the *Kopfton*, the upper voice rapidly retraces the entire arpeggiation during the movement's dramatic climax preparation (see also chapter 2, example 2.14). The centrifugal force of this accelerated motivic parallelism catapults the arpeggiation two thirds beyond the octave to E♭. Losing control of the momentum it generated and overshooting the next third by a half step, the arpeggiation bursts out of the confines of $OCT_{2,3}$ and into $OCT_{0,1}$ space.

The subsequent alternation of $OCT_{0,1}$ with WT_0 moves back and forth between a German and a French augmented sixth chord on F# (see chapter 2, example 2.11). The resolution of the appoggiatura A to G in violin II marks the arrival at scale degree 2 and the end of the interrupted, first branch. When the bass's F# moves to G, we perceive the upper voices as a V^7/V chord that leads to the structural dominant on C, prolonged by the repeated #I-ii-V motion in the bass from mm. 122–123. Although the C-major seventh chord (Ravel spells it with an A# instead of B♭ because of the OCT and WT contexts) is structurally superior, the French augmented sixth chord has the last word: prolonged by collection WT_0, in mm. 126–128, it functions like a caesura fill and moves to the tonic triad by chromatic voice leading.[41] As I will explain in section 4.4, the chromatic voice-leading of this somewhat unusual progression does not serve a coloristic purpose only. In subjecting the tonal paradigm to the control of referential collections at this important

---

[41] I provide a detailed description of this retransition's voice-leading in chapter 2.

formal juncture, Ravel sharpens our sensibilities for the arrival of the pitch F, which has been absent for fourteen measures.

4.2.3. Voice Leading in the Recapitulation

The recapitulation's branch begins like that of the exposition. The changed consequent of theme p^1, however, causes a break in the theme's linear descent as the consequent continues with a third progression A–G–F#. With the octatonic transformation of p^2, the upper-voice F#, enharmonically reinterpreted as G♭, reaches over the obligatory register to form a subsequent foreground parallelism (see example 4.10). Skipping from G♭ to E♭ and passing through D to C (mm. 141–145), the p^2 transpositions reiterate the motive's initial interval structure from m. 141. At the middleground, the C forms only a cover tone above the regained headtone. The return of theme p^1 (mm. 145–149) successfully completes the sixth progression from F back to the headtone. Measures 149–154 follow the same voice leading as their corresponding measures in the exposition. However, in m. 155, Ravel changes the bass progression, forcing the upper voices to follow suit in m. 156. The changed course heads to the flat region, recalling the development's A♭ minor in mm. 159–167. As in mm. 31–34, I interpret as unresolved appoggiaturas the octatonic substitutions a half-step above the supposed chord root. The paradigmatic progression of mm. 156 to 167 first prolongs the E♭ dominant seventh chord of m. 156 through 162, then alternates D♭ with A♭ in plagal motion (mm. 163–164). A♭ becomes an upper neighbor to the half-diminished seventh chord G–B♭–D♭–F prolonged into m. 171.

Functioning as a ii^{ø7} in F, G–B♭–D♭–F initiates the dominant lock of mm. 172–179. In m. 180, the bass continues the dominant prolongation by moving back and forth between ii^{9} and V. However, as in mm. 24–27, the upper voices take on a will of their own and return to the "old" MC^{2} on A as if to prepare for a D-minor return of theme s. At the deep middleground, this D-minor/F-major conflict has been resolved in favor of F major (it is the recapitulation, after all). The foreground graph of **example 4.13** shows how theme s, sounding at the identical pitch level as in the exposition, adjusts to the F-major context. Despite the changed tonal context, m. 188 is identical to m. 59. E♭ major, ♭II in D minor, now functions as ♭VII to proceed via ii to complete the fundamental structure with a PAC in mm. 191–192. Theme s needs to change only its last three notes to comply and complete the structural descent at the same time. The structural descent occurs an octave above the obligatory register. The post-cadential expansion in mm. 193–196 seeks to remedy this by moving back and forth between the higher and the obligatory register. Especially interesting is the imitation of the interruption structure by the A4–G4 at the obligatory register in mm. 193 and 195. The upper register responds with G5–F5 to no avail. When G5 finally drops to F4 in m. 198, the cello's C# has already foiled the attempt at closure in the obligatory register.

As in the exposition, the C-zone (mm. 198–209), a coda in the Schenkerian sense, traverses a whole-tone progression in the bass to return to the thus prolonged tonic. Meanwhile, the upper voices move in contrary motion in a 5–3–5–3 interval pattern (G# above C#, D# above B, E above A, B above G.) In the codetta (mm. 209–213), the whole-tone progression continues one step beyond the goal tone F to recall the ♭VII in a neighboring motion. Since the final cadence substitutes a II^{9} for the dominant, the upper voice cannot retrace the $\hat{3}$–$\hat{2}$–$\hat{1}$ descent (doing so would result in parallel octaves—not a satisfying closure). Instead, the upper voice reaches up to 5 in contrary motion. The final C6 also completes the last 3–5 interval pattern.

4.3. Motivic Analysis

The network of motivic relationships in the first movement of Ravel's String Quartet contributes significantly to the movement's coherence and helps the listener identify and track the succession of the various zones and modules of the sonata form. To illustrate Ravel's motivic techniques, I divide my discussion of motivic transformations into five subsections. In the first **(4.3.1)**, I show how Ravel uses *Knüpftechnik* to generate the entire P-zone's themes from the opening measure.[42] In the second (**4.3.2**), I show how the first measure's rhythm becomes the seed for a small number of related rhythmic cells that shape most of the movement's motives. In the third (**4.3.3**), I focus on step-based transformations between related motivic cells and themes. In the fourth (**4.3.4**), I demonstrate how even the basic rising F-major scale that accompanies the P-theme participates in thematic development and transformation. In the final subsection (**4.3.5**), I relate the various thematic transformations to the movement's Type 3 sonata form and

---

[42] The term *Knüpftechnik* (linkage technique) goes back to Schenker. In Oswald Jonas' explanation, "Another method to create musical continuity is the so-called linkage technique, which is based on the principle of repetition. It either occurs when the beginning of a new phrase takes up the end of the previous [phrase], initially in the same formal section as in Beethoven, Sonata G major, op. 49/2, or [it occurs] to inspire a new formal section, as the Trio in [the third movement of] Brahms, Clarinet Sonata, op. 120/1." Oswald Jonas, *Einführung in die Lehre Heinrich Schenkers: Das Wesen des musikalischen Kunstwerkes*, rev. edition (Vienna: Universal Edition, 1972); 6–8; my translation. See also David Beach, "Thematic Content: A Schenkerian View," *Aspects of Schenkerian Theory* (New Haven: Yale University Press, 1983), 39–60; 44–46. For further examples of *Knüpftechnik* in the music of Beethoven and Brahms, see Eytan Agmon, "The First Movement of Beethoven's Cello Sonata, Op. 69: The Opening Solo as Structural and Motivic Source," *The Journal of Musicology* 16/3 (1998), 394–409; Peter H. Smith "Brahms and the Shifting Barline: Metric Displacement and Formal Process in the Trios with Wind Instruments," *Brahms Studies* vol. 3 (2001), 191–229.

show how the motives and their transformations help the listener perceive the design of the sonata form.

4.3.1. Motivic Transformation and *Knüpftechnik* in the P-zone

Ravel develops the P-zone's two themes, p^1 (mm. 1–8 and mm. 17–23) and p^2 (mm. 9–16) from the initial measure by combining motivic transformation and *Knüpftechnik* (see **example 4.16**).[43] The initial five-note motive of m. 1 undergoes rhythmic and step-based transformations to arrive at the motive of m. 2: the initial pitch A4 is embellished by the eighth-note lower third F. The skip in m. 1 from A4 to E4 between beats 1 and 3 (filled by a "passing" G) is inverted (A4 to E5) and compressed into the space of two beats. The fifth is filled by C4. Because of the compression, the descending second, E–D, now arrives at D already on beat 3 of m. 2. The motivic cell G–A–E of beats 2 and 3 of m. 1, occurs an octave higher in retrograde in m. 3 as E–A–G, mapped onto the same rhythmic cell on beats 2 and 3. The passing motion from beat 3 into the downbeat of m. 4 revisits the descending second E–D. The ordered step-interval motive [+4+2] from m. 2 (F–C–E) is step-transposed up by five steps to D–A–C to complete the p^1 antecedent. The two transformations of the three-note motivic cells (shown in the example by the arrows above the top system) form an interweaving pattern. On a slightly larger scale, the transformations of ordered step-interval motives between on-beat pitches link measures 1 and 3 by inverting the central interval i^2; [–1–2–1]

---

[43] In the example, the numbers above each system show ordered step-intervals between consecutive pitches, while the numbers below each system show the ordered step-intervals between consecutive pitches at a quarter-note distance. Here, the transformational arrows focus on the surface transformations that demonstrate the *Knüpftechnik*. As I will show in section 4.4, the *Knüpftechnik* also provides motivic continuity in the movement's development section.

becomes [–1+2–1]. If we reduce the basic intervallic gesture of each measure to its first and last note, the melodic outline, A4–D4–A4–D5–F5–E5–D5–C5, shows how D minor already infuses the movement's initial measures with the ambiguity that plays a central role in the overall sonata design.

The modulating consequent of p^1 begins with a transformation of m. 1 that stretches the first three step-intervals: i^1 and i^2 are stretched by 2 steps each ($IT_{-2/+2}$) to thrice their original size, and i^3 is stretched by three steps (IT_{-3}) to twice its original size. Since the descending second at the end of the measure remains a second, we can now deduce that it is the more essential of the two steps of the principal p^1 motive. Measure 6 shares the same rhythmic transformation of p^1 as m. 2.[44] The step-interval transformations between mm. 5 and 6 (excluding the repeated D♭ in m. 6) change i^1 and i^2 of m. 5 by one step each so that [–3+3] becomes [–4+2] and i^3 by two steps (–6 to –4); i^4 remains the same. As the ordered step-interval numbers below the system show, the intervals between the on-beat pitches add up to the same distance (an octave) in both measures. Moreover, the ordered step intervals between the first three beats form an inversion of the three-note step-interval motive from mm. 2 and 4: [–4–2].

The *Knüpftechnik* is most obvious between mm. 6 and 7, where the transposed triadic three-note motive ♪♪ ♩ [+2–4] is moved metrically and repeated to form the melodic content of m. 7. The ascending tetrachord that concludes the consequent in m. 8 inspires both the stepwise descent of p^2 from m. 9 into m. 10, and its ascent in m. 10, now in eighth notes. At the same time, the four quarter notes in m. 9 are a step-interval

[44] Since the essential rhythmic transformations are based on quarter and eighth notes, I interpret note values longer than a quarter note as equivalent to the number of quarter notes they replace.

transformation of the quarter-note step intervals of m. 5: IT i^2+2 turns [–3–3+1] into [–3–1+1]. In these first twelve measures, the *Knüpftechnik* serves to provide continuity and musical flow to the main thematic ideas of the P-zone.

Although the small three-note motives of mm. 1, 2, and 6 are most obvious at the surface of the music, it is the sub-surface motives that shape the thematic content of the movement. From the initial four measures we can deduce three kinds of motivic cells as candidates for further transformations: (1) the rhythmic cell ♩ ♪♪ ♩ ♩; (2) the pitch motive A–E–D, and (3) the ordered step-interval motive [–1–2–1] or step-skip-step motive. In the following paragraphs, I trace some of their transformations throughout the movement.

4.3.2. Rhythmic Cells

Taking the first measure's rhythm as the basic rhythmic motive, I view most of the movement's rhythmic figures as transformations of this five-note cell (see **example 4.17**). In the top four systems of example 4.17, I have arranged rhythmic cells at four levels according to the number of transformations that separate each of them from the basic pattern of four quarter notes shown at level 0. Our principal rhythmic motive resides on level 1, since it is one transformation removed from the basic pattern. It is in column b, because the transformation changes the *second* beat from a quarter into two eighth notes. Level 2 shows further transformations of the principal motive. The motives appear in the order of the changed beats: the change between the principal motive (1b) into motive 2c affects the first beat; that into 2d, the third; and that into 2e, the fourth. Motive 3f transforms the two eighth notes on beat 4 of motive 2e into an eighth-note triplet. Assigning a different column to each rhythmic motive has two advantages: (1) we can identify each motive by its column, and (2) themes and theme fragments can be placed below their corresponding rhythmic motives in the order in which they appear.

I have aligned the movement's three main themes (p^1, p^2, and s) and two transformations of p^1 (the chromatic form of p^1, $p^{1\ chr}$; and the dominant form of p^1, p^1dom) according to the rhythmic motives they incorporate. The alignments show immediately how all p^1 themes are closely related through rhythmic motives b and c, and how p^2 forms a contrast by using rhythmic motives a and d. In addition, we can observe relationships that link themes by subtly recalling characteristic elements of single rhythmic motives. For example, rhythmic motive c of m. 8, the last measure of p^1, elongates the first eighth-note by tying it to the last eighth note of the previous measure. The resulting figure, ♪_♪♪♪♪♩, is displaced by just one beat and is one eighth note shorter than motive d of p^2 in m. 10, ♩♪♪♪♪♩. More easily perceived, theme s (mm. 55 ff.) alludes to the transformation of motive p in mm. 31, 33, 37, and 38 in the transitional passages that follow theme p^3 by recalling the latter's double-neighbor triplet figure on the fourth quarter note. In addition, theme s uses rhythmic motive e, which we first heard in m. 3 as part of p^1's antecedent.

4.3.3. The Pitch Motive A–G–E–D and Step-Based Transformations of Motive p

As shown in **example 4.18**, motive p in the first violin's opening measure has two descending seconds, A–G and E–D. In m. 1, they are separated by a descending third. The combined pitch motive A–G–E–D has the ordered step-based intervals [–1–2–1]. Example 4.16 illustrates how both pitch motive and step-interval motive play a role in subsequent p-motive derivations. In m. 2, G is replaced by A’s lower third, F, and E is displaced to the second half of beat 2 by its lower third, C, so that only A and E–D remain of the pitch motive. The pitch motive returns an octave higher in m. 3, the skip from G to E filled out by a passing F. It then returns in the same octave (with the passing F) in mm. 9–10 and 11–12 as part of theme p^2.[45] In m. 17, the initial motive is split between the violins and the viola: while the viola plays the neighbor figure A–G–A, thus taking care of the first half of the pitch motive, the violins leap from C6 and A5 to the second E5-D5, thus taking care of the second.

The bottom two systems of **example 4.18** illustrate the derivation of theme p^3 from p^1: in m. 24, the pitch motive is reduced to A–G–E; m. 25 rearranges the pitches of m. 2. If we disregard the C5 of m. 2, E and A change places around F4, while D5 remains the final pitch both times. While the E5 in m. 2 serves as an upper neighbor to D5, E4 in m. 25 serves as an appoggiatura to F4.

Since the p-motive is most prominent at the opening of each theme, I shall follow its step-interval transformations by tracking the theme heads shown in the first column of **systems 1–5**. With the exception of the simultaneous presentations of the combined violin and viola parts in m. 17, the transformation chain among consecutive theme heads follows the diachronic succession of the first 17 measures. All transformations are interval transformations (IT).

---

[45] The modulating consequent in mm. 5–8 changes keys and thus does not feature the pitch motive.

m. 1 5 9 17 vls. 17 vla.

$$\begin{tikzcd}
p^1 \arrow[r, "i^1-2,\ i^2-1"] & p^1 \arrow[r, "i^2+2"] & p^2 \arrow[r, "i^1+1,\ i^2-2"] & p^{2/1} \arrow[r, dashed, "i^1+1,\ i^2+3"] & p^1 \\
p^1 \arrow[rr, "i^1-2,\ i^2+1"] & & p^2 \arrow[rr, "i^1+2,\ i^2+3"] & & p^1 \\
p^1 \arrow[rrr, "i^1-1,\ i^2-1"] & & & p^{2/1} & \\
p^1 \arrow[rrrr, "i^2+2,\ i^2+3"] & & & & p^1
\end{tikzcd}$$

Without detailing the interval transformations numerically, **example 4.19** shows how p-motive derivations permeate the motivic fabric of the entire movement. All p-motives in the example share the first four note values of the rhythmic motive b; that is, their rhythmic values may differ only on beat 4. The example introduces additional labels for certain p^1 transformations based on their specific characteristics or their function in the sonata form. For example, $p^{1\ dom}$ is the form p^1 takes when prolonging the dominant before the arrival of MC^2; and $p^{1\ clos}$ labels p^1 forms in the closing section. The example arranges the transformations of the p-motive by intervallic categories.

Column a shows motive forms that preserve the lower neighbor figure in the first two beats. Columns b and c show closely related transformations of the a-column motives in lines I–V. In line I, the motives in columns a and c share the original ordered step-interval pattern of [–1+1–3–1].[46] In line II, the motives in columns a to c share the same stepwise interval pattern [–1+1–1–1]. In lines III and IV, columns a and b include motives with chromatic transformations of the neighbor motion.

Line V introduces the $p^{1\ dom}$ versions of exposition and recapitulation. In lines VI and VII, column a presents denouement transformations of p^1 with the rhythmic motive e, whose descending skip-sequence alternates fourths and fifths. In lines I–VII, all motives

---

[46] In this example, I include all consecutive step-intervals.

of column c form a u-shaped contour, returning to their initial pitch on the downbeat of the next measure. The s motive in column c of line VIII is a transformation of the s motive above it by IT (i^1, i^2) –1. All motives in column d, lines I–III, share the interval of a rising fourth between the two eighth notes on beat 2. Finally, lines VII and VIII of column d show the closing forms of p^1 characterized by their rising motion from beat 3 to the next downbeat (not shown).

Although I have not detailed the exact interval transformations of the p-motive in this example, it clearly shows how (1) Ravel draws different yet related motivic shapes from a single source, thus fulfilling the organicist ideal of unified variety; (2) the different motivic shapes take on individual characters and expressions; and (3) their individual characteristics fulfill specific formal functions of the sonata form. I will expand on the last point in section 4.3.5.

4.3.4. The Counter-p-Theme

What at first appears to be a simple accompanying scale in the cello's and second violin's opening measures, turns out to be a significant thematic unit that supplies much of the motivic substance of the movement. To account for the theme's accompanying role, forming a counterpoint against theme p^1, I label it the "counter-p theme," or cp.[47] Like the other themes, cp undergoes a series of transformations in tandem with the different formal functions it represents in the course of this Type 3 sonata. As with the other themes, we can divide cp into motivic segments based on the measure unit. **Example 4.20** demonstrates how this segmentation allows us to relate theme cp more

[47] I chose the label cp (instead of cp^1), because Ravel uses it as an accompaniment to all three p themes.

precisely to its subsequent transformations. The basic form of cp occurs in the cello and is shown in the first system of the example. Accompanying the antecedent of p^1, it takes up four measures and divides into three consecutive tetrachords (tc^1– tc^3) and a turning figure (tn). Since in many cases its continuation features the same step interval, a descending second (ds), I have included m. 5 as an extension. Although mm. 6–8 continue the accompaniment, now descending in nearly step-wise manner, these measures are less significant for the remainder of the movement and I therefore do not include them in my example or discussion. I should point out, however, that in m. 5, the second violin plays a transposition of the first violin's opening measure in the rhythmic transformation of motive a (see **example 4.3**). Similar figures in the subsequent measures of second violin, viola, and cello can all be interpreted as transformations of the principal motive of p^1. The second violin follows the cello's ascending scale in parallel tenths, embellished only on beat 3 of m. 4 to echo the first violin's D-A eighth-note figure (shown in the second system).

These first five measures establish the role of the cp-theme as an accompaniment. Ravel is very consistent in assigning the transformations of cp and cp fragments: with the exception of mm. 9–16 and 31–34 in the exposition, and the corresponding mm. 137–144 and 159–162 in the recapitulation, [48] violin II and the cello play all cp statements and fragments. This confirms that the transformations of cp are indeed conceived as such and are not a compositional coincidence.

---

[48] In mm. 9–16 in the exposition, the two violins trade roles, so that violin II can echo violin I. In the corresponding measures of the recapitulation, mm. 137 –144, the viola takes over the accompanying cp fragments while the violins trade p^2. In mm. 31–34 and 159–162, violin II carries the main melody, so that the accompanying role falls to violin I.

Two fragments of cp, tc^1 and ds, accompany p^2 in mm. 9–16 (see **system 3 of example 4.20**). It is because of this transformation of the viola's opening measure from A–B♭–C–D into A–B♮–C–D that I interpret the passage's overall harmony as prolonging a major V^9 chord, despite the cello's G-minor arpeggiation.

The accelerated transformation of cp in m. 24 into overlapping octatonic tetrachords (see **system 4**) greatly contributes to the unstable nature of the TM^1/TR^1 section. In double diminution of the original model, the four sixteenth-note tetrachords, squeezed into a single measure, create the momentum that signals that we have left the P-zone. In addition, the transformation of the F-major tetrachords into $\text{OCT}_{0,1}$ tetrachords contributes to the harmonic instability we associate with transitional passages. A fourth tetrachord, tc^4 replaces tn; ds connects to m. 25. Because of the overlapping pattern (the first two pitches of tc^2 to tc^4 repeat the last two of the previous tetrachord), the measure outlines a diminished seventh chord at the quarter-note level.

The cello's scales in mm. 45 and 47 are also transformations of cp (**system 5**). This is especially obvious in mm. 47–48, where the continuation forms a slightly modified inversion (itn) of the turning figure tn. To reflect the adjacency of scale and turn, I have labeled the two tetrachords tc^2 and tc^3.[49] Moreover, the alignment directly relates the passage's tonal context to that of the original F-major scale: in both, tc^2 and tc^3 outline the dominant. Beginning on scalar step 4, the D-harmonic-minor scale delays the arrival at the octave to the next downbeat by inserting a chromatic passing tone (#6). The eighth-note pace of the two tetrachords forms a simple diminution; the turn itn sounds at the model's quarter-note pace.

---

[49] The placement of itn to the far right accommodates the alignment with the next system.

In mm. 91–92, violin II plays a sequence of six sixteenth-note tetrachords, again with the two-pitch overlap (**system 6**). Beginning like another octatonic pattern in tc^1, this instance of cp is actually governed by the A♭-melodic-minor collection. Since tc^4 in m. 91 (beat 4) repeats on beat 1 of m. 92, it receives the same label. If we treat the overlapping segments as extensions of every second tetrachord to arrive at a continuous scale, we can reduce the number of tetrachords to three (the alternative tc labels are shown in italics above the system). As in the original form of cp, the turn follows tc^3—this time in its inverted form, itn, as in m. 48.

In the center of the development section, we find what is perhaps the most interesting and striking transformation of cp (mm. 110–116, **system 7**). An augmentation of tc^1 in half notes, prefaced by half a tetrachord, begins an octatonic ascent through $OCT_{2,3}$ in the cello. Continuing the ascent toward the movement's climax, tc^2 and tc^3 accelerate to a quarter-note pace to culminate with the turning figure, now played with a sixteenth-note tremolo and repeated thrice. In mm. 110 and 111 cp sounds against s-fragments—the only time this occurs in the movement. Additionally, the rapid succession of the triplet-fragments in mm. 112 and 113 relates these measures to both s and the rhythmic transformation of p^1 (rhythmic motive f), which takes over in mm. 114–116.

What makes this transformation particularly salient is its rhythmic augmentation, followed by the return to the original quarter-note pace. First the augmentation calls our attention to the pattern. The alternation of whole and half steps creates the particular kind of tension I have described in chapter 3. The acceleration and the return to quarter notes—for the first time since the opening of the movement—invites us to relate this cp transformation to its original form. The continuously intensifying repetition of the turning figure—the last element to complete the pattern—calls for some kind of release. The tension associated with the climax preparation and its octatonic quality make this passage the goal of the development. At the same time, the transformation of cp foreshadows the return of the opening measures. This suggests that Ravel prepares for the recapitulation in three stages: (1) motivically, through the transformation of cp in mm. 110–118; (2) thematically, through the p^1 fragments in the denouement; and (3) harmonically, through the combination of V/V, V, and the French and German augmented-sixth chords described in chapter 2.

The final transformation of cp shown in **system 8** of **example 4.20** is the recapitulatory form of the cello's dominant prolongation, traversing the F-harmonic-minor scale from C to C. This time, the original turning figure follows tc^2 and tc^3.[50] To show the close relationships between the last two cp transformations and the original cp, system 9 recalls the opening (and recapitulatory) statements of cp.

4.4. Thematic Transformation and Sonata-Form Design

All motivic and thematic transformations in this movement serve the sonata form's design. In chapter 3, I have shown reciprocal relationships among the motivic transformations of theme p^2, the Schenkerian interpretation of its step-based transformations, and the sonata form process. In this section, I shall trace transformations of the remaining themes (p^1, p^3, and s) and elucidate how the small changes in their motivic content and interval structure correspond to the character of the formal functions

---

[50] By relating this dominant-prolonging scale directly to the opening form of cp, Ravel confirms that the inverted itn in m. 48 is indeed a transformation of the turning figure.

they fulfill. **Examples 4.21a–c** place the various themes next to their corresponding formal sections. (For quick reference, see the overview of themes in **example 4.2**.)

Most thematic transformations directly link exposition and recapitulation forms of p^1 and p^1-derived themes, since Ravel limits the main thematic content of the development to transformations of p^2 and s. This design encourages us to hear the sonata form's ternary subdivision as a function of thematic content.[51] Thus we perceive the boundary between exposition and development by thematic contrast as well as by changes in articulation and texture. Because the p^1-based themes are absent throughout most of the development, when they come back in the recapitulation, we associate them more strongly with return. This sonata process is essentially different from one where a primary theme is "developed" during the development and "restored" to its original form at the beginning of the recapitulation. Assigning the developmental task to p^2, Ravel draws our attention to the p^2 transformations, which become the focus of the transformational thread that weaves through all three rotations.

4.4.1. ***Knüpftechnik*** in the Development and Transformations of p^2 and s

As I have detailed in chapter 3, theme p^2 becomes the catalyst that helps us track the changes in referential collections on its path through the sonata form's tonal landscape. The other theme that plays a central role during the development is theme s (beginning on beat 2 of m. 102, see **example 4.22**). Unlike p^2, whose developmental

---

[51] As I pointed out earlier, the rhythmic motives of p^2 are different enough from those of p^1 that we hear p^2 as a contrasting theme—in spite of its intervallic relation to p^1. Although more closely related to p^1 than to p^2, p^3 distinguishes itself through its hemiola (see example 4.4) and is separated from the p^1-p^2 rounded binary by the "false" MC (MC^1).

transformations were mainly intervallic (not only leaving its basic two-bar structure intact, but appending a four-bar suffix based on the "waiting-third" motive), the transformations of s involve intervallic, rhythmic and metric changes. The durational and melodic accent of the theme's opening leap (originally forming a syncopation) now falls on the strong beat 3. Adjusting to the octatonic context of $OCT_{2,3}$, the leap's original interval, a fifth, has changed to a minor third. The theme's characteristic half-note is elongated by a tied-over quarter-note; the theme's triplet (on beat 2 of m. 103) leads back to repeat the tied-over half-note/triplet combination. In place of the original descent and ascent through a whole-tone tetrachord, this energy-gathering fragmentation rises another minor third to beat 4 (tied over to the next downbeat) before returning to the D#4 on which the theme began.

Ravel ingeniously links the two themes p^2 and s through *Knüpftechnik*. The "waiting" minor thirds of the p^2 extension (mm. 88–89 and 95–96) become the main melodic motive (E♭–G♭) in mm. 99–100. Respelled enharmonically, they open the transformed theme s in m. 102. The concluding four pitches of theme s, on the other hand, are an octatonic transformation of the syncopated opening of p^2. The latter transformation foreshadows the octatonic return of p^2 in the recapitulation (mm. 137–142). Heading toward the movement's main climax at the end of the development, the triplet-figure of s combines with p^1-fragments, thus linking s with the denouement's descending chain of p^1-fragments (mm. 119–120). In m. 122, the chain's p^1-motive merges with an augmented form of $p^{1\ tra}$: first the triplets become straight eighth notes (m. 122), then the repeat of $p^{1\ tra}$ doubles the first four note values (mm. 123–124) and quadruples the first augmentation's eighth notes (m. 122) to syncopated half notes (mm.

124–126). In turning the almost insignificant motive of $p^{1\ \mathrm{tra}}$—which in m. 31 initiated the departure from p^3—into the agent of the retransition's composed-out *ritardando*, Ravel brings to mind Schenker's idea of *Aussaat und Ernte* (seed and harvest).

While the four instances of the p^2-theme form a chain of continuous transformation from exposition to recapitulation, the s-theme's transformations take on the more "traditional" role of thematic development. The s-theme, a coherent thematic unit in the exposition, gets fragmented and taken over by the climactic octatonic ascent, the force of whose intervallic progression robs it of its former serene identity. Dismantled rather than transformed during the development, theme s returns to its original expositional form in the recapitulation.

There, its melodic line remains unchanged for a full seven measures and three beats. Between exposition and recapitulation, theme s undergoes a thematic process of disintegration and restoration. However, since the recapitulation's harmonic motion has inevitably changed course (as it should for the S-zone), theme s finds itself in the different environment of F major, to which it adapts gracefully with the ESC in mm. 191–192. Overlapping with the ESC by one measure, an additional s-theme in mm. 192–200 transforms the corresponding s-theme of mm. 63–68 by MODROT and INTTRANS. Its initial tone A, $\tilde{4}$ of D minor, becomes C, $\tilde{4}$ of F major, and its first step interval is reduced from 4 to 2. The INTTRANS turns the theme's reciting tone from a 9–8 appoggiatura above D minor in the exposition into the minor seventh of F major. Mirroring the turn to the subdominant of many classical codas, the reflective mood of theme s at the minor seventh signals that the movement is about to complete its journey.

4.4.2. Transformations of p^1 Themes between Exposition and Recapitulation

While the antecedent of theme p^1 opens the recapitulation unchanged, its consequent undergoes harmonic changes that affect its interval structure (see **example 4.23**). In m. 133, the p^1 head motive is mapped onto the interval structure of the first violin's p^1 return (cf. m. 145). In mm. 134–136, the consequent sounds a half step lower than the corresponding measures in the exposition (mm. 6–8). Heading for a half cadence on #i (v of #4), the consequent prepares the octatonic transformation of p^2: F# in the upper voice is reinterpreted enharmonically as G♭, and F# in the bass moves to F, above which p^2 outlines the diminished seventh chord G♭–E♭–C–A.

The T_{11} relationship between the p^1 consequents also affects the subsequent transformations between the expositional and recapitulatory forms of p^3, p$^{1\ tra}$ and p$^{1\ chr}$. For p^3, the T_{11} transposition also prompts a modal change; E–a^{add6} becomes E♭^{7}–A♭^{add6}. The transposition by ST_2 of p$^{1\ dom}$ from prolonging A to prolonging C reflects the recapitulation's return to the F-major tonic with TM^3/S.

More difficult to compare are the C-zone's combinations of s and p^1 themes since they are not quite parallel. If, as in my analysis, the boundary of C is determined by the onset of the underlying whole-tone progression, the exposition's C begins with s in violin I (m. 69), while in the recapitulation's C the end of the post-ESC s theme in the viola (mm. 198) overlaps with the onset of p^1 in m. 201. Although it is easier to perceive m. 201 as a "beginning," I place the beginning of C with the cello's C# in m. 198. This interpretation is not only consistent with my analysis of form, it also allows me to compare p^1 in m. 74 with p^1 in m. 201 and aligns the remaining s- and p^1-theme fragments correspondingly. Apart from the transpositional relationship of T_{10}, the transformation of p^1 from m. 74 to 201 is interesting because its INTTRANS i^4+4 turns the exposition's original p^1 head motive into $p^{1\,dom}$. The key to the transformation lies in the rearrangement of step-relationships between bass and upper voice. In m. 74, the prolonged tone was the first note, C, a consonant third above the cello's A♭. In m. 201, the initial tone, A#, is an appoggiatura to the G# on beat 4, so that $p^{1\,dom}$ provides the consonant resolution, whereas the original p^1 would have resulted in a dissonant D# above the cello's C#. The s-themes of mm. 77 ff. and mm. 205 ff. are related by enharmonic change and interval transformation of their endings. Of the final p^1 statements in the exposition and recapitulation, only the first measure is directly comparable by motivic transformation. At the end of the exposition, the p^1 head motive is a transposition of the original p^1 head motive from m. 1. At the end of the movement, the descending leap has changed from a fourth into a fifth, creating a double appoggiatura, G–F as 9–8 above F, and C–B♭ as 6–5 above E♭.

4.5. Conclusion: The Interaction of Diatonic and Non-Diatonic Forces

In the first movement of his String Quartet, Ravel integrates into the sonata form non-diatonic elements, such as the octatonic passages and whole-tone progressions. Serving specific formal functions, these non-diatonic elements replace some of the tonal conventions of the classical-period models. Rather than basing the tonal design of the form on the tonic-dominant polarity that we most often associate with major-mode sonata forms, Ravel explores the pairing of third-related keys that we usually associate with minor-mode sonata form.[52] According to Hepokoski and Darcy, "in the mid-nineteenth century, the move to V, the key of generic tradition, remained a first-level default for expositions, but other tonal choices were also acceptable (especially various shades of mediants and *submediants*) as lower-level defaults for idiosyncratic structural implications."[53] Ravel carries this "lower-level default" to new heights in two ways.

(1) Rather than treating the two related keys as directly opposing forces, Ravel exploits the fact that they share the same collection by introducing an element of tonal ambiguity from the first phrase of the movement. That the F-major/D-minor juxtaposition becomes the central tonal issue of the sonata design is not a question of outright conflict but one of competitive coexistence: whatever tonic takes control of the bass also controls the harmonic motion but not necessarily the details of the upper voices. For example, in mm. 24–25, the bass progression implies a resolution from the dominant C to F in the cello. While violin I also resolves its appoggiatura E to F during the downbeat of m. 25, violin II pursues a progression that leads from the diminished seventh chord C#–E–G–B♭ to D minor. Similarly, the s-theme, harmonized in D minor in the exposition, returns at the identical pitch level in the recapitulation, but now in the context of F major. Only with its last three pitches does the theme adapt to the new reality (mm. 191–192), barely in time to complete the ESC with the bass's ii–V–I PAC. I see in this competitive coupling of relative keys a predecessor of the Piano Trio's double-tonic complex.

---

[52] The exploration of VI for S-themes originated with Beethoven. Hepokoski and Darcy cite Beethoven's String Quintet in C, op. 29, as an example where the "S-theme begins in a bright A major VI (mm. 41–51) but soon decays to A minor (m. 52), for the remainder of the exposition." See *Elements,* 120. Schubert experimented with similar key relationships.
[53] Ibid.; the emphasis is mine.

(2) Ravel integrates octatonic and whole-tone textures into this F-major/D-minor juxtaposition by assigning specific formal functions to each collection. He maximizes shared subsets to create smooth transitions between collections. As unordered collections, WT_0 and WT_1 serve as a buffer between the "incompatible" $OCT_{0,1}$ and the diatonic F-major/D minor collections. As ordered stepwise progressions in the bass, they outline the trajectory of the movement's closing zones, each collection associated with the key area whose pitch class it contains. $OCT_{2,3}$, which includes the pitches of both the F-major and D-minor triads, forms the connective tissue between these keys and collection $OCT_{0,1}$ during the development. The task of $OCT_{0,1}$ is to destabilize F major in the exposition (thus enabling D minor), and to dramatize the movement's climax before WT_0 negotiates the return of F major. In addition, Ravel employs the chromatically altered versions of the minor mode: melodic minor to leave the diatonic for the octatonic sphere, and harmonic minor as dominant preparation to return from octatonic to diatonic sections. Each of these collections is linked to specific thematic ideas and formal segments, so that we continuously associate thematic content, identity of collection, and formal function.

Thomas Kabisch explains the structural role of octatonicism in Ravel's String Quartet as follows: "Whereas the role of octatonicism in the exposition serves to create a transition between functionally clearly defined key areas, in the development the octatonicism becomes the intrinsic principle of organization."[54] However, I disagree on two grounds with Kabisch's interpretation that mm. 84–98 belong to the octatonic sphere

[54] "Dient die Oktatonik in der Exposition dazu, einen Übergang zwischen funktional eindeutig bestimmten Augangs- und Zieltonarten zu schaffen, so wird sie in der Durchführung des Quartetts zum eigenständigen Organisationsprinzip." Thomas Kabisch, "Oktatonik," 123; my translation.

with the melodic diatonic elements being "foreign" to the governing collection.[55] (1) In mm. 84–90, the beginning of the development, Ravel provides no aural clues that would entice the listener to hear the D-minor seventh chord in an octatonic context; moreover, the A♭-minor passage of mm. 91–98 is only *related* to the octatonic collection $OCT_{2,3}$ and not governed by it.[56] (2) Kabisch's analysis misses the process of gradual transformation from the diatonic D-minor/F-major sonority to the octatonic sonorities (mm. 98 ff.) via the A♭-minor collection of mm. 91–98. Ravel not only guides the listener with the clear melodic contour of p^2—whose subtle intervallic shifts help us perceive the changes in collection, he maximizes the shared subsets between successive collections to create smooth transitions between them.

Ravel's carefully crafted succession of referential collections (**example 4.24**) is intrinsic to the sonata form's design.[57] The example reveals how adjacent collections share at least half the pitch-class content of the "smaller" collection (that with the lower cardinality). Since the movement's central diatonic collection manifests itself as both F major and D minor, the pitches of both tonic triads are marked by white note heads. Tracking the presence of the two tonic pitches, F and D, in consecutive collections (vertical boxes), we can clearly see the shift from F to D in the course of the exposition. All collections that provide the pitch material for the P-zone include F. With the change to $OCT_{0,1}$, F loses its control over the pitch domain. It is still present (in fact, it is the tone of melodic resolution in mm. 25 and 26), but it is now in conflict with the new governing

---

55.Kabisch speaks of "diatonische[n] 'Verstöße' der Melodiestimme gegen die eindeutig oktatonische Ordnung" (diatonic 'violations' of the melody [in mm. 86–87] against the unequivocal octatonic order). Kabisch, "Oktatonik," 124.

56 Unlike Kabisch, I do not view the A♭-minor collection as a "modification" of the octatonic (p. 123). Perhaps Kabisch was tempted by the similarity of the second violin's figurations to those of mm. 24 ff.

57 On that point I agree with Kabisch.

collection. The intrusion of the octatonic sphere begins to destabilize the tonic. $OCT_{0,1}$ prolongs the diminished seventh chord C#–E–G–B♭. Its resolution to D minor in m. 25 foreshadows the trajectory of the TMB toward D. After a brief detour to the neighboring collection $OCT_{1,2}$, the return of $OCT_{0,1}$ serves to complete the motion to the A-major dominant. The combination of $OCT_{0,1}$ and $OCT_{1,2}$ in mm. 37–38 is therefore no coincidence as the two collections share the diminished seventh chord C#–E–G–B♭. Neither is it a coincidence that Ravel again places $OCT_{1,2}$ after $OCT_{0,1}$: sharing the maximum number of pitches (subset and identity relations excluded) with D harmonic minor, $OCT_{0,1}$ functions as the ideal hinge for the transition into diatonic territory and the motion to VI. With $OCT_{1,2}$, the pitch D establishes its presence as a permanent member of the collections that govern mm. 41 to 90.

In m. 91, Ravel again uses a chromatically altered minor scale, this time A♭ minor, to mediate between diatonic and octatonic areas (see **example 4.24**). Moving toward its climax, the development is driven by a linear ascending progression of $OCT_{2,3}$. Although the collection contains the pitch classes F and D, Ravel centers the passage on the diminished seventh chord D#–F#–A–C (respelled as F#–A–C–E♭ as the build-up nears its peak). At the moment of climax (in triple *fortissimo*), the sudden change to $OCT_{0,1}$ introduces a collection that includes neither D nor F. Only by alternating this collection with WT_0, with which it shares a four-note subset, does Ravel reintroduce D to the pitch repertoire. Not coincidentally, the shared four-note subset is the French augmented sixth chord, whose special role I have describe in previous sections.[58] By limiting the pitch

[58] For another discussion of the juxtaposition of collections before and at the movement's dramatic climax, see Steven Baur's excellent analysis of this passage in "Ravel's 'Russian' Period," 547–554.

repertoire to $OCT_{0,1}$ and WT_0 throughout mm. 119–128, Ravel withholds the pitch F. In fact, the last F we hear before the recapitulation is the chromatic passing tone in the viola in m. 114. This suggests that Ravel chose the unusual progression of the French augmented sixth chord (spelled as #I, but resolving like a ♭II) not only for its enticing coloration but to make the arrival of F a special pitch event.

Each of the referential collections fulfills a specific role in the sonata form's fabric of pitch repertoire and tonal design. To illustrate the relationship between the succession of collections and the sonata process, **example 4.25** maps the music's path through the various referential collections from the exposition to the beginning of the recapitulation. The collections are organized by areas. At the top level is the one-flat diatonic scale in both its F-major and D-minor rotations. The three octatonic collections take up the center of the diagram; the two whole-tone collections are at the bottom. The collections are arranged in a manner that allows shared subsets to be placed between any two adjacent collections. The subsets shown in this manner form harmonies that play significant roles in the sonata form's progress. Below the two diatonic scales are the F-major and D-minor triads and between them their combined sonority of the D-minor seventh chord. All three chords are also subsets of the $OCT_{2,3}$ collection beneath them. Below and to the right of $OCT_{2,3}$ is the diminished seventh chord it shares with $OCT_{1,2}$ (the collection beneath the chord). Below and to the left of $OCT_{2,3}$ is the diminished seventh chord it shares with $OCT_{0,1}$ (shown below that chord). Between $OCT_{0,1}$ and $OCT_{1,2}$ is their shared diminished seventh chord.

Below these two octatonic collections I have placed two whole-tone sonorities that play a role in the movement. On the left is the aforementioned French augmented sixth chord, a shared subset between $OCT_{0,1}$ and WT_0. On the right is the dominant ninth chord (with #4) that forms both the exposition's and the recapitulation's MC^1. A subset of WT_1, it also shares four of its five pitches with $OCT_{1,2}$ (all but the ninth, A).

The arrows connect the harmonies that represent various stages of the sonata form from exposition to recapitulation. They do not indicate voice-leading in a Schenkerian sense—although in many cases, the harmonies connect with a minimum of stepwise motion. The path begins with the movement's tonic, F major. The first arrow leads to the dominant ninth chord of MC^1 (mm. 21–23), which resides in the WT_1 area of the diagram. The chord functions as V/V to prepare TM^1. TM^1 (mm. 24 ff) is not represented by the bass's progression to C but by the collectional change to $OCT_{0,1}$ and the diminished seventh chord C#–E–G–B♭. As described above, this diminished seventh chord first functions only locally as a dominant to D-minor. A small "detour" to the neighboring $OCT_{1,2}$ and D–E#–G#–B (mm. 32–34), shown by the dashed arrows 2a and 2b, returns us to C#–E–G–B♭. Now representing both $OCT_{0,1}$ and $OCT_{1,2}$ (mm. 35–43), C#–E–G–B♭ merges with the A-major dominant (not shown since it belongs already to D minor) and resolves to the s-theme's D minor (mm. 55–68). The dotted arrow from WT_0 to the D-minor collection indicates that the whole-tone progression prolongs D. Since WT_0 ultimately does not change the D-minor harmony, the path moves directly from the EEC's D minor to the D-minor seventh chord that begins the development (m. 84). Since the subsequent A♭-minor collection of mm. 91–97 plays no role in the remainder of the movement, it is not included in the graph.

During the development's course, the motion to $OCT_{2,3}$ and $OCT_{1,2}$ transforms the initial D-minor seventh chord into the diminished seventh chord D#–F#–A–C (mm. 102–

118). The change to $OCT_{0,1}$ at the point of climax and its alternation with WT_0 produce the French augmented sixth chord that leads back to the F-major tonic. Although the diagram does not trace the recapitulation's path, I have included an arrow connecting collection WT_1 of the post-ESC whole-tone progression to the F-major tonic.

Examples 4.24 and 4.25 both provide excellent illustrations of the interaction of collections as they shape the movement's sonata form. As the only octatonic collection to contain the pitches of the F-major and D-minor triads, $OCT_{2,3}$ functions as a link to the diatonic sphere, especially at the beginning of the development. Although the collection's interval structure provides an aural contrast, its pitch content bridges the gap between the diatonic and octatonic spheres. The fact that in the recapitulation p^2 returns in none other than $OCT_{2,3}$ confirms this role. $OCT_{0,1}$, on the other hand, serves to provide contrast and introduce tonal instability. However, Ravel always mediates between $OCT_{0,1}$ and the one-flat diatonic collection by means of a brief whole-tone passage. In the exposition, WT_1 prepares for $OCT_{0,1}$, while at the end of the development, $OCT_{0,1}$ is followed by WT_0 to prepare the return of the F-major collection. As unordered collections, WT_1 and WT_0 serve the tonal function of a dominant; as ordered step-wise progressions, they prolong D minor and F major, respectively. The chromatically altered scales of harmonic and melodic minor maximize shared subsets to link the octatonic and diatonic spheres. The melodic minor leads away from the diatonic to the octatonic, while the harmonic minor prepares for its return. Signaling this succession of changing referential contexts, the motivic transformations become the aural markers that help us track the various zones of the sonata form.

Perhaps the non-diatonic collections are only pawns in the family feud involving the F-major/D-minor siblings. To conclude my analysis and the chapter, I offer a somewhat tongue-in-cheek narrative of the movement's sonata form. From the opening of the movement, D minor attempts to manipulate the shared family collection in its favor. In response, F major calls in WT_1 to set up an MC, MC^1 at V/V. As soon as TM^1/TR^1 takes place, D minor calls upon its acquaintance, $OCT_{0,1}$, to subvert at least violin I and II to its side, but since the cello allies its bass line with F, F still controls the family affairs. In its eagerness to assert its tonal power, however, F major fails to produce a satisfactory motion toward the EEC and loses the chance to introduce its C-major ally. Instead, the arrival during TM^2/TR^2 of the second octatonic visitor, $OCT_{1,2}$, weakens F major further. The two octatonic visitors conspire to set the dominant-stage (mm. 44–54) for a D-minor take-over. Rather than relying on any outsider's help, D minor produces the more convincing MC^2 itself and begins its reign with TM^3/S. The C-zone's WT_0 seems to appear neutral and leaves D-minor in control.

D-minor is going strong at the beginning of the development—although F major still asserts some influence at the family's seventh-chord table. With the visit of the distant relative A♭ minor (perhaps invited by F major, whose in-law, F minor, is very close to A♭ minor, especially since the latter decides to arrive on F), the family affairs get unsettled again. When $OCT_{2,3}$ decides to get involved during the second half of the development, it leads everybody into a big open crisis. At the crisis' culmination, $OCT_{0,1}$ takes over and, having had enough of the back and forth, works out a solution with WT_0 who—almost secretly—prepares for F major's return to power.

$OCT_{2,3}$ also returns during the recapitulation and reveals that its role was that of a mediator all along. After another few octatonic episodes, D minor returns to the family table during TR^3/S, but no longer challenges F. WT_1, still loyal to F major, clears the air and all is well.

CHAPTER 5

Sonata Form in Ravel's Piano Trio

In both of the Piano Trio's sonata-form movements, the opening *Modéré* and the concluding *Final*, Ravel plays with classical prototypes. While invoking classical models, he at the same time subverts them through subtle harmonic manipulation, wedding the aesthetics of classical form with the sophisticated harmonic language of the early twentieth century.[1] In both movements we find a recursive relationship between the formal divisions of the sonata type and those of the primary-theme zone: a binary design in the first movement and a ternary in the fourth.

Of all the pre-war sonata forms I discuss in this dissertation, the first movement of Ravel's Piano Trio is by far the most sophisticated. The movement's "Type 2" sonata form[2] features an A-minor/C-major double-tonic complex.[3] This has very interesting implications, both for a Schenkerian interpretation and for the overall tonal trajectory of the four-movement cycle. Since the first movement does not attain the original tonic's major mode, this task falls to the final movement. In fact, the tonal function of the first movement's double-tonic complex relates to the Trio's four-movement cycle as an exposition to a minor-mode sonata movement. The first movement's primary theme is not only indebted to the *rhythmic* characteristics of the Basque *Zortziko* as a musical

---

[1] In chapter 6, I point to some similarities between Ravel's formal designs and possible historical models, especially from Mozart and Chopin.
[2] Hepokoski and Darcy's term, see chapter 17 of Hepokoski and Darcy, *Elements of Sonata Theory*, 353–87. Throughout this chapter, I provide summaries of their concepts as relevant to my discussion.
[3] A thorough discussion of the origins and the term "double-tonic complex" follows on pp 181–82.

dance[4] but also to the verse and syllabic structure of the *Zortziko* as a *poetic* form. Thus, just as the *Pantoum* inspires the second movement,[5] a literary model also inspires the first movement (or at least its primary theme).

In contrast to the first movement's double-rotational Type 2 sonata form, the fourth movement's formal design follows that of the triple-rotational "Type 3" (or "textbook") sonata form but with the special features of a "continuous exposition" (without a medial caesura and secondary-theme zone) and with a "false start" to the recapitulation. While the first movement's design merges the developmental and recapitulatory spaces into one large, continuous section, the fourth movement's design foregoes the normative separation of the exposition into two sections in favor of a continuous expositional space.

As a sonata cycle, Ravel's Piano Trio exhibits a variety of cyclical features: a unifying tonal trajectory spanning the four movements; a highly complex network of motivic and thematic relationships; and symmetries and parallelisms in the formal design of movements, including the rhetorical role and placement of non-diatonic climax preparations.

The three parts of this chapter will (1) present an in-depth analysis of the trio's first movement **(5.1)**, (2) provide a formal analysis of the fourth movement **(5.2)**, and (3) detail the motivic, thematic, harmonic, and architectural forces that shape the trio's sonata cycle **(5.3)**.

---

[4] For a description of the *Zortziko* as a musical dance, see Denis Laborde, "Basque Music," *Grove Music Online*, ed. L. Macy (accessed 7/30/07), http://www.grovemusic.com.
[5] See Brian Newbould, "Ravel's Pantoum," *The Musical Times*, 116 (1975), 228–31.

5.1. Analysis of the First Movement

Ravel's Piano Trio, completed in 1914, forms the pinnacle of his pre-war compositions. The first movement's sophistication stems from the unusual path a highly condensed "Type 2" double-rotational sonata form takes through an A-minor/C-major double-tonic complex. The exposition's secondary-theme zone does not sound in the relative major (or in any of the keys suggested as lower-level defaults by Hepokoski and Darcy)[6] but instead remains in the tonic. The double-tonic complex arises because the motion to III is deferred to the point of essential structural closure (ESC) of the movement. When the secondary theme returns at the same pitch-level in the second rotation, its harmonic stability is undermined by the larger-scale motion toward the new C-major tonic.

This tonal scheme has multiple implications for a Schenkerian interpretation. First, unlike the other sonata forms of Ravel's pre-war period, the trio's background structure does not conform to Schenker's paradigm for a minor-mode sonata. It neither prolongs a single tonic nor shows the large-scale interruption of an *Ursatz* at the end of the development section and its subsequent completion at the end of the recapitulation. To negotiate between the first movement's double-tonic complex and Schenker's mono-tonal background structure, I will interpret the movement's trajectory from A minor to C major in two different contexts: that of the movement itself and that of the Trio's overall harmonic scheme.

---

[6] For a discussion of the harmonic defaults of the medial caesura and secondary-theme zone, see Hepokoski and Darcy, *Elements of Sonata Theory*, 25–36.

Second, although the middleground exhibits many typical features, such as descending fifth-progressions from the headtone E for both the primary and secondary themes and linear-intervallic progressions of parallel thirds and fifths, we also find non-diatonic progressions in the middleground.

In the following paragraphs, I first explain how Ravel bases the first movement's primary theme on the Basque *Zortziko* **(5.1.0).** I then relate the movement's overall form to Hepokoski and Darcy's model of the "Type 2" sonata **(5.1.1)**. Including a detailed Schenkerian reading of the whole movement, I discuss the tonal structure of its double-tonic complex **(5.1.2)** and detail intra-movement motivic relationships **(5.1.3)**.

5.1.0. The Basque *Zortziko* as Source for the Primary Theme

In his autobiographical sketch, Ravel refers to the "Basque flavor" of the "first theme" of his Piano Trio.[7] While previous studies have pointed out that the first movement's primary theme follows the characteristic *Zortziko* rhythm,[8] I will demonstrate that it also follows the syllabic and verse structure of the *Zortziko*'s poetic form.

The typical *Zortziko* rhythm

often appears in 5/8 meter, with a grouping of 3+2 eighth notes (see **example 5.1a),** but other meters are also possible (see **example 5.1b**).[9] The alternation of 5/8 and 3/8 meters

[7] See "An Autobiographical Sketch by Maurice Ravel" in Orenstein, *Ravel Reader*, 29–37; 32.
[8] See Hans Heinz Stuckenschmidt, *Maurice Ravel. Variationen über Person und Werk* (Frankfurt am Main: Suhrkamp, 1966), 182.
[9] The tunes of examples 5.1a–c and 5.5a–b were accessed through the database of Basque *Bertsolari* songs at www.bertsozale.com on June 24, 2007.

in **example 5.1c** features the same 3+2+3 grouping as in Ravel's compound 8/8 meter. Previous authors have speculated about which models may have inspired Ravel's *Zortziko*. Stuckenschmidt mentions the Basque song "Errefusa," arranged by Charles Bordes (**example 5.2**),[10] which shows the same metrical grouping, and cites also examples by Albeniz and Saint-Saëns (**examples 5.3 and 5.4**). I think there is evidence that Ravel was inspired directly by the traditional folk tunes themselves.

A *Zortziko* is not only a dance form with a characteristic rhythm, it is also a poetic structure, having eight lines and a specific syllabic pattern to each line (the Basque word *zortzi* means eight).[11] Most of the poetry was—and still is—sung or improvised to existing tunes. Since the distribution of text is mostly syllabic, the number of syllables for each verse closely corresponds to the number of musical notes of the tune to which the poetry is sung.

In the poetic form *Zortziko nagusia* (*nagusi* means "chief"), each odd-numbered verse has ten syllables, each even-numbered eight. In the *Zortziko txikia* (*txiki* means "small") the verses alternate between seven- and six-syllable lines (**example 5.5a**).[12] **Example 5.5b** shows how sometimes the six-syllable lines musically imitate the seven-syllable lines' feminine ending by adding a note to the last syllable.

A closer look at the first movement's P-theme in Ravel's Piano Trio shows that the theme follows the syllabic and verse structure of the *Zortziko txikia*: (1) the seven

---

[10] See Charles Bordes, "Douze Chansons amoureuses du Pays Basque françaises," *Chansons Populaires, Archives de la Tradition Basque* (Paris: Rouart, Lerolle & Cie, 1900), 20.
[11] See Laborde, "Basque Music," *Grove Music Online*; and Israel J. Katz, "*Bertsolaritza* and its Musical Foundations: Some Observations," *Voicing the Moment: Improvised Oral Poetry and Basque Tradition*, ed. Samuel G. Armistead and Joseba Zulaika (Reno: University of Nevada Press, 2005), 343–70.
[12] See Gorka Aulestia, *Improvisational Poetry from the Basque Country*, trans. Lisa Corcostegui and Linda White (Reno: University of Nevada Press, 1995), 22–24.

notes in each measure correspond to the seven syllables per line,[13] and (2) the eight measures of the repeated theme correspond to the eight lines of the poetic structure. To illustrate this correspondence, **example 5.6** juxtaposes the Trio's P-theme with the poem of the song "Amodio baida." While in the folk tunes the eight short lines are each different and form a single large unit, the division of the trio's first eight measures into two thematic units of 4+4 incorporates the parallelism of classical phrase structure. Instead of alternating measures with seven and six notes, which would have interrupted the melodic and rhythmic flow, Ravel prefers a feminine ending for all eight measures.

It is likely that Ravel had access not only to Bordes's Basque folk-song editions but also to other nineteenth-century collections of Basque folk tunes.[14] I found melodic similarities between the Trio's P-theme and the song "Adios Izar ederra" from Sallaberry's 1870 collection of Basque songs (**example 5.7**).[15] The similarities include the identical melodic outline of the first six notes, and the similar contour of the melodic descent in the tune's mm. 7 and 8. Knowing Ravel's eclecticism, I find it unlikely that he based his theme on a single folk tune.[16] Ravel would have been familiar with a variety of *Zortziko* features based on his interest in Basque music and folk tunes in general.[17]

---

[13] This might be one of the reasons Ravel chose the 8/8 meter: each measure corresponds exactly to one line with seven syllables, while the metric grouping exhibits the asymmetrical compound nature of the Zortziko rhythm.

[14] I purposefully drew all my examples of Zortziko folk tunes from such nineteenth-century compilations which can be accessed at the Basque site http://www.bertsozale.com and searched by century and poetic meter. A search for nineteenth-century *Zortziko txikia* tunes yielded 545 matches.

[15] Jean-Dominique-Julien Sallaberry, *Chants Populaires du Pays Basque* (Bayonne: Imprimerie de Veuve Lamaignêre, 1870), 214. A pdf file of the complete book is available at the internet archive of books, Canadian Libraries, URL: http://www.archive.org/details/paysbasque00salluoft.

[16] Unless I or someone else finds a specific Basque song as a convincing source for the Trio's theme, I will adhere to this hypothesis.

[17] See André Révész, "The Great Musician Maurice Ravel Talks About his Art," in Orenstein, *Ravel Reader*, 431–35; 431. See also Gustave Samazeuilh, "Maurice Ravel en Pays Basque," *La Revue musical* 19/187, (December 1938), 392–95.

5.1.1. Formal Considerations

Example 5.8a shows how the first movement of the Piano Trio fits the double-rotational form of Hepokoski and Darcy's "Type 2" sonata form. Hepokoski and Darcy describe Type 2 sonatas as "'binary' (or 'binary variant') structures in which what others have called the 'recapitulation' begins not with the onset of the primary theme (P) but substantially after that, most commonly at or around the secondary theme (S). … In a Type 2 format [the second] rotation begins as more normatively developmental section in a nontonic key. … At their conclusions, Type 2 sonatas may also be provided with a post-tonal-resolution (post-second-rotation) coda based on P."[18] **Example 5.8b** presents the formal divisions of the Piano Trio's first movement proportionally according to measure numbers. The alignment shows the near-perfect symmetry of the movement's design: the 59 measures of the first rotation balance the 58 measures of the second rotation plus coda.

5.1.1.1. Hepokoski and Darcy's Sonata Theory

In Hepokoski and Darcy's terminology, the principle of "rotation" is a "basic architectural principle of large-scale recurrence. … Rotational structures … extend through musical space by recycling one or more times—with appropriate alterations and adjustments—a referential thematic pattern established as an ordered succession at the piece's outset."[19] In sonata form, then, the referential thematic pattern is based on the four formal functions ("zones") present in the exposition (assuming that all four are present):

---

[18] Hepokoski and Darcy, *Elements*, 344. The rotational principle lies at the center of Hepokoski and Darcy's Sonata Theory.

[19] Ibid., 61.

the primary-theme zone (P); the transitional zone (TR); the secondary-theme zone (S); and the closing zone (C). In a normative two-part exposition, the "medial caesura" (MC), a rhetorical gesture of a pregnant pause before the onset of S (expressed by Hepokoski and Darcy with the evocative symbol ', an intake of breath), audibly divides the exposition into two larger parts: P followed by TR, and S followed by C. These four segments become the referential pattern for the remainder of the sonata form, both for the composer (who can choose to follow the sequence of sections or alter it), and for the listener, who will track the movement according to the presence or absence of thematic references to the four segments.

In Hepokoski and Darcy's classification, a "textbook" sonata form ("Type 3") has three rotations, one for the exposition, one for the development, and one for the recapitulation. The development's rotation is the most likely to show alterations (incomplete rotations or "writing over" new materials in place of one of the segments).[20] Rather than viewing double-rotational sonata forms as a deformation of the "textbook" sonata form, Hepokoski and Darcy explain them from a historical perspective. The "Type 1" sonata (containing only exposition and recapitulation, labeled *Sonatina* by A. B. Marx) has its origins in the early eighteenth century,[21] and the "Type 2" sonata "seems to have affinities with the less fully elaborated, earlier-eighteenth-century binary dance forms" and the binary sonatas of Domenico Scarlatti.[22]

---

[20] I explain Hepokoski and Darcy's concept of "writing over" on p. 175.
[21] Hepokoski and Darcy, *Elements*, 346.
[22] Ibid., 355.

Rather than viewing the formal design of the first movement of Ravel's Piano Trio as a deformation of a "textbook" sonata form, I shall discuss it in light of the Type 2 model.

5.1.1.2. The Piano Trio's First Movement as a Type 2 Sonata Form

Exposition

As in the normative Type 2 model, the exposition forms the first rotation of this sonata movement. The four-bar primary theme is first presented by the piano (**example 5.9**). The descent to scale degree 1 is only implied;[23] the tonic arrival at A major (!) is approached by arpeggiation, B, G, E. The fact that the P-theme fails to attain a PAC has implications for the overall melodic and tonal trajectory of the movement, which I discuss later. In m. 5, the strings join the piano to repeat the P-theme in a higher register. Ravel's choice to repeat the four-bar P-theme creates a small binary division of the P zone, which will be reflected in the large binary division of the movement's Type 2 sonata design.

The transition begins with a varied reiteration of the P-theme (mm. 9–12; see **example 5.10**).[24] Ravel's melodic and harmonic alterations signal that the P-theme is destabilizing, gathering momentum to launch the "energy-gaining" force of the TR phase.[25] One early indicator of the increase in activity is that now the strings join the piano in the theme's reiteration after only two measures. Ravel's subtle reharmonization of the theme's beginning (m. 9), with a C-major rather than an A-minor chord in the

---

[23] See my Schenkerian interpretation in section 5.1.3.
[24] This is a common TR-launching procedure; see Hepokoski and Darcy, *Elements*, 95.
[25] Ibid., 93.

piano's right hand above the bass tone A1, has multiple connotations. In the immediate, local context, the A-minor seventh chord initiates the descending circle-of-fifths motion from A through D (m. 11), G, and C (m. 13) to F (m. 14). At the same time, the A-minor seventh-chord sonority contains both triads of the A-minor/C-major double-tonic complex. In the overall context of the movement, the harmonization foreshadows the theme's C-major reharmonization in the coda, the only time in the remainder of the movement that P returns at its original pitch level, register, dynamic, and timbre. After the arrival at F major (m. 14), an ascending linear sequence of seventh chords on G–C, A–D, and B–E (mm. 15–17) gains momentum for the movement's first climactic passage in C# minor (mm. 17–20). The denouement from mm. 20 to 23 concludes with a PAC in B major. As V/V, this B-major sets up an expectation of a V:HC medial caesura preparing for an S-zone in V or v. However, in m. 24 the B major turns into a half-diminished seventh chord on B, launching another modulatory passage with which the TR-zone enters its second phase. The modulatory passage dissolves the energy-gain of two fifths "above" the tonic by returning to the dominant of A minor. Above the dominant pedal (mm. 28–34), an ascending motivic sequence contrasts a hemiolic grouping of 3+3+2 quarter notes with the bass's 3+2+3 *Zortziko* eighth-note grouping. (see **example 5.11**). The sequence, rising in crescendo, arrives at the medial caesura on E (i:HC) at the end of m. 31. Measures 32 to 34 function as caesura-fill (CF), whose alternating E-major and G-minor chords result in a phrygian melodic descent from E to A via B♭.

As a consequence of the E-major MC, the secondary-theme zone opens in A minor (see **example 5.12**). Hepokoski and Darcy offer a nice "whimsical" image for the role of the MC: “It may be thought of as metaphorically analogous to the moment of the opening of elevator doors onto a higher floor—making S-space possible or opening to the second part of the exposition.”[26] In this case, when the elevator doors open, we find ourselves still on the first floor! A brief glimpse at the deep-middleground graph (example 5.18) reveals that upon having reached a (melodically and harmonically) higher floor at m. 17, the elevator returns to the ground floor without having opened its doors. Ravel’s exposition thus begins the S-zone in the A-minor tonic.

The phrase structure of the S-zone’s first module (S^1, **example 5.12**) resembles that of a *Fortspinnung*-type sentence whose divisions are mostly articulated by transposition levels and changes in instrumentation or texture. The violin’s three-measure presentation of the S-theme in A minor (b.i., b.i. repeated, varied b.i. to *Fortspinnung*) is answered by the cello’s two-measure presentation (b.i., varied b.i. to *Fortspinnung*) in D minor. The piano accompanies the contrapuntal texture of the two string instruments with rather static, pianissimo block chords before taking over the theme in a descending *stretto* sequence (mm. 42–43), joined by the cello in m. 44 and the violin in m. 45 to reach A6. In the S-zone’s second phase (S^2, mm. 46–50; see **example 5.13**), the first violin descends pentatonically from A6, while the piano sustains the pedal tone E2 underneath descending accompanying harmonies drawn from the enneatonic collection $ENN_{0,1,2}$.[27] The cello descends twice chromatically from B♭ through A and G# (in two different

---

[26] Ibid., 25.

[27] My labeling of the three enneatonic collections is modeled after Joseph Straus’s labeling of the whole-tone and octatonic collections: the subscript numbers give the pitch-class transpositions of the specific collection’s interval cycle. Since the enneatonic collection is based on three pc transpositions of the augmented triad, the pc content of $ENN_{0,1,2}$ consists of the three augmented triads built on pc 0, pc1, and pc 2, thus C–E–G#, C#–F–A, and D–F#–A#, or [0, 1, 2, 4, 5, 6, 8, 9, 10]. To paraphrase Straus: the three enneatonic collections are identified by the two numerically lowest pitch-class semitones that uniquely define them. See Straus, *Introduction to Post-Tonal Theory* (3rd ed.), 144.

octaves) before settling on the E2 pedal tone as well. On the downbeat of m. 50, the violin arrives at the "essential expositional closure" (EEC). This PAC is approached from scale degree 2 (violin) and natural scale degree 7 (cello) and is supported by a clear v-i motion in the bass (piano). A small two-measure link that recalls the *stretto* episode returns the top voice to E6 (m. 52), where a P-based *ostinato* signals the closing zone (mm. 52–59; see **example 5.14**).

The closing zone combines the P-based *ostinato* in the piano with the S-zone's contrapuntal motive (see violin, mm. 39–44). While the bass of the section prolongs A2 (doubled with A1), the upper voices traverse a linear descent from E6 to E5 (mm. 52–58, the cello doubling the violin). A motion from an inner voice (B–C#–D) in the strings and a chromatic shift in the piano's harmony to B♭–D–G provide a parsimonious link to the onset, in D# minor, of the second rotation (A#–D#–F#, m. 60).

In the context of the classical era, a minor-mode exposition that fails to reach the relative major at the end of S invites hermeneutic interpretation. Hepokoski and Darcy describe the "extra burden of minor-mode sonatas" in great detail.[28] From the late eighteenth century onward, the minor mode was associated with "negative" connotations (e.g., darkness, gravity, oppression, etc.).[29] If major and minor form a binary opposition,[30] minor-mode sonata forms might represent a struggle to overcome the negative by transforming it into the "positive" major mode. In the exposition, the motion to the relative major is normally accomplished by S. Hepokoski and Darcy regard this move to III as such a "strong first-level default with regard to key choice" that "proceeding to any

---

28 Hepokoski and Darcy, *Elements*, 306.
29 Ibid., 308.
30 Ibid., 307.

other key area … suggests a set of uncommonly forceful expressive circumstances."[31] For cases in which TR fails to produce the MC that opens the S-space at III, Hepokoski and Darcy suggest two possible scenarios: TR might "initiate a motion" in the direction of a III:HC MC or be "still in the grip of the grounding tonal principle of the P-zone."[32] In both cases, the "initial field of the minor mode is represented as so coercive that it seems not to permit the generic modulation at all within part 1, resulting in a i:HC or highly rare i:PAC."[33]

In considering Ravel's Piano Trio, we should hesitate simply to adopt the hermeneutic pathways Hepokoski and Darcy offer for classical minor-mode sonata forms. Even though Ravel designs a great number of his sonata forms after classical models, a hermeneutic interpretation has to be based on the context of his *oeuvre*; that is, based on historical and analytical evidence. I will offer such a hermeneutic interpretation later on. In the next subsections, I will lay out how the exposition's attachment to the tonic key influences the movement's second rotation.

Development/Tonal Resolution

In their discussion of the Type 2 sonata, Hepokoski and Darcy point to the inappropriateness of the term "recapitulation" for this particular form.[34] The term "recapitulation" describes the "simultaneous arrival of P and the tonic key."[35] In Type 2 sonata forms, the tonic key may return only with S—but unlike P, S cannot signal the

---

[31] Ibid., 310.
[32] Ibid., 29.
[33] Ibid., 311.
[34] Ibid., 353.
[35] Ibid.

beginning of a rotation. Therefore a "recapitulation" cannot really begin with S.[36] Instead, Hepokoski and Darcy refer to the two parts of the second rotation as "Development" and "Tonal Resolution," respectively. As shown in **examples 5.8a and b**, the development contains P- and TR-based modules, while the tonal resolution is achieved by S and C.

The second rotation begins the development with P-based material. Rather than launching the development with the P-theme itself, Ravel chooses to alternate the P-based ostinato of the C-zone in the piano's left hand (mm. 60, 62, 64, and 66) with P-theme fragments, first in the violin (mm. 61 and 65), then in the cello (mm. 63 and 67). The violin's contrapuntal motive from mm. 39–44 functions as secondary voice in the strings (whenever the individual string part does not have the P-theme). At the same time, the piano's right hand alternates a sixteenth-note accompaniment figure, based on the S-theme,[37] with thirty-second-note arpeggios of seventh chords. While the complex interaction of multiple themes is certainly a hallmark of the developmental space, the absence of a more "pure" P-theme suggests that the P-space has been "written over."[38] "A P-based opening [of the developmental space] invites the understanding that a new rotation is underway. This is reinforced if the development proceeds into TR."[39] Hepokoski and Darcy consider a development that begins with a C-based module as a third-level default: "In most cases what begins the development is not C^1 but reverberations of ideas from the end of C. … When such C-based openings occur, they imply the presence of a strong 'final' that captures and arrests our attention, one whose

---

[36] As I am presenting here a very abbreviated version of Hepokoski and Darcy's explanation, the reader may want to consult chapter 17 of their book.
[37] This thematic correspondence was first pointed out by Braun; see *Die Thematik*, 121.
[38] Hepokoski and Darcy, *Elements*, 212–15.
[39] Ibid., 212.

forcible gestures, still echoing, override the more standard appearance of P at this point."[40] This suggests a "curious overlapping of rotational implications,"[41] since the P signals a new rotation, while the C-based opening seems to extend "the ideas of the expositional rotation into the developmental space."[42]

Since Ravel's second rotation begins with an eight-measure hybrid between a C-based and P-based (and, to a much lesser degree, S-related) opening, the implications are subtler. While the C-based ostinato certainly blurs the boundary between the first and second rotations (or between the end of the exposition and the beginning of the development), the fact that C itself is derived from P does maintain the rotational order of thematic sequence. The alternation of the closing ostinato with upper-voice P fragments in a call-and-response pattern further tilts the opening hybrid in favor of P. The S-based accompaniment ripples provide only a surface disturbance of the overall clear waters of the P/C-based hybrid. **Examples 5.8a and b** show that these eight measures parallel the beginning of the first rotation. The next four measures (68–71) recall the opening theme more explicitly while continuing the S-based accompaniment and maintaining the two-measure call-and-response pattern between the piano and the strings. The parallelism of thematic sequence suggests that, as in the first rotation, this statement of P—in E minor over a C# pedal tone—launches TR. This is confirmed by the ascending linear sequence of seventh chords in mm. 72–74 (E–A, F#–B, and G#–C#), which culminates in the *fortissimo* arrival at the B♭-minor chord in m. 74.[43] Prolonging the B♭-minor harmony, a

---

[40] Ibid., 215.
[41] Ibid.
[42] Ibid.
[43] Unlike mm. 15–17, an explicit crescendo is lacking this time. In the Schenkerian graphs of examples 5.18–20, the E in parenthesis signifies that E, present in the cello on the fourth eighth note of m. 72, is

second rapid climactic ascent leads to the *fortissimo* statement of P at m. 77. Alas, the climactic return of the P-theme does not signal a tonal return or a recapitulation; the bass's leap from A to the dissonant D at the end of m. 77 proves that, as in the exposition, the climactic arrival is just a short moment *en route* to the S-zone. The denouement, mm. 78–79, parallels that of the exposition (mm. 21–22) but then merges with the approach to S. Unlike the exposition, the approach here does not articulate a caesura. On the contrary, the melodic descending-fifth line, formerly the caesura-fill E–D–C–B♭–A, continues into the S-space: while the cello begins the secondary theme in m. 83, the piano completes the descent from E to A in mm. 83–85, even going beyond A to G. (The overlap is shown in **examples 5.8a and b**.)

Harmonically, the return of S does not provide the expected tonic resolution either. Even though S returns at its original A-minor pitch level, the return to an A-minor tonic has been thwarted by the unyielding D pedal, which first spoiled the P-theme's tonic triumph and now literally undermines the secondary theme's rootedness in A minor.

As I explained in chapter 2, the bass's D in m. 77 forms a "hostile" subposition that alters the function of the harmony, thus altering the course of the second rotation and with it, the tonal trajectory of the whole movement. During mm. 77–85, the ninth chord on D changes its function from iv of A minor into ii of C major. This is the juncture that determines the final course of the movement's double-tonic complex.

Compared to the expositional rotation, the theme of S^1 is redistributed; its first two measures (b.i. repeated) sound in the cello, followed by the varied b.i. in the piano

---

implied in the bass. The actual bass note sounds B. Because B participates in a larger-scale whole-tone progression in the bass, it has precedence over the sequential pattern that implies the E.

(mm. 83–85). The D-minor version of the theme (played by the cello in the exposition) follows in the piano, but now above a G pedal tone (mm. 86–89). S^2 again features the violin's pentatonic descent accompanied by the piano's chords drawn from the enneatonic collection $ENN_{0,1,2}$ (mm. 90–93). In m. 93, all voices finally cooperate with the G pedal's dominant function to provide the movement's essential structural closure (ESC) in C major (m. 94). As in the first rotation, a two-measure link connects the cadence with the C-zone. This time, the link's ascending S-based sequence reaches E♭6 to begin the closing zone. E♭ is the top voice of an A♭-major 6/3 chord. My Schenkerian reading reveals how this A♭-major harmony, prolonged throughout the closing section, relates to the C major it embellishes as a common-tone neighboring sixth chord. In the course of the second rotation's closing section, initially extreme registers (spanning from C1 in the bass to E♭6 in the top voice) in m. 96 contract into the space of a minor sixth as the voices converge in m. 107 on C3, E♭3, G♭3 and A♭3 (the B♭ is passing). This harmony functions as a common-tone augmented-sixth-chord neighbor to the coda's C major.[44]

The coda recasts the movement's beginning in the light of C major— a C major colored both with F# (which initially had provided the dorian inflection of A minor) and with harmonizations whose A♭ and B♭ carry the vestiges of the C-zone's A♭-major harmony (Riemann's *Leittonwechselklang*/leading-tone-exchange chord of C minor). This is the first time since the beginning of the movement that we hear a true return of the P-theme at its original pitch level and in the same texture. As if slightly distorted sounds were reaching us from a distance, the C-major reharmonization evokes the movement's

[44] See Aldwell and Schachter, *Harmony and Voice Leading*, , 557. For contextual reasons, Ravel spells what otherwise would be an F# as G♭.

beginning. Placed in the coda, the C-major P-theme appears like an afterthought, a memory of its original A-minor manifestation transformed by distance in space and time. Ravel's indication *lointain*—from afar—directly expresses this idea. Rather than arriving at a known destination, as a classical sonata would, this music dissolves into open space.

As the return of S in rotation 2 changes course toward an ESC in C major, we realize that Ravel has postponed the attainment of the major-mode III—which we expected during the exposition's S-zone—to the end of the movement. The movement's formal design as a Type 2 sonata and the tonal trajectory of its double-tonic complex are intricately connected. The exposition's inertia, its refusal to leave the tonic plateau, postpones the motion to C major until the second rotation's return of S. The Type-2 model is the ideal vehicle for merging the developmental function with an unexpected tonal resolution: in this movement, a separation between the "development" and "recapitulation" spaces is not merely "inappropriate," it is impossible.[45]

Succumbing to a kind of tonic inertia, the S-theme cannot accomplish its "normal" mission. Not only does it remain in the minor tonic in rotation 1, it does not even sound in the new tonic, C major, when it returns. C major is accomplished *in spite* of the S-theme's insistence to return at pitch. Since the S-theme does not undergo any transformation "voluntarily," it is forced to surrender to the bass's tonal trajectory.

The same compositional forces that postponed the motion to III also motivate the hybrid theme-structure at the onset of the second rotation. Ravel saves the "pure" return

---

[45] This might explain the great discrepancies among some of the published analyses of the movement. Richard Dowling, for example, locates the beginning of the recapitulation at rehearsal No. 8 (m. 68). See Dowling, "Maurice Ravel's *Trio pour piano, violon et violoncelle*," 189. Braun, on the other hand, places the recapitulation at the return of the secondary-theme zone (m. 83). This analysis reflects the conventional reading of Type 2 second rotations, as discussed in Hepokoski and Darcy. See Braun, *Die Thematik,* 121.

of P for the coda. As I will show in my Schenkerian interpretation, the motion to III at the end of the movement and the reiteration of the head-tone E, both of which leave the movement somewhat open-ended, are part of a larger design that spans all four movements.

5.1.2. Tonal Structure

The first movement of Ravel's Piano Trio begins in A minor and ends in C major. The tonal implications of this seemingly simple fact are rather complex and interesting. Recent theoretical writings refer to interaction between two tonal centers variously as "directional tonality," "tonal pairing," and "double-tonic complex" (henceforth DTC).[46] In this movement, the DTC permeates all levels of musical activity, shaping motives, harmonic sonorities, and the large-scale tonal structure. My discussion of the movement's DTC takes up each of these topics in a separate section.

5.1.2.1. The Double-Tonic Complex: Introduction

The term "double-tonic complex" shall serve as an umbrella for a group of related tonal phenomena. According to previous definitions by Robert Bailey, Christopher Lewis, Harald Krebs, and Boyd Pomeroy, we may distinguish three DTC scenarios, to which I add a fourth.

---

[46] The terms "directional tonality" and "double-tonic complex" were coined by Robert Bailey; the concepts appear first in"The Genesis of Tristan und Isolde and a Study of Wagner's Sketches and Drafts for the First Act" (PhD diss., Princeton, 1969), the terms themselves in "An Analytical Study of the Sketches and Drafts," in *Prelude and Transfiguration from "Tristan und Isolde*," ed. Bailey (New York: Norton, 1985), 113–46.

1. *Directional Tonality*: the tonal center shifts from one tonic to another over the course of the movement/piece.[47]
2. *Tonal Pairing*: "Two keys simultaneously occupy the highest position in a tonal hierarchy"[48]—"without (necessarily) entailing any overall directional process."[49]
3. *Merged Pairing*: Two tonic triads merge into a single "dissonant referential [tonic] sonority," for example, a diatonic seventh chord merges two third-related triads.[50]
4. *Bitonality/Polytonality*: "The concurrent horizontal prolongation of two or more keys."[51]

According to Bailey, in a DTC "either triad [of the pair] can serve as the local representative of the tonic complex. Within that complex itself, however, one of the two elements is at any moment in the primary position while the other remains subordinate to it."[52] Based on Christopher Lewis's discussion of tonal pairing,[53] Krebs provides a

---

[47] Boyd Pomeroy, "Tales of Two Tonics: Directional Tonality in Debussy's Orchestral Music," *Music Theory Spectrum* 26/1 (2004), 87–118; 88.
[48] Harald Krebs, "Some Early Examples of Tonal Pairing: Schubert's 'Meeres Stille' and 'Der Wanderer'," *The Second Practice of Nineteenth-Century Tonality*, ed. William Kinderman and Harald Krebs (Lincoln, NE: University of Nebraska Press), 17–33; 17. Krebs understands the term "Double-Tonic Complex" as a synonym to "tonal pairing."
[49] Pomeroy, "Tales of Two Tonics," 89.
[50] While I base my definition on Pomeroy's, the term "Merged Pairing" is my own. See Pomeroy, 89. Pomeroy thinks of this scenario as a special case of "Tonal Pairing" and restricts it to third-related keys. My definition of "Merged Pairing" elevates Lewis's conflated "tonic sonority" from a surface feature to the level of a dissonant *structural* prolongation. It is conceivable to include other (than third-related) common-tone pairings in this separate category.
[51] Pomeroy, 89. Ravel seems to have explored the option of bitonality only after the war. A fascinating article that explores prolongational aspects of bitonality in Ravel's post-war works is Kaminsky's "Ravel's Late Music and the Problem of 'Polytonality'."
[52] Robert Bailey, "An Analytical Study of the Sketches and Drafts," 121–22; quoted in Krebs, "Some Early Examples," 17.
[53] Christopher Lewis, *Tonal Coherence in Mahler's Ninth Symphony*, Studies in Musicology no. 79 (Ann Arbor: UMI Research Press, 1984), 6.

summary of the ways in which tonal pairing may manifest itself at the musical surface: "(1) juxtaposition of musical fragments implying the two tonics in succession or alternation; (2) mixture of the two tonalities, exploiting ambiguous and common harmonic functions; (3) use of a tonic sonority created by the conflation of the two tonic triads; and (4) superposition of lines or textures in one key on those in another."[54]

In the first movement of Ravel's Piano Trio, *directional tonality* operates at the level of the movement as it progresses in time from A minor to C major. Aspects of *tonal pairing* emerge when we consider the role of the coda and the first and second movements' tonal relationship (the second movement's opening immediately recontextualizes the first movement's final sound, the third C–E, in A minor). In addition, we find all of Lewis's surface manifestations of tonal pairing. The conflation of A minor and C major into a single seventh chord informs the motivic structure of both primary and secondary themes and shapes transitional sections. Its continued presence as a sonority subtly hints at the simultaneous presence of both keys even where the succession of voice-leading events shifts the balance from one tonal center to the other. For example, the brief post-cadential expansion after the A-minor EEC (m. 50) adds a G to the prolonged A minor in m. 51, while the ESC in m. 94 colors its C-major arrival with the added sixth A.

[54] Krebs, "Some Early Examples," 18.

5.1.2.2. The Double-Tonic Complex: Motivic Considerations

The combined pitches of the A-minor and C-major triads, A–C–E–G, function almost like a Schoenbergian "musical idea" or a Rétian "basic cell."[55] To avoid the connotations that go along with these terms, and to avoid mixing too many analytical methods, I will call A–C–E–G a "referential motivic set" (RMS). The RMS contains a limited number of pitches that serve as a matrix for melodic, harmonic, and structural features of the movement. **Example 5.15** juxtaposes the movement's most salient passages built from the RMS. I will discuss the motivic relationships in the order of the example.

Main Themes

At the beginning of the primary theme (m. 1), the *Zortziko* rhythm metrically emphasizes the A-minor triad on the first and fourth eighth notes and the C-major triad on the sixth eighth note of the measure. In Schenkerian terms, Ravel connects the *Kopfton* of the initial A-minor harmony, E, with its upper third G, harmonized with a C-major chord. As discussed earlier, in m. 9 Ravel reharmonizes the primary theme's beginning with an A-minor seventh chord to launch the transition's circle-of-fifths progression, thus merging the A-minor and C-major triads into a single sonority.

The secondary theme (mm. 35 ff.) outlines the RMS melodically as a series of ascending thirds, A–C–E–G (B is passing, D is the lower neighbor to E). The

[55] See, for example, Arnold Schoenberg, *Fundamentals of Musical Composition*, ed. Gerald Strang and Leonard Stein (London: Faber and Faber, 1967); *The Musical Idea and the Logic, Technique, and Art of Its Presentation* ("Der musikalische Gedanke und die Logik, Technik und Kunst seiner Darstellung," 1925–36), ed. and trans. Patricia Carpenter and Severine Neff (New York: Columbia University, 1995); Rudolf Réti, *The Thematic Process in Music* (London: Faber, 1961).

transposition of the S-theme to D (m. 38), outlining D–F–A–C, foreshadows that harmony's role as structural subdominant (of A minor) or supertonic (of C major) in m. 80. More strikingly, the theme's varied continuation in m. 39, arpeggiating D–F–A–C–E, with E echoing the violin's 9–8 suspension, anticipates the large-scale suspension of mm. 80–86.[56] The S-based accompaniment figure of the development locally prolongs the same seventh-chord sonority, first transposed to D#–F#–A#–C# (mm. 60 and 62), then transformed into a major-minor seventh chord, G#–B#–D#–F# (mm. 64 and 66). Even the non-motivic arpeggios in the intervening measures are based on seventh-chord sonorities (D# half-diminished in mm. 61 and 63, B major-minor in mm. 65 and 67).

Other Manifestations of the RMS

The RMS figures prominently also in the second module of the S-zone (S^2 with post-cadential link in the first rotation, mm. 46–50, and S^2 plus link in the second rotation, mm. 90–95). The violin's pentatonic descent combines the P-theme's lower-neighbor figure with the S-theme's rhythm and third-chain (almost an inversion of the original outline, only that the passing tone D now fills out the second third; see **example 5.15**, fourth system). This passage reveals the close relationship between Ravel's pentatonic melodic motives and the minor seventh chord or its first inversion, the major added-sixth chord. Since the minor seventh chord is a four-note subset of the pentatonic, Ravel needs only to add a passing tone between the pitches of the chord's major third to complete the collection.

[56] Please refer to my Schenkerian graphs of the movement (exx. 5.17–5.20).

The almost obsessive reiterations of the S-derived accompaniment figure in the strings at and after the movement's final climax (mm. 77–82) prepare for the entry of S^1. Even though this figure presents the original RMS A–C–E–G, it is ultimately subordinate to the transposed, subdominant RMS D–F–A–C. The combined RMSs form a super-RMS, the eleventh chord D–F–A–C–E–G (m. 80). The eleventh, G, is the least structural of these pitches, ultimately dropping to an inner voice to function as a lower neighbor to A. The ninth, E, forms a 9–8 suspension above D. However, just as the DTC allows us to perceive the RMS as two simultaneous triads, A minor and C major, with the shared third C–E, Ravel's instrumentation lets us hear the super-RMS as two simultaneous seventh chords with a shared third, A–C. The overall effect of the super-RMS is tonal ambiguity. That the S-theme insists on its original pitch level, remaining seemingly oblivious to the bass's new trajectory, obscures the turn toward the "new" tonic at least until m. 86. Even then, the S-theme's transposition to D prevents us from securely identifying the bass's G as the structural dominant.

5.1.2.3. The Double-Tonic Complex: A Schenkerian Interpretation

How can we reconcile the DTC with Schenker's paradigm—either with the "prolongation of a division (interruption) [that] gives rise to sonata form"[57] (see **examples 5.16a and b^1**) or with one of the undivided *Ursatzformen*? Though Schenker did not accept non-mono-tonal background structures, we can conceive of a background paradigm at least for third-related tonal centers. Pomeroy offers such a paradigm for moving from the first tonic to the second a third higher: "An initial primary tone of $\hat{5}$

[57] Schenker, *Free Composition*, 134.

(supported by the opening tonic) eventually becomes $\hat{3}$ over the final tonic, subsequently completed by a $\hat{3}$–$\hat{2}$–$\hat{1}$ descent."[58]

In the first movement of Ravel's Piano Trio, the motion from A minor to C major involves such a reinterpretation of the movement's headtone E, from $\hat{5}$ in A minor to $\hat{3}$ in C major (**example 5.16c**). More challenging, however, is to place the reinterpretation in the context of sonata form. *If*, as Schenker states, a sonata form depends on the interruption structure (**examples 5.16a and b^1**), we must find a background structure for the DTC that places the reinterpretation of the primary tone *after* the interruption.[59] **Examples 5.16d, e, f and g** show three possible interruption forms. At **d**, the fundamental line's first branch is interrupted at scale degree 2 of the original tonic. At the beginning of the second branch, the primary tone is reinterpreted from $\hat{5}$ in the original tonic to $\hat{3}$ in the new tonic, arriving at the new scale degree 1 after only two steps, "too early" in terms of the trajectory suggested by the initial fundamental line. At **e**, the first branch is interrupted at scale degree 2 over the dominant. $\hat{2}$ becomes an inner-voice leading tone to scale degree 1 of the new tonic. At **f**, the interruption occurs also at scale degree 2 of the original tonic, but this time it is supported by a prolonged dominant. V becomes III# of the new tonic, while $\hat{2}$ turns into $\hat{7}$ of the new tonic.[60] At **g**, the interruption occurs at $\hat{4}$ over V7. This situation constitutes an interruption rather than a

---

[58] Pomeroy, 88. However, Krebs points out that "the tonal dualisms … cannot be captured in detail in a single sketch." (Krebs, footnote 7, 32.) Instead, Krebs vertically aligns alternative readings for each key of the tonal pairings in the Schubert songs he discusses.

[59] A reinterpretation before the interruption would suggest an off-tonic beginning that most likely would not truly belong to the background itself.

[60] In *Harmony*, Schenker describes such a tonicization by descending third, III#-I, as inducing "some kind of deceptive cadence effect," which is weaker than a tonicization by fifth. See Heinrich Schenker, *Harmony*, trans. Elisabeth Mann Borgese, ed. and ann. Oswald Jonas (Chicago: University of Chicago Press, 1954), 265–68.

lower neighbor motion because as seventh of the V7, scale degree 4 has a tendency to descend; thus the fundamental line's downward trajectory is interrupted.[61] At the outset of the fundamental line's second branch, the primary tone is reinterpreted as $\hat{3}$ and proceeds to complete the $\hat{3}$– $\hat{2}$–$\hat{1}$ descent.

However, as Ernst Oster explains in his famous footnote in *Free Composition*, uninterrupted sonata movements that begin on $\hat{5}$ are not infrequent.[62] In a sonata exposition whose S-zone cadences in the dominant, the headtone $\hat{5}$ can be prolonged above an inner-voice motion from $\hat{3}$ to $\hat{2}$. In that case, the dominant functions as a divider, and $\hat{5}$ carries through to the recapitulation. Since in Schenker's prototypical minor-mode sonata form the fundamental structure moves to $\hat{3}$ above III at the end of the exposition (**example 5.16b^1**), it is equally plausible that the descent to $\hat{3}$ is to an inner voice above which the headtone $\hat{5}$ is still active (**example 5.16b^2**).

In the strictly mono-tonal practice of Schenkerian analysis, the structures shown as **examples 5.16c–g** are incomplete. Rather than presenting the fundamental structures of an entire sonata movement, they resemble the structure of a minor-mode sonata exposition. **Examples 5.16h–j** show their hypothetical completions.[63] In Ravel's Piano Trio, however, the large-scale motion from A minor to C major spans the entire first

---

[61] Schenker presents this type of interruption in his *Eroica* analysis. "The first middleground layer … shows the interruption $\hat{3}$-$\hat{2}$ || $\hat{3}$–$\hat{2}$– $\hat{1}$. The seventh over V, instead of arising as a result of passing motion from the octave (V^{8-7}) , seems to come about by means of a leap of a third from the fifth ($V^{5-\flat 7}$). However, the elevation of $\hat{3}$ ultimately creates an *impression* of neighbour-note motion $\hat{3}$–$\hat{4}$–$\hat{3}$." See Heinrich Schenker, *The Masterwork in Music vol. III (1930)*, ed. William Drabkin, trans. Ian Bent, William Drabkin, Alfred Clayton, and Derrick Puffett, *Studies in Music Theory and Analysis* (New York: Cambridge University Press, 1997), 10–68; 10 and figure 1, the emphasis is mine. The graph of figure 1 shows that Schenker places the interruption after scale degree 2. Although the seventh in question, A♭ above B♭ major is slurred both to the F ($\hat{2}$) and, as a neighbor note, to the second-branch $\hat{3}$, its black notehead shows it as subordinate to the interruption at $\hat{2}$.

[62] Schenker, *Free Composition*, 139n.

[63] See Krebs's hypothetical endings in his examples 1 and 3, pp. 21 and 29.

movement (**example 5.17**). Does the DTC leave the movement tonally incomplete? If so, what are the consequences for the Trio as a four-movement cycle?

To answer the first question, we must investigate the balance between A minor and C major as well as the movement's path from the first to the second key. I will address the second question in section **5.3.**

5.1.2.4. A Schenkerian Reading of the First Movement

Examples 5.18 and 5.19 show voice-leading graphs of the first movement at two levels of the middleground, while **example 5.20** shows four layers of foreground. The middleground graph of **example 5.18** aligns the formally corresponding sections of the two rotations above each other

The headtone E is prolonged throughout the exposition. Unlike "standard" minor-mode sonata forms, the secondary-theme zone (S) continues to prolong the A-minor tonic.[64] Both primary and secondary themes feature two complete fifth-descents. In both themes, the first descent is in the obligatory register (E5 to A5); the second descent is an octave higher in the P-theme (E6 to A6) and an octave lower in the S-theme. In the P descents, the first 5-line's arrival at scale degree 1 is only implied as the arpeggiation to the inner-voice E4 suggests a *Tieferlegung* of the headtone E5, subsequently coupled with E6. In the S progressions, the first 5-line's arrival at scale degree 1 forms a dissonance over a locally prolonged diminished seventh chord on E2, while the

[64] The exposition's tonic S-zone may have been inspired by Chopin's Piano Sonata op. 4 (I) and his Concerto op. 11. In the C-minor Piano Sonata, the exposition's S-zone never leaves the C-minor tonic. In the first movement of the E-minor Concerto, the exposition's S-zone sounds in the parallel key of E major. In the recapitulation, it returns in G major before the movement's conclusion finds its way back to E minor. The third relationship, i(I)-III, between the two S-zones is the same as that in the first movement of Ravel's Piano Trio.

completion of the second S-progression brings about the exposition's EEC—an octave below the obligatory register.

Subordinate linear progressions shape the exposition's TR- and C-zones. TR first traverses a linear ascent from E5 to E6 (colored with F# and B♭, #$\hat{6}$ and ♭$\hat{2}$ in A minor) to gather momentum for the movement's first climax (reh. 2). A circle-of-fifths progression in the bass creates a larger descending third, from the tonic A1 through G1 to F2, in contrary motion to the upper voice's ascent. Once the outer voices have reached F2 and A5, they progress in parallel tenths (these are voice-leading tenths, not literal tenths, since Ravel widens the registral space in preparation for the climax) through four whole steps, traversing WT_1 in the bass and WT_0 in the upper voice.[65] From the peak E6, the upper voice descends through D#6 (m. 20), C#6, and B#5 before the denouement drops to an octave below the obligatory register for a PAC in B major (II# or V/V). The B-major cadence does not keep its promise to lead us toward the dominant, away from the tonic's gravitational pull. Instead, a second TR-module resumes the stepwise descent in the higher register, moving through intervals 7–6–5 above B and thus prolonging the half-diminished seventh chord B–D–F–A. Both upper voice and bass lead in contrary motion back to E. The arrival at the dominant forms the movement's medial caesura, subsequently filled out (caesura-fill, CF) by a small fifth-descent that recalls the high register and mirrors the phrygian coloration at the outset of TR. The final linear

[65] An alternative reading of this compound LIP (10-5, 10-5, etc.) is possible: rather than interpreting the downbeat intervals between upper voice and bass as the more structural pattern, one could take every other bass note (the resolution on the last dotted quarter of each measure) as the main strand of the circle-of-fifths progression. This would yield the parallel fifths C–G, D–A, E–B. I prefer the parallel-tenth pattern for three reasons: (1) the tenths are metrically emphasized; (2) the purpose of this passage is a dynamic motion forward toward the climax, reading the weak-beat resolutions, as the main voice is counterintuitive to the forward motion; and (3) the fifth pattern would not coincide with the strong arrival at the melodic peak in m. 17.

progression spans the entire C-zone, once more traversing the octave from E6 to E5 above the pedal A2 (with A1 doubling) and confirming the prolongation of headtone E by returning it to the obligatory register. The accompanying harmonies are less stable: at the outset of C (m. 52), A minor is enriched with an added sixth, F#—a subtle variation of the RMS sonority. Measures 56–59 prolong a major ninth chord above the A pedal, destabilizing the tonic function in preparation for the development. Measure 59 provides a chromatic link between the exposition's A minor and the development's D# minor. (Together, the two tonics outline $OCT_{0,1}$.) While these keys form opposing poles in the diatonic spectrum, Ravel links them smoothly with a passing G minor chord above the A pedal: C# moves to D, G remains, and B moves to B♭. Parsimonious voice leading then connects D to D#, connects G to F#, and turns B♭ into A#. The bass's dissonant skip from A2 to D#2 cannot be explained directly in diatonic terms. Knowing Ravel's predilection for unresolved appoggiaturas, I imply an elided motion from A2 to B♭2 with G as an unresolved appoggiatura to F; the implied B♭-major chord (♭II in A minor, with added sixth G) functions enharmonically as V of D# minor.

The bass's D# (m. 60) initiates a large-scale whole-tone progression in the bass that eventually leads to the structural dominant G in m. 86. C#2 (doubled with C#1) in m. 68 combines with the E-minor return of the P-theme to form a passing half-diminished seventh chord; B in m. 72 launches the TR circle-of-fifths/whole-tone progression toward the movement's second climax (mm. 74–77). The climax seems to bring about the return of the P-theme at registral extremes with the headtone E7 above the tonic A0. However, as shown in chapter 2, the hostile subposition of D below A minor thwarts P's triumphant return to the A-minor tonic. As the upper voice holds on to the head tone E while the inner voices move on to prolong a D-minor seventh chord (mm. 80–82), E becomes a dissonant suspension. Its transformation from stable headtone of the fundamental line into a suspension that must resolve to D initiates the final descent toward the ESC.

The subposition of the pedal tone D below A minor causes a momentary ambiguity (*Doppeldeutigkeit*) of the D-minor eleventh chord, which can be heard as a subdominant in both A minor and C major. While this type of ambiguity recalls Rameau's idea of *double emploi*, Ravel's intention is, of course, very different: the ambiguity serves as a hinge between A minor and C major. The moment the piano's upper voices concur with the D bass tone in m. 80, E becomes a 9–8 suspension. The suspension invites a reinterpretation of the E from $\hat{5}$ of A to $\hat{3}$ of C.

Although the secondary theme itself returns in A minor (m. 83), the persistence of the D pedal prevents a complete and satisfying sense of tonic arrival. When in the following measures the motion of the bass again precedes the upper-voice harmonies that duly support its harmonic function, the effect is similar to watching a slow-motion replay: the gravitational forces of directed tonality seem almost suspended. The pedal tone G, which emerges as structural dominant in measures 92–93, must first coexist with statements of the secondary theme outlining D minor, then sustain the descent through the A-pentatonic theme before it finally exerts its cadential power and brings about the structural close in C (m. 94). In the upper voice (violin), the descending pentatonic theme (mm. 90–92) returns to the head tone E in m. 92 and continues to $\hat{2}$ on the third eighth of m. 93. E4 in m. 93 is an upper neighbor, since it is $\hat{2}$ that is inflected by the chromatically altered V chord on the last eighth of that measure. The implied D materializes as an appoggiatura in the piano in m. 94, delaying the arrival of $\hat{1}$ to the third eighth of that measure. At the same time, the third note of the cello's A-minor S-fragment reaches $\hat{1}$ from below.

The movement's structural descent forms the ESC of its Type 2 sonata form. The momentum of the movement's directional tonality has shifted the ESC from A minor to C major. However, just like the EEC, the ESC does not sound in the movement's obligatory register—unless one wants to argue that these two powerful cadences define the obligatory register of the upper voice as A3–E4. The shift in register between $\hat{2}$ of m. 86 (D6) and $\hat{2}$ of m. 93 (D4) strikingly resembles that before the B-major PAC in mm. 20–23. Back then, the music following the cadence made it clear that the arrival was only temporary, not complete. To assess if the ESC of this sonata movement marks the final tonal goal and completes the structural descent—albeit in a different key—and thus to answer our initial question about the DTC's tonal function, we have to consider the prolongations and linear progressions of the closing zone and coda, both of which follow the ESC.

The closing zone (mm. 96–107) imitates the exposition's 5-line that ultimately eluded the second rotation (development/tonal resolution). Although the descent here has the major quality that we might have expected as final transformation of the original 5-line, it arrives too "low." Not only do we hear the pitches B♭ and A♭—a half step below the B and A that would complete the A-minor fundamental line—we hear them an octave below the obligatory register. Ironically, this major-mode descent serves as a prolongation of $\flat\hat{3}$—the scale degree that we now interpret as a minor-mode inflection of the new tonic, C.

Ravel restores scale degree 3 to its "natural" major-mode state in the coda. As in the movement's opening, the theme arpeggiates downward to E4 instead of cadencing on C5. Though one can infer a C5, the line does not provide a definitive arrival on C in the obligatory register. The final measures approach inversions of the C-major harmony with inversions of the neighboring augmented triad B♭–D–F#, revisiting the various registers of the movement. The third station of the resulting arpeggiation (E6–G5–C5, mm. 112–13) finally provides scale degree 1 in the obligatory register, but the final neighboring motion drops again to E4. The last sonority of the movement leaves us with the sound of the third E5 above C5.

Rather than confirming the $\hat{3}$–$\hat{2}$–$\hat{1}$ descent in C major, then, the coda prolongs E5. This suggests that the headtone E has been transformed or recontextualized from A minor to C major but not truly displaced by a descent of the fundamental line. Perhaps it has yet to complete its journey to $\hat{1}$, whether in C or A. Though tilting toward C major at the end of the movement, the double-tonic complex seems to create an equilibrium that allows the E to remain suspended as if in mid-air. At the very end of the movement, after the cello's C-major pizzicato, our ears are left with the sound of the third C–E, leaving open the possibility of a return to A minor at any moment. Indeed, the second movement's opening A2 immediately absorbs the third into the A-minor sonority.

I interpret the movement's DTC as a filtering-out process of components of the referential sonority A–C–E–G. First, A is filtered out in the bass but persists as an added sixth at the ESC (m. 94). The closing zone (mm. 96–107) shifts three of the four pitches (all but C) down by a half step to a neighboring common-tone augmented-sixth chord (for motivic consistency and voice-leading, Ravel spells the chord's F# as a G♭), further clouding the C-based sonority. Finally, the coda filters out the harmonic turbidity of the flats and added sixth to sound a pure and crystal-clear C major. In this light, the final C major represents what is "left" of the double-tonic complex's seventh-chord sonority A–C–E–G after its root has been filtered out.[66] From a prolongational perspective, the movement may be interpreted as incomplete—not only because the descent of the fundamental line is not entirely satisfactory but also because the fundamental sonority has shifted its root from A to C, changing its manifestation from a seventh chord (A minor) to an added-sixth chord (C major).

For the classical minor-mode paradigm, Hepokoski and Darcy derive their hermeneutic interpretations from the "extra burden of minor-mode sonata form,"[67] where the motion to the relative major "can only offer the promise of tonal release. … A more stable emancipation from the tonic minor, however, can be effected only by a lasting conversion into the *tonic* major."[68] The key relationships Ravel employs in this formal design turn the conventions of a classical minor-mode sonata model upside down—the exposition's secondary theme sounds in the tonic key, while the movement's ESC and coda shift to the relative major. Because of that, Ravel's sequence of key relationships

---

[66] This description calls to mind Riemann's explanation of *Parallelklänge*. The characteristic dissonance of the relative chord (the *parallel clang*) is a sixth, added to the fifth of the triad. In major, this characteristic dissonance is added above the root of the triad, in minor, it is added below the prime (Riemann understands the minor triad's "top" note as its generating prime). If the fifth is omitted, the resulting chord is *feigning consonance*. See Hugo Riemann, *Harmony Simplified (Vereinfachte Harmonielehre, oder die Lehre von den tonalen Funktionen der Akkorde)* (1893), trans. anonymous (London: Augener Ltd., 1896), 71. See also David Kopp, *Chromatic Transformations in Nineteenth-Century Music*, Cambridge Studies in Music Theory and Analysis ser. 17 (Cambridge: Cambridge University Press, 2002), 87–88. We obtain the *parallel clang* of A minor by adding a sixth below the E, thus G–A–C–E. Omitting the A, we arrive at the feigned consonance *(Scheinkonsonanz)* of C major, which functions as a "dissonant" substitute for the A-minor tonic. Riemann's explanation of *Parallelklänge* also resonates with the hermeneutic interpretation of the C major ending of the Trio's first movement that I offer later in this chapter.

[67] Hepokoski and Darcy, *Elements*, 306.

[68] Ibid., 311.

appears almost as a subversion of the classical paradigm. If we associate the A-minor root with "being firmly grounded in reality," the C-major harmony might well signify a certain loss of that reality.[69] The Piano Trio's backward-looking coda evokes the idea of memory, which refers to a *past* reality.[70] The classical paradigm's relative-major "promise" refers to a *future* reality, that of the parallel major. Perhaps Mozart's "not yet" is Ravel's "not anymore."[71] The "Basque flavor" of the Trio's primary theme provides additional support for such a hermeneutic interpretation. We know that Ravel's mother, "a Basque from Saint-Jean-de-Luz, but probably of Spanish origin," lulled Ravel "to sleep singing guajiras"[72] and probably also Basque songs. Knowing also that Ravel composed the Trio "entirely … at Saint-Jean-de-Luz," a Basque town near the French/Spanish border and across the river from his birthplace of Ciboure, we can assume that the location would conjure up idealized memories of childhood.[73]

Even without such a hermeneutic interpretation, we are likely to perceive the ending of the first movement of Ravel's Piano Trio as if suspended, needing completion or resolution. If the movement itself does not accomplish tonal closure, we have to look toward the remaining movements to accomplish that task. As I will demonstrate in

---

[69] This contrast brings to mind the A-minor/C-major contrast in the first act of *Tristan und Isolde*. Based on research by Lorenz and Bailey, William Kinderman summarizes this tonal relationship in *Tristan* as "a pairing and alternation of A minor and C major to underscore the dichotomy between the real of the lovers and the external world, the dreaded realm of 'Day.'" See William Kinderman, "Wagner's *Parsifal*: Musical Form and the Drama of Redemption," *Journal of Musicology* 4/4 (1985–1986), 431–46; 432. Perhaps Ravel's tonal pairing is an ironic play that reverses Wagner's tonal relationship into one where C major is the key that represents the internal and intimate.

[70] In playing with the classical model, Ravel looks back also to the Romantic period, where we find many examples of directional tonality from a minor tonic to its relative major. .

[71] Following the line of this interpretation, reality is achieved with the last movement: the tonic key in major mode.

[72] See Révész, "The Great Musician Maurice Ravel," Orenstein, *Ravel Reader*, 431–435; 431.

[73] Since Ravel spent only the first three months of his life in Ciboure before his family moved to Paris, he would not have remembered the place. However, his frequent visits to the nearby Saint-Jean-de-Luz suggest that the place and his Basque heritage were important to him.

section 5.3, the overall tonal plan of the Trio does indeed follow one of the classical paradigms elucidated by Hepokoski and Darcy.

5.1.3. Intra-Movement Motivic Relationships

In this section, I apply the methodology outlined in chapter 3 to describe the multiple motivic relationships and transformations between segments of the P, TR, S, and C themes of the first movement of Ravel's Piano Trio. While the details and sheer number of motivic connections might at times appear overwhelming, they serve to shed light on Ravel's motivic "wizardry." Linking Ravel's art of motivic combinatoriality to the formal functions of sonata form, we find that his techniques of forming phrases, using fragmentation to build momentum, and deriving all thematic materials from small motivic cells and an overarching "musical idea" have much in common with the procedures employed by the Viennese classical composers. Moreover, the details of motivic relationships explain some of the aesthetic appeal of Ravel's music: the sophisticated and complex networks of transformational relationships provide an intricate fabric of patterns generated from a limited pool of simple motivic ideas. As in some of the most magnificent examples of Near Eastern architecture, a myriad of fine details—such as the painted tiles that embellish the surface of a mosque and delight the senses—are subordinate to the simple lines and perfect proportions of the overall architecture. It is these larger structures that guide the eye and integrate the smallest of details.

The themes of the Trio's first movement are closely related not only through the double-tonic complex (DTC) and the four pitch classes A–C–E–G that form the referential motivic set (RMS), but also through minute transformations between the motives that form the themes' building blocks. Following the metric emphases of the *Zortziko* and disregarding repeated notes, I divide each measure of the P-theme's four-bar phrase into three dyads (see **example 5.21a**). For measure 4, I propose alternate endings. The first takes the actual pitches, ending with the arpeggiation B–G–E. In this case, the final dyad is a third, G–E. We will revisit this ending later in the chapter. The second takes as its last pitch the A that completes the fifth-descent implied by the v-I cadence. With a final dyad of G–A, *all* of the P-theme's dyads (mm. 1–4) are now major and minor seconds; that is, step-interval 1. In **example 5.21a,** the first system shows that in each measure Ravel varies the pattern of ascending and descending seconds: ↓↑↓ in m. 1; ↓↓↑ in m. 2; ↑↑↑ in m. 3; and ↑↓↑ in m. 4.[74] Following the strong-beat chords, we can see how Ravel's underlying harmonic patterns of i–i–ii; i–i–ii; ♭II–iv–ii; and ♭II–cad.6/3–v (VII)–I vary the intervals *between* the dyads as well. The ordered step-intervals between the consecutive dyads are:

Measure 1			Measure 2			Measure 3			Measure 4		
E–D	E–F#	G–F#	E–D	E–D	A–B	D–E	D–E	A–B	D–E	C–B	G–(A)
si	**+1**	**+1**	–1	**+1**	**–3**	+2	**–1**	**–4**	+2	**–2**	**–2**

These details serve to illustrate Ravel's economy of musical resources and the beautiful and elegant equilibrium of the opening phrase. The cells and their combinations into three- and four-note motives become the resources for all the other themes of the movement.[75]

[74] This applies only to the implied second of m. 4. If the actual foreground is taken, the third dyad of m. 4 is a falling third, creating the pattern ↑↓↓ which is also unique. The implied version, however, features a nice symmetrical relationship between m. 1 and m. 4.

[75] Ravel uses the same motivic cells to create the main themes for the remaining three motives. The motivic and thematic inter-movement relationships are the subject of section 5.3.1

Example 5.21b is an explanatory key to **example 5.21a**, listing the most important of the three- and four-note motives. To best show Ravel's subtle manipulations of dyadic combinations, I interpret most measures as a pair of overlapping four-note motives. I choose four-note motives for two reasons: (1) in the first four measures, it is the final four notes that give each measure its distinctive contour and melodic gesture; (2) four-note motives drive the transitions, where Ravel accelerates the pace of melodic motion with hemiolic groupings; (3) the two-note overlap between each measure's four-note motives means we do not have to label the intervallic distances that would arise between two disjunct three-note motives. **Example 5.22a** shows how the three- and four-note motives are related by a limited number of step-operations: interval transformations (INTTRANS), step-inversions (SI), retrograde (R), and retrograde step-inversions (RSI). The upper graph shows the reciprocal inversional and retrograde relationships between the three-note motives. The lower graph demonstrates how the first measure's initial four-note motive (placed in the center of the transformational network) generates all other four-note motives.

All p-based segments arise from combinations of overlapping four-note motives shown in **example 5.21a**. However, to link the motivic transformations of all P-based themes more closely to the sonata process, I will now trace the transformational paths of each of the four six-note p-segments and show how they group into larger two- and four-measure thematic units (**example 5.22b**).

To be considered a direct transformation of a p-segment, a variant must share the first three step-intervals with the original segment. In other words, p-segments with the same superscript order number share the first four-note segment (or its transposition). In most cases, two related p-segment forms share the first four step-intervals, thus are related by an i^5 interval transformation (INTTRANS). All other transformations are either INTTRANS of i^4 or MODSHIFT operations. The first segment, $p^{1.0}$, has five transformations; the second, $p^{2.0}$, has four. Segments $p^{3.0}$ and $p^{4.0}$ are transformed only once, when the coda recalls the opening theme. That $p^{1.0}$ has the highest number of transformations confirms that the Trio's first measure serves as a motivic matrix for the whole movement if not the whole work.

Example 5.23. The combinations of p-segments create four categories of p-based themes: (1) complete statements of p that include all four p-segments; (2) combinations of two two-measure pairs of different p-segments; (3) passages that present consecutive fragments of a single p-segment; and (4) sections that statically repeat a single p-segment. Each category fulfills a specific formal function. The two complete statements of the P-theme open and close the movement, showing the theme's transformation from A minor to C major. **Example 5.23a** depicts the symmetry between the initial and final statements of the P-theme that frame all other p-related themes and the transformational path of the different segments, while **example 5.23b** lists each p-segment's interval structure and the transformations between the consecutive p-segments. Two-measure pairs signal the beginning of transitional sections; p-segment fragments then accelerate the pace and drive toward a climax. The transformational arrows do not relate the p-derived denouement motives p^D because they are more than a single transformation removed from the other segments; nevertheless, I have included them in the table. Finally, static one-measure repetitions of p-segments form the p-based closing sections and the beginning of the development.

Example 5.24. Three of the four zones of a complete rotation—P, TR, and C—derive their themes from motive p. Even the secondary theme that shapes the third zone, S, is more closely related to P than it seems at first. **Examples 5.24a and b** demonstrate that S is related to P by inversion as well as transposition. Since S contains two modules, S^1 and S^2, I label their respective motives s^1 and s^2.

a) The first four notes of s^1 are a transposition (T_5) of motive *mp+*, the last four notes of segment $p^{1.1}$. At the same time, the second through fifth notes of s^1 are a step-inversion at SI_0 of motive *unm–* from $p^{2.1}$ in m. 10. The most striking inversional relationships are between the original $p^{4.0}$ with the arpeggiated ending (m. 4) and s^1 (m. 36 plus the lower neighbor G from m. 35). Interpreting the two embellishing neighbor notes of each six-note motive as slightly displaced mirroring notes, s^1 originates as a step inversion at SI_3 of $p^{4.0}$. Alternatively, if we leave out the embellishing neighbor notes and include both endings of $p^{4.0}$, we find the same inversional relationship between $p^{4.0}$ and the first six notes of s^1. Even without these slight manipulations, one still has to acknowledge the inversional connection between the two interlocking four-note motivic subsets of $p^{2.1/4.0}$ and s^1.

b) A combination of *ric* (again transposed by T_5) and *ptc* (T_0) shapes the contrapuntal voice to s^1 (s^{1CP}) in m. 40. Its continuation in m. 41, on the other hand, contains the interlocking motives *mp–* and *fln–* from the denouement, p^D of m. 20. Motive s^2 merges the pentatonic *cambiata ptc* from m. 2 with motive *mp–*, first heard as part of $p^{2.2}$ in m. 12.

c) The string parts of the closing section that form a contrapuntal voice against the piano's p^1-ostinato are also a transformation of p^4's combination of *ric* and *unm–*. With the exception of an additional B in m. 54, this measure recalls m. 4 as a direct T_0 variant, subsequently transposed by T_7.

d) System d compares the forms of p^D at the two denouements (mm. 20 ff and mm. 62 ff).

e) Chromatic transformations of *lnf+* characterize each rotation's climactic passage. At m. 17, *lnf+* inserts a chromatic passing tone between its first two pitches. At m. 28, the last interval of this chromaticized version changes from a fourth into a diminished fifth (INTTRANS i^4 +1). Without detailing exact transformational relationships, the juxtaposition of pitch successions reveals the similarity of the overall progression in terms of contour and shared pitch classes.

Surprisingly, the number of transformations that link the selected P, S, C, and TR segments listed in **example 5.24** is very limited: pitch-class transpositions are at T_0, T_4, and T_5 (or its inversion, T_7). Their corresponding step transpositions are at ST_0, $ST_{+3/-3}$, and ST_{-4}; the step inversions are only SI_0 and SI_3. The small number of transformations not only illustrates Ravel's economy of means, it also highlights the tonal relationships that shape this Type 2 sonata form: transpositions by third, fourth, and fifth; the inversion at the octave (SI_0, here within the A-minor diatonic collection); and the inversion at a third (SI_3), which, in the minor mode, maps the third-related triads of III and v onto each other (another instance of Riemann's *Leittonwechsel*).

Should the large number of motivic connections signal the danger of missing the forest for the trees, it might help to realize that most of these connections are the result of overarching factors that shape the thematic substance of the Piano Trio. Among these, the relationship between pentatonicism and the referential motivic set of the double-tonic complex accounts for many of the omnipresent three- and four-note motives. **Example 5.25** illustrates the subset relations among the RMS, the pentatonic, A minor/dorian and some of the three- and four-note motives. For example, both $p^{2.0}$ and $p^{3.0}$ are based on the four-note subset A–B–D–E (also present as motive *ptc*) of the pentatonic collection E–G–A–B–D. Also belonging to the pentatonic sphere are *mp*– and *Mp*+. Both share a three-note (triadic) subset with the RMS—itself a subset of the pentatonic: they both outline a triad whose major third is filled in by a passing tone.[76] In addition to *ptc*, the three-note motives *unf*–, *fln*–, and *lnf*+ are all subsets of the pentatonic. Overlapping combinations of these three- and four-note motives generate entirely pentatonic melodic lines in m. 20, mm. 46–50, and m. 62. For example, the S-based accompaniment figure in mm. 60 and 62 is a manifestation of the complete pentatonic "black-key" collection D#– F#–G#–A#–C#.

If we place a passing tone between the first two pitches of the pentatonic collection A–C–D–E–G, we arrive at the six-note collection A–**B**–C–D–E–G (an incomplete A minor/A dorian, if you will) that not only forms motive S (A–B–C–E–G–D) but also controls mm. 35–37. This is just one example that demonstrates how Ravel employs shared subsets between referential collections to create close motivic

[76] The same is not true for *Mp*– and *mp*+ where the passing tone fills out the *minor* third.

relationships. At the same time, the motives' interval structures become aural signifiers for the collections that govern them.

5.2. Analysis of the Fourth Movement's Sonata Form

The fourth movement's sonata form differs significantly from that of the first movement. In contrast to the double-rotational design of the Type 2 sonata, which merges developmental and recapitulatory functions into a single rotation, the fourth movement features a triple-rotational Type 3 sonata. While the Trio's opening sonata movement presents the elegant equilibrium of two perfectly balanced parallel halves, its closing sonata form delights us with a fluid and dynamic symmetrical design. As in the first movement, Ravel plays with our expectations of certain formal boundaries: (1) the movement has no medial caesura and therefore no division of exposition and recapitulation into primary- and secondary-theme zones; (2) two off-tonic starts of the primary theme obscure the exact beginning of the recapitulation, allowing two possible locations for this important boundary; (3) neither exposition nor recapitulation offer a clear PAC where we expect the EEC and ESC. In both cases, the strongest cadence occurs at the end of the closing zone, eliding with the beginning of the development and the coda, respectively. Appropriate for the character of a sonata cycle's last movement, these features greatly contribute to the movement's overall dynamic energy, continuously moving forward from one thematic idea to the next. Although cycling through three main thematic ideas might remind some listeners of the rondo principle, this movement is best described as a Type 3 sonata with a "continuous exposition."

Replacing the older "textbook" definition of sonata form, the Type 3 sonata has three rotations: exposition, development, and recapitulation. The coda, which often follows the final rotation, belongs to a "parageneric space" outside the "sonata-space proper."[77] The rotational principle suggests that as the underlying "higher-level default," all three rotations contain most or all of the zones P, TR, S, and C (assuming a normative two-part exposition). The most flexible rotation, of course, is the development, which has the widest tolerance for "lower-level defaults," deviations, or "deformations."[78]

The lack of a medial caesura in the fourth movement's sonata form has classical precedents. Hepokoski and Darcy describe expositions without this rhetorical articulation as "continuous expositions":

> The continuous exposition is identified by its lack of a clearly articulated medial caesura followed by a successfully launched secondary theme. Instead of providing a TR that leads to a medial caesura and thence to an S, as with the two-part exposition, the continuous exposition … usually fills up most of the expositional space with relentlessly ongoing, expansive spinning out (*Fortspinnung*) of an initial idea or its immediate consequences. … As a result, … one should not try to determine where the secondary theme is located: there is none, since that concept pertains only to the two-part exposition.[79]

Hepokoski and Darcy differentiate between two subtypes of the continuous exposition, an "expansion-section subtype"[80] and one that features an "early PAC in the new key followed by (varied) reiterations of the cadence."[81] Lacking such PAC reiterations, the fourth movement of Ravel's Piano Trio falls under the first subtype.

---

[77] Hepokoski and Darcy, *Elements*, 281–92.
[78] Hepokoski and Darcy provide a gradation of defaults for classical-era conventions depending on their number of occurrences in compositional practice. "Deformations" are based on a composer's decision to deviate from the implied norms or standard options to achieve a particular expressive meaning. See *Elements*, 8–10 and 614–21.
[79] Ibid., 51–52.
[80] Ibid., 52.
[81] Ibid., 60.

> Following a P-idea, the composer enters TR and continues to spin it out in a succession of thematic or sequential modules for most of the rest of the exposition, never pausing for the MC breath and the subsequent launch of S (even though some of the modules might impress us in passing as thematic). TR-rhetoric proceeds considerably past the last possible point where one would expect to find an MC and subsequent S (given the proportions or scale of the exposition) … The presence of a continuous exposition involves issues of musical perception, interpretation and reinterpretation …As we move through …continuous expositions, what we at first suppose is an ongoing TR (on its way to an MC) continues past the last possible S-point, or what we designate as the *point of conversion*. Sensing that TR has passed beyond this conceptual point forces our reassessment of what is occurring generically. We come to realize that we are dealing instead with an expansion section.[82]

In their illustrations, Hepokoski and Darcy mark the "point of conversion" by an arrow, followed by the abbreviation for *Fortspinnung*, FS (TR has become FS). They describe two techniques for the *Fortspinnung* modules: a "moment-to-moment 'spinning out' of motives (most common in Haydn), or … a succession of differing, melodically profiled modular links, more a thematic chain than *Fortspinnung* proper (as sometimes in Mozart)."[83] Given Ravel's admiration for the music of Mozart, it comes as no surprise that the continuous exposition of the Piano Trio's fourth movement presents the listener with a thematic chain.

Example 5.26 provides an overview of the movement's form and its details. Because of the lack of a secondary theme, I have labeled the different thematic ideas with lower-case a, b, and c rather than the familiar P and S labels because the S label would contradict the idea of a continuous exposition.[84]

---

[82] Ibid., 52.
[83] Ibid., 53.
[84] An alternative reading with a more normative two-part exposition is possible; see p. 208.

Exposition

The P-zone forms a small ternary by contrasting the first theme (a) with a second thematic idea (b^1) before returning to a. While theme a is closely related to the primary theme of movement I through inversion and retrograde (see my discussion in the next section), theme b recalls the first movement's characteristic *Zortziko* rhythm:

The contrasting b-theme's attempt to launch TR with escalating, ascending b^1 fragments in mm. 9–11 comes to naught when the violin's ascent merges with the return to a (the diminuendo in m. 11 foreshadows the impending return to a, thus signaling that this is not yet the energy-gathering TR). As in the first movement, Ravel switches the roles of melody and accompaniment between the piano and the strings for the first theme's return. An E-major PAC at the end of m. 16 concludes the P-zone. The subsequent TR launch with theme b^2 (m. 17 ff) proves successful. Although a transformation of b^1 (inserted pitch and interval transformation), it distinguishes itself through its N-figure opening and the different metric placement of the eighth-note figure. In addition, the openings (each first measure) of the two consecutive b^2 statements, mm. 17–20 and 21–25 (an example of model-sequence technique), outline an octatonic ascent through $OCT_{1,2}$ (B, C#, D and D, E, F) that leads to the octatonic wedge, mm. 26–30, which culminates in the triumphant "closing theme." Since this "C-like" section occurs before the EEC, the term “closing” is somewhat problematic. According to Hepokoski and Darcy such an “apparent C-Zone in the absence of an EEC” is characterized by a theme that seems “to bestride both the S- and C-concepts.”[85] To describe this situation, Hepokoski and Darcy have ‘devised the label S^C, which is intended to suggest the presence of a theme literally in precadential, S-space that in other respects sounds as though it is more characteristically a closing theme. … Its equivalent in a continuous exposition (which contains no S) is $C^{\text{pre-EEC}}$.”[86] Since I interpret the Piano Trio’s fourth movement as having a continuous exposition, I have adopted this label in **example 5.26**.

The dramatic arrival of an F#-major 6/4 chord above the C# pedal (coupled with an intense upper-voice C#-trill pedal) announces this pre-EEC closing theme. Neither the elision at the closing group’s opening nor the end of the closing group provide the strong PAC to form the clearly articulated EEC we would expect in a classical Type 3 sonata form. By avoiding a PAC or even an IAC, Ravel creates a sensation of suspense. What we can only identify as a “closing zone” does not at all confirm the safe arrival at a precise destination that we associate with that formal function. Instead, the music prolongs the six-four chord for eight measures to give way unobtrusively to a root-position F#-major triad in m. 39. Though the augmented seventh chord C#–E#–Gx–B# functions like a dominant to F#, we hardly perceive the arrival as definite because the change in octave of the violin’s C# trill draws our attention to the still ongoing upper-voice pedal. Without a PAC, we cannot place an EEC at this juncture. The most articulated point of arrival occurs in m. 42, where the accent on the piano’s F#2 draws

---

[85] Hepokoski and Darcy, *Elements*, 190–191.
[86] Ibid., 191.

our ears to the return of theme a in the bass voice. Through elision, this point of arrival is a point of departure: theme a initiates the P-module of the developmental rotation.

Another reading of the exposition is possible. Because of the fermata at rehearsal 4 (m. 30), we can interpret the arrival at the C# culmination point as a medial caesura (MC), filled out by the piano's glissando. With C# as its dominant, the F#-major passage beginning in m. 31 can be read as the S-zone.[87] In this alternative interpretation (see **example 5.27**), the S-zone's failure to achieve the EEC motivates Hepokoski and Darcy's S^{C} label. Slightly problematic is the placement of the MC: as the example shows, it is hardly "medial," since P and TR take up roughly three quarters of the exposition.

In either interpretation, Ravel's tonal plan does not conform to classical standards: $C^{\text{pre-EEC}}/S^{C}$ sound in VI in the exposition and begin on IV in the recapitulation. Which of these two readings we perceive when listening to the movement (continuous exposition with a pre-EEC closing theme or two-part exposition with MC followed by S^{C}) might actually depend on the individual performance: the more time the players take at the fermata, the more likely we are to perceive it as an MC. Players who might want to emphasize the continuous momentum of this final movement, on the other hand, might move forward through the fermata and glissando.

Development

The development's P-module combines two measures of theme a with two measures of b^1. In m. 44, the first four pitches of b^1 (D, E, F#, and G#) form a WT_0

[87] We find S openings similarly supported by a 6/4 chord in Beethoven's Piano Sonatas op. 2/1 (mm. 20–24) and op. 13 (mm. 51ff).

whole-tone segment. However, with the persisting C# trill in the cello, one could also interpret the pitches as belonging to the F#-minor collection (shifting from the F# major of m. 42). More importantly, however, all on-beat pitches from beat 4 of m. 44 to m. 46 outline a linear ascent through $OCT_{2,3}$ (F#, G#, A, B, C, D, D#). A sequence of the four-measure a-b^1 combination (another instance of model-sequence technique) continues the ascending $OCT_{2,3}$ line from beat 4 of m. 48 through m. 49 (D#, E#, F#, G#, A, B, C) to arrive at C-major on beat 6 of m. 49. With the arrival of the C pedal, the TR-based phase of the development ensues.

As in the exposition, the b^2-based TR follows an ascending octatonic line, this time $OCT_{0,1}$. The shift to a new octatonic collection and the new centricity of C goes hand in hand with a change of texture, signaling to the listener that the development has entered its second module. The harmonies of the first two modules of the development bear interesting connections to the first movement.

1. The F# major of the P module is a tritone removed from the C major of the TR module. At opposing poles in the circle of fifths, this harmonic relationship recalls the A minor – D# minor opposition at the juncture of exposition and development in the first movement. While in the first movement C major was the goal of the double-tonic complex, Ravel's juxtaposition of C major with F# major in the development of the fourth movement seems to evoke C major as a very distant key.
2. In mm. 51 to 52, the C major/$OCT_{0,1}$ combination yields to an A♭-major sixth chord, forming the same common-tone relationship we heard in the first movement's coda. Revisiting the salient harmonic features of the opening

movement, which set forth the tasks to be accomplished by the final movement, Ravel seems to recall the harmonic path traveled earlier before moving on to complete the piece's journey.

A second b^2-based section in G lydian above a B pedal leads into the development's large climactic phase. At the end of b^2's sentence-like structure in m. 58, theme c combines with a b^2 stretto. Again, the new phase comes with a shift in centricity, expressed by the C# pedal in the piano with C# major-minor 7th arpeggiation in the cello. With dynamics increasing from pianissimo to fortissimo, this phase culminates in a triumphant repeated statement of b^2's second gesture above an E pedal (mm. 62–63).

The E pedal beginning in m. 62 marks the beginning of a long-range whole-tone progression in the bass that plays an important role in determining the exact juncture between development and recapitulation. From m. 64 on, a sequence of reaching-over b^2 fragments (based on b^2's ending gesture) builds toward the movement's biggest climax in triple fortissimo (m. 69). The upper-voice reaching-over pattern is propelled by a circle-of-fifths progression in the bass that results in two parallel descending whole-tone progressions, WT_0 (E–D–C–B♭–G#–F#–E) and WT_1 (A–G–F–E♭). WT_0, the more structural progression, leads into the recapitulation at m. 84 (see **example 5.28**). I have mentioned before that Ravel likes large-scale descending whole-tone progressions to shape retransitions. As in the first movement of the string quartet, the climax and denouement at the end of the development function as a retransition to the recapitulation.

The climax culminates with the arrival of E♭ in m. 69. The climax's zenith and denouement are based on alternating enneatonic segments (D♭, E♭, E, F, F#; A, B, B#, C#, D; and F, G, G#, A, B♭) whose transposition levels outline the augmented triad D♭–F–A.

The E♭ pedal combines with the augmented triad D♭–F–A to form the dominant lock at the end of the development. The piano left hand outlines the augmented triad with its series of on-the-beat chords. Prolonged for four measures and respelled as D# with C#–E#–A, this dominant lock prepares for the "wrong" key!

Recapitulation and Coda

The return of the one-measure accompaniment prefix that opened the movement, followed by theme a, suggests that the recapitulatory rotation begins with P in m. 73, in the "wrong" key of G# major. On the other hand, theme a does return in the "correct" key of A major at measure 84, followed by b^1 as at the opening of the movement. Hepokoski and Darcy distinguish among three different possibilities for "false starts" of the recapitulation:

> The first encompasses mid- or late-developmental statements that might be initially considered under the problematic rubric of the false recapitulation. … Whatever the difficulties involved with this concept, the implication is that the off-tonic P-statement will be reabsorbed into an ongoing developmental texture continuing at some length. The second includes differing methods of producing a string of off-tonic false starts to the recapitulatory rotation, which eventually takes off at the proper tonic level. The third is the off-tonic beginning to the recapitulatory rotation proper.[88]

Example 5.26 suggests that the fourth movement of Ravel's Piano Trio embodies the third situation: the recapitulatory rotation proper simply begins in the wrong key. In this interpretation, the P module starts in the "wrong" key, G# major, which had been prepared by the "wrong" dominant lock on D#. Supporting this interpretation are (1) the return of the one-measure prefix, which only appears before the opening P and here, and

[88] Hepokoski and Darcy, *Elements*, 260.

(2) the arrangement of thematic sections, which suggests that the recapitulatory rotation would be incomplete and out of balance with the first rotation without the off-tonic sections.

The immediate repeat of the a and b^1-fragment combination at a different pitch level in mm. 79–83, however, mirrors the second situation:

> In the classic false-start situation the developmental space proper comes to its end with a dominant-key preparation, though often on the "wrong key." At this point, P strides forth, as if beginning a recapitulation, but on the wrong pitch level. This leads to one or more immediate restarts, as if P were trying to shake off the effects of the "bad start" and seek its way back to the tonic. Unlike the possible false-recapitulation situation, we do not plunge back into the development. … The overall effect is that of a multiple statement of the p-incipit on different levels—P ("No"), P ("No"), P ("Yes!")—a stuttering reopening of the new rotation. … Additionally, the set of false starts often seems to articulate a strategy of retransition, a way of mediating between two clearly delineated blocks, the development and the recapitulation. In these cases—absent other indications to the contrary—we consider the recapitulation proper to begin with the tonic statement of the theme.[89]

Example 5.29 shows the off-tonic return of "P" as still belonging to the development. Supporting this interpretation is that (1) the underlying whole-tone progression in the bass reaches its goal only with the "true" A-major return of theme a in m. 84; (2) the foreground harmony and voice leading of mm. 73 to 83 contribute to the feeling of instability (see **example 5.28**); (3) the texture, register and motivic structure in mm. 84 ff. are closely related to the opening; and (4) rather than reintroducing first the complete theme a and then theme b^1 as at the exposition's opening, Ravel combines fragments of a and b^1 in both segments as at the outset of the development (see **example 5.29**).

The "true" returns of the P- and TR-zones hover above a grand dominant pedal (mm. 84–100) as if the recapitulation's only purpose were to prepare for the final ESC

[89] Ibid.

rather than providing the tonic return itself. The "closing theme" seems unable to escape the gravitational pull of the whole-tone progression in the bass that led from the development into the recapitulation. Instead of taking charge of the situation with a decisive V-I motion, the triumphant $C^{\text{pre-EEC}}/S^{C}$ theme sets out in D major before modulating through a circle-of-fifths progression from C#-major back to the dominant E (mm. 105–111).

In this interpretation, the coda serves not only to provide the much-needed ESC but also to balance the movement. As my arrangement of sections shows, the addition of the two-part coda makes up for the P-segments "lost" to the development and thus creates a symmetrical arrangement among exposition, development, and recapitulation. In combining the two themes that frame each rotation, the coda once more traverses, as if in a final grand gesture, the entire movement.

Because of the structural importance of the large-scale whole-tone progression, the return of the tonic key and opening texture, and the symmetrical balance demonstrated in **example 5.29**, I regard this interpretation as superior. However, Ravel's carefully crafted ambiguity encourages us to perceive both possibilities at the same time. When listening to the movement, we experience its sophisticated design as wonderfully fluid and dynamic. Its continuous motion perfectly suits its role as the final movement of the sonata cycle.

5.3. Ravel's Piano Trio as a Sonata Cycle

The techniques Ravel employs to create a coherent, organic, and unified sonata cycle resonate with the two main requirements Vincent d'Indy lists in the chapter "La

Sonate cyclique" in his treatise *Cours de composition musicale, IIe livre, 1re partie*:[90] a "cyclic theme" based on a "principal idea,"[91] and a key scheme that closely relates the tonalities of the various movements. In the following paragraphs, I demonstrate in detail how Ravel links the four movements into a sonata cycle with motivic and thematic techniques, shared rhetorical and formal features, and an overall harmonic plan. In Chapter 6, I will explore Ravel's cyclic forms in the light of d'Indy's ideas and discuss cyclic sonatas in the music of Franck and Debussy that may have been available to Ravel as models.

5.3.1. Inter-Movement Motivic and Thematic Relationships

The motives of the first movement generate much of the thematic material of the whole sonata cycle. A thorough analysis of the abundant motivic connections exceeds the scope of this chapter. Instead, I shall limit my exploration of inter-movement motivic and thematic relationships to the most salient connections among the primary themes of all four movements.

Most of the motivic connections I describe are pitch- or step-based. However, in the final segment of this section, I will also discuss aspects of rhythm, meter, gesture, and grouping that help to associate the four primary themes. To convey all the different aspects of multiple motivic connections clearly, I illustrate them in a series of related **examples, 5.30–5.35.**

---

[90] d'Indy, Vincent, *Cours de composition musicale, IIe livre, 1re partie* (Paris: Durand, 1909), 389–90; Merle Montgomery, "Vincent d'Indy, *Cours de composition musicale,* English translation of the sixth edition (1912)" (Ph.D. diss., University of Rochester, Eastman School of Music, 1948). Quoted in Marianne Wheeldon, "Debussy and *La Sonate cyclique*," *Journal of Musicology* 22/4 (2005), 644–79; 659.
[91] Wheeldon, "Debussy and *La Sonate cyclique*," 662.

My discussion focuses on four specific features: (1) the presence of three and four-note motives familiar from the first movement in all primary themes; (2) the five-note principal motive (PM) whose transformations generate all four primary themes; (3) the combinations of the three or four PM-segments that shape each theme, and (4) shared features in the rhythm, metric placement, and grouping structure of the four primary themes.

5.3.1.1. The Three and Four-Note Motives

Example 5.30 shows that many of the three- and four-note motives I identified in the first movement also permeate the melodic structure of movements II–IV. The primary themes of movements II–IV not only feature the familiar double-neighbor and *cambiata* figures, they introduce new transformations of these figures. For example, the fourth at the center of the pentatonic *cambiata* (ptc) is stretched to a fifth to form the "large inverted *cambiata*" (*lic*) at the beginning of the second movement. Other figures, such as the pentatonic *cambiata* and double-neighbor figures, appear in inversion (*iptc* and *idn*) in movements III and IV. The ending of the expansive pentatonic theme of the *passacaille* features a transposition of the first movement's S-based accompaniment figure that includes the minor-mode ascending triadic motive with passing tone (*mp+*) as well as its major-mode variant (*Mp+*). The bracket labeled "S!" refers to that measure's transpositional relationship (T_{10}) to the S-derived pentatonic accompaniment figure from the first movement (mm. 60ff).

The dotted lines show shared pitch classes between the movement pairs that share the same collection: movements I and II share the A-minor/C-major collection and movements III and IV C#-phrygian/A-major collection. A pentatonic subset of that collection, C#–E–F#–G#–B, governs not only the entire theme of movement III but also measures 1 and 4 of the fourth movement's theme.

5.3.1.2. The Principal Motive

Example 5.31 shows the opening measures of each movement. At first glance, the primary themes of all four movements share the following intervallic characteristics: a neighbor figure precedes a skip that is followed by a step in the opposite direction. I shall call this five-note combination the *principal motive* (PM). In the first movement's first measure, the skip (the third E–G) is filled out by the passing tone F#. We can infer the skip as the basic form by recalling that the opening is based on the RMS, and more importantly, by comparing the opening manifestation of the PM to its subsequent forms in all four movements. For example, the second and third measures of the first movement feature the principal motive transformed by step-inversion and interval transformation of the skip.

The second movement's primary theme expands the size of the PM's skip to a fifth (m. 1) and fourth (m. 3). Measure 3 shortens the PM by one note, removing the descending second but retaining the repeated "post-leap" notes from m. 2.[92] The transformation expresses the playful character of the *Pantoum*, which functions as the Scherzo movement of the Piano Trio. The first and second movements' primary themes are also closely related through the repetition of the PM's first pitch. This repetition forms two-thirds of a three-note motivic parallelism based on the motive E–E–D, which

---

[92] As I explain in section 5.3.1.6, the shortening of the PM is the result of an overlap of two PM-segments.

not only sounds as the first three notes of both movements but also governs the transposition levels of the PM's first three statements.

The third movement's primary theme removes the repeated note from the musical surface and expands the PM by two notes. Since they also form a descending second, the PM can be read in two different ways. If we understand the expansion as an insertion of the pitches F# and E, the PM ends on the second note of m. 2. If we understand the expansion as an addition of the pitches G# and F# in m. 2, the PM ends in the first measure. I prefer the first interpretation because the metric placement of the descending second on the accented beat parallels that of the first two movements. Moreover, the descending second that begins m. 2 shows the same stepwise expansion as the second movement's first PM-segment.

The fourth movement bases its primary theme on the inversion of the PM drawn from m. 3 of movement I (see **examples 5.32 and 5.34**). The expansion of the PM by an upper neighbor creates a nearly symmetrical form whose last five pitches form the PM's retrograde. The complete retrograde's order of pitch classes (see lower bracket) is identical to that of the third movement's measure 3 to the downbeat of measure 4.

5.3.1.3. Principal-Motive Transformations

The motivic connections among the four movements' primary themes go beyond the surface appearances of the PM that I have discussed so far. **Example 5.32** illustrates the various transformations of the PM in the four primary themes. A larger solid bracket connects all three elements of the PM's three motivic cells or small gestures: the neighbor figure (N), a skip, and a step (2^{nd}) in the opposite direction. The smaller solid bracket shows N, the diagonal line the skip, and the dashed bracket the step. As each primary theme contains more than one statement or transformation of the PM, comparing the themes offers multidimensional transformational paths. The various PM statements divide each movement's primary theme into three to five segments (see the curly brackets). Based on their characteristic gestures, the segments are labeled a (a^1/a^2), b (b^1/b^2), and c (c^1/c^2/c^3) and aligned vertically. The various degrees of complexity in the themes' subdivisions reflect each movement's characteristic rhetorical and formal role in the sonata cycle.[93]

Studying the relationships between the manifestations of the PM, we not only find changes in pitch, interval structure, mode, and step designations, we also observe expansions, insertions, and abbreviations. Although my methodology does not address the latter types of transformations, they are clearly shown in the example through smaller note heads and the placement of square and curly brackets with their extensions. The dotted slurs indicate the near and perfect retrograde relationships between Ib^2, IIIb, and IVa^1. The solid slurs in theme III show forms of *mp* and *Mp*. Their ascending forms in mm. 5–8 articulate the theme's three c-segments.[94] In addition to the close motivic connections between the collection-related movement pairs, the vertical alignment of segments highlights connections between the framing movements' pairs of b-segments as well as the inversional relationship between the endings of themes I and III (see the dotted slurs in Ic and $IIIc^s$).

---

[93] I discuss this aspect in more detail in section 5.3.1.6.

[94] The threefold outline of *mp*+(shortened to a fourth in m. 8) recalls the motivic parallelism of movements I and II: The motive's upper pitches are G#, G#, and F#—all emphasized by either longer note values or metric placement (featuring a sarabande-like emphasis on beat 2). As in themes I and II, the three pitches form the fifth and fourth above the tonic.

Example 5.33 translates these relationships into a network of motivic transformations.[95] The example allows both diachronic and synchronic interpretations of motivic relationships. The network in the upper half of the example favors the diachronic view as the horizontal arrows show the intra-movement paths between consecutive PM-segments and the vertical and diagonal arrows show inter-movement paths between related PM-segments. To emphasize the diachronic nature of the transformation graph, I have used unidirectional arrows even for inversional relationships.

The lower half of the example lists each PM-segment's ordered interval structure, thus enabling synchronic comparisons that reveal various degrees of motivic similarity. In many cases, the insertions, expansions, and abbreviations allow alternative interpretations of a motive's interval structure. The minor adjustments I have made to favor of the more salient motivic structure are indicated by an asterisk in the network graph and detailed in the table notes. Where I allow alternative parsings to coexist, both are shown in the table only.

In the table, interval successions in italics indicate inversional forms of the PM. Both network graph and comparison table show that the corresponding segments among movements tend to form the closest (or simplest) relations. Especially close are the motivic connections among the initial a-segments. This makes perfect aural sense, since it allows listeners to consciously or subconsciously relate the movements' primary themes from the start.

Also closely related are the b-segments. The inversional forms of Ib^1 and Ib^2 generate not only subsequent b-segments but all segments of the fourth movement's

---

[95] With the exception of segment IIIc^3, the alignment of segments in the graph follows that of example 5.32.

primary theme. Less closely related are the c-segments. This is mostly due to their closing function, which responds to the needs of each theme's individual harmonic structure. Nevertheless, if we accept the two forms of segment Ic suggested earlier, we find direct and implied connections to the c-segments of the other movements: the ascending second that concludes Ic with the implied A also concludes IIc. The four-note motive *unm–* returns inverted at the conclusion of movement III. Note that the harmonic relationship between A minor and C# phrygian yields a direct correspondence of letter-name designations (Ic: C–B–G–E; IIIc^3: E–G#–B–C#). The correspondence between Ic and IVc is below the surface: both themes are based on an underlying fifth-progression, of which the ending provides the final four steps. The third movement's *passacaille* theme includes many phrase expansions.

To simplify the comparison of segments, **example 5.34** provides a condensed juxtaposition of segments without the phrase expansions of theme III. As the corresponding PM-segments a (a^1/a^2), b (b^1/b^2), and c ($c^1/c^2/c^3$) sound in the same order in each movement, they combine to form related thematic units at a higher level. On closer observation, we find at least two such connections. The first arises from the three- to five-segment combinations of PM in each theme. The second places each theme's temporal aspects of rhythm, metrical placement, and grouping structure in the context of its individual movement.[96] I will take up each of these topics in the next two sections.

[96] Due to my focus on primary-theme relationships, I have not discussed how Ravel derives other themes in movements II, III, and IV from the PM idea. For example, a quick look at theme b^2 of movement IV (mm. 17–19) reveals that its opening shares the N figure (as double neighbor *ts*), a leap of a fourth, and, taking out the additional skip up a third, the descending second. Its continuation combines *ts* with *unf–*.

5.3.1.4. PM-Segment Combinations

In addition to showing the various manifestations of the principal motive, **example 5.32** demonstrates how the varied reiterations of the PM in each movement combine to form similar patterns of three to five PM statements for each movement's primary theme.

Earlier in this chapter, I described the first movement's primary theme as a repeated four-bar phrase based on the poetic form of the *Zortziko txikia*. Ravel constructs the phrase by juxtaposing the first measure's PM form (a) with a contrasting PM form (b^1) in m. 2 to form a small two-measure unit. The third measure introduces a variation of the PM that I consider more closely related to the second measure's PM than to the first measure's. Therefore I label measures 2 and 3 as b^1 and b^2. The PM of m. 4 is related to that of m. 3 by a single interval transformation (i^2–1) if one takes the implied A. In either version, measure 4 provides the cadence. As the phrase's conclusion, the c label identifies it as the third and final manifestation of the PM.

In an earlier transformational graph,[97] I showed how each theme forms similar metrical and rhythmical patterns of four units. However, the second movement contains only three, labeled simply as segments a, b, and c, and shown in the second system of **example 5.32**. Segments a and b are closely related, while the concluding segment c changes the leap to a step.

The more expansive nature of the *passacaille* warrants a theme that is less tightly organized than those of the first two movements. Therefore, the primary theme's phrase structure contains many expansions, all of them based on fragments of the PM that

---

[97] See chapter 3, page 107, and example 3.19

feature the three- and four-note motives familiar from the first movement. These are especially salient as the *passacaille* theme is entirely pentatonic. Because it parallels the second movement's initial PM statement and its metric placement, I consider the PM's form in this movement as an expansion created by the insertion of the major second F#–E (shown in smaller note heads). This interpretation has two advantages: first, it allows a smaller form of PM to nest inside a larger form, with the expansion being an organic outgrowth of the PM's structure. Second, the continuation of the PM's descending second now emerges as a further expansion of the PM form of theme II, thus creating a continuous chain of expansions from theme I through theme II second to theme III. The parallel opening places segment b at m. 3; its expansion takes up m. 4. Segments c^1 to c^3 are more closely related to the first movement's S-theme than to the PM. To include the interval of the second that ends most of the PM forms, segment c^1 extends to the downbeat of m. 6. Segment c^2 begins on beat two of m. 6 and ends on the downbeat of m. 7. Because of the concluding function of segment c^3, the PM's characteristic second ascends from B, scale degree 7, to the tonic, C#.

Similarly to the closing of the first movement's P-theme, segment c^3 allows two possible interpretations, both based on underlying voice leading rather than on the immediate surface of the motive. For the first interpretation, I read the cello's C#3 in m. 9 as the goal of the piano's B2. In the second interpretation, I regard the cello's F#3 in m. 9 as coming from the G#2 in m. 8. Both readings maintain the essential intervallic components of the PM. While the two interpretations are compatible in voice leading (although G#2 in m. 8 can more easily be heard as going to the piano's F# in m. 9), the alternative readings change the composition of the PM forms. In the first, the PM inversion form skips from the upper-neighbor figure E–F#–E up to B–C#, changing the direction of the skip by inverting the descending fourth of Ib^2 to the ascending fifth of $IIIc^3$. As pointed out earlier, this version contains as its concluding four notes the step-based retrograde of motive *um–* from Ic, transformed by MODSHIFT and transposition from A dorian to C# phrygian (MODSHIFT $A7^2$, $C\#7^3$, ST_{-2}).

The second reading relates segment $IIIc^3$ to segment Ia by inverting the latter's neighbor figure. Interestingly, the seemingly complex combination of MODSHIFT/ST and T operations leaves the central fifth, E-B, unchanged. Both motives share the same letter-name pitches for the third (G/G#), the passing tone (F/F#), and the upper neighbor (C/C#)—the basic transformation being the addition of three sharps through the C#-phrygian collection.

The relationship between the P-themes of the first and last movement resembles that between the two complete P-theme statements in the first movement. In both cases, the later theme is the only instance that presents the four segments of the original theme: p^1, p^2, p^3, and p^4 in the first movement's initial and coda statements; and a (a^1/a^2), b^1, b^2, and c in the first and fourth movements' P-themes. The fourth movement's P-theme takes the inverted form of segment Ib^2 as its point of departure and transforms it into segment IVa by inserting an upper neighbor before the ascending second. For a^2, the fifth interval, i^5, gets stretched to another fourth for a brief flirtation with the C# tonic of the previous movement (mm. 1 and 4 even revisit the same pentatonic collection!). Measure 4 relates to m. 3 as segment Ib^2 to segment Ib^1: the initial lower-neighbor figure is inverted to an upper-neighbor figure, beginning b^2 a step lower than b^1.

Like segment Ic, segment IVc features an embellished fourth descent that concludes the theme. Unlike the descent of theme I (with the implied A), theme IV arrives at scale degree 5, since the entire theme's melodic trajectory outlines two interlocking fourth progressions: the first traces B–A–G–F# (see the downbeats of mm. 1–4), the second A–G#–F#–E (m. 5).

As we have observed in the first movement, the p-segment transformations and groupings support the formal functions of the different sonata-form zones. Similarly, in the sonata cycle overall, the motivic transformations and combinations of PM-segments phrase structures reflect the character and formal and rhetorical functions of the individual movements.

5.3.1.5. Primary Themes: Rhythm, Metric Structure, and Grouping

Unlike the previous examples, **example 5.35** addresses the temporal aspects of rhythm, metrical placement, and grouping structure of the four primary themes. The alignment of the four themes shows the relative proportional rhythmic correspondence of each movement's initial PM-segment. In the first two movements, the first eighth note's repetition on the pitch E takes up the span of a quarter note (elongated by a sixteenth note in the first movement due to the *Zortziko* rhythm), while the second pitch, D, is half as long (shortened by a sixteenth note in the first movement). In the third movement, the initial pitch, C#, an eighth note, is also twice as long as the next note value. In the final movement, the proportion between the first two note values changes to 3:1. In all four neighbor figures the neighbor note's value never exceeds half the value of the main note. The following table shows the patterns of long and short note values:

	Meter/Beat Grouping	Principal Motive:	Neighbor			Skip	Step	Unit/ Sum
I	**8/8**	**Pitch**	**E**	**D**	**E**	**G**	**F#**	**8^{th}**
	3+2+3	**Value**	**2***	**1***	**2***	**1**	**2**	**8**
II	**3/4**	**Pitch**	**E**	**D**	**E**	**B**	**A**	**8^{th}**
	2+1	**Value**	**2**	**1**	**1**	**2**	**1**	**7**
III	**3/4**	**Pitch**	**C#**	**B**	**C#**	**F#**	**E**	**16^{th}**
	1+2	**Value**	**2**	**1**	**1**	**6**	**2**	**12**
IV	**5/4**	**Pitch**	**B**	**C#**	**B**	**F#**	**E**	**8^{th}**
	3+2	**Value**	**3**	**1**	**2 (+1)**	**1**	**1**	**9**

*On the musical surface, these values are altered by 0.5 (a sixteenth note).

Although these relationships are not proportionally exact, that would not be desirable in any case. While preserving each theme's individual character, Ravel combines aspects of pitch and rhythm just enough for the listener to relate the primary themes to each other.

The musical notation of **example 5.35** aligns the themes according to their corresponding pitches, and the accompanying graph takes the eighth note as its unit to show exact proportional relationships. That means that regardless of the movement's tempo, we can compare the various themes' extensions and subdivisions in terms of eighth notes. Unlike my previous comparative examples, which showed the themes in their entirety, the graph shows only the first two statements of PM for movements I, III, and IV, and the first four statements for movement II. The vertical placement shows the pitch level of each note, while its horizontal extension shows its relative length. The smallest temporal unit (indicated by the thinner vertical lines) shows the beat level of the time signature. The medium-thick vertical lines represent the metric subdivision into beat groups; the bold lines represent bar lines. This alignment allows us to compare the metric placement of each theme, the groupings of motives within the metric grid, the relative temporal extension of thematic units, and the grouping structure of the themes. (Henceforth, I will refer to each theme simply by its movement number.)

The graph's vertical dotted lines immediately reveal that all themes feature phrase subdivisions into four sections (or, in the case of the complete themes I, III, and IV, into multiples of four). The graph also shows how these subdivisions, though varied in the different themes, are intricately linked to the motivic structure of PM.

The *Zortziko* rhythm of theme I groups the 8/8 meter into 3+2+3 eighth notes. With the repeated initial note and the sixteenth-note passing tone, the PM's lower-neighbor figure takes up the first two groups of five eighth notes. The descending second takes up the final three eighth notes. If we think of the irregularly grouped 8/8 meter as an asymmetrical triple compound meter, the LN segment takes up two beats and the PM's descending second one. The graph's long dotted lines show this division.

Forming an overall sentence-like phrase structure (with a foreshortened second basic idea in the presentation), theme II is completed by another shortened statement (PM^S) to span 22 eighth notes in its entirety. With a complete second basic idea, the theme would begin on the downbeat of m. 1. The normative prototype might sound somewhat like this: EEDEBB (m. 1) BBAGBB (m. 2). In other words, we can think of the presentation as actually comprising two statements of PM^S with a one-beat overlap, forming an elision on the downbeat of m. 2. As a result, Ravel's version is infinitely more sophisticated and playful than the square prototype. Theme II's asymmetrical grouping places the initial N motive on beats 2 and 3 of the triple meter so that the first metric emphasis coincides with the leap. Ravel's beaming shows the asymmetrical grouping of the two PM statements into 4+4+2 eighth notes for PM, and 4+2 eighth notes for PM^S. (In the graph, the different shades of gray show the groupings indicated by Ravel's beaming.) Notwithstanding the irregular metric placement of theme II's initial PM, the themes I and II share the metrical placement of the PM's motivic components: two beats for the LN-segment followed by the accented placement of the leap and subsequent descending second. The *pantoum*'s basic PM form is the three-beat pattern of the shortened principal motive (PM^S) that we hear in measures 3 and 4. This shortened form of PM has the same distribution of beats as in theme I: two beats for the LN and one for the note(s) following the leap.

In movement III, the slow *passacaille* with a *sarabande*-like emphasis on beat two, this metric distribution is reversed. Transformed to half the previous note values (in relation to the metric unit), N now occupies only one beat, while the descending second extends over beats 2 and 3. The descending second, reiterated a step higher on the next downbeat, recalls the metric emphasis it was given by the initial PM of theme II. To embody the expansive spirit of the slow movement, theme III expands the first PM by a full measure before its restatement a fifth lower (with varied extension). The two expanded statements measure a total of 24 eighth notes or 12 beats compared to theme I's 16 notes or 6 (compound) beats. These four measures form the "presentation" of the *passacaille* theme's sentence structure.[98] Its continuation, which builds on the S-based accompaniment figure of movement I, takes up another four measures plus one beat (28 eighth notes) to elide with the theme's second statement.

[98] For a definition of the musical sentence and its components, see Caplin, *Classical Form*, 35–48.

Theme IV also forms a sentence, with a one-measure prefix[99] before the presentation and a one-measure internal expansion of the continuation. The first two statements of PM are now cast into the asymmetrical structure of a 5/4 meter. Because of the circularity of the recurring neighbor figures, the division into motivic components is not as clear-cut as in the previous themes. Since I am comparing the metric placement, my division here follows the beat grouping of 3+2 quarter notes indicated by Ravel's beaming and slurs. Thus, the inverted N figure takes up three beats (= six eighth notes) and the skip and step (expanded to a second N) the remaining two beats (four eighth notes). Together, the first two PM statements of theme IV, which form the presentation of the sentence, take up 20 eighth notes.

Transferring the beat groupings shown in **example 5.35** to the complete P-theme statements of all four movements for comparison, we observe once again how each theme's grouping structure is closely related to the rhetorical and formal role it plays in the entire sonata cycle:

P-theme	measures of P-theme	notated meter	notated beat groupings	total no. of beats	total 8th-note count
I	4	8/8	(3+2+3)x4	12 (c)	32
II	3.3	3/4	2+3x3	11	22
III	8	3/4	irregular	24	48
IV	5	5/4	(3+2)x5	10 (c)	50

c = compound beats

If we regard the 12-beat structure of theme I as the prototype, the 11 beats of theme II show a condensation by one beat through the motivic overlap. The 24 beats of theme III show an expansion to twice the prototype's length, while the 10 beats of theme

[99] For an explanation of the "prefix" as an "external phrase expansion," see Rothstein, *Phrase Rhythm*, 68.

IV reflect the accelerated pace of this final movement. The first theme's prototypical four-bar phrase structure is shortened by a beat for theme II, doubled for theme III, and extended by one measure for theme IV.

These comparisons show how Ravel uses the same combination of motivic elements with related rhythmic structures and similar metric placements to create closely related, yet uniquely characteristic themes that adapt classical phrase structures. While fulfilling the individual purpose of each movement, the themes create a closely-knit network of motivic and thematic relationships that unify the sonata cycle as a whole.

5.3.2. Shared Rhetorical Features

All four movements of Ravel's Piano Trio have at least one climactic passage. In Ravel's music, the rhetorical function of these passages is closely linked to the formal design since they always occur at the end of a formal section. Resembling the syntactic gesture of a colon, the climactic passages herald the immediate or pending arrival at a formal juncture. Where the arrival is immediate, the climax itself might initiate the new formal section (as in the fourth movement). Where the arrival is pending, the denouement functions as a transition to the next section (as in the third movement). In most cases, Ravel builds the climaxes by forming a wedge between a faster-moving, ascending upper voice against a slower-moving, descending bass line or pedal tone.

The first movement's Type 2 sonata form features two climactic passages at parallel junctures in the first and second rotations (mm. 17–20 and 74–77). In the first rotation, the climax and its denouement lead to the transition's second module. In the second rotation, due to the shortened transition, the parallel climactic passage and its denouement lead to the secondary- theme zone.

The second movement’s ternary form also contains two climactic passages, again at corresponding locations in the outer sections (mm. 99–105 and 247–257). Here the first climax occurs at the end of the A section, its denouement preparing for the B section, while the second climax, at the end of the A’ section, leads to the movement’s conclusion.

The *passacaille*’s ternary form introduces its single climactic progression in the center of the movement around the midpoint of the central B section (mm. 41–49, denouement 49–57). The climax forms the movement’s single point of culmination, from which we descend to the return of the *passacaille* theme.

Finally, the fourth movement’s Type 3 sonata form pays homage to both the parallel and symmetrical divisions of the earlier movements, offering three climactic passages (mm. 26–31; 59–69; 94–104). All occur in corresponding locations in their individual rotations; the central and biggest climax is reserved for the end of the development section to prepare for the return of the P zone. In exposition and recapitulation, the climactic ascent reaches its goal with the arrival of the closing zone. If we compare the locations of all passages in their respective movements, we find that they are perfectly balanced not only within each movement, but also in their combined locations for all four movements (**example 5.36**).

Since Ravel likes to shape climactic passages with non-diatonic progressions, we find that six of the Trio’s eight climactic passages are based on either a whole-tone or octatonic progression or a combination of such progressions (the two climactic passages of the first movement are based on diatonic patterns with chromatic embellishments). **Example 5.37** shows one representative climax for each movement. The climactic progressions in movements II, III, and IV share the thematic lower-neighbor figure in the ascending upper voice. (In **example 5.37**, the Schenkerian reduction of the fourth movement's climactic passage does not show the neighbor notes.)

5.3.3. The Overall Harmonic Plan

In my discussion of the first movement's double-tonic complex, I suggested that the lack of tonal closure at the movement level has consequences for the overall tonal plan of the trio. First, we expect the trio's sonata cycle to accomplish the harmonic closure not achieved by the first movement. Second, if Ravel follows classical paradigms laid out by Hepokoski and Darcy, the trio's sonata cycle has to transform the "burden" of the minor-mode sonata by attaining the major mode in the tonic key.

The four movements of Ravel's Piano Trio feature the following order and key scheme:

1.	*Modéré*	Opening movement, sonata form	A-minor/C-major DTC
2.	*Pantoum*	Scherzo/Minuet-type form with Trio	A minor
3.	*Passacaille*	Slow Movement, ternary form	C# phrygian
4.	*Final*	Fast final movement, sonata form	A major

Hepokoski and Darcy introduce the idea of large-scale symmetry, a 2+2 binary grouping of the "standard four-movement pattern."[100] While the most common order of a four-

[100] Hepokoski and Darcy, *Elements*, 337

movement sonata cycle is Allegro (tonic), Slow (often non-tonic), Minuet (tonic), and Finale (tonic), the alternative ("second-level default") ordering of Allegro, Minuet or Scherzo, Slow, and Finale is usually associated with

> the persistence of the tonic into the second movement (the more normal place to move away from that key). This results in a heavily weighted tonic-balance in the work's first half. At times the impression is that the tonic cannot be escaped from, as though it were insistently exerting its authority. In minor-mode works (with a tonic-minor second-movement minuet or scherzo) this effect can be ominous or menacing. The possibility of an expressive escape from the tonic is consequently deferred to the (slow) third movement, and the burden of resecuring the tonic falls squarely on the shoulders of the finale.[101]

We have reason to believe that some of the major-minor dichotomy still held sway during Ravel's lifetime. In his treatise on composition, d'Indy describes how in Cesar Franck's Piano Quintet the keys of the outer movements, F minor and F major, form "poles of attraction, always in antagonism, until the victory of one over the other."[102] Paraphrasing d'Indy, Wheeldon describes the relationship between major and minor in terms quite similar to those used by Hepokoski and Darcy: "The eventual triumph of the major tonic over the minor—or, metaphorically, of light over darkness—ends the antagonism between keys."[103]

The correspondences between this model and Ravel's Piano Trio are the more poignant as the first movement's failure to attain the major-mode tonic, or even to achieve tonic closure in the monotonal, Schenkerian sense, calls exactly for this kind of tonal plan to remedy both failures. Hepokoski and Darcy's discussion implies a parallelism between the key schemes of a first-movement minor-mode sonata form and

---

[101] Ibid.
[102] d'Indy, *Cours de composition musicale*. Quoted in Wheeldon, p. 665.
[103] Ibid., 666.

that of a minor-mode sonata cycle. In a minor-mode sonata movement, the S-zone's motion to III during the exposition promises a release from the "burden" of the minor mode, but only the recapitulation's attainment of the major-mode tonic brings true liberation.[104] If the first movement remains in the darkness of the minor tonic key, the task of reaching for the light of the major mode falls to the final movement.

Hepokoski and Darcy explain that the listener's awareness influences the linearity of multi-movement successions: "Since we know that other movements are to follow, we are aware that the entire piece is not yet brought fully to rest." Where the tonic is abandoned in the second (or third) movement, "the finale will be obliged to recover the displaced tonic with its own ESC. Consequently, in any multi-movement work the first movement's ESC is only a provisional attainment, valid for that movement only."[105] With the first movement's double-tonic complex, Ravel transfers the harmonic task of the first movement to the whole sonata cycle. We have observed earlier how the DTC-based background structure of the complete first movement resembles that of a typical minor-mode exposition. Harmonically, then, the first movement relates to the whole sonata *cycle* as an exposition would to a sonata *movement*. This parallelism between movement and cycle does not equate the remaining movements with other sections of standard sonata form: the *Pantoum* and *Passacaille* do not function like developmental sections within the whole cycle, even if the *Final* does fulfill the harmonic task we otherwise ascribe to the recapitulation. If we compare the key relationships within the first

[104] Hepokoski and Darcy, *Elements*, 311.
[105] Ibid., 337.

movement to those of the cycle, we find another recursive parallelism that relates the binary symmetry of the type 2 sonata form to that of the four-movement sonata cycle:

Movement 1	**Rotation 1**		**Rotation 2**	
Section	P +TR	S+C	P +TR	S+C (+coda)
Key	**a (E)**	**a**	**e** above C#	**C**
Thematic Symmetry	P = p^1, p^2, p^3, p^4			P = p^1, p^2, p^3, p^4
Formal Symmetry	P-theme opens			P-theme closes
Four-Mvmt. Cycle	**Pair 1**		**Pair 2**	
Movement	I *Modéré*	II *Pantoum*	III *Passacaille*	IV *Final*
Key	**a** (**C**)	**a**	**C#** phrygian	**A**
Thematic Symmetry	P = a, b^1, b^2, c			P = a, b^1, b^2, c
Formal Symmetry	Sonata Form	Large Ternary	Large Ternary	Sonata Form

In the first movement's Type 2 sonata, the first rotation cannot escape the tonic key, A minor. With the help of the tritone shift to D# minor, the primary theme returns in E minor above a passing C#. Although in a Schenkerian sense the E minor is not stable, I chose this passage to aurally represent the first half of rotation 2 because of the return of P. C major then represents the second half of rotation 2.

In the four-movement cycle, the first pair remains in A minor. In this larger context, I view the DTC's C major as the boundary between the two A-minor movements, just as in the first movement's exposition, the E-major medial caesura forms the boundary between the exposition's two halves. The *passacaille* takes a first step toward attaining A major by centering its three-sharp diatonic collection on C#, the major third of the overall tonic key. Similarly, we can interpret the primary theme's E-minor return in the first movement as centered on the C-major tonic's major third.

The shared collections are not the only indication that Ravel clearly designed the four movements as two pairs of related movements. While movements I and II share the motivic parallelism of E–E–D, movements III and IV are closely linked through their motivic substance, sharing pentatonic subsets in their main themes (as shown in **examples 5.30–5.35**). Moreover, Ravel separates the movements only by a thin double bar, instructing the players to link the two movements with the term "*Enchainez*" (Fr., literally, to chain, to thread). **Example 5.38** summarizes some of the Piano Trio's most salient cyclic features.

5.4. Conclusion

In both outer movements, Ravel plays with the formal boundaries of sonata form, especially the development/recapitulation boundary. In the opening *Modéré*, Ravel not only chooses the formal path of a Type 2 sonata form in which there is no true "recapitulation"; he also undermines the normative tonal resolution at the return of S by steering the tonal structure away from the initial A minor to the double-tonic complex's second key, C major. Though the concluding *final* follows the more conventional Type 3 sonata form, its continuous exposition circumvents the clear bisection of the opening (and subsequent rotations) into P/TR and S/C zones. In addition, the return of the first theme at the end of the development in the "wrong" key encourages two competing interpretations that place the onset of the recapitulation in two different locations. By offering the listener two options in close succession to locate the recapitulation's onset, Ravel again confounds the listener's experience of the formal boundary.

In both movements, the formal structure of the P-zone mirrors that of the movement at large. In the first movement, the binary principle governs both the P-zone's repeated four-bar phrase and the movement's double-rotational Type 2 sonata form. In the fourth movement, the ternary principle governs the P-zone's small ABA design as well as the triple-rotational Type 3 sonata form.

While we can find classical models, especially in Mozart, for the harmonic structure and order of the sonata cycle, the different sonata types, their formal segmentations, phrase structures, and even lower-default formal procedures (such as an expositional S-zone that remains in the tonic or a continuous exposition), Ravel's creative transformations of classical models create a unique brand of sonata form. As we hear whole-tone progressions in the bass shape climax preparations toward the ends of formal sections, notice contrasts between octatonic, enneatonic, and diatonic passages, gravitate between fields of active or suspended tonality, wonder about formal boundaries, all against the background of implied classical prototypes, we experience sonata form as a dialogue between the eighteenth and early twentieth centuries. By purposefully evoking classical models, Ravel places himself in the classical tradition while at the same time delightfully subverting that very tradition. Achieving a perfect equilibrium between Mozartian form and Ravelian content, between old models filled with a new meaning, he adds a new and original chapter to the history of sonata form.

CHAPTER 6

Conclusion

Ravel composed slowly and meticulously. To capture the essence of his music, one has to analyze it in every detail. I have developed the tools to do so and, in applying them to just a limited repertoire, have uncovered valuable insights into his style, tonal language, and treatment of form.

In this concluding chapter, I evaluate my methodology and review the stylistic features it uncovered (**6.1**); summarize my analytical findings and place each in a larger context (**6.2**); and identify avenues for further research (**6.3**).

6.1. Methodologies and General Observations

The three main methodologies I have applied to Ravel's sonata forms—Hepokoski and Darcy's Sonata Theory, my adaptation of Schenkerian analysis, and the set of transformational tools I developed to analyze Ravel's pre-war music—yield a wealth of insights into Ravel's artistry. In the following paragraphs, I summarize the analytical benefits each provides.

6.1.1. Hepokoski and Darcy's Sonata Theory

The flexibility of Hepokoski and Darcy's rotational concept allows us to engage deeply with Ravel's sonata forms by enabling a very precise reading of each individual form. Their thorough account of classical norms and typical deviations at each level of subdivision—from rotations to zones to modules to phrases—provides analytical concepts and a vocabulary capable of describing every nuance of Ravel's formal designs. Applying these concepts to Ravel's sonata forms thus reveals how in each of them he explores a different premise.[1]

The multi-layered approach, with various levels of default, provides a framework for the hermeneutic interpretation of Ravel's sonata forms. This is especially true since many of the meanings associated with certain characteristics, such as "the burden of the minor mode," still held sway during Ravel's time—even if only as a historical backdrop informing his compositional choices.

That Hepokoski and Darcy's concepts can be so successfully applied to Ravel's sonata forms not only speaks to the sophistication of their methodology but also demonstrates how much Ravel's formal designs owe to classical and pre-classical models. Since Ravel's "deviations" from first-level defaults provide clues that help us track down precedents, Hepokoski and Darcy's examples illustrating lower-level defaults become excellent "suspects" in the search for possible historical models.

6.1.2. Schenkerian Analysis

The process of adapting a Schenkerian methodology to enable the analysis of Ravel's pre-war music in itself reveals many of characteristics of his tonal language.

---

[1] Although we do not know much about Ravel's compositional process—no one was allowed to observe him while composing and he destroyed many sketches—we can infer from some of his remarks that perhaps he worked out a movement's formal design before actually composing its music. Asked about "inspiration" in 1928, Ravel replied: "All that I am able to affirm is that in 1924, when I undertook the Sonata for violin and piano, I had already determined its rather unusual form, the manner of writing for the instruments, and even the character of the themes for each of the three movements before 'inspiration' had begun to prompt any of these themes. And I don't think that I chose the easiest way." See inquiry by L. Dunton Green, *The Chesterian* (January–February 1928), 9 (68), 105–118; 115; reproduced in Orenstein, *A Ravel Reader*, 389.

After having demonstrated in chapter 2 that Ravel thought “prolongationally,” I identified some of the hallmarks of his style: his use of unresolved appoggiaturas, stepwise octatonic and whole-tone progressions at climax preparations, and diatonic and non-diatonic dissonant prolongations based on the harmonic series.

Providing a matrix for tonality, Schenkerian analysis helps us to understand the interaction between non-diatonic and tonal forces in Ravel’s music. When we apply the Schenkerian methodology to penetrate into the deeper structural layers of one of Ravel’s movements, we observe at which levels non-diatonic prolongations tend to function, and which formal functions they fulfill as the sonata moves through its rotations.

By comparing the deep middleground and background structures of Ravel’s sonata forms to Schenker’s sonata-form paradigms, we can see exactly how Ravel deviates from them or plays with conventions. My Schenkerian analysis of the Quartet, for example, has demonstrated that the interruption form of the Quartet’s fundamental structure deviates in that its headtone is prolonged throughout the development. This prolongation is enabled by Ravel’s choice of the submediant for the exposition’s s-theme. The Piano Trio, on the other hand, features no interruption structure, but its double-tonic complex reinterprets the headtone E, scale degree 5 of A minor, as scale degree 3 of C major before the final descent. The interpretation of this fundamental structure as “incomplete” in the Schenkerian sense forms an important argument for my hermeneutic reading not only of the movement but of the sonata cycle as a whole.

Moreover, the Schenkerian approach highlights Ravel’s artistry by revealing motivic parallelisms—from simple foreground parallelisms that map consecutive transpositions of a motive onto its interval structure (as in theme p^2 of the String

Quartet's recapitulation) to the *Übertragung der Ursatzformen* (as in the embedded parallelism of the String Quartet's interruption form).

However, the theoretical underpinnings of my adaptation of Schenkerian methodology are not yet fully developed. In section 6.4, I will outline what theoretical problems still need to be solved.

6.1.3. The Step-Based Approach to Motivic Analysis

The set of analytical tools I developed in chapter 3 reveals hitherto unexplored motivic relationships in Ravel's music. This is true especially for inversional and retrograde relationships. While Jürgen Braun, for example, has noted many of the motivic connections in the String Quartet,[2] he misses most of the motivic relationships in the Piano Trio.[3] The reason for this discrepancy lies in the fact that the motivic relationships of the String Quartet are more accessible without the analytical tools of set and transformation theory. Analytical tools that combine set-theoretical principles with the concept of step and step class are able to uncover the inversional and retrograde relationships in the Piano Trio's first movement and among the cycle's primary themes.[4]

Once we can relate the various shapes of a motive to each other with precision using the step-based approach to motivic transformation, we can not only link the motive forms to the different collections that govern them but also associate them with their formal functions. For example, in the String Quartet, the transformation of motive p^1

---

[2] Braun, *Thematik*, 85–88 and 149–52.
[3] Ibid., 91–92 and 154–56.
[4] Although Braun acknowledges cyclic connections between the four movements' primary themes, he claims that "there is no immediately obvious relationship between the various themes of the work." "Eine unmittelbar ins Auge fallende Beziehung zwischen den verschiedenen Themen des Werkes gibt es nicht." Braun, 91, my translation.

(introduced in the Quartet's first measure) from its diatonic to its "chromatic" form (p^{1chr}) reflects the change from a diatonic to an octatonic environment, whereas the interval transformation of its last interval (i^5) from the original descending second into an ascending minor third, followed by a return to the motive's first pitch to create the dominant form of p^1 ($p^{1\ dom}$), accomplishes the formal function of preparing for the secondary theme.

By defining the various types of transformations Ravel employs, we gain a better insight into his astounding motivic "wizardry." Moreover, as I have demonstrated in chapter 3, the analytical tools I have introduced may also be applied to other repertoires.

6.2. Ravel's Sonata Forms: A Preliminary Evaluation

Future in-depth studies of other sonata-movements of Ravel, pre-war and postwar, will reveal how my analytical findings for the String Quartet and the Piano Trio relate to works such as *Jeux d'eau* (1901), the *Sonatine* (1903–05), the *Introduction et Allegro* (1905), the *Sonate pour violon et violoncelle* (1920–22), the *Sonate pour violon et piano* (1923–27), the *Concerto pour la main gauche* (1929–30), and the *Concerto pour piano et orchestre* (1929–31). However, we can already deduce certain trends in Ravel's treatment of sonata form by comparing the first movements of the Quartet and Trio and looking to earlier and later sonata works to verify our observations.

When comparing the sonata form of the String Quartet's first movement to that the Piano Trio, we may observe four trends: (1) the overall sonata form becomes more condensed as Ravel moves from a triple-rotational Type 3 to a double-rotational Type 2 sonata form; (2) the String Quartet's tonal ambiguity, characterized by the F-major/D-minor combination, develops into a full-fledged A-minor/C-major double-tonic complex in the Piano Trio; (3) in the Piano Trio, the non-diatonic collections and progressions interact more intensely with the movement's diatonic (tonal) framework and permeate deeper structural levels; and (4) the network of motivic transformations in the later work is denser and more highly developed.

The condensation of the outer form (from three rotations into two) goes hand in hand with an increase in complexity of tonal, structural, and motivic content. In the following paragraphs I discuss each trend in detail and speculate on how Ravel's concept and treatment of sonata form evolve.

6.2.1. Condensation of Form

That the Piano Trio's first movement features a Type 2 sonata while the earlier String Quartet follows the more usual pattern of a Type 3 sonata invites a number of considerations. First, Ravel's turn to a historically earlier and, at least outwardly, "simpler" sonata-form model suggests that at the time he wrote the Trio, he viewed it as better serving his quest for the perfection of form. Knowing Ravel's awareness of historical models, we may even speculate that he meant to invoke the binary forms of the Baroque keyboard sonata. Hepokoski and Darcy provide Scarlatti's Sonata in G, K. 2 as a "touchstone example" for the pattern ‖: A^1+B^1 :‖: A^2+B^1 :‖.[5] Of course, as my analysis of the Trio's first movement has shown, Ravel playfully subverts the tonal conventions of this kind of binary form. Other evidence that Ravel might have used Baroque forms as an expression for "things past" supports my interpretation of the Trio's first movement as an

---

[5] Hepokoski and Darcy, *Elements*, 355.

expression of remembrance or nostalgia.[6] In *Le Tombeau de Couperin* (1914–1917) he uses Baroque forms (*Prélude, Fugue, Forlane, Rigaudon, Menuet,* and *Toccata*) to pay homage to eighteenth-century French music and, after the war, dedicates each movement to the memory of a fallen comrade.[7]

Secondly, Ravel's tendency to condense the sonata form is confirmed when we expand our examination of the repertoire to include the single-movement early Violin Sonata op. posthumous. This work, with which the Piano Trio's first movement shares its A-minor tonic and much motivic substance,[8] suffers from a somewhat lengthy and static development that takes up 120 of the movement's 251 measures (ca. 48%). In contrast, the String Quartet's development lasts 45 of the movement's 213 measures (ca. 21%), and in the Piano Trio, the "development" part of the second rotation (without the tonal resolution) takes up 23 of the movement's 117 measures (ca. 19%). Moreover, Ravel also increasingly condenses the form as a whole. In the early Violin Sonata, he still follows the convention of repeating the exposition, giving this Type 3 sonata 324 measures. Contrast with this the 213 measures of the Quartet's first movement (66%) and the 117 measures of the Trio's (36%).

---

[6] See also Michael Puri's dissertation," Theorizing Memory in Maurice Ravel's *Daphnis et Chloé,*" in which he relates elements of form in *Daphnis et Chloé* to Marcel Proust's *À la recherche du temps perdu*.
[7] See Orenstein, *Ravel: Man and Musician*, 185–86. Carolyn Abbate offers a fascinating interpretation of *Le Tombeau* by linking the idea of "tomb" and "monument" to characteristics of the mechanical piano. See Carolyn Abbate, "Outside Ravel's Tomb," *Journal of the American Musicological Society* 52/3 (fall 1999), 465–530.
[8] This was first pointed out by Arbie Orenstein, who edited the sonata's posthumous publication. "The opening key adumbrates the beginning of the Trio, both in melodic contour and mood. Moreover, the theme is treated similarly in both pieces." See Orenstein, *Ravel: Man and Musician*, 144–45.

6.2.2. From Tonal Ambiguity to the Double-Tonic Complex (and Beyond)

In chapter 4, I point out how the String Quartet's F-major/D-minor ambiguity foreshadows the Piano Trio's double-tonic complex. Tracing the tonal design of sonata movements from the posthumous A-minor Violin Sonata—whose exposition concludes in C major and recapitulation in A major[9]—to the String Quartet, the Piano Trio, and the post-war Violin Sonata, I see successive stages of Ravel's exploration of triadic relationships. In the first stage (Violin Sonata op. posth.), he enriches the harmonic first-level default of minor-mode sonata form with chromatic progressions but does not challenge the overall tonic-mediant relationship between expositional and recapitulatory tonal goals. In the second stage (Quartet), he explores a submediant relationship in a major-mode sonata form in which the two third-related keys compete for control over their shared collection. In the third stage (Trio), he subverts a minor-mode sonata form by turning the expected key relationships between exposition and recapitulation upside down: the exposition remains in the tonic key, while the recapitulation moves to the mediant. This time, the third-related keys do coexist as equals in the double-tonic complex. In the fourth stage (the post-war Violin Sonata),[10] Ravel experiments by superimposing harmonically unrelated keys (keys distant by T_{11}) to create "polytonal"

---

[9] The overall process of getting there is not as conventional as this suggests, however.

[10] It is quite possible that my "fourth" stage is actually a "fifth" stage in this supposed trajectory: Peter Kaminsky intimates that the *Sonata for Violin and Cello*, which precedes the post-war violin sonata by a year, "[incorporates] features … belonging to the nineteenth-century notions of tonal pairing." See Kaminsky, "Ravel's Late Music," 257, footnote 29.

juxtapositions.[11] For at least the first three of these stages, the harmonic and structural relationships of the keys are closely linked to the individual sonata form.[12]

6.2.3. Integration of Diatonic and Non-Diatonic Collections

When we compare the Piano Trio to the String Quartet, we find Ravel changes the way non-diatonic collections function in the diatonic/tonal framework.

In the String Quartet, octatonic and whole-tone passages (1) serve the delineation of formal sections by providing contrasting sonorities at the surface; (2) negotiate transitions by maximizing shared subsets; (3) provide substitutes for conventional progressions by fulfilling or replacing tonal functions; and (4) serve the movement's F-major/D-minor tonal framework by creating dissonant prolongations whose harmonic tension propels the motion between tonally stable sections. All these functions go hand in hand: the brief whole-tone passage in mm. 21–23, for example, provides a contrasting sonority to the preceding diatonic P-zone while prolonging a V#11/9/7 and at the same time mediating between the diatonic and octatonic collections with shared subsets.

In the Piano Trio, the use of non-diatonic collections reaches a new level of sophistication. Additional diatonic and non-diatonic collections, such as the pentatonic and enneatonic, are more deeply embedded in the prolongational structures, reaching into deeper levels at places where non-diatonic prolongations control a diatonic surface. Although the non-diatonic collections still provide contrasting sonorities, their interaction

---

[11] Ibid., 257–63. Although the term "bitonal" is usually only applied to the Violin Sonata's second movement ("Blues), Kaminsky demonstrates T_{11} relationships also for the first movement. He sees the T_{11} as possibly originating from Ravel's practice of unresolved appoggiaturas.

[12] I would not be surprised if the same holds true for the Violin Sonata; however, I cannot make such claims without carrying out detailed analyses.

with the movement's tonal structure is much more complex. More integrated into the pitch-fabric of the movement, their formal functions are harder to define here than in the String Quartet. Generated by circle-of-fifth progressions, whole-tone progressions work at deeper levels of the structure and assume a more important structural role.

When we include the early Violin Sonata in the comparison, the trend from surface-level progressions in the Violin Sonata to large-scale and more structural progressions in the Piano Trio (see example **6.1**) becomes apparent. In the Violin Sonata, a chromatic slide is mapped onto the WT_0 progression. Progressing through three steps and taking up only three measures, it is easily perceived at the music's surface. The Quartet's WT_0 progression is already more embellished. Progressing through its five steps more slowly over a larger span of time, it requires more structural awareness on the part of the listener.[13] The large-scale WT_0 progression in the fourth movement of the Trio,[14] which leads from the second half of the movement's development into the recapitulation, is perhaps only perceptible once analysis has revealed the deeper structural function of the progression. Traversing an octave, the progression spans fifteen measures. Tracking it aurally is more difficult because the pace of the consecutive steps changes twice (see example 6.1). The comparison suggests that, as time went on, Ravel became more and more interested in the structural ability of the WT progression to span larger formal sections (especially, to create a continuous trajectory from the developmental into the

[13] Falling chronologically between the Quartet and the Trio, another example of a larger-scale whole-tone progression is the opening of *Daphnis and Chloé* (1909–12). Spanning the first forty measures of the ballet—A (mm. 1–14), G (mm. 15–18), F (mm. 19–24), D# (mm. 25–28), C# (mm. 29–31), B (mm. 32–39), A (mm. 40 ff), the progression serves as the unifying delineation of the "Introduction" that sets the pastoral scenery; its arrival at the original pitch class signals the beginning of the "Danse religieuse."
[14] An even larger and deeper level WT progression spans the entire development (reaching into the tonal resolution) in mm. 60–86 of the Piano Trio's *first* movement. However, because of its length and complexity, the excerpt would have been more difficult to incorporate into example 6.1.

recapitulatory space), and less in the surface impact of the sliding progression's sonority.[15] What remains consistent throughout all these works is that all the descending progressions appear at or toward the end of sections (while the few ascending progressions, such as in the Piano Trio's first movement, signal departure).

6.2.4. Motivic Transformation

The ways Ravel creates motivic connections, transforms individual motives, and uses the transformations to create coherence within the first movement and among the four movements are different in the String Quartet and the Piano Trio. In the String Quartet's first movement, most of the motivic connections and transformations are easily audible at the surface level and thus reveal much about the "construction" of the movement and its various sections. In the Piano Trio's first movement, on the other hand, the motivic connections and transformations are more deeply embedded into the harmonic and pitch structure. Not perceptible without analysis, they work below the listener's conscious apprehension of the movement's organic structure. In the Trio, Ravel realizes his goal of creating objects of beauty without revealing the hard labor that went into it in a much more sophisticated manner.

A comparison of the motivic techniques Ravel employs in either work shows the following differences:

[15] Ravel explored structural WT progressions also in his vocal repertoire. In the song "Sur l'herbe" from 1907, for example, the song's ternary structure is characterized by the alternation of two descending WT progressions: the first stanza's WT_1 progression is interrupted after four steps by the second stanza's WT_0, before WT_1 resumes and completes its progression with the third stanza. See Heinzelmann, "Cyclic Pitch-Class Collections in the Music of Maurice Ravel," 83–86. Since the song was written in the years between the Quartet and the Trio, we can assume that Ravel continuously developed the structural function of descending WT progressions.

1. In the Quartet, the first measure generates the rhythmic motive ♩ ♪♪♩ ♩, the pitch motive A–G–E–D, and the step-interval motive [–1–2–1]. Since most motivic transformations retain at least two of these elements and work at the same level (the measure unit), the listener can easily perceive the resulting motivic shapes as related. In the Trio, Ravel generates the motives and themes and their transformations from a group of much smaller motivic cells. Since most transformations work at the cellular level, they do not combine to a uniform transformational operation at the measure level. This makes the transformations much harder, if not impossible, to track aurally and more difficult to explain analytically. However, since Ravel groups combinations of these cells and motives in similar ways, the listener does perceive a kind of organic coherence.
2. In the Quartet, the interval structures of the motivic shapes and the themes or theme-fragments into which they group, explicitly express the collections by which they are governed. Since both, motive forms and collections, are associated with specific formal functions, the motives also help us track the sonata movement's process through the zones and their modules. In the Trio, Ravel seems more interested in shaping the different themes by using cells whose pitch content remains more or less consistent. Shared subsets serve not so much to negotiate between different successive collections, but to create thematic unity. As these subsets shape the main motivic cells, they weave a pentatonic thread that remains consistent throughout changes in collection and harmony. To highlight how—between the Quartet and the Trio—Ravel

changes not only the motivic techniques, but the way he incorporates them into the formal structure, I shall risk the following crude simplification: within the (more or less) unified instrumental timbre of the Quartet's first movement, Ravel directs our perception of form toward the changing shapes of motives and themes, whereas within the unified motivic fabric of the Piano Trio's first movement, Ravel directs out perception of form to the changes in texture and instrumentation (and, to some degree, by the changing sonorities between the diatonic and enneatonic collections).

3. Although the motivic connections in the Trio are less direct than those in the Quartet, the motivic cells influence more of the movement's thematic substance. As a result, the Trio's organic unity permeates deeper into the movement's and the sonata cycle's structure. For example, the secondary theme in the Quartet shares no immediate motivic connection with the initial form of the first theme—only the subsequent rhythmic transformations of p that include the fourth-beat triplet create a connection to the s-theme. In the Piano Trio, however, the pitch structure of P- and S-themes are related—below their immediate surface—by inversion. We can observe similar differences in the treatment of thematic relationships between the Quartet and the Trio at the cyclic level. In the Quartet, the cyclic aspects that link the four movements are limited to aurally more obvious, but structurally less deeply embedded thematic "quotations": The second movement recalls the first movement's secondary theme (theme s), the third movement recalls the dominant form of theme p, and the fourth movement features both a rhythmic

transformation of $p^{1\ dom}$ and a melodic (INTTRANS) transformation of theme s. As I have shown in chapter 5, Ravel creates the Piano Trio's cyclic connections among the movements through sophisticated and complex transformations between the movements' various P-themes.

6.3. Looking Forward: Avenues for Future Research

Like the streets fanning out from the *Arc de triomphe*, the paths for future research point in many directions: toward further development and refinement of my methodologies, toward expanding the body of analyses to the remaining sonata forms by Ravel, toward studies comparing Ravel's sonata forms to those of other early-twentieth-century composers, toward thorough analytical exploration of the relationships between Ravel's forms and possible models, toward a rigorous study of Ravel's tonality and harmonic language, and toward many more. Below, I outline the issues and questions associated with some of these topics.

6.3.1. Methodological and Theoretical Studies

I developed the methodologies outlined in part I specifically to analyze this dissertation's repertoire. Therefore, they can and should be further developed.

Schenkerian Analysis

My Schenkerian analyses raise questions that need to be addressed in a systematic study on voice-leading in Ravel's music. For example: What are the contrapuntal constraints on outer-voice structures in Ravel's prewar music? How do we decide whether a ninth above the bass is a structural upper-voice note or an appoggiatura? How are sevenths, ninths, and thirteenths (or added sixths) expected to behave contrapuntally when they appear in a middleground analysis? What importance does the boundary interval of a linear progression have within a single structural voice? Is its importance different when the referential collection is non-diatonic (for example, motion through an augmented fifth within a whole-tone scale)? Such a study, possibly modeled after Kofi Agawu's study on voice-leading in Mahler,[16] could take into account Ravel's training in counterpoint under André Gedalge[17] and build on previous work on Ravel's counterpoint by Volker Helbing.[18]

Motivic Analysis and Step-Based Transformation

The analytical tools I introduced in chapter 3 serve primarily the analysis of motivic transformations in Ravel's pre-war repertoire. A more systematic study would provide a rigorous theoretical framework for a step-based theory that could solve some of the following theoretical issues: Which mathematical and group-theoretical underpinnings would enable a systematic solution to the "cardinality problem" (how to compare referential spaces of different sizes). Taking Michael Berry's recent dissertation on non-tonal pitch-class spaces and their implications for voice-leading as a point of

---

[16] See Kofi Agawu, "Prolonged Counterpoint in Mahler," *Mahler Studies* (Cambridge: Cambridge University Press, 1997), 217–47.
[17] See André Gedalge, *Traité de la fugue* (Paris: Enoch & Cie, 1901); Renate Groth, *Die französische Kompositionslehre des 19. Jahrhunderts* (Wiesbaden: Franz Steiner Verlag, 1983).
[18] See Volker Helbing, "Kontrapunkt hinter Glas: Zur Fuge des *Tombeau de Couperin*," in *Musiktheorie zwischen Historie und Systematik*, ed. Ludwig Holtmeier, Michael Polth, and Felix Diergarten (Augsburg: Wißner Verlag, 2004), 398–411.

departure,[19] one could expand and systematize the list of transformation-operations and simplify their labeling.

There is also a need for a systematic treatment of transformations that involve temporal changes—of rhythm, meter, order, and grouping—to describe the motivic transformations in the music of Ravel and others more precisely. Such research would incorporate concepts from studies in meter and rhythm[20] as well as studies of motivic treatment by individual composers.[21]

6.3.2. Further Analytical Studies

Ravel's Sonata Forms

Because this dissertation focuses on a small repertoire of Ravel's sonata forms, it invites a larger study that includes in-depth analysis of all of Ravel's works in sonata form. On the basis of these we could (1) gain a more complete understanding of Ravel's forms (sonata form specifically, but also form in general); (2) assess Ravel's progress as a composer in the light of his sonata forms; (3) trace changes in his style through the lens of sonata form; and (4) evaluate his contribution to sonata form in the early twentieth century by comparing his sonata compositions to those of his contemporaries (Debussy, Scriabin, Bartók, Stravinsky, and Berg, to name just a few).

Marianne Wheeldon's recent article on the sonata cycle in Debussy's music inspires a comparable exploration of the relationship between Ravel's sonata cycles and

---

[19] Michael Berry, "An Exploration of Some Non-Tonal Pitch-Class Spaces with Implications for a Theory of Voice-Leading," PhD diss., City University of New York, 2007.
[20] To name just a few: Rothstein, *Phrase Rhythm*; Harald Krebs, *Fantasy Pieces: Metrical Dissonance in the Music of Robert Schumann* (Oxford: Oxford University Press, 2003); Fred Lerdahl and Ray Jackendoff, *A Generative Theory of Tonal Music* (Cambridge, MA: The Massachusetts Institute of Technology, 1983).
[21] For example, Gingerich, "A Technique for Melodic Motivic Analysis in the Music of Charles Ives."

d'Indy's postulates.[22] In his study on thematic treatment in Ravel's chamber music, Braun suggests that "Ravel's compositional practice seems to contradict his theoretical rejection of d'Indy's teachings"[23]—a conclusion that resonates with my observations on the cyclic nature of the Piano Trio. Although Braun discusses some of the cyclic aspects in Ravel's chamber music, his limited analytical tools keep him from exploring the topic more fully.

Ravel and His Models

More than most, Ravel was keenly aware of the works of his predecessors and contemporaries. Where other composers suffered from "anxiety of influence,"[24] he thought that to imitate models was the best way for a composer to learn his craft and find his originality. He advised his pupils: "If you have something to say, this something will never emerge more distinctly than in your unintended unfaithfulness to a model."[25]

Ravel takes his inspiration both from other composers and from a variety of other sources, ranging from folk songs to literary models. We know it is central to Ravel's art to evoke past styles and formal models, to then playfully or ironically distance himself from them. Because of his eclecticism, we are unlikely to find a single source of inspiration for a given piece; nonetheless, we can usefully speculate about a range of

---

[22] Wheeldon, "Debussy and *La Sonate cyclique*."
[23] "Der Praxis von Ravels Schaffen scheint allerdings die theoretische Ablehnung der Lehre d'Indys zu widersprechen." Braun, *Die Thematik*, 82, my translation.
[24] See Harold Bloom, *The Anxiety of Influence: A Theory of Poetry* (London/New York: Oxford University Press, 1973); 2nd ed. 1997. Incorporating Bloom's ideas into a context of musical influence, Kevin Korsyn cites Brahms as an example of a composer with "influence-anxiety." See Kevin Korsyn, "Towards a New Poetics of Musical Influence," *Music Analysis* 10/1–2 (1991), 3–72; 15.
[25] See Roland Manuel, "Des valses à *La Valse*," in Colette *et al.*, *Maurice Ravel*, 141–51; 145. See also Roland Manuel, *Ravel*, trans. Cynthia Jolly (New York: Dover, 1972), 134.

possible sources. This is only interesting, however, if we study how Ravel adapts, changes, or subverts the model.

The study *Ravel und die Modelle* by Elisabeth Winnecke offers historical and biographical evidence about composers and compositions Ravel might have chosen as models but insufficient analytical support to establish definitive influences.[26] Throughout my analyses, I mention works by Mozart, Beethoven, Chopin, and others as possibly inspiring some of Ravel's compositional choices, but a thorough comparative study of Ravel's sonata forms and possible models is beyond the scope of this dissertation. Debussy's String Quartet has often been cited as a possible model for Ravel's Quartet, but only close analytical study will reveal connections that reach past the most obvious similarities, such as texture. Since the Quartet is the first "mature" sonata by Ravel, I suggest that we look for models in the music of Mozart, who for Ravel was "perfection."[27] The first movement's trimodular block—or another interpretation for the apparent double MC, for example, Hepokoski and Darcy's "declined" medial caesura[28]—provides a point of departure.

I consider the following to be possible inspirations for the form of the Piano Trio's first movement: (1) the first movement of Mozart's Piano Sonata in D, K 311, as

---

[26] Winnecke, *Ravel und die Modelle*.

[27] Asked in an interview about the greatest of all composers, Ravel replied: "For me it is Mozart. Mozart is perfection: he is Grecian, whereas Beethoven is Roman. The Greek is great, the Roman is colossal. I prefer the great. There is nothing as sublime as the third act of Mozart's *Idomeneo*." Orenstein, *A Ravel Reader*, 433.

[28] *Elements*, 45–47. Hepokoski and Darcy's description of one of the possible ways in which an MC can be declined resonates strongly with the events in the String Quartet's exposition: "A second way to decline a I:HC MC is by remaining in the tonic key, even though a new theme is sounded. Following the proposed I:HC MC, the music refuses to modulate, staying in the original tonic key and providing new material." Ibid., 45.

an example of a Type 2 sonata whose coda recalls the opening theme;[29] (2) the first movements of Chopin's Piano Sonata op. 4 and his E-minor Piano Concerto as examples for expositional S-zones that remain in the tonic key; and (3) Chopin's *Ballade* op. 38 and Debussy's "Gigues" from *Images* for orchestra as exemplifying various shades of the double-tonic complex.[30] For the fourth movement's feature of introducing the S^C-theme above a 6/4 chord, we find precedents in the first movements of Beethoven's Piano Sonatas op. 2 no. 1 and op. 13, while the order of movements and the tonal plan of the Trio's four-movement cycle resembles that of Mozart's String Quintet K. 516. On the other hand, the Trio's cyclic features, especially those achieved by thematic transformation, recalls Cesar Franck's A-major Violin Sonata.

Literary Influences

Both Brian Newbould's fascinating article on Ravel's translation of the Malay *Pantoum* into the musical structure of the Piano Trio's second movement[31] and my observation that the structure of the Trio's opening theme is based on the poetic form of the Basque *Zortziko* suggest that poetic forms served as a source of inspiration for Ravel in more instances. Given Ravel's fascination with Edgar Allan Poe's *The Raven* and Poe's theoretical work "The Philosophy of Composition,"[32] an inquiry into literary works

---

[29] In chapter 4, I have already elaborated on the movement's indebtedness to the Basque *Zortziko*.
[30] See Kevin Korsyn, "Directional Tonality and Intertextuality: Brahms's Quintet op. 88 and Chopin's Ballade op. 38," in *The Second Practice of Nineteenth-Century Tonality*, 45–83. See also Pomeroy, "Tales of Two Tonics." Not only does the F-minor/A♭-major DTC of "Gigues" feature the same key-relationship as Ravel's Trio, it was first performed in Paris on January 26, 1913—about a year before Ravel began working on the Trio.
[31] Newbould, "Ravel's *Pantoum*."
[32] Ravel read Poe's essay in Baudelaire's translation. See Orenstein, *A Ravel Reader*, 455 (footnote 2). In an interview with André Révész, Ravel stated: "My teacher in composition was Edgar Allan Poe, because

or principles as models for Ravel's musical structures promises further interesting results. Bibliographical information available in the works of Arbie Orenstein, Jean-Michel Nectoux, Elisabeth Winnecke, and others may provide clues in the search for literary sources that might have inspired Ravel.[33]

* * *

Having thus gained a better understanding of Ravel's music, we may view Stravinsky's somewhat disparaging remark that Ravel was "the most perfect of Swiss clockmakers"[34] in a different light: Ravel's works are masterpieces of extraordinary beauty and craftsmanship that hide a complex and perfect mechanism behind the beautiful design of an elegant and seemingly simple face and casing.

---

of his wonderful poem, *The Raven*." André Révész, "The Great Musician," in Orenstein, *A Ravel Reader*, 433. Orenstein also discusses Ravel's relationship to the work of Poe. Ibid., 21–22.

[33] Orenstein, *Ravel: Man and Musician* and *A Ravel Reader*; Jean-Michel Nectoux, "Maurice Ravel et sa bibliothèque musicale," *Cahiers Maurice Ravel* 3 (1987), 54–63;Winnecke, *Ravel und die Modelle*.

[34] José Bruyr, "En marge … d'un premier chapitre," *La Revue musicale* 19, special issue (December 1938), 279–80; 279.

BIBLIOGRAPHY

Abbate, Carolyn. “Outside Ravel’s Tomb.” *Journal of the American Musicological Society* 52/3 (1999): 465–530.

Agawu, Kofi. “Prolonged Counterpoint in Mahler.” In *Mahler Studies*, edited by Stephen E. Hefling, 217–47. Cambridge: Cambridge University Press, 1997.

Agmon, Eytan. “The First Movement of Beethoven’s Cello Sonata, Op. 69: The Opening Solo as Structural and Motivic Source.” *The Journal of Musicology* 16/3 (1998): 394–409.

Akeret, Kurt. *Studien zum Klavierwerk von Maurice Ravel*. Rapperswil: Gasser & Co., 1941.

Aldwell, Edward and Carl Schachter. *Harmony and Voice Leading*. 3rd ed. Belmont: Thomson & Schirmer, 2003.

Antokoletz, Elliott. *Musical Symbolism in the Operas of Debussy and Bartók*. Oxford: Oxford University Press, 2004.

———. *The Music of Béla Bartók: A Study of Tonality and Progression in Twentieth–Century Music*. Berkeley: University of California Press, 1984.

———. *Twentieth-Century Music*. Englewood Cliffs, NJ: Prentice Hall, 1992.

Aulestia, Gorka. *Improvisational Poetry from the Basque Country*. Translated by Lisa Corcostegui and Linda White. Reno: University of Nevada Press, 1995.

Baeck, Erik. “La mort de Maurice Ravel.” *Revue Belge de Musicologie* 51 (1997): 187–93.

Bailey, Robert. “An Analytical Study of the Sketches and Drafts.” In *Prelude and Transfiguration from “Tristan und Isolde,”* edited by Robert Bailey, 113–46. New York: Norton, 1985.

———. “The Genesis of *Tristan und Isolde* and a Study of Wagner’s Sketches and Drafts for the First Act.” PhD diss., Princeton, 1969.

Baker, James M. “Schenkerian Analysis and Post-Tonal Music.” In *Aspects of Schenkerian Theory*, edited by David Beach, 153–86. New Haven: Yale University Press, 1983.

Basque *Bertsolari* songs. Bertsozale Elkartea. http://www.bertsozale.com/english/doinutegia/doinutegia-bilaketa1.php

Bass, Richard. "Models of Octatonic and Whole-Tone Interaction: George Crumb and his Predecessors." *Journal of Music Theory* 38/2 (1994): 155–86.

———. "Sets, Scales and Symmetries: The Pitch-structural Basis of George Crumb's Makrokosmos I and II." *Music Theory Spectrum* 13/1 (1991): 1–20.

Baur, Steven. "Ravel's 'Russian' Period: Octatonicism in His Early Works, 1893–1908." *Journal of the American Musicological Society* 52/3 (1999): 531–92.

Berger, Arthur. "Problems of Pitch Organization in Stravinsky." *Perspectives of New Music 2* (1963): 11–42.

Berges, Ruth. "That elusive *Prix de Rome*." *The Music Review* 55/2 (1994): 146–52.

Berry, Michael. "An Exploration of Some Non-Tonal Pitch-Class Spaces with Implications for a Theory of Voice-Leading." PhD diss., City University of New York, 2007.

Berry, Wallace. *Form in Music*. 2nd ed. Englewood Cliffs, NJ: Prentice Hall, 1986.

Beyer, Richard. *Organale Satztechniken in den Werken von Claude Debussy und Maurice Ravel*. Neue Musikgeschichtliche Forschungen, vol. 19. Wiesbaden: Breitkopf und Härtel, 1992.

Bhogal, Gurminder Kaur. "Arabesque and metric dissonance in the music of Maurice Ravel." PhD diss., University of Chicago, 2004.

Bloom, Harold. *The Anxiety of Influence: A Theory of Poetry*. 2nd ed. Oxford and New York: Oxford University Press, 1997.

Bordes, Charles. "Douze Chansons amoureuses du Pays Basque françaises." *Chansons Populaires, Archives de la Tradition Basque*. Paris: Rouart, Lerolle & Cie, 1900.

Braun, Jürgen. *Die Thematik in den Kammermusikwerken von Maurice Ravel*. Kölner Beiträge zur Musikforschung, vol. 33. Regensburg: Gustav Bosse, 1966.

Brown, Matthew. *Explaining Tonality*. Rochester: University of Rochester Press, 2005.

Bruyr, José. "En marge … d'un premier chapitre." *La Revue musicale* 19, special issue (1938): 279–80.

Burkhart, Charles. "Schenker's 'Motivic Parallelisms'." *Journal of Music Theory* 22/2 (1978): 145–75.

Burnham, Scott. “The Second Nature of Sonata Form.” In *Music Theory and Natural Order from the Renaissance to the Early Twentieth Century*, edited by Alexander Rehding, 111–41. Cambridge: Cambridge University Press, 2001.

Burstein, Poundie. ““The Trimodular Block, the Three-Part Exposition, and the Classical Transition Section.” Paper presented at the annual meeting of the American Musicological Society and the Society for Music Theory, Los Angeles, CA, November 2–5, 2006.

Caballero, Carlo. “Fauré and French Musical Aesthetics.” PhD diss., University of Pennsylvania, 1996.

———. “Patriotism or Nationalism? Fauré and the Great War.” *Journal of the American Musicological Society* 52/3 (1999): 593–625.

Caplin, William E. *Classical Form: A Theory of Formal Functions for the Instrumental Music of Haydn, Mozart, and Beethoven*. Oxford and New York: Oxford University Press, 1998.

Chong, Eddy Kwong Mei. “Extending Schenker’s *Neue musikalische Theorien und Phantasien:* Towards a Schenkerian Model for the Analysis of Ravel’s Music.” PhD diss., Eastman School of Music, University of Rochester, 2002.

Chrisman, Richard. “Describing Structural Aspects of Pitch-Sets Using Successive-Interval Arrays.” *Journal of Music Theory* 21/1 (1977): 1–28.

Christensen, Thomas. *Rameau and Musical Thought in the Enlightenment* Cambridge: Cambridge University Press, 1993.

Clark, William. “Heinrich Schenker and the Nature of the Seventh Chord.” *Journal of Music Theory* 26/2 (1982): 221–59.

Cohn, Richard. “Bartók’s Octatonic Strategies: A Motivic Approach.” *Journal of the American Musicological Society* 44/2 (1991): 262–300.

———. “Maximally Smooth Cycles, Hexatonic Systems, and the Analysis of Late-Romantic Triadic Progressions.” *Music Analysis* 15/1 (1996): 9–40.

———. “Uncanny Resemblances: Tonal Signification in the Freudian Age.” *Journal of the American Musicological Society* 57/2 (2004): 285–324.

Cortot, Alfred. *La musique française de piano*. 5th ed. Paris: Presses Universitaires de France, 1948. First published 1930.

Darcy, Warren, and James Hepokoski. “The medial caesura and its role in the eighteenth-century sonata exposition.” *Music Theory Spectrum* 19/2 (1997): 115–54.

DeVoto, Mark. “Harmony in the Chamber Music.” In *The Cambridge Companion to Ravel*, edited by Deborah Mawer, 97–117. Cambridge: Cambridge University Press, 2000.

d’Indy, Vincent, *Cours de composition musicale, IIe livre, 1re partie*. Paris: Durand, 1909.

Dowling, Richard William. “Maurice Ravel’s *Trio pour piano, violon et violoncelle*: A preliminary study for a New Performing Edition.” DMA diss., University of Texas at Austin, 1990.

Dunoyer, Cecilia. *Marguerite Long: A Life in French Music, 1874–1966*. Bloomington: Indiana University Press, 1993.

Forte, Allen. “Debussy and the Octatonic.” *Music Analysis* 10/1–2 (1991): 125–69.

Fulcher, Jane F. “The Composer as Intellectual: Ideological Inscriptions in French Interwar Neoclassicism.” *Journal of Musicology* 17/2 (1999): 197–230.

Gauldin, Robert. “ The Cycle-7 Complex.” *Music Theory Spectrum* 5 (1983): 39–55.

Gedalge, André. *Traité de la Fugue*. Paris: Enoch & Cie, 1901.

Gingerich, Lora L. “A Technique for Melodic Motivic Analysis in the music of Charles Ives.” *Music Theory Spectrum* 8 (1986): 76–93.

Goebels, Franzpeter. “Le Tombeau de Couperin: Bemerkungen und Anregungen zu Ravels Klavierwerk.” *Musica* 41/4 (1987): 319–22.

Green, L. Dunton. “On Inspiration.” *The Chesterian* (1928), 9 (68): 105–18.

Gronquist, Robert. “Ravel’s Trois Poèmes de Stéphane Mallarmé.” *Musical Quarterly* 64/4 (1978): 507–23.

Gut, Serge. “Les deux aspects de la gamme par tons.” *Cahiers de l’harmonie vivante* 3 (1979): 15–19.

———. “Permanence et transformation des structures mélodiques grecques antiques dans les Mélodies populaires grecques de Maurice Ravel.” *Revue de musicologie* 84/2 (1998): 263–76.

Harris, Simon. “Chord-Forms based on the Whole-Tone Scale in Early Twentieth-Century Music.” *The Music Review* 41/1 (1980): 36–51.

Headlam, Dave. *The Music of Alban Berg*. New Haven: Yale University Press, 1996.

Heinzelmann, Sigrun B. “Cyclic Pitch-Class Collections in the Music of Maurice Ravel.” MM thesis, University of Massachusetts Amherst, 1998.

Helbing, Volker. “Choreografie und Distanz. Studien zur Ravel-Analyse.” PhD diss., Technische Universität Berlin, 2005.

———. “Kontrapunkt hinter Glas: Zur Fuge des *Tombeau de Couperin*.” In *Musiktheorie zwischen Historie und Systematik (1. Kongreß der Deutschen Gesellschaft für Musiktheorie, Dresden 2001)*, edited by Ludwig Holtmeier, Michael Polth, and Felix Diergarten, 398–411. Augsburg: Wißner Verlag, 2004.

———. “*L’impression d’un tournoiemont fantastique et fatale*: Aneignung und Verzerrung in Ravels La Valse.” In *Individualität in der Musik*, edited by Oliver Schwab-Felisch, Christian Thorau, and Michael Polth, 175–200. Stuttgart: J.B. Metzler, 2002.

———. “Noctuelles by Ravel: An essay on the morphology of sound.” *Tijdschrift voor Muziektheorie* 8/2 (2003): 142–51.

Hepokoski, James A. “Beyond the sonata principle.” *Journal of the American Musicological Society* 55/1 (2002): 91–154.

Hepokoski, James and Warren Darcy. *Elements of Sonata Theory: Norms, Types, and Deformations in the Late-Eighteenth Century Sonata*. New York: Oxford University Press, 2006.

———. “The Medial Caesura and Its Role in the Eighteenth-Century Sonata Exposition.” *Music Theory Spectrum* 19/2 (1997): 115–54.

Hirsbrunner, Theo. “Gaspard de la Nuit von Maurice Ravel.” *Archiv für Musikwissenschaft* 44/4 (1987): 268–81.

Hopkins, G.W. “Maurice Ravel.” In *The New Grove Twentieth-Century French Masters*, 151–93. New York: W.W. Norton, 1986.

Howat, Roy. “Debussy, Ravel and Bartók: Towards Some New Concepts of Form.” *Music and Letters* 58/3 (1977): 285–93.

———.”Ravel and the Piano.” In *The Cambridge Companion to Ravel*, edited by Deborah Mawer, 71–96. Cambridge: Cambridge University Press, 2002.

Huron, David. “Tone and Voice: A Derivation of the Rules of Voice-leading from Perceptual Principles.” *Music Perception* 19/1 (2001): 1–64.

Ivry, Benjamin. *Maurice Ravel: A Life*. New York: Welcome Rain Publishers LLC, 2000.

Jankélévitch, Vladimir. *Ravel*. Hamburg: New York: Grove Press, 1959.

Jonas, Oswald. *Einführung in die Lehre Heinrich Schenkers: Das Wesen des musikalischen Kunstwerkes*. Rev. edition. Vienna: Universal Edition, 1972.

Kabisch, Thomas. "Franz Liszt und die Tradition der 'nicht-diskursiven' Musik." *Studia Musicologica* 28/1–4 (1986): 125–36.

———. "Kompositionstechnische und ästhetische Aspekte der Sonatine für Klavier (1. Satz) von Maurice Ravel." In *Musik als Schöpfung und Geschichte: Festschrift für Karl Michael Komma zum 75. Geburtstag*, 125–43. Laaber: Laaber Verlag, 1989.

———. "Oktatonik, Tonalität und Form in der Musik Maurice Ravels." *Musiktheorie* 5/2 (1990): 117–36.

Kahan, Sylvia. "'Rien de la tonalité usuelle': Edmond de Polignac and the Octatonic Scale in Nineteenth-Century France." *19th-Century Music* 29/2 (2005): 97–120.

Kaminsky, Peter "Composers' Words, Theorists' Analyses, Ravel's Music (Sometimes the Twain Shall Meet)." *College Music Symposium* 43 (2003): 161–77.

———. "Of Children, Princesses, Dreams and Isomorphisms: Text-Music Transformation in Ravel's Vocal Works." *Music Analysis* 19/1 (2000): 29–68.

———. "Ravel's Late Music and the Problem of 'Polytonality'." *Music Theory Spectrum* 26/2 (2004): 237–64.

———. "Vocal Music and the Lures of Exoticism and Irony." In *The Cambridge Companion to Ravel*, edited by Deborah Mawer, 162–87. Cambridge: Cambridge University Press, 2002.

Karpinski, Gary S. *Aural Skills Acquisition*. Oxford and New York: Oxford University Press, 2000.

———. "Structural Functions of the Interval Cycles in Early Twentieth-Century Music." *International Journal of Musicology* 4 (1995): 183–206.

Katz, Israel J. "*Bertsolaritza* and its Musical Foundations: Some Observations." In *Voicing the Moment: Improvised Oral Poetry and Basque Tradition*, edited by Samuel G. Armistead and Joseba Zulaika, 343–70. Reno: University of Nevada Press, 2005.

Kelly, Barbara. "History and Homage." In *The Cambridge Companion to Ravel*, edited by Deborah Mawer, 7–26. Cambridge: Cambridge University Press, 2002.

Kinderman, William. "Wagner's *Parsifal*: Musical Form and the Drama of Redemption." *Journal of Musicology* 4/4 (1985–1986): 431–46.

Kinderman, William, and Harald Krebs, editors. *The Second Practice of Nineteenth-Century Tonality*. Lincoln: University of Nebraska Press, 1996.

Klumpenhouwer, Henry. "Anti-Cartesianism in Lewin's *Generalized Musical Intervals and Transformations*." *Music Theory Spectrum* 28/2 (2006): 277–89.

Kopp, David. *Chromatic Transformations in Nineteenth-Century Music*. Cambridge Studies in Music Theory and Analysis ser. 17. Cambridge: Cambridge University Press, 2002.

Korsyn, Kevin. "Directional Tonality and Intertextuality: Brahms's Quintet op. 88 and Chopin's Ballade op. 38." In *The Second Practice of Nineteenth-Century Tonality*, edited by William Kinderman and Harald Krebs, 45–83. Lincoln: University of Nebraska Press, 1996.

———. "Towards a New Poetics of Musical Influence." *Music Analysis* 10/1–2 (1991): 3–72.

Kramer, Jonathan. "The Fibonacci Series in Twentieth-Century Music." *Journal of Music Theory* 17/1 (1973): 110–48.

Krebs, Harald. *Fantasy Pieces: Metrical Dissonance in the Music of Robert Schumann*. Oxford and New York: Oxford University Press, 2003.

———. "Some Early Examples of Tonal Pairing: Schubert's 'Meeres Stille' and 'Der Wanderer'." In *The Second Practice of Nineteenth-Century Tonality*, edited by William Kinderman and Harald Krebs, 17–33. Lincoln: University of Nebraska Press, 1996.

Kuhn-Schließ, Ortrud. *Klassizistische Tendenzen im Klavierwerk von Maurice Ravel*. Kölner Beiträge zur Musikforschung, vol. 171. Regensburg: Gustav Bosse, 1992.

Laborde, Denis. "Basque Music." *Grove Music Online*, edited by L. Macy (Accessed 7/30/07), http://www.grovemusic.com.

Laloy, Louis. *La musique retrouvée, 1902–1927*. Paris: Desclée de Brouwer, 1974.

Lambert, J. Philip. "Interval Cycles as Compositional Resources in the Music of Charles Ives." *Music Theory Spectrum* 12/1 (1990): 43–82.

Larson, Steve. "The Problem of Prolongation in 'Tonal' Music: Terminology, Perception, and Expressive Meaning." *Journal of Music Theory* 41/1 (1997): 119–20.

———. "Schenkerian Analysis of Modern Jazz: Questions about Method." *Music Theory Spectrum* 20/2 (1998): 209–41.

Lenormand, Rene. *Twentieth-Century Harmony; A Treatise and Guide for the Student-Composer of Today,* Vol. 1: Harmony in France to 1914. Translated by Herbert Antcliffe. London: Joseph Williams, 1915. Reprint, New York: Da Capo Press, 1976. French original published in 1913.

Lerdahl, Fred. *Tonal Pitch Space*. Oxford and New York: Oxford University Press, 2001.

Lerdahl, Fred and Ray Jackendoff. *A Generative Theory of Tonal Music*. Cambridge, MA: The MIT Press, 1983.

Lester, Joel. "Rameau and Eighteenth-Century Harmonic Theory." In *The Cambridge History of Western Music Theory*, edited by Thomas Christensen, 753–811. Cambridge: Cambridge University Press, 2002.

Lewin, David. *Generalized Musical Intervals and Transformations*. New Haven: Yale University Press, 1987.

———. *Musical Form and Transformation: Four Analytical Essays*. New Haven: Yale University Press, 1993.

———. "Some Instances of Parallel Voice-leading in Debussy." *19th-Century Music* 11/1 (1987): 59–72.

Lewis, Christopher. "Mirrors and Metaphors: Reflections on Schoenberg and Nineteenth-Century Tonality." *19th-Century Music* 11/1 (1987): 26–42.

———. *Tonal Coherence in Mahler's Ninth Symphony*. Studies in Musicology no. 79. Ann Arbor: UMI Research Press, 1984.

Mawer, Deborah. "Ballet and the Apotheosis of Dance." In *The Cambridge Companion to Ravel*, edited by Deborah Mawer, 140–61. Cambridge: Cambridge University Press, 2000.

———. *The Ballets of Maurice Ravel: Creation and Interpretation*. Aldershot: Ashgate, 2006.

———. "Musical Objects and Machines." In *The Cambridge Companion to Ravel*, edited by Deborah Mawer, 47–67. Cambridge: Cambridge University Press, 2000.

Mead, Andrew. "Shedding Scales: Understanding Intervals in Different Musical Contexts." *Theory and Practice* 22–23 (1997–98): 73–94.

Messiaen, Olivier and Yvonne Loriod-Messiaen. *Ravel: Analyses des oeuvres pour piano de Maurice Ravel*. Paris: Durand, 2003.

Meyer, Leonard B. "A Pride of Prejudices; Or, Delight in Diversity." *Music Theory Spectrum* 13/2 (1991): 241–51.

Montgomery, Merle. "Vincent d'Indy, *Cours de composition musicale,* English translation of the sixth edition (1912)." PhD diss., University of Rochester, Eastman School of Music, 1948.

Morgan, Robert P. "Dissonant Prolongations: Theoretical and Compositional Precedents." *Journal of Music Theory* 20/1 (1976): 49–91.

Myers, Rollo H. *Ravel: Life and Works*. New York and London: Thomas Yoseloff, 1960. Reprint, New York: Da Capo Press, 1976.

Nakagawa, Eri. "A Stylistic Analysis of the Piano Trios of Saint-Saëns and Ravel." DMA diss., Ball State University, 1996.

Nectoux, Jean-Michel. "Maurice Ravel et sa bibliothèque musicale." *Cahiers Maurice Ravel* 3 (1987): 54–63.

Newbould, Brian. "Ravel's Pantoum." *The Musical Times* 116 (1975): 228–31.

Newman, William S. *A History of the Sonata Idea*. 3 vols., 3rd ed. New York: W.W. Norton, 1972.

Nichols, Roger, ed. *Ravel Remembered*. New York: W.W. Norton, 1988.

Ohno, Sarina Saori. "The Piano Chamber Music of Maurice Ravel." DMA diss., City University of New York, 2005.

Orenstein, Arbie. Introduction to Ravel, *Sérénade grotesque*. Paris: Salabert, 1975.

———. *Ravel: Man and Musician*. New York and London: Columbia University Press, 1975.

Orenstein, Arbie, comp. and ed. *A Ravel Reader*. New York: Columbia University Press, 1990.

Orledge, Robert. "Evocations of Exoticism." In *The Cambridge Companion to Ravel*, edited by Deborah Mawer, 27–46. Cambridge: Cambridge University Press, 2000.

Parks, Richard S. *The Music of Claude Debussy*. New Haven: Yale University Press, 1989.

Perle, George. "Berg's Master Array of Interval Cycles." *The Musical Quarterly* 58/1 (1977): 1–30.

Peters, Penelope Miller. "French Harmonic Theory in the Conservatoire Tradition: Fétis, Reber, Durand, and Gevaert." PhD diss., University of Rochester, Eastman School of Music, 1990.

Petersen, Cornelia. *Die Lieder von Maurice Ravel*. Europäische Hochschulschriften (Reihe Musikwissenschaft). Frankfurt am Main: Peter Lang, 1995.

Pfann,Walter. *Zur Sonatengestaltung im Spätwerk Maurice Ravels*. Regensburg: Gustav Bosse, 1991.

Pomeroy, Boyd. "Tales of Two Tonics: Directional Tonality in Debussy's Orchestral Music." *Music Theory Spectrum* 26/1 (2004): 87–118.

Puri, Michael James. "Theorizing Memory in Maurice Ravel's *Daphnis et Chloé*." PhD diss., Yale University, 2004.

Rameau, Jean-Philippe. *Treatise on Harmony*. Translated by Philip Gossett. New York: Dover, 1971.

Réti, Rudolph. *Thematic Patterns in Sonatas of Beethoven*. New York: Macmillan, 1967.

———. *The Thematic Process in Music*. New York: Macmillan, 1951.

Révész, André. "The Great Musician Maurice Ravel Talks About his Art." In *A Ravel Reader*, compiled and edited by Arbie Orenstein, 431–35. New York: Columbia University Press, 1990.

Riemann, Hugo. *Harmony Simplified (Vereinfachte Harmonielehre, oder die Lehre von den tonalen Funktionen der Akkorde)* (1893), trans. anonymous. London: Augener Ltd., 1896.

Rifkin, Deborah. "A Theory of Motives for Prokofiev's Music." *Music Theory Spectrum* 26/2 (2004): 265–89.

Roig-Francolí, Miguel A. *Harmony in Context*. New York: McGraw-Hill, 2003.

Roland Manuel. "Des valses à *La Valse*." In Colette et al., *Maurice Ravel*, 141–51.

———. *Ravel*. Translated by Cynthia Jolly. New York: Dover, 1972.

Rosen, Charles. *Sonata Forms*. New York: W.W. Norton, 1980. Revised edition, 1988.

Rothgeb, John. “Thematic Content: A Schenkerian View.” In *Aspects of Schenkerian Theory*, edited by David Beach, 39–60. New Haven: Yale University Press, 1983.

Rothstein, William. “On Implied Tones.” *Music Analysis* 10/3 (1991): 289–328.

———. *Phrase Rhythm in Tonal Music*. New York: Schirmer, 1989.

Russom, Philip Wade. “A Theory of Pitch Organization for the Early Works of Maurice Ravel.” PhD diss., Yale University, 1985.

Sallaberry, Jean-Dominique-Julien. *Chants Populaires du Pays Basque*. Bayonne: Imprimerie de Veuve Lamaignère, 1870.

Salzer, Felix. *Structural Hearing: Tonal Coherence in Music*. 2 vols. New York: Charles Boni, 1952.

Samazeuilh, Gustave. “Maurice Ravel en Pays Basque.” *La Revue musicale* 19, special issue (1938): 392–95.

Sannemüller, Gerd. “Die Sonate für Violine und Violoncello von Maurice Ravel.” *Die Musikforschung* 28/4 (1975): 408–19.

Santa, Matthew. “Analysing Post-Tonal Diatonic Music: A Modulo 7 Perspective.” *Music Analysis* 19/2 (2000): 167–201.

———. “Defining Modular Transformations.” *Music Theory Spectrum* 21/2 (1999): 200–29.

———. “Studies in Post-Tonal Diatonicism: A Mod7 Perspective.” PhD diss., City University of New York, 1999.

Schachter, Carl. “The Triad as Place and Action.” *Music Theory Spectrum* 17/2 (1995): 149–69.

Schenker, Heinrich. *Five Graphic Music Analyses*. New York: David Mannes School of Music, 1933. Reprint, New York: Dover, 1969.

———. *Free Composition*. Translated and annotated by Ernst Oster. New York: Longman, 1979.

———. *Harmony*. Translated by Elisabeth Mann Borgese, edited and annotated by Oswald Jonas. Chicago: University of Chicago Press, 1954.

———. *The Masterwork in Music vol. III (1930)*. Edited by William Drabkin, translated by Ian Bent, William Drabkin, Alfred Clayton, and Derrick Puffett. Studies in Music Theory and Analysis ser. 10. Cambridge: Cambridge University Press, 1997.

Schneider, Herbert. "Analyse der Violinsonate A-Dur von C. Franck." *Revue Belge de Musicologie* 45 (1991): 127–44.

Schoenberg, Arnold. *Fundamentals of Musical Composition*. Edited by Gerald Strang and Leonard Stein. London: Faber and Faber, 1967.

———. *The Musical Idea and the Logic, Technique, and Art of Its Presentation* ("Der musikalische Gedanke und die Logik, Technik und Kunst seiner Darstellung," 1925–36). Edited and translated by Patricia Carpenter and Severine Neff. New York: Columbia University Press, 1995.

Seroff, Victor I. *Maurice Ravel*. New York: Henry Holt and Company, 1953.

Siciliano, Michael. "Toggling Cycles, Hexatonic Systems, and Some Analysis of Early Atonal Music." *Music Theory Spectrum* 27/2 (2005): 221–47.

Smith, Peter H. "Brahms and the Shifting Barline: Metric Displacement and Formal Process in the Trios with Wind Instruments." *Brahms Studies* vol. 3 (2001): 191–229.

Spencer, Peter and Peter M. Temko. *A Practical Approach to the Study of Form in Music*. Englewood Cliffs, NJ: Prentice Hall, 1988.

Stegemann, Michael. *Camille Saint-Saëns and the French Solo Concerto from 1850 to 1920*. Translated by Ann C. Sherwin. Portland, OR: Amadeus Press, 1991. (Translation of: *Camille Saint-Saëns und das französische Solokonzert von 1850 bis 1920*. Mainz: B. Schott's Söhne, 1984.)

Straus, Joseph N. *Introduction to Post-Tonal Theory*. 3rd ed. Upper Saddle River, NJ: Pearson/Prentice Hall, 2005.

———. "The Problem of Prolongation in Post-Tonal Music." *Journal of Music Theory* 31/1 (1987): 1–21.

———. *Remaking the Past: Musical Modernism and the Influence of the Tonal Tradition*. Cambridge, MA: Harvard University Press, 1990.

———. "Response to Larson." *Journal of Music Theory* 41/1 (1997): 137–39.

Stuckenschmidt, Hans Heinz. *Maurice Ravel. Variationen über Person und Werk*. Frankfurt am Main: Suhrkamp, 1966.

Suchoff, Benjamin. *Concerto for Orchestra—Understanding Bartók's World*. New York: Schirmer, 1995.

Taruskin, Richard. "Chernomor to Kashchei: Harmonic Sorcery; or, Stravinsky's 'Angle'." *Journal of the American Musicological Society* 38/1 (1985): 72–142.

———. "Chez Pétrouchka: Harmony and Tonality in Stravinsky." *19th-Century Music* 10/3 (1987): 265–86.

———. *Stravinsky and the Russian Traditions*. Berkeley, Los Angeles: The University of California Press, 1996.

Tchaikovsky, Peter Ilyitch. *Guide to the Practical Study of Harmony*. Translated by Emil Krall and James Liebling. Leipzig: P. Jurgenson, 1900. Reprint, Mineola: Dover, 2005. Russian original published 1871.

Teboul, Jean-Claude. *Ravel: Le langage musical dans l'oeuvre pour piano - A la lumière des principes d'analyse de Schoenberg*. Paris: Léopard d'Or, 1987.

Tymoczko, Dmitri. "The Consecutive-Semitone Constraint on Scalar Structure: A Link Between Impressionism and Jazz." *Intégral* 11 (1997): 135–79.

Väisälä, Olli. "Concepts of Harmony and Prolongation in Schoenberg's Op. 19/2." *Music Theory Spectrum* 21/2 (1999): 230–59.

———. *Prolongation in Early Post-Tonal Music*. Studia Musica 23. Sibelius Academy, Helsinki: Hakapaino Oy, 2004.

———. "Prolongation of Harmonies Related to the Harmonic Series in Early Post-Tonal Music." *Journal of Music Theory* 46/1&2 (2002): 207–83.

van Ackere, Jules. *Maurice Ravel*. Brussels: Elsevier, 1957.

van den Toorn, Pieter. *The Music of Igor Stravinsky*. New Haven: Yale University Press, 1983.

———. "Octatonic Pitch Structure in Stravinsky." In *Confronting Stravinsky: Man, Musician, and Modernist*, edited by Jann Pasler, 130–56. Berkeley: University of California Press, 1986.

———. *Stravinsky and the Rite of Spring: The Beginnings of a Musical Language*. Berkeley: University of California Press, 1987.

Weiss-Aigner, Günter. "Eine Sonderform der Skalenbildung in der Musik Ravels." *Die Musikforschung* 25/3 (1972): 323–26.

Wheeldon, Marianne. "Debussy and *La Sonate cyclique*." *Journal of Musicology* 22/4 (2005): 644–79.

Wile, Kip Douglas. "Collection in Neocentric Music: A Study in Theory and Analysis of the Music of Debussy, Scriabin, Bartók, and Ravel." PhD diss., University of Chicago, 1995.

Wilson, Paul. "Concepts of Prolongation and Bartók's Opus 20." *Music Theory Spectrum* 6 (1984): 79–89.

Winnecke, Elisabeth. *Ravel und die Modelle*: *Kulturhistorische Untersuchungen zum Gebrauch von Modellen und Beiträge zu einer Ästhetik Maurice Ravels*. Musik Kontext, vol. 1. Frankfurt am Main: Peter Lang/Europäischer Verlag der Wissenschaften, 2001.

Yasser, Joseph. *A Theory of Evolving Tonality*. New York: American Library of Musicology, 1932.

Yih, Annie K. "Analysing Debussy: Tonality, Motivic Sets and the Referential Pitch-Class Specific Collection." *Music Analysis* 19/2 (July 2000): 203–29.

Zank, Stephen. *Maurice Ravel: A Guide to Research*. New York: Routledge, 2005.

LIST OF SCORES

Ravel, Maurice. *Introduction et Allegro*. Paris: Editions Durand & Cie, 1906.

———. *Piano Trio, Mallarmé Poems, and Other Chamber Works*. New York: Dover Publications, Inc., 2004.

———. *Quatuor à cordes*. Paris: Editions Durand & Cie, 1910.

———. *Sérénade Grotesque*. Paris: Editions Salabert, 1975.

———. *Sonate Posthume*. Paris: Editions Salabert, 1975.

———. *Sonate pour violon et piano*. Paris: Editions Durand & Cie, 1927.

———. *String Quartet*. New York: Dover Publications, Inc., 1987.

———. *Trio pour violon, violoncelle et piano*. Paris: Editions Durand & Cie, 1915.

———. *Valses nobles & sentimentales*. Paris: Editions Durand & Cie, 1911.

SONATA FORM IN RAVEL'S PRE-WAR CHAMBER MUSIC

by

SIGRUN B. HEINZELMANN

VOLUME II: EXAMPLES

A dissertation submitted to the Graduate Faculty in Music in partial fulfillment of the requirements for the Degree of Philosophy, The City University of New York.

2008

Example 2.1 Referential collections and chords

CHORD STRUCTURES					DIATONIC COLLECTIONS***				NON-DIATONIC COLLECTIONS			
		Collection name			pentatonic	pure diatonic	harmonic minor	melodic minor	whole-tone	hexatonic	octatonic	enneatonic
	*	Number of pitch classes →			5	7	7	7	6	6	8	9
		↓	pc set →		(0,2,4,7,9)	(0,1,3,5,6,8,10)	(0,1,3,4,6,8,9)	(0,1,2,4,6,8,10)	(0,2,4,6,8,10)	(0,1,4,5,8,9)	(0,1,3,4,6,7,9,10)	(0,1,2,4,5,6,8,9,10)
			↓	→	[2-2-3-2-3]	[1-2-2-1-2-2-2]	[1-2-1-2-2-1-3]	[1-2-1-2-2-2-2]	[2-2-2-2-2-2]	[1-3-1-3-1-3]	[1-2-1-2-1-2-1-2]	[1-1-2-1-1-2-1-1-2]
Chord Name	SPECIES		root position	↓ Interval Sequence**	Number of distinct transpositions of chord type within referential collection							
diminished triad		3	(0,3,6)	[3-3-6]	-	1	2	2	-	-	6	3
minor triad		3	(0,3,7)	[3-4-5]	1	3	2	2	-	3	4	6
major triad		3	(0,4,7)	[4-3-5]	1	3	2	2	-	3	4	6
augmented triad		3	(0,4,8)	[4-4-4]	-	-	1	1	2	1	-	3
diminished 7th chord		4	(0,3,6,9)	[3-3-3-3]	-	-	1	-	-	-	2	-
half dim. 7th chord	3	4	(0,3,6,10)	[3-3-4-2]	-	1	1	2	-	-	4	3
minor min. 7th chord	2	4	(0,3,7,10)	[3-4-3-2]	1	2	1	1	-	-	4	2
minor maj. 7th chord	-	4	(0,3,7,11)	[3-4-4-1]	-	-	1	1	-	3	-	6
major min. 7th chord	1	4	(0,4,7,10)	[4-3-3-2]	-	1	1	2	-	-	4	3
major maj. 7th chord	4	4	(0,4,7,11)	[4-3-4-1]	-	1	1	-	-	3	-	3
French aug. 6th chord	-	4	(0,4,6,10)	[4-2-4-2]	-	-	-	1	2	-	2	3
dim. min. 9th chord	3	5	(0,3,6,10,1)	3-3-4-3	-	1	1	1	-	-	4	-
min. min 9th chord	2	5	(0,3,7,10,1)	3-4-3-3	-	1	-	1	-	-	4	-
min. maj. 9th chord	2	5	(0,3,7,10,2)	3-4-3-4	-	2	1	-	-	-	-	4
maj. min. 9th chord	1	5	(0,4,7,10,1)	4-3-3-3	-	-	1	-	-	-	4	-
maj. maj. 9th chord	1	5	(0,4,7,10,2)	4-3-3-4	-		1	1	2	-	-	3
maj. maj. 7th maj. 9th	4	5	(0,4,7,11,2)	4-3-4-3	-		2	-	-	-	-	4

* The species are based on Reber-Dubois for 7th chords, and Gevaert for 9th chords (see Table 3).

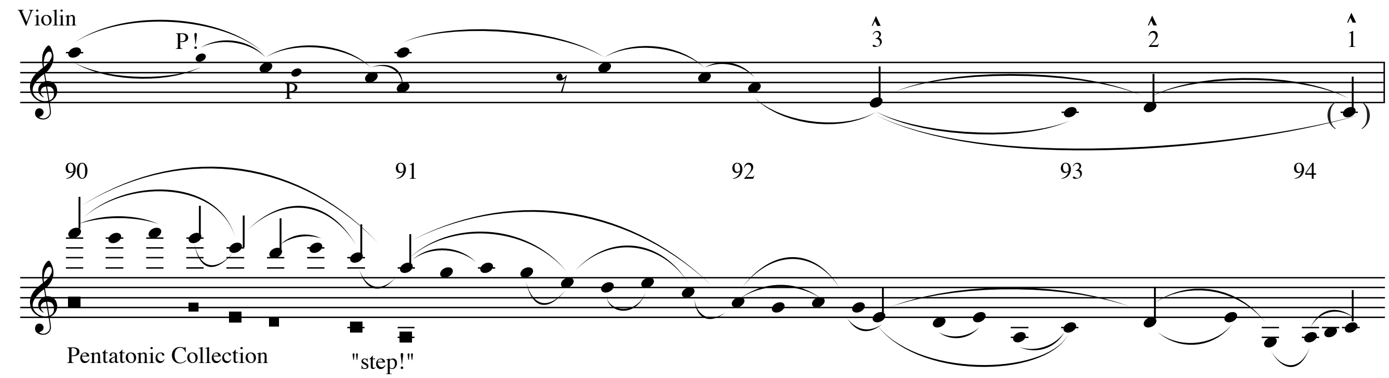
** Interval sequences in square brackets indicate "successive interval array," or SIA. See Richard Chrisman, "Describing Structural Aspects of Pitch-Sets Using Successive-Interval Arrays," *Journal of Music Theory* 21 (1977), 1–28. Interval sequences that exceed the span of an octave are given without brackets. Thus, for the ninth chords, the numbers in the column refer to the order of stacked major and minor thirds.

*** For simplicity, the diatonic collections include the pentatonic (a subset of the diatonic) and the modified collections of the harmonic and melodic minor. All other modes are regarded as rotations of the pure diatonic.

Example 2.2 Triads in referential collections

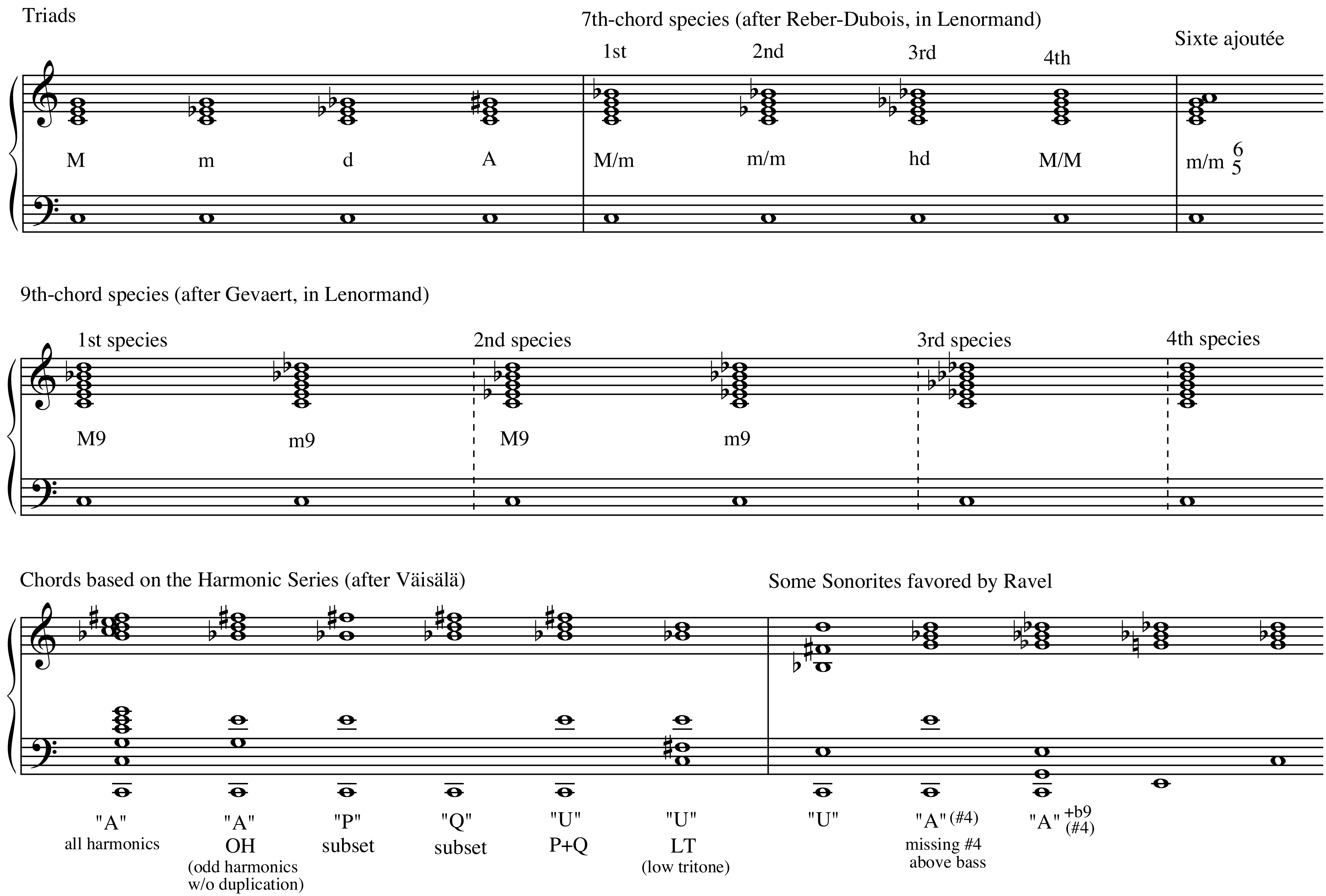
Example 2.3 Ravel, Piano Trio, I, 90–94: Prolongation in a pentatonic context

Graph



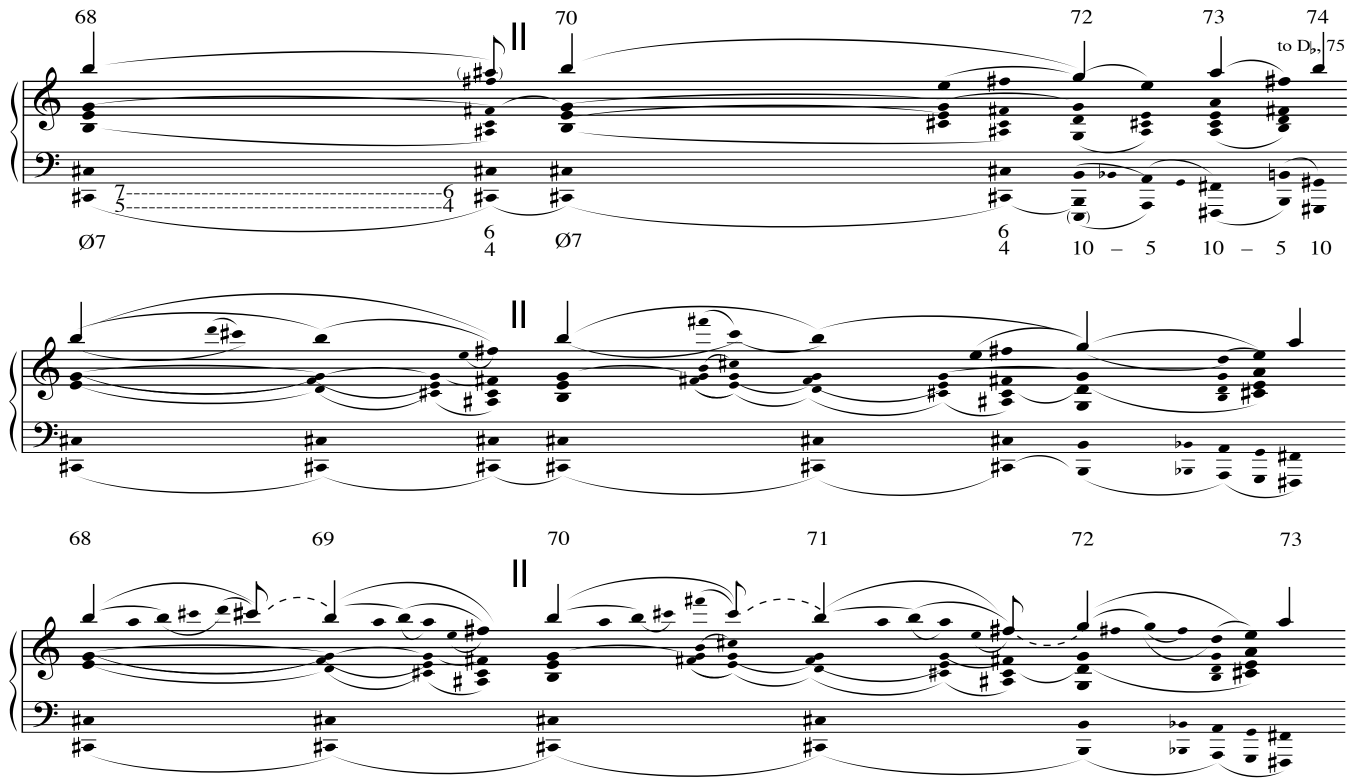
Score Excerpt

Example 2.4 Classification of triads, 7th and 9th chords; chords based on the harmonic series

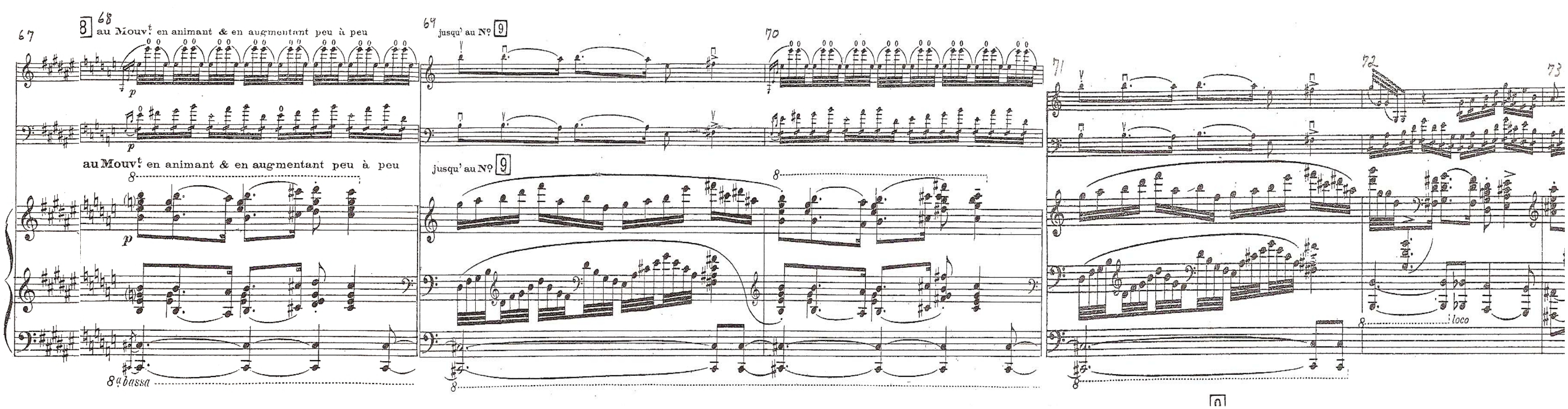


Example 2.5 Ravel, Piano Trio, I, 68–73: Seventh-chord prolongation

Graph



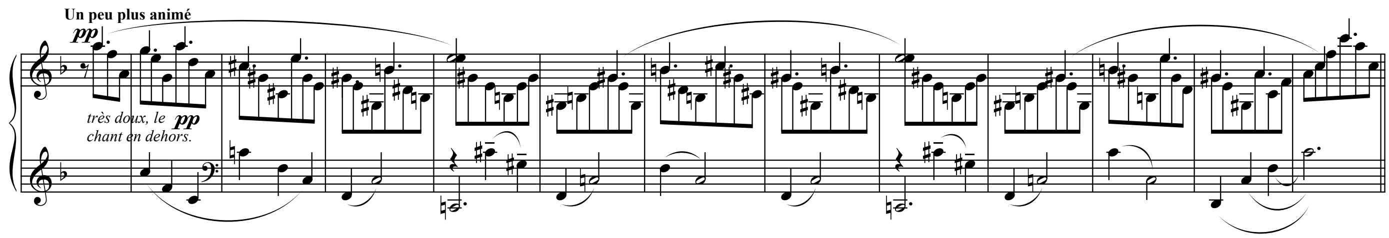
Score Excerpt



Example 2.6 Ravel's unresolved appoggiaturas/prolongation of an added-sixth chord

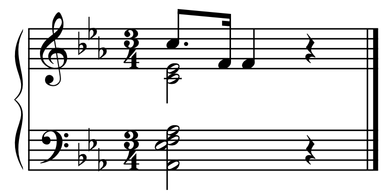
a: Ravel's analysis for Lenormand (reproduced after Orenstein, *Ravel Reader*, 519–20)

Ravel wrote: "With regard to unresolved appoggiaturas, here is a passage which might interest you. It is taked from a suite of waltzes which were performed some time ago at the S.M.I., and which should be published shortly by Durand, entitled *Valses nobles et sentimentales*." [The example shows mm. 67–78 of no. VII of the *Valses nobles et sentimentales*.]



"This fragment is based upon a single chord:

which was already used by Beethoven, without preparation, at the beginning of a sonata [op. 31 no. 3]:"



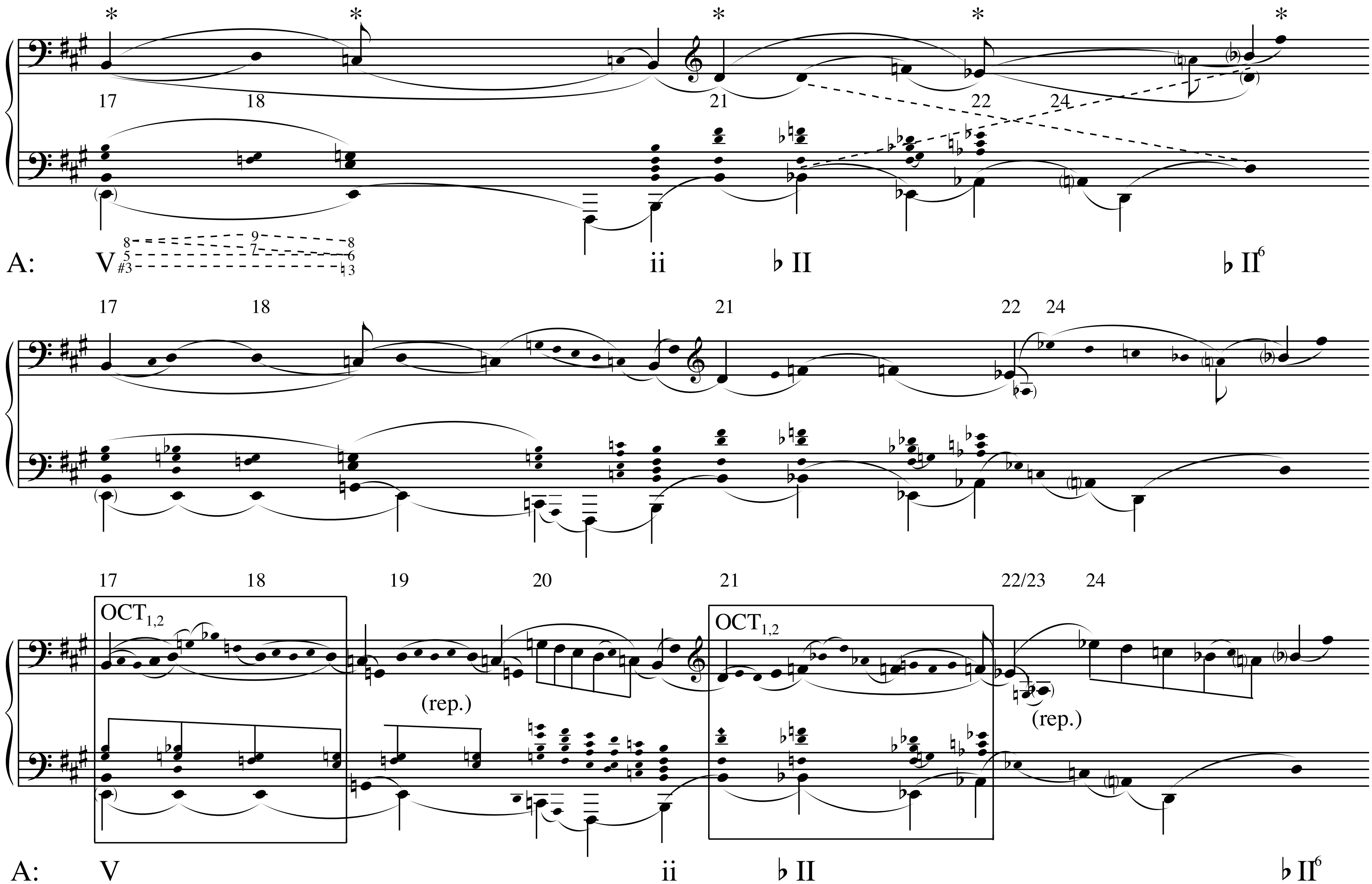
"Here now is the passage with the appoggiaturas resolved; actually, the resolution does not occur until measure A, where the chord changes."

"The E [(a) and (b)] does not change the chord. It is a passing tone in both cases."

b: A Schenkerian interpretation of Ravel's analysis

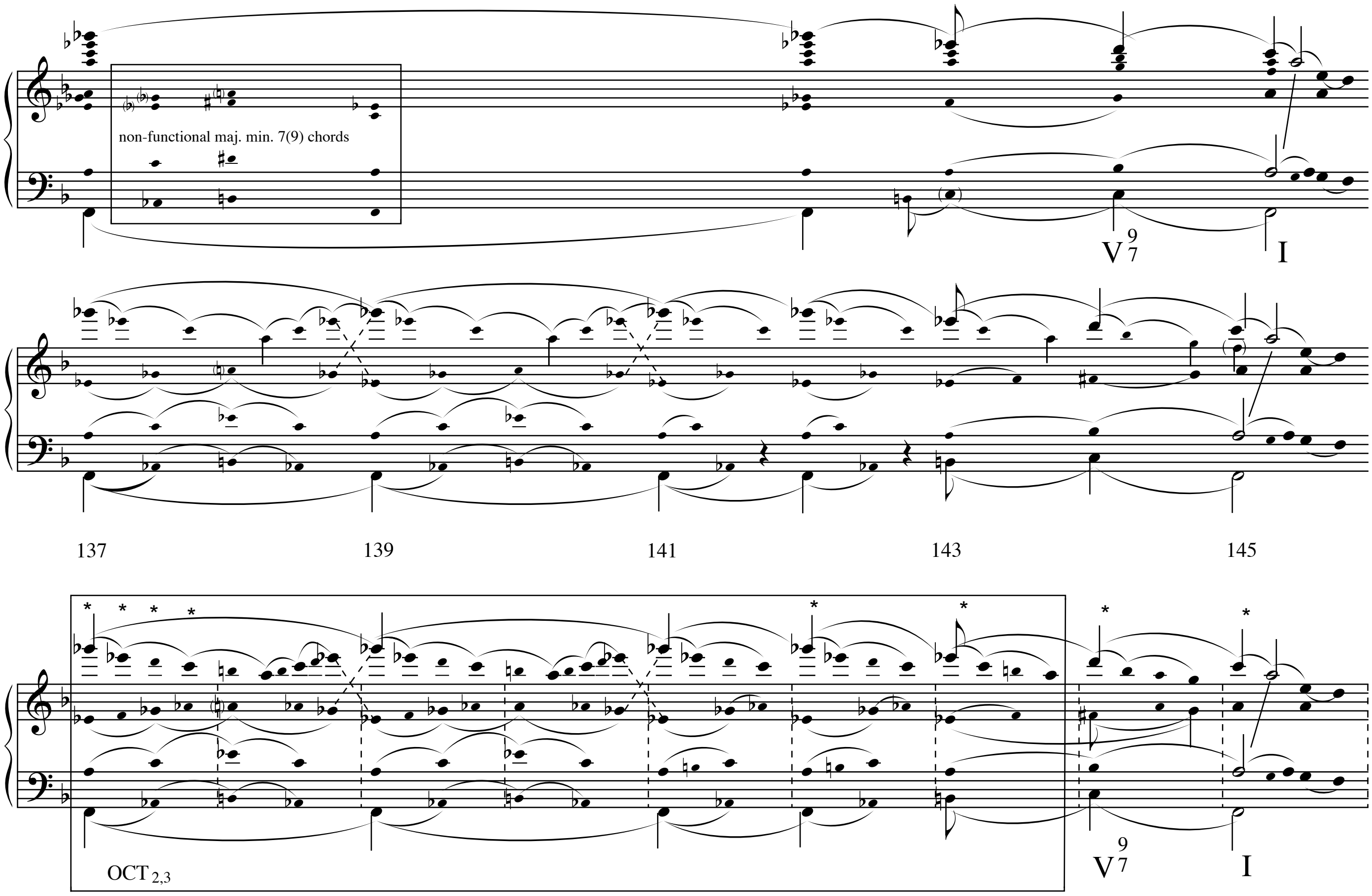
Example 2.7 Ravel, Piano Trio, IV, 17–24: Prolongation in octatonic contexts

* octatonic progression, merges with octatonic wedge in mm. 26–29 (see example 2.12)and continues chromatically to the climax on C# in m. 30



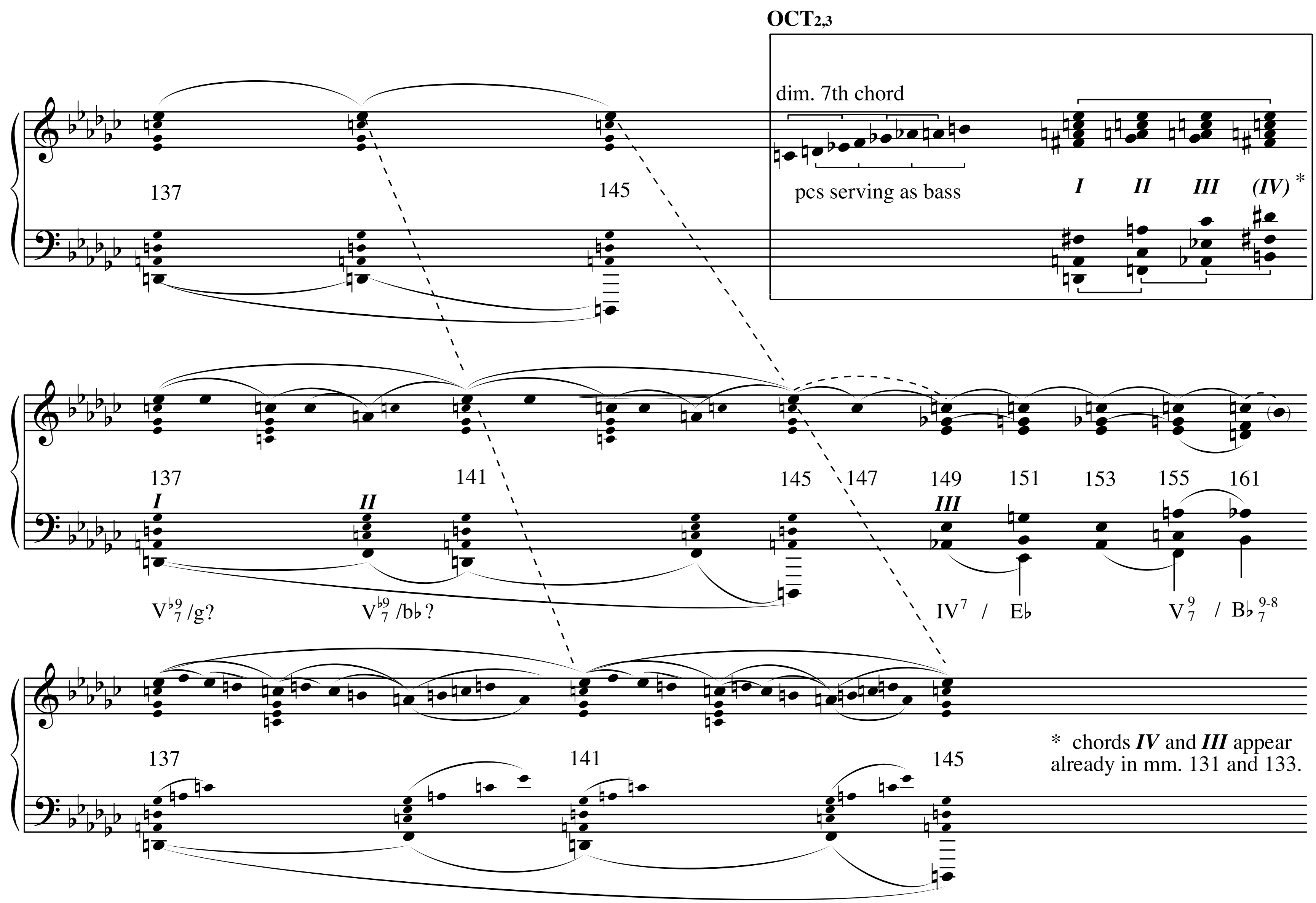
Example 2.8 Ravel, String Quartet, I, 137–145: Octatonic prolongation

Graph



Score Excerpt

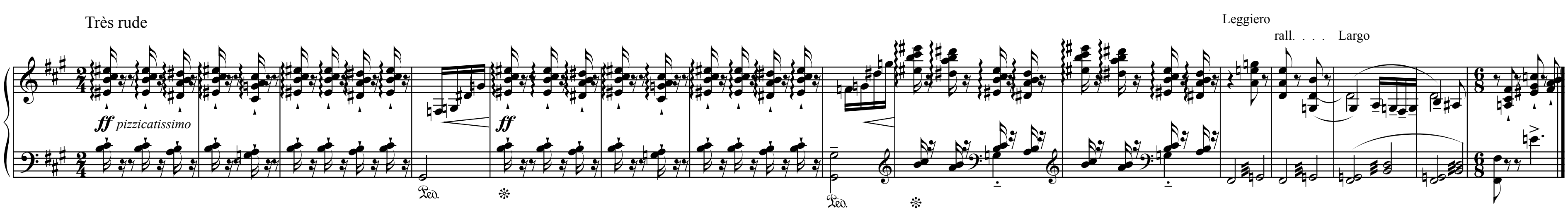
Example 2.9 Ravel, *Introduction and Allegro*, 137–145: Octatonic prolongation



Example 2.10 Ravel, *Sérénade grotesque*, 1–15: Prolongation of a French augmented sixth chord

Graph

Score Excerpt

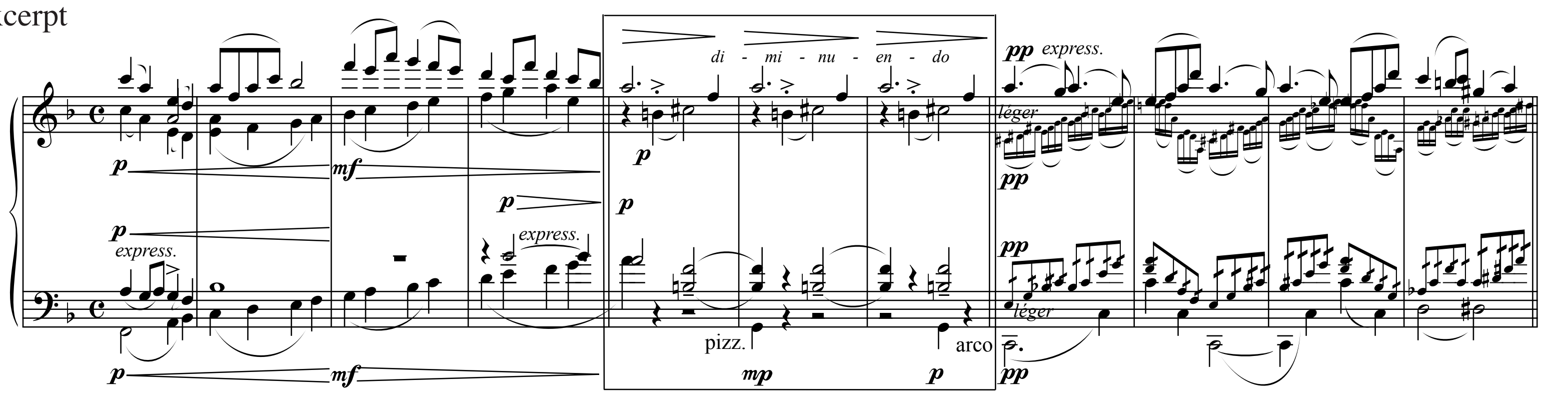


Example 2.11 Ravel, String Quartet, I, 119–129: Prolongation of a French augmented sixth chord

Example 2.12 Ravel, String Quartet, I, 17–27: Prolongation of a whole-tone collection

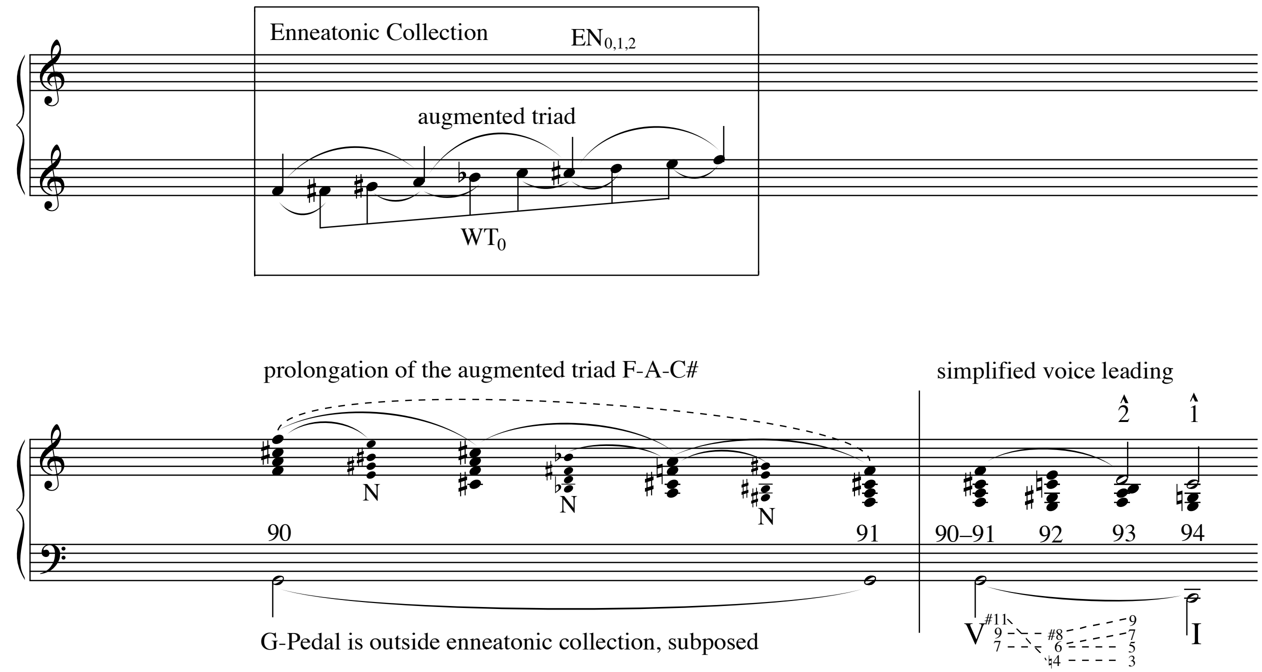
Graph

Score Excerpt



Example 2.13 Ravel, Piano Trio, I, 90–91: Prolongation of an augmented triad

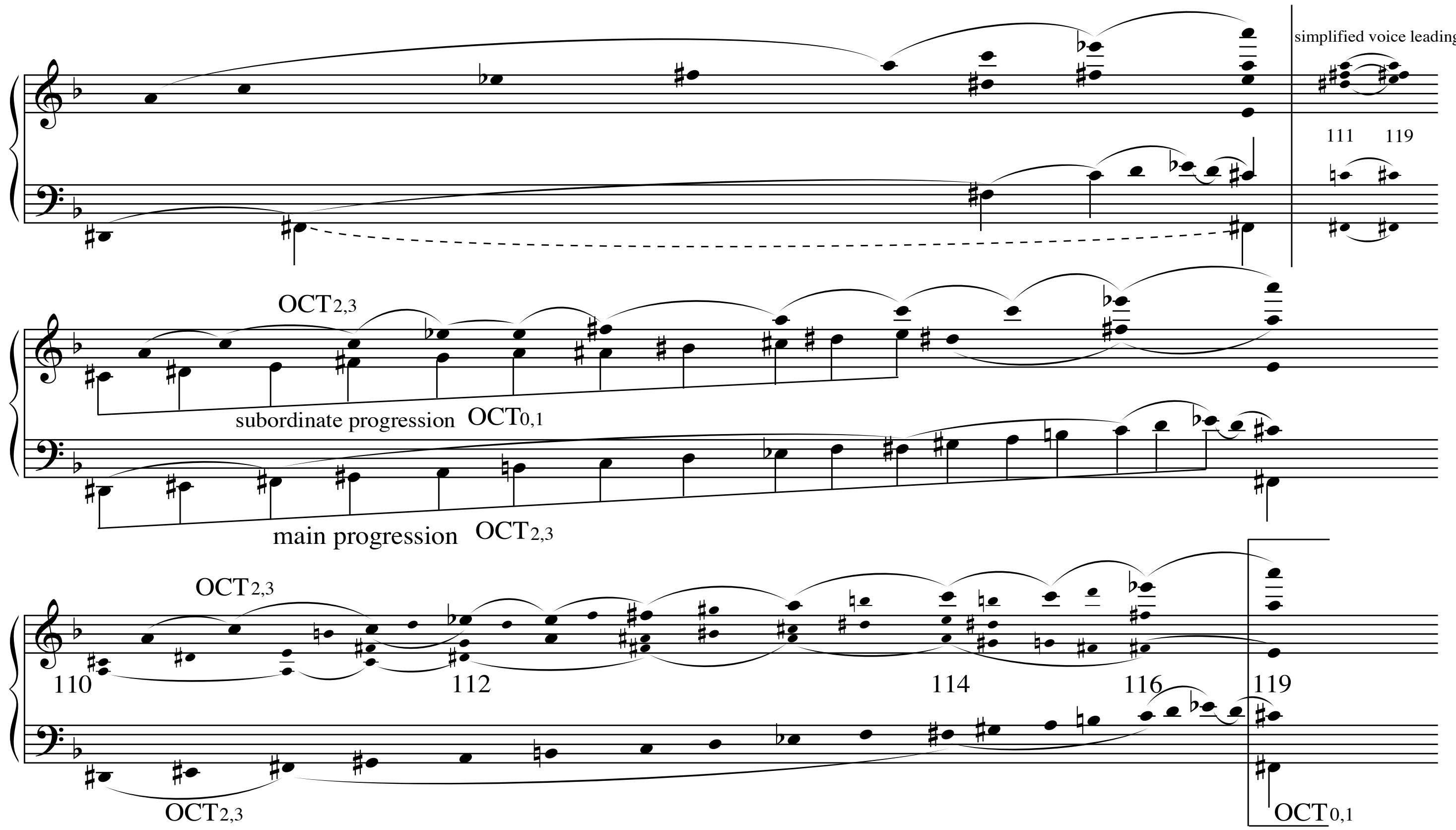
Graph



Score Excerpt

Example 2.14 Ravel, String Quartet, I, 110–119: Octatonic linear progressions

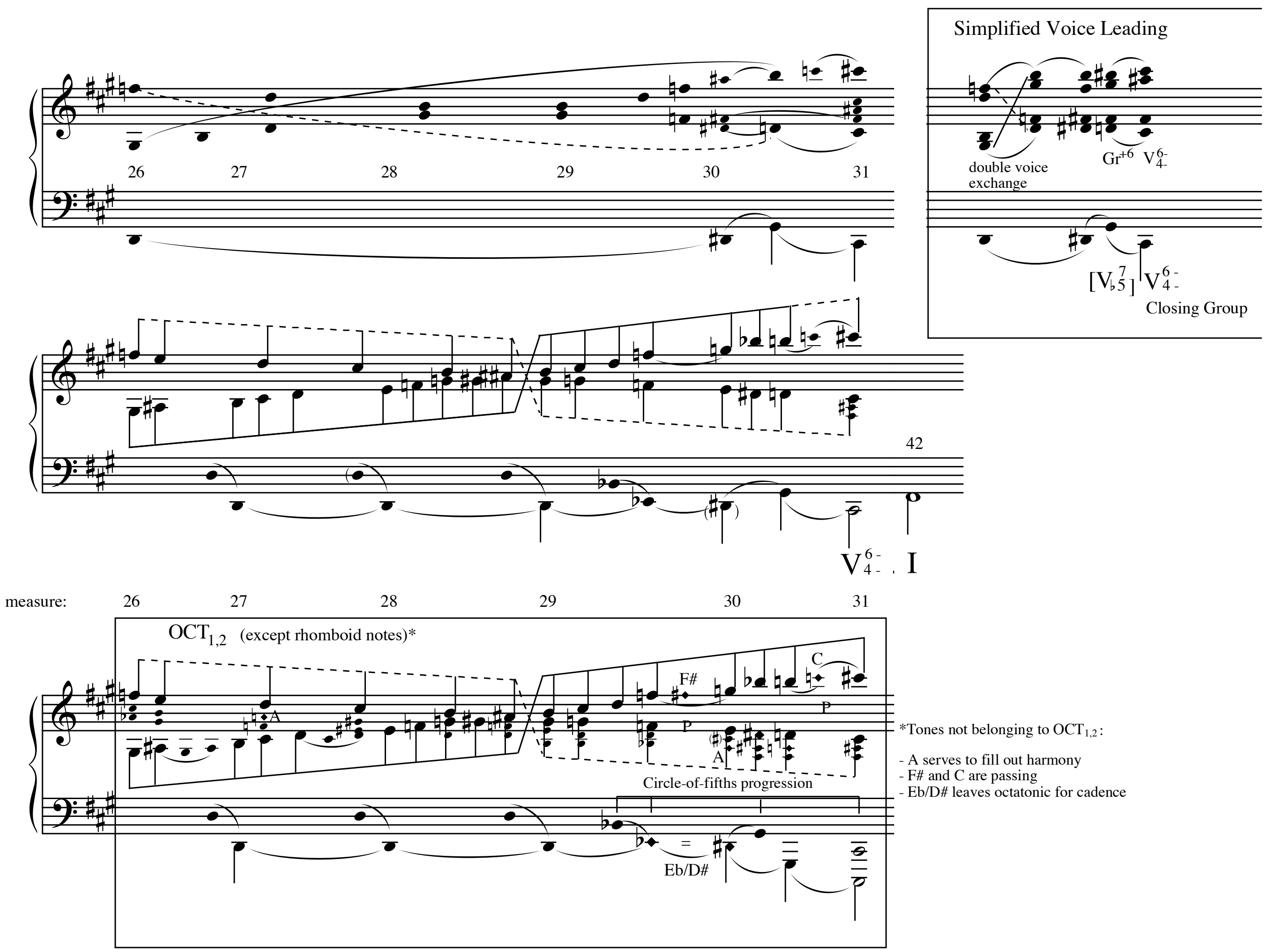
Graph



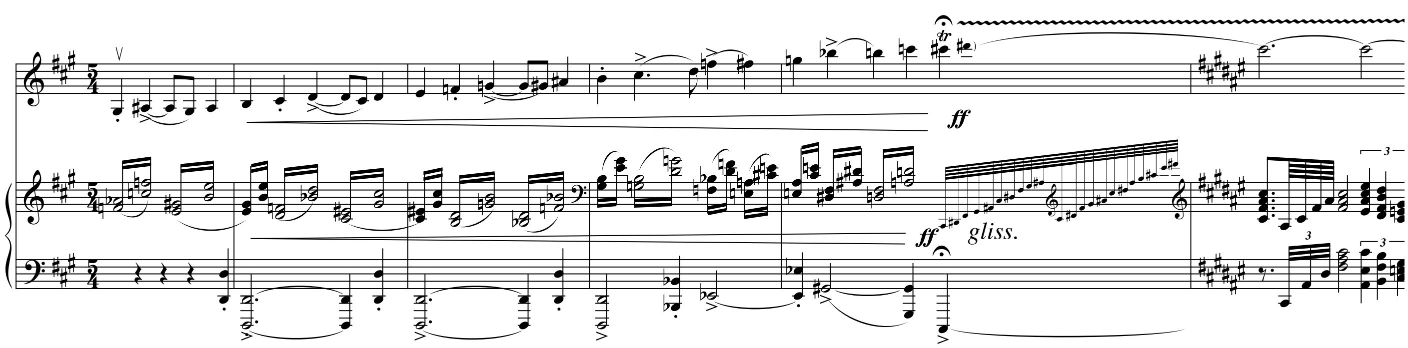
Score Excerpt

Example 2.15 Ravel, Piano Trio, IV, 26–31: Octatonic linear progressions

Graph



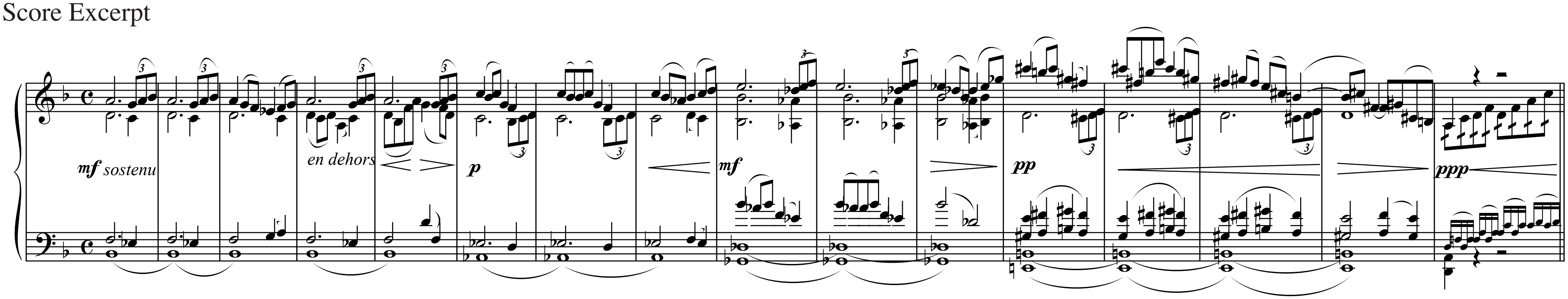
Score Excerpt



Example 2.16 Ravel, String Quartet, I, 69–84: Whole-tone linear progression

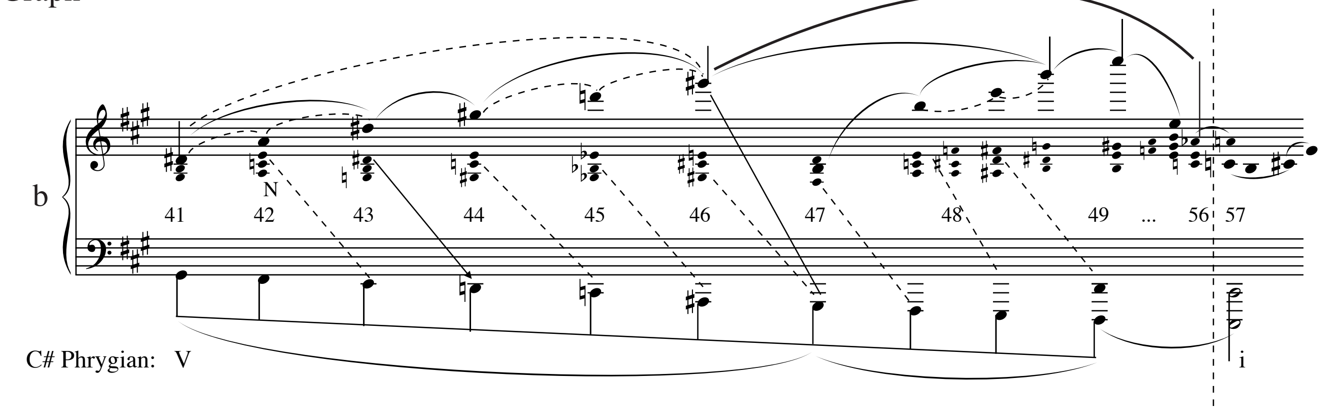
Graph

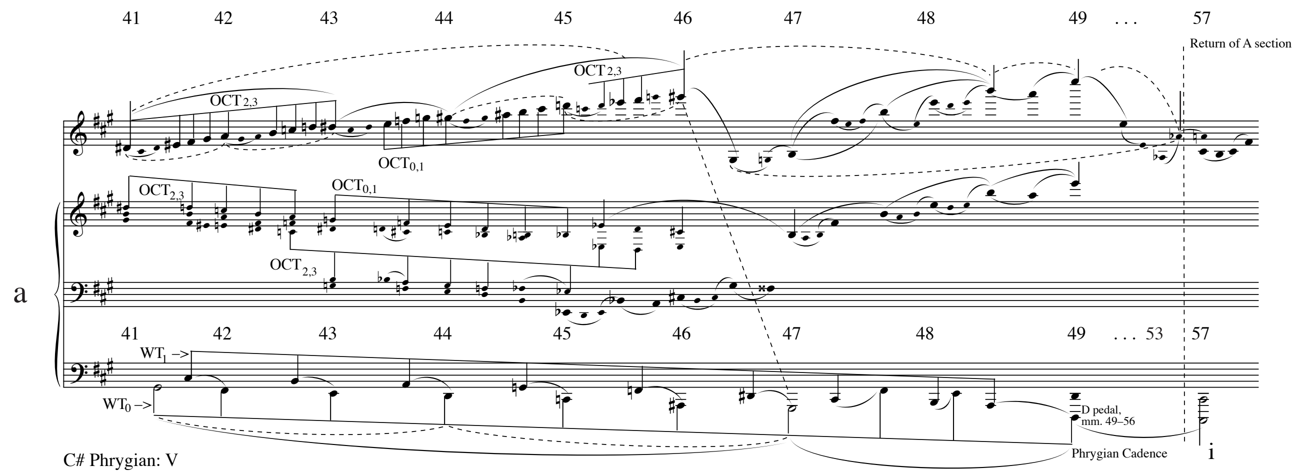
Score Excerpt



Example 2.17 Ravel, Piano Trio, III, 41–57: Combined linear progressions

Graph

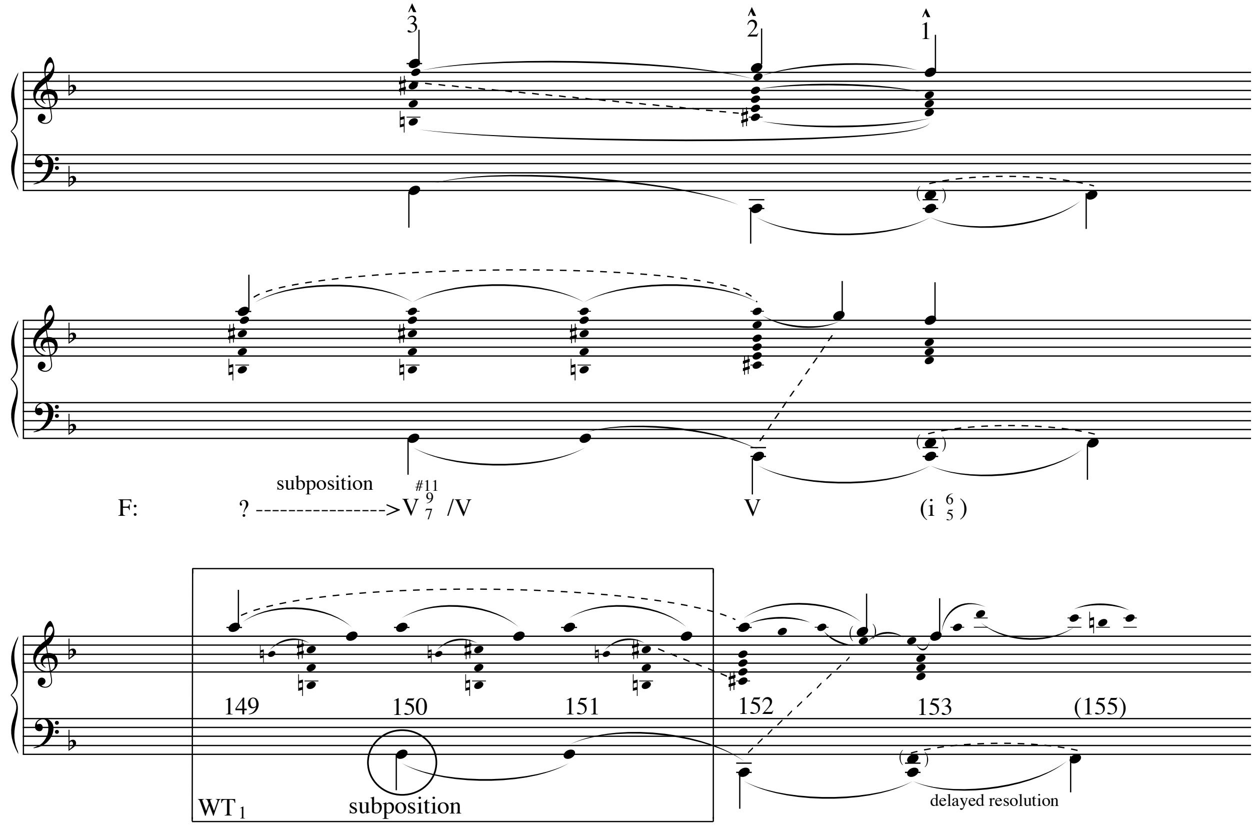




Score Excerpt

Example 2.18 Ravel, String Quartet, I, 149–153: "Friendly" subposition

Graph



Score Excerpt

Example 2.19 Ravel, Piano Trio, I, 77–80: "Hostile" subposition

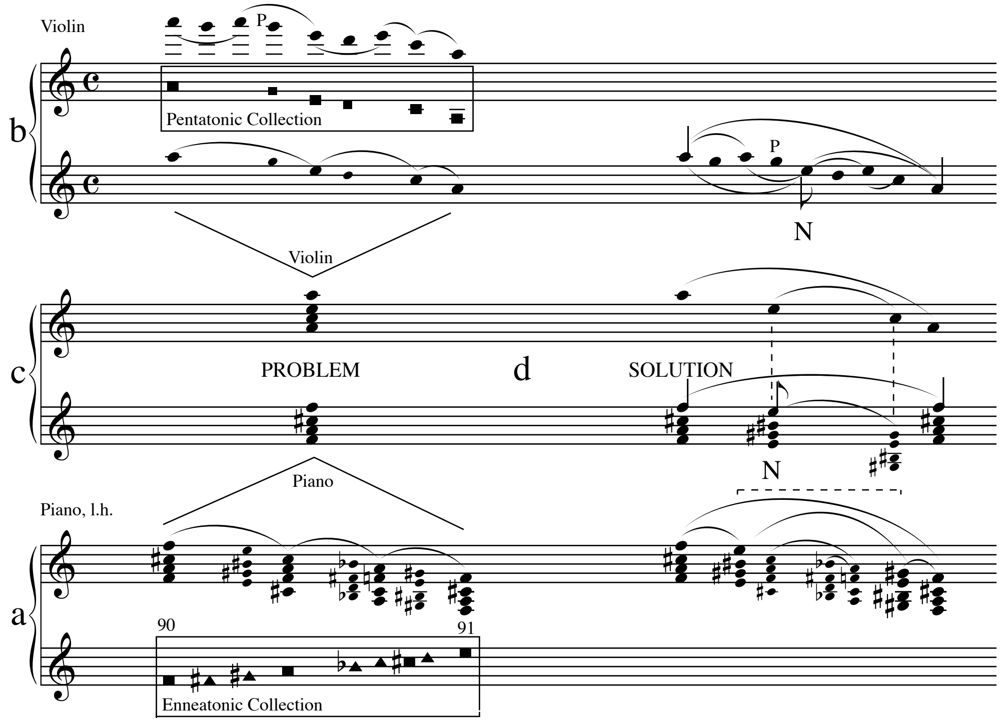
Graph

Score Excerpt

Example 2.20 Ravel, Piano Trio, I, 77–86: Bass/upper voice conflicts

Example 2.21a Ravel, Piano Trio, I, 90–91: Conflicting prolongations

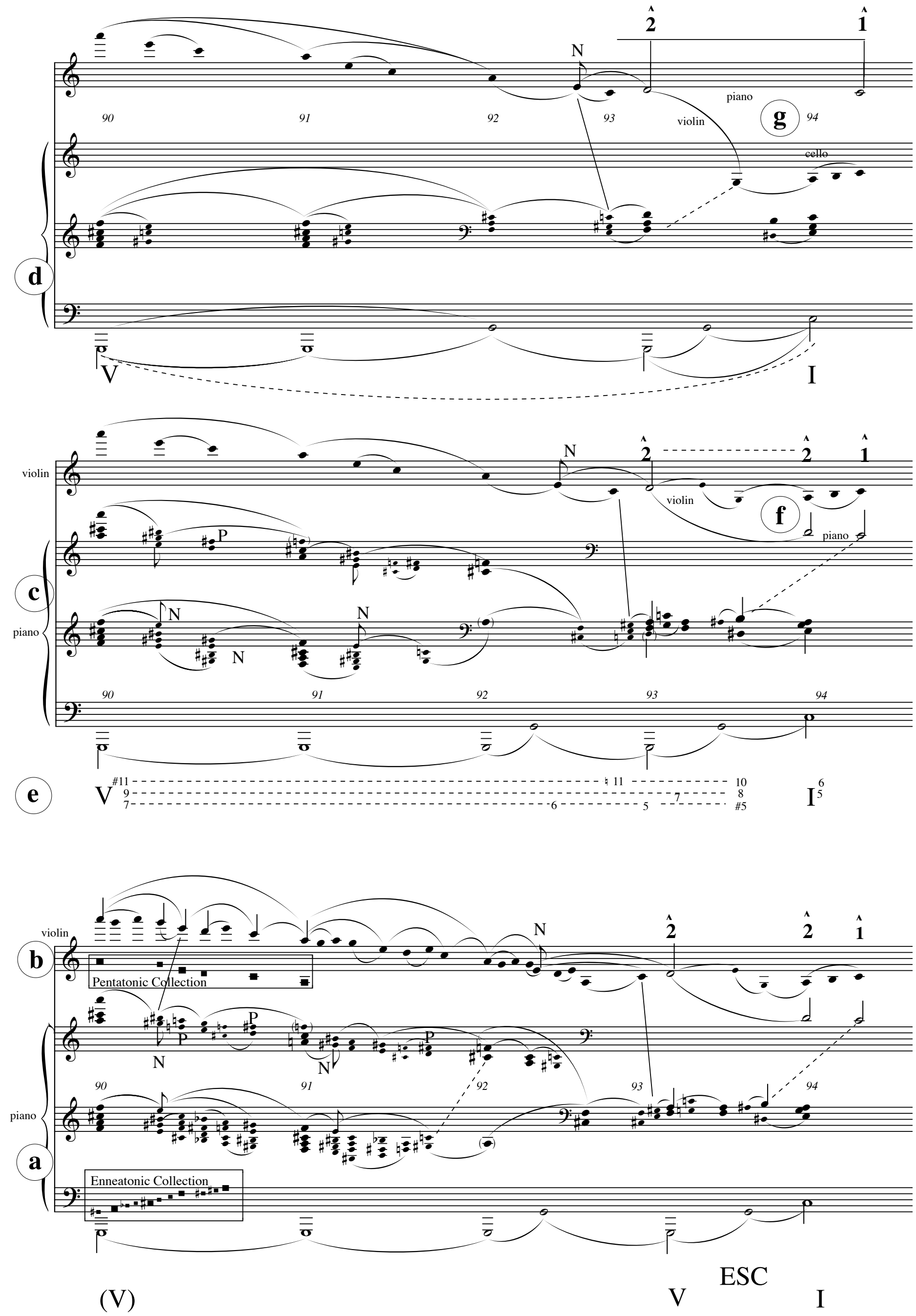
Graph



Score Excerpt

Example 2.21b Ravel, Piano Trio, I, 90–95: Interaction of collections

Graph



Score Excerpt

Example 2.22 Prolongation phenomena and their corresponding levels

(a) STRUCTURAL LAYERS AND ASSOCIATED TYPES OF PROLONGATION IN RAVEL'S TONAL MUSIC

TONALITY	*Mono-Tonal or Double-Tonic Complex*	
	horizontal (linear) structures	**vertical (harmonic) structures**
Background	Schenker's *Ursatzformen*	
Middleground 1	large-scale whole-tone progressions in the bass	triadic, tonally functional prolongations
Middleground 2	whole-tone progressions in the bass	triadic prolongations, parallel prolongations (of more than one harmony)
Middleground 3	whole-tone and octatonic progressions in the bass, linear progressions based on diatonic and cyclic collections	tertian chords based on diatonic and non-diatonic collections
Foreground	unresolved appoggiaturas, linear progressions based on diatonic, pentatonic, and cyclic collections	consonant and dissonant diatonic chords, chords based on cyclic collections, chord-tone substitutions
REFERENTIAL COLLECTIONS	*diatonic and non-diatonic/cyclic collections (whole-tone, hexatonic, octatonic, enneatonic)*	

(b) CHORD TYPES and the relative STRUCTURAL LEVELS at which they tend to function

Type of Chord	'species'	Surface	Foreground	Middlegr.3	Middlegr.2	Middlegr.1	Background
Triads	Major	x	x	x	x	x	x
	Minor	x	x	x	x	x	x
	Dimin.	x	x	x	x	(x)	
	Augm.	x	x	x	(x)		
Seventh Chords	M/m	x	x	x	x	x	
	m/m	x	x	x	x	x*	
	m/M	x	x				
	M/M	x	x				
Added Sixth Chord		x	x	x	x	x*	
Ninth Chords	1^{st} m	x	x	x			
	1^{st} M	x	x				
	2^{nd} m	x	x	x			
	2^{nd} M	x	x				

* in the special case of a minor/relative-major double-tonic complex

Example 3.1 Ravel, *Introduction and Allegro*: Thematic transformation

Flute, mm. 78–81

Harp, 137–140

Example 3.2 Pitch-class representations of step classes in select moduli

Modular Space (Collection)	**Modulus**	**Interval Sequence**	**Pitch-Class Representations of Step Classes** $\overset{\approx}{\mathbf{0}}$	$\overset{\approx}{\mathbf{1}}$	$\overset{\approx}{\mathbf{2}}$	$\overset{\approx}{\mathbf{3}}$	$\overset{\approx}{\mathbf{4}}$	$\overset{\approx}{\mathbf{5}}$	$\overset{\approx}{\mathbf{6}}$	$\overset{\approx}{\mathbf{7}}$	$\overset{\approx}{\mathbf{8}}$	$\overset{\approx}{\mathbf{9}}$	$\overset{\approx}{\mathbf{10}}$	$\overset{\approx}{\mathbf{11}}$
chromatic	**12**	1-1-1-1-1-1-1-1-1-1-1-1	0	1	2	3	4	5	6	7	8	9	10	11
enneatonic	$\mathbf{9^1}$	1-1-2-1-1-2-1-1-2	0	1	2	4	5	6	8	9	10			
	$\mathbf{9^2}$	1-2-1-1-2-1-1-2-1	0	1	3	4	5	7	8	9	11			
	$\mathbf{9^3}$	2-1-1-2-1-1-2-1-1	0	2	3	4	6	7	8	10	11			
octatonic	$\mathbf{8^1}$	1-2-1-2-1-2-1-2	0	1	3	4	6	7	9	10				
	$\mathbf{8^2}$	2-1-2-1-2-1-2-1	0	2	3	5	6	8	9	11				
diatonic	$\mathbf{7^1}$	2-2-1-2-2-2-1	0	2	4	5	7	9	11					
	$\mathbf{7^2}$	2-1-2-2-2-1-2	0	2	3	5	7	9	10					
	$\mathbf{7^3}$	1-2-2-2-1-2-2	0	1	3	5	7	8	10					
	$\mathbf{7^4}$	2-2-2-1-2-2-1	0	2	4	6	7	9	11					
	$\mathbf{7^5}$	2-2-1-2-2-1-2	0	2	4	5	7	9	10					
	$\mathbf{7^6}$	2-1-2-2-1-2-2	0	2	3	5	7	8	10					
	$\mathbf{7^7}$	1-2-2-1-2-2-2	0	1	3	5	6	8	10					
whole-tone	**6W**	2-2-2-2-2-2	0	2	4	6	8	10						
hexatonic	$\mathbf{6H^1}$	1-3-1-3-1-3	0	1	4	5	8	9						
	$\mathbf{6H^2}$	3-1-3-1-3-1	0	3	4	7	8	10						
pentatonic	$\mathbf{5^1}$	2-2-3-2-3	0	2	4	7	9							
	$\mathbf{5^2}$	2-3-2-3-2	0	2	5	7	10							
	$\mathbf{5^3}$	3-2-3-2-2	0	3	5	8	10							
	$\mathbf{5^4}$	2-3-2-2-3	0	2	5	7	9							
	$\mathbf{5^5}$	3-2-2-3-2	0	3	5	7	10							

Example 3.3 Summary of step-based interval types

ordered unordered	**in linear space**	**in modular space**	
within a single modulus	1 **step-space interval** **ss-i** 2	3 **step interval** **s-i** 4	**step interval class s-ic**
within all moduli	5 **step-class-space interval** **scs-i** 6	7 **step-class interval** **sc-i** 8	**step-class interval class sc-ic**
	without octave equivalence	**with octave equivalence**	

The interval types are listed in the four center boxes. Each type exists in unordered and ordered form. The numbers in the corners correspond to the order in which the interval types are listed in the text. Odd numbered types are ordered, even numbered types are unordered. Numbers 1, 2, 5, and 6 are intervals in linear space; that is, without octave equivalence. Numbers 3, 4, 7, and 8 are intervals in modular space; that is, with octave equivalence. The step interval class includes interval types 1 through 4, the step-class interval class includes interval types 5 through 8.

Example 3.4 Intervals in modular spaces

3.4a: Step-Interval Class Members of Step-Class Interval Classes

sc-ic →		**0**	**1**	**2**	**3**	**4**	**5**	**6**
mod 12	**si-c**	0	1	2	3	4	5	6
mod 9	**si-c**	0	1	2	3	4		
mod 8	**si-c**	0	1	2	3	4		
mod 7	**si-c**	0	1	2	3			
mod 6W	**si-c**	0	1	2	3			
mod 6H	**si-c**	0	1	2	3			
mod 5	**si-c**	0	1	2				

3.4b: Pitch-Class Interval Sizes of Step-Interval Classes

	mod 12		**mod 9**		**mod 8**		**mod 7**		**mod 6W**		**mod 6H**		**mod 5**	
s-i	s-ic	size*	s-ic	size	s-ic	size	s-ic	size	s-ic	size	s-ic	size	s-ic	size
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1, **2**	1	1, 2	1	1, 2	1	2	1	1,3	1	2, 3
2	2	2	2	**2**, 3	2	3	2	3, 4	2	4	2	4	2	4, 5
3	3	3	3	4	3	4, 5	3	5, **6**	3	6	3	5, 7	2	7, 8
4	4	4	4	5, **6**	4	6	3	**6**, 7	2	8	2	8	1	9,10
5	5	5	4	**6**, 7	3	7, 8	2	8, 9	1	10	1	9,11		
6	6	6	3	8	2	9	1	10,11						
7	5	7	2	9,**10**	1	10,11								
8	4	8	1	**10**,11										
9	3	9												
10	2	10												
11	1	11												

*The size of the intervals is measured in number of half steps, or according to mod12.

3.4c: Possible Pitch-Class Intervals per Step-Class Interval Class*

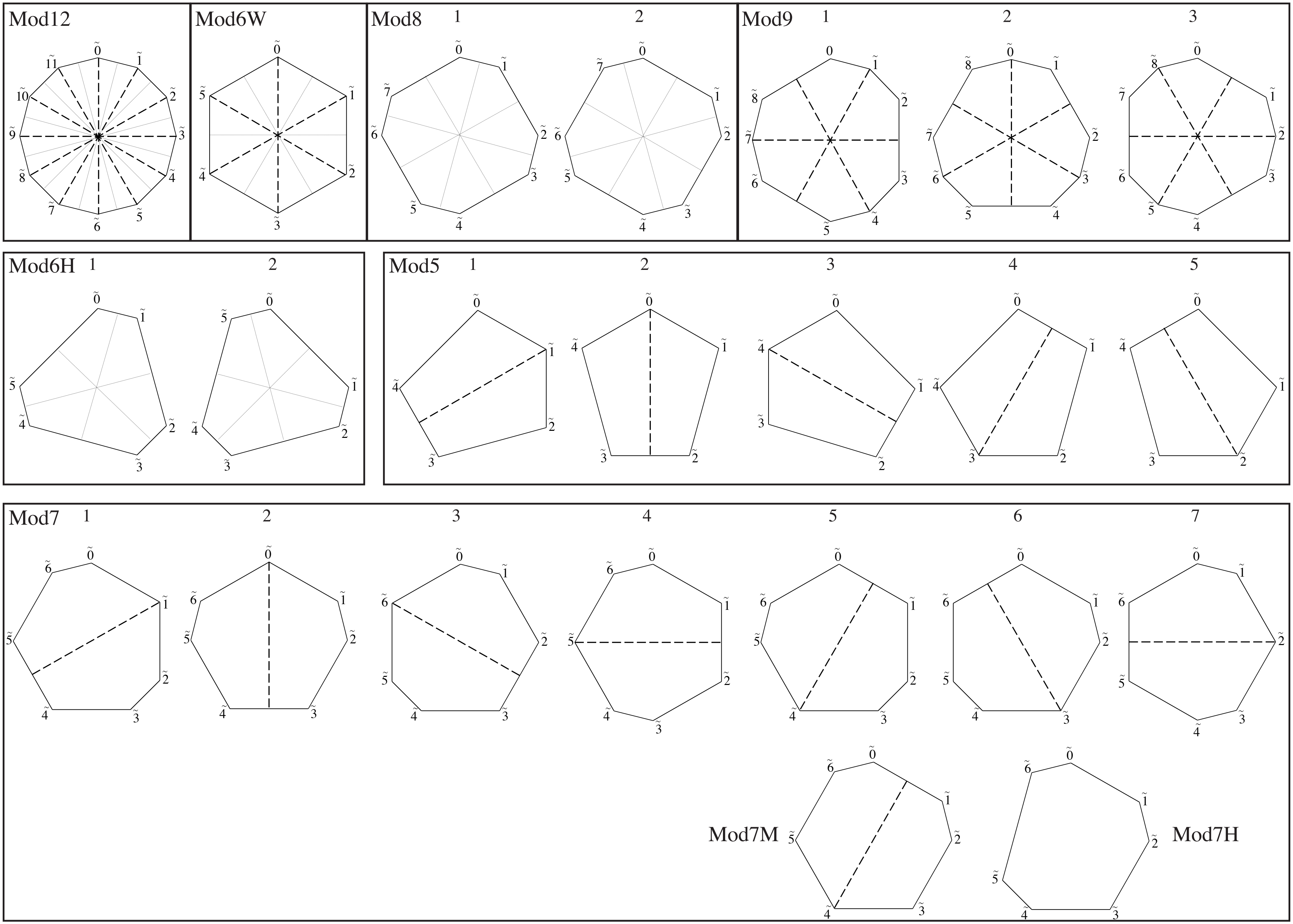
sc-ic	**mod 12**	**mod 9**	**mod 8**	**mod 7**	**mod 6W**	**mod 6H**	**mod 5**	**total no.**
0	0	0	0	0	0	0	0	**1**
1	1, 11	1, 2, 10, 11	1, 2, 10, 11	1, 2, 10, 11	2, 10	1, 3, 9, 11	2, 3, 9, 10	**6**
2	2, 10	2, 3, 9, 10	3, 9	3, 4, 8, 9	4, 8	4, 8	4, 5, 7, 8	**8**
3	3, 9	4, 8	4, 5, 7, 8	5, 6	6	5, 7		**7**
4	4, 8	5, 6, 7	6	6, 7				**5**
5	5, 7							**2**
6	6							**1**

*Interval sizes are given in half steps as they occur within the given modular spaces. The last column gives the total number of different interval sizes each step-class interval class may assume for all given modular spaces.

3.4d: Possible Step Intervals per Pitch-Class Interval

pc-i	**mod 12**	**mod 9**	**mod 8**	**mod 7**	**mod 6W**	**mod 6H**	**mod 5**
0	0	0	0	0	0	0	0
1	1	1	1	1	-	1	-
2	2	1, 2	1	1	1	-	1
3	3	2	2	2	-	1	1
4	4	3	3	2	2	2	2
5	5	4	3	3	-	3	2
6	6	4, 5	4	3, 4	3	-	-
7	7	5	5	4	-	3	3
8	8	6	5	5	4	4	3
9	9	7	6	5	-	5	4
10	10	7, 8	7	6	5	-	5
11	11	8	7	6	-	5	-

Example 3.5 Modular spaces: Moduli and axes of symmetry



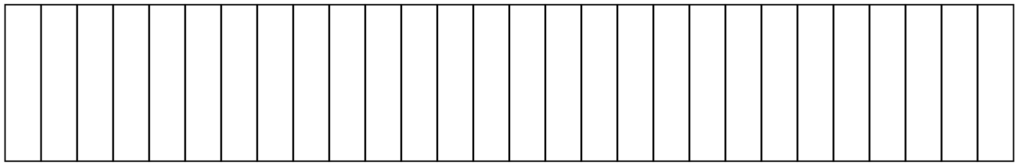
Example 3.6 Modular spaces: Aspects of symmetry

modulus	recurring interval pattern	number of rotations	number of axes	step index numbers	step axes
12	[1]	1	12	all: 0 to 11	all: 0 to 11 and all pairs
9^1	[1-1-3]	3	3	2, 5, 8	1–5/6, 4–8/0, 7–2/3
9^2	[1-3-1]	3	3	0, 3, 6	0–4/5, 3–7/8, 6–1/2
9^3	[3-1-1]	3	3	1, 4, 7	2–5/6, 5–0/1, 8–3/4
8^1	[1-2]	2	4	1, 3, 5, 7	1/2–5/6, 7/0–3/4
8^2	[2-1]	2	4	1, 3, 5, 7	0/1–5/4, 2/3–6/7
7^1	[2-2-1-2-2-2-1]	7	1	2	1–4/5
7^2	[2-1-2-2-2-1-2]	7	1	0	0–3/4
7^3	[1-2-2-2-1-2-2]	7	1	5	6–2/3
7^4	[2-2-2-1-2-2-1]	7	1	3	5–1/2
7^5	[2-2-1-2-2-1-2]	7	1	1	4–0/1
7^6	[2-1-2-2-1-2-2]	7	1	6	3–6/0
7^7	[1-2-2-1-2-2-2]	7	1	4	2–5/6
6W	[2]	1	6	0, 2, 4 1, 3, 5	0–3, 1–4, 2–5, 0/1–3/4, 1/2–4/5, 2/3–5/0
$6H^1$	[1-3]	2	3	1, 3, 5	0/1–3/4, 1/2–4/5, 2/3–5/0
$6H^2$	[3-1]	2	3	1, 3, 5	0/1–3/4, 1/2–4/5, 2/3–5/0
5^1	[2-2-3-2-3]	5	1	2	1–3/4
5^2	[2-3-2-3-2]	5	1	0	0–2/3
5^3	[3-2-3-2-2]	5	1	3	4–1/2
5^4	[2-3-2-2-3]	5	1	1	3–0/1
5^5	[3-2-2-3-2]	5	1	4	2–4/0

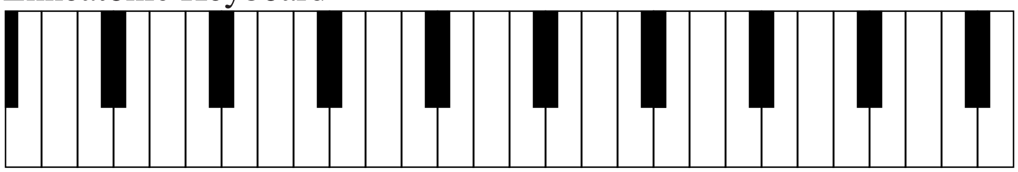
Example 3.7 Modular keyboard designs

Each white-key sequence reflects the pitch-class interval sequence of the specific collection.

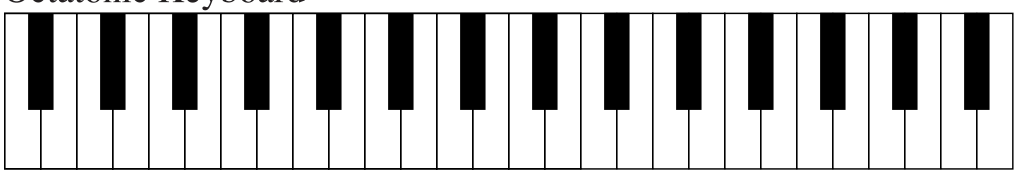
Chromatic Keyboard



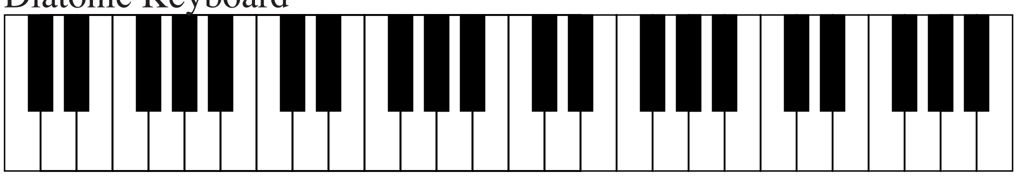
Enneatonic Keyboard



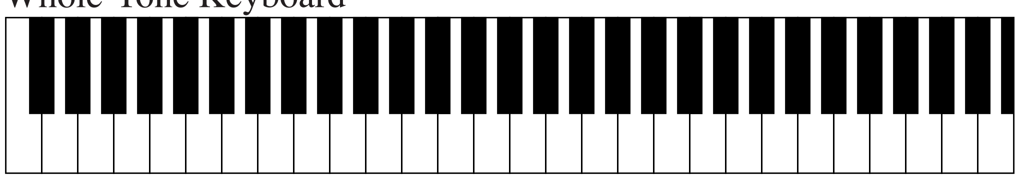
Octatonic Keyboard



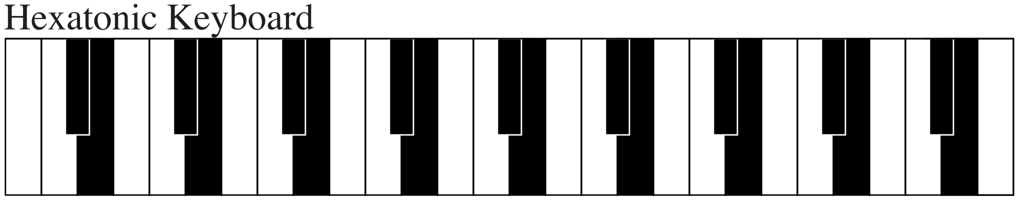
Diatonic Keyboard



Whole-Tone Keyboard



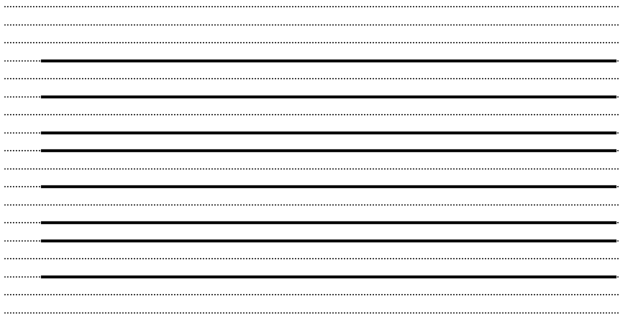
Hexatonic Keyboard



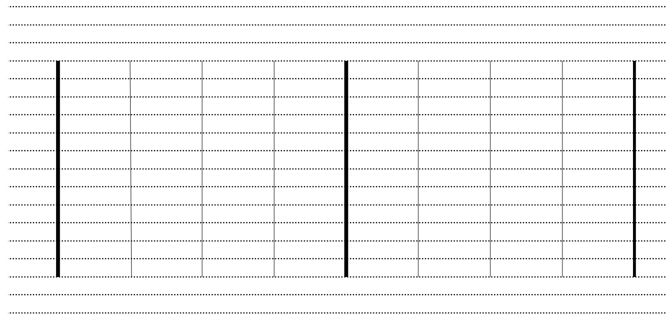
Pentatonic Keyboard

Example 3.8 A graphic tool to depict motivic transformations

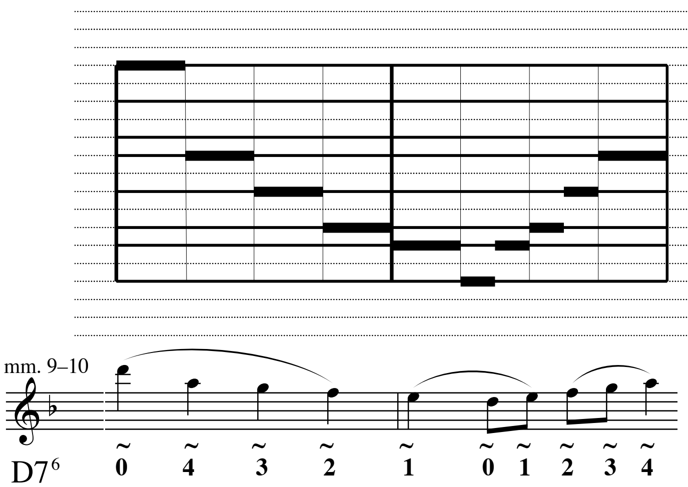
Diatonic Modular Grid 7^6
mapped onto aggregate



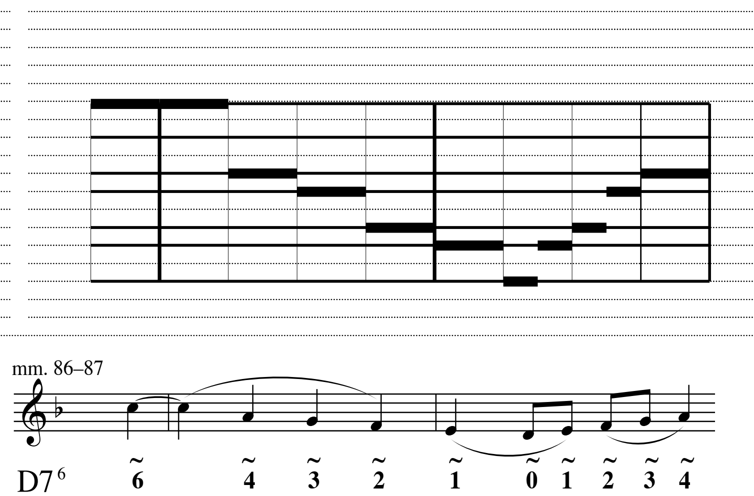
Metric Grid (Quadruple Meter)



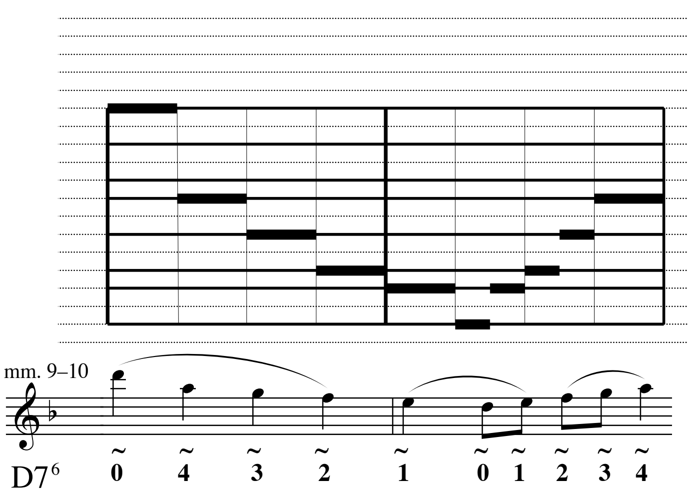
Ravel, String Quartet, I, Motive p^2
mapped onto modulus 7^6



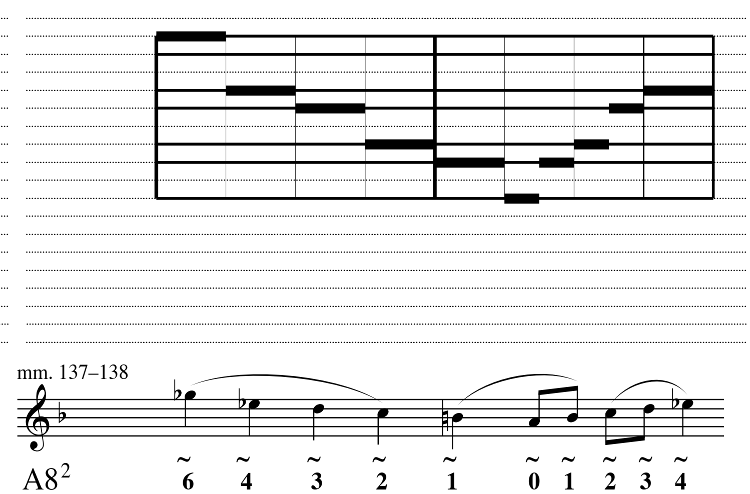
Motive p^2 transformed: first interval reduced by one step, first note one beat longer



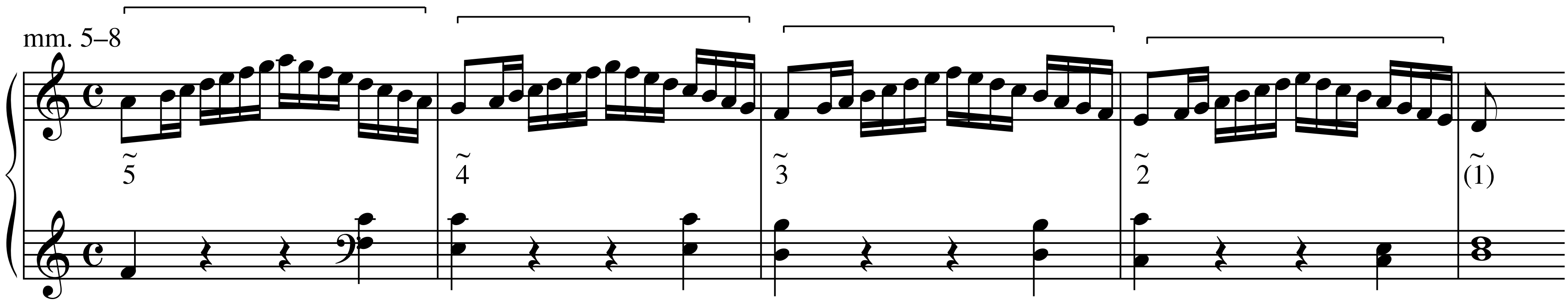
Motive p^2 in modulus 7^6

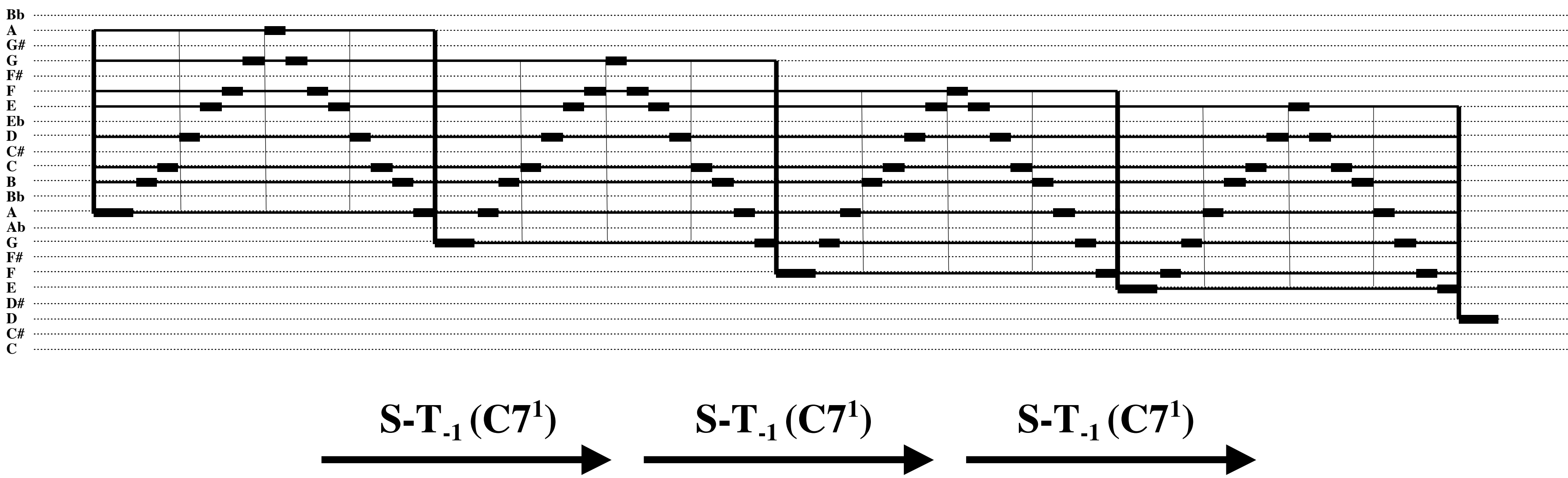


p^2 transformed: mapped onto modulus 8^2, first interval reduced by one step, transposed by T_7

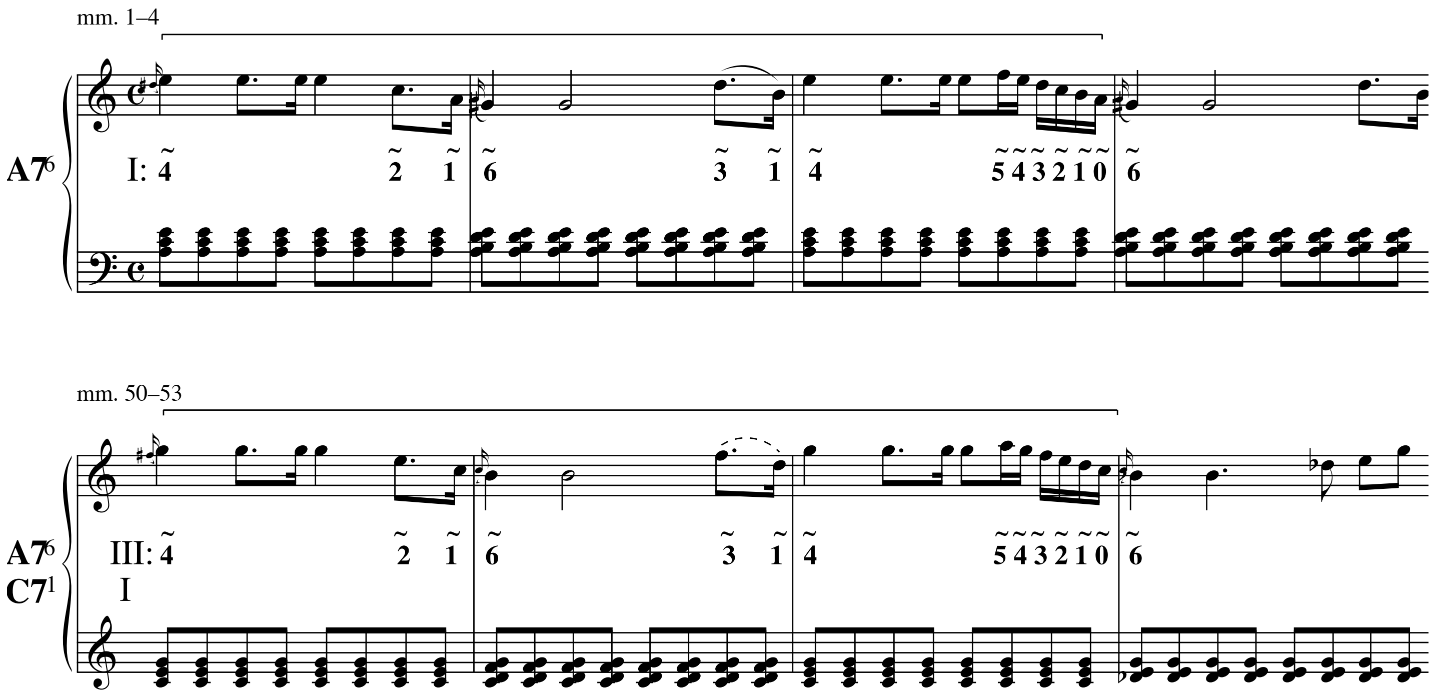


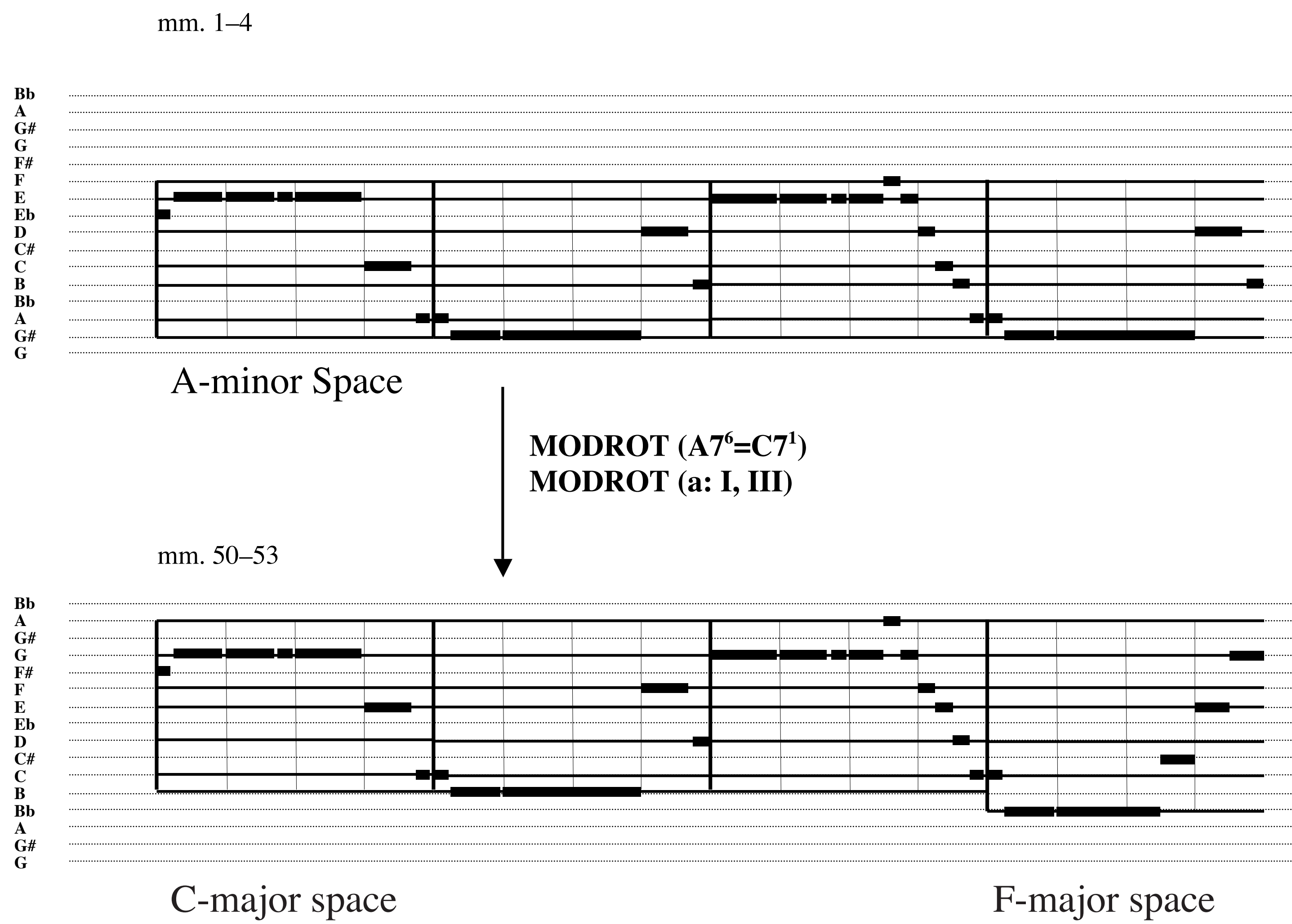
Example 3.9 Mozart, Piano Sonata in C major, K. 545, I: STEPTRANS



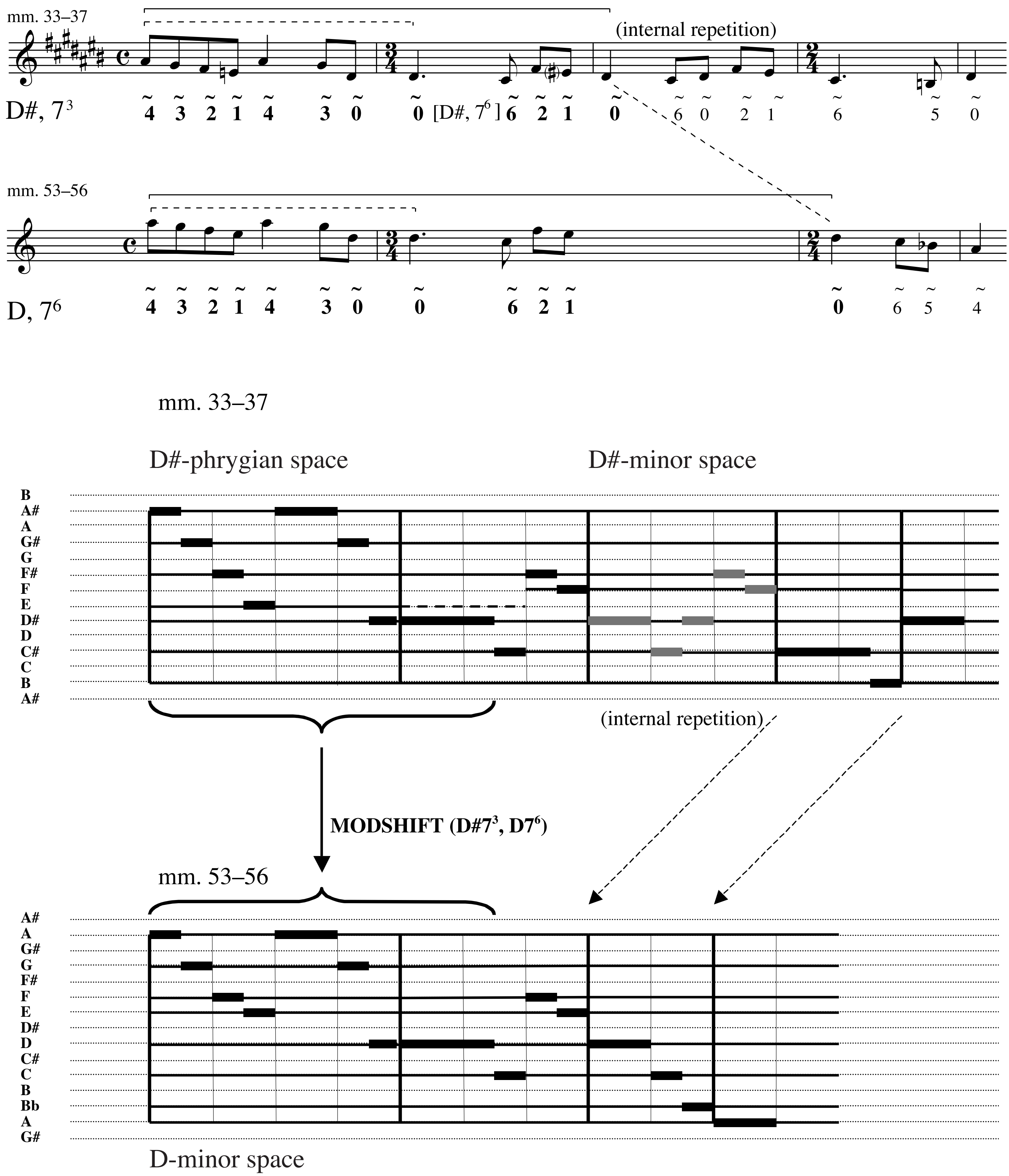


Example 3.10 Mozart, Piano Sonata in A minor, K. 310, I: MODROT

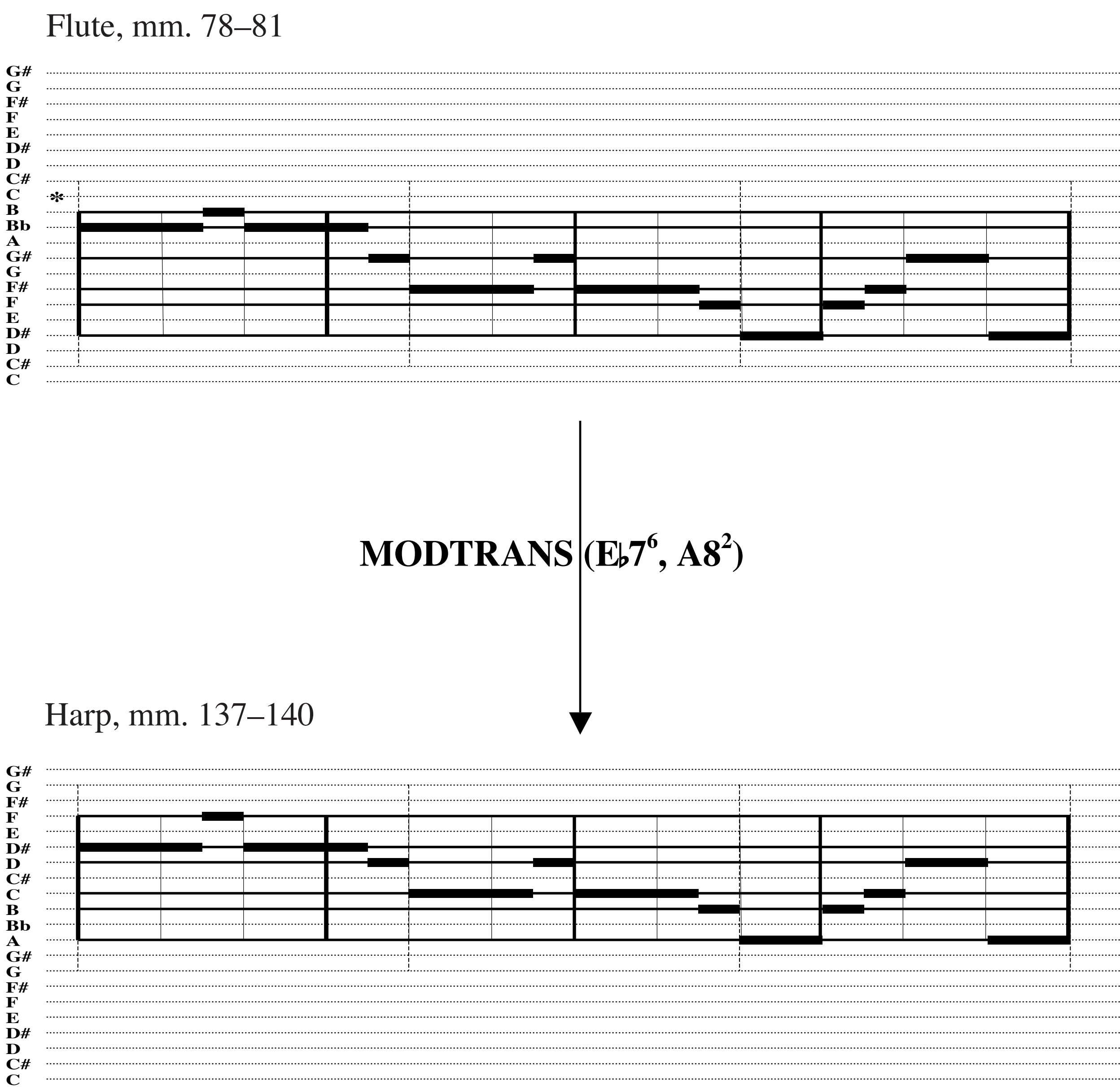




Example 3.11 Ravel, *Gaspard de la nuit*, "Ondine": MODSHIFT



Example 3.12 Ravel, *Introduction and Allegro*, S-theme: MODTRANS

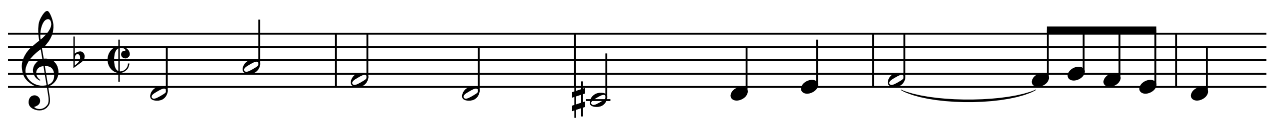


*The longer, dashed veritcal lines indicate the perceived meter (4/4)

Example 3.13 Bach, *Art of the Fugue*: Step inversion

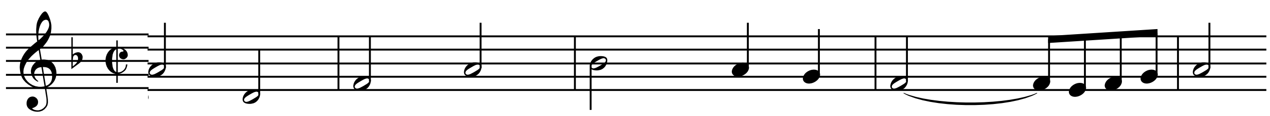
Example 3.13a Pitch-class inversion

J.S. Bach, *The Art of the Fugue*, Contrapunctus 1



pcs 2 9 5 2 1 2 4 5 7 5 4 2

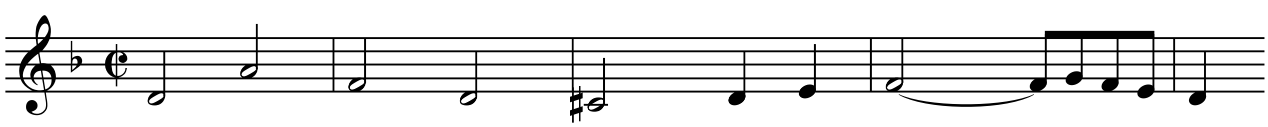
J.S. Bach, *The Art of the Fugue*, Contrapunctus 4



pcs 9 2 5 9 10 9 7 5 4 5 7 9

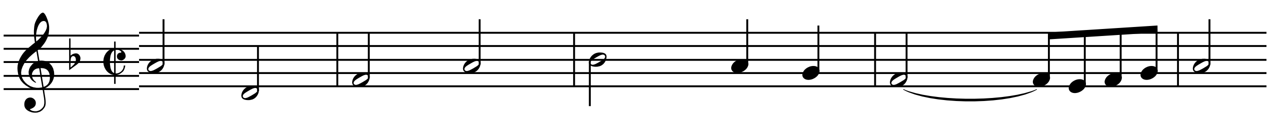
Example 3.13b Step inversion

J.S. Bach, *The Art of the Fugue*, Contrapunctus 1



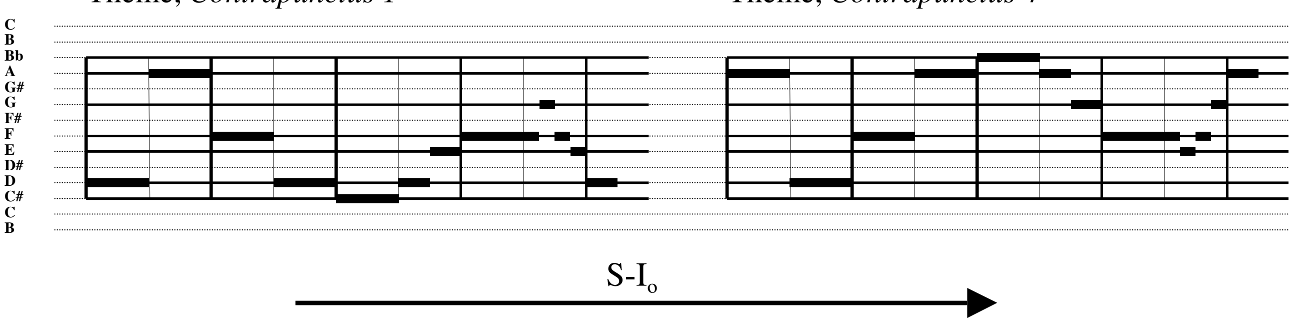
D7 6 $\tilde{0}$ $\tilde{4}$ $\tilde{2}$ $\tilde{0}$ $\tilde{6}$ $\tilde{0}$ $\tilde{1}$ $\tilde{2}$ $\tilde{3}$ $\tilde{2}$ $\tilde{1}$ $\tilde{0}$

J.S. Bach, *The Art of the Fugue*, Contrapunctus 4

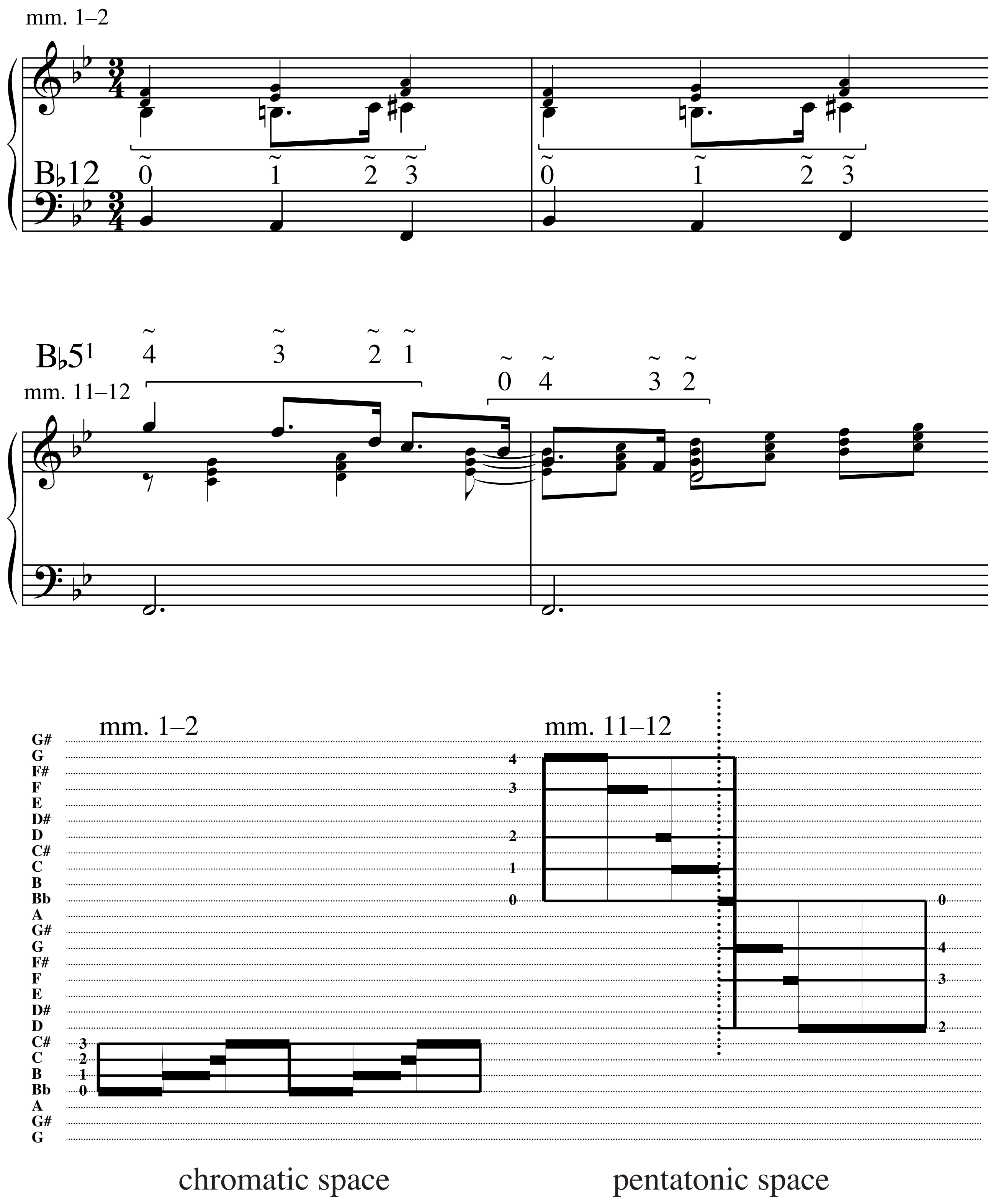


D7 6 $\tilde{4}$ $\tilde{0}$ $\tilde{2}$ $\tilde{4}$ $\tilde{5}$ $\tilde{4}$ $\tilde{3}$ $\tilde{2}$ $\tilde{1}$ $\tilde{2}$ $\tilde{3}$ $\tilde{4}$

Theme, *Contrapunctus 1* Theme, *Contrapunctus 4*

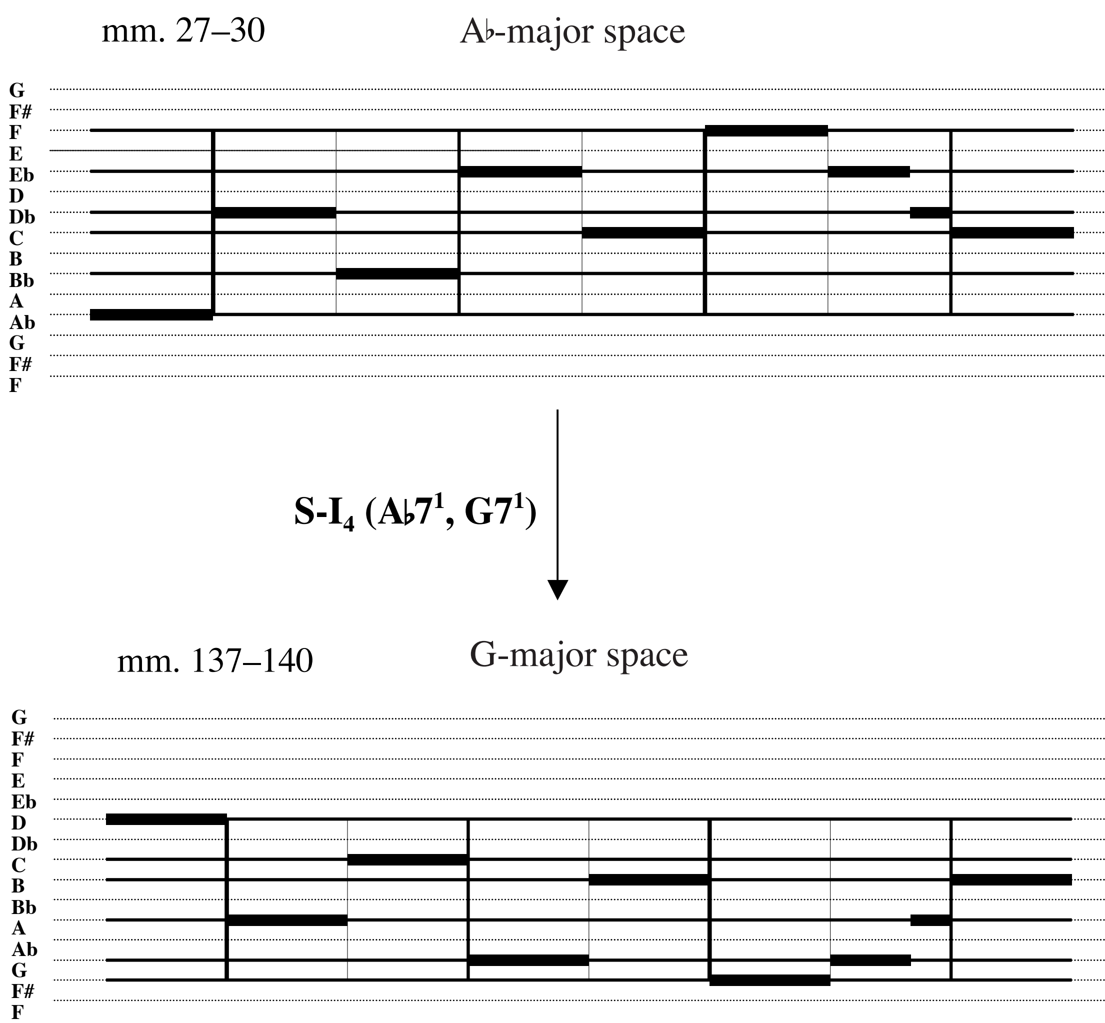


Example 3.14 Debussy, *Préludes*, Book I, "Danseuses de Delphes": MODTRANS-I

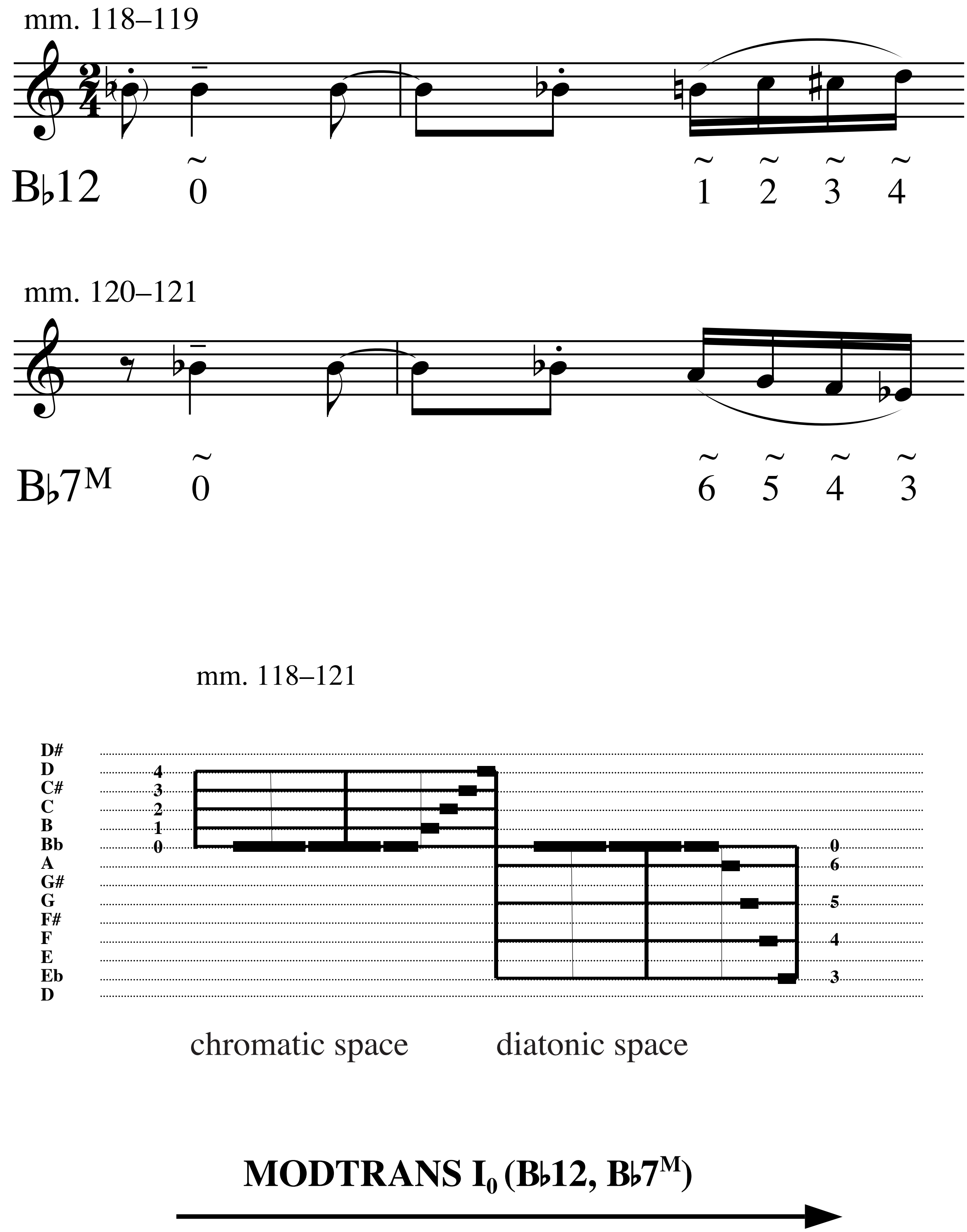


MODTRANS I_4 , I_0(B♭12, B♭5^1)

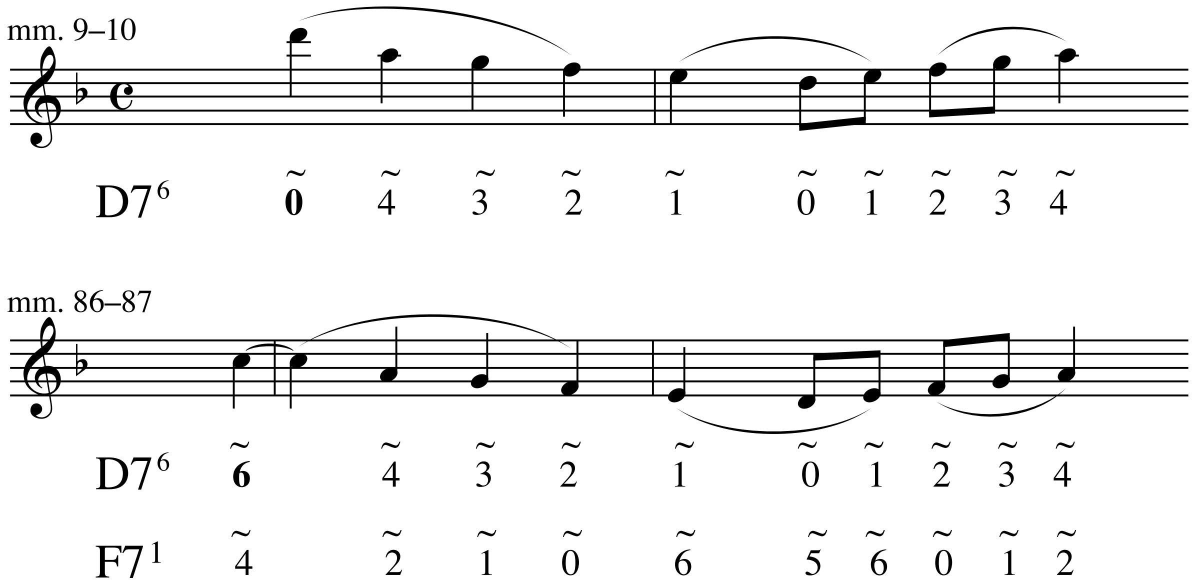
Example 3.15 Beethoven, Piano Sonata, op. 110, III: Step inversion

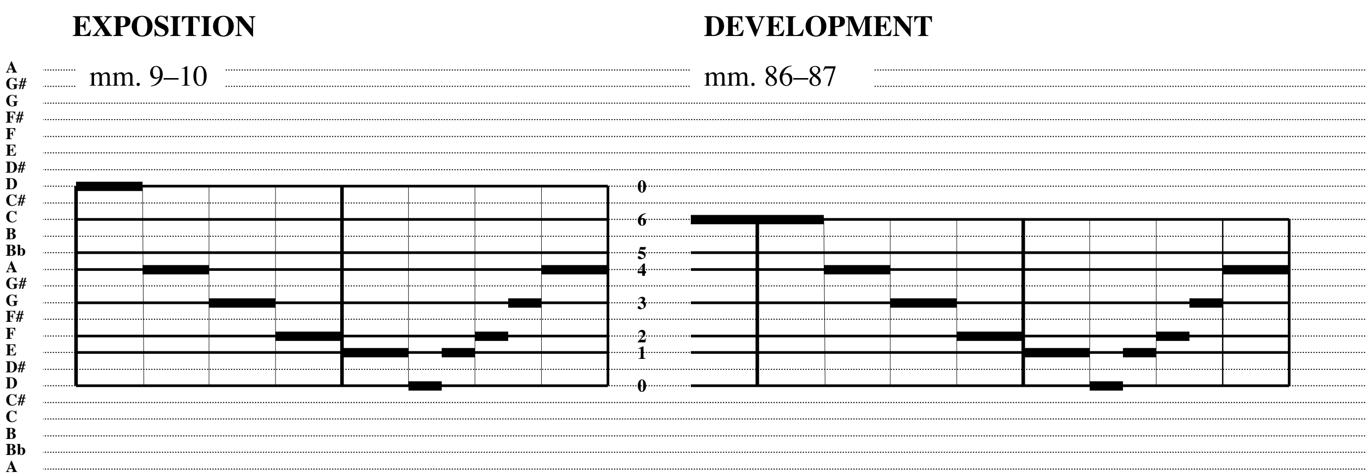


Example 3.16 Bartók, String Quartet, op. 17, II: MODTRANS-I



Example 3.17 Ravel, String Quartet, I: INTTRANS

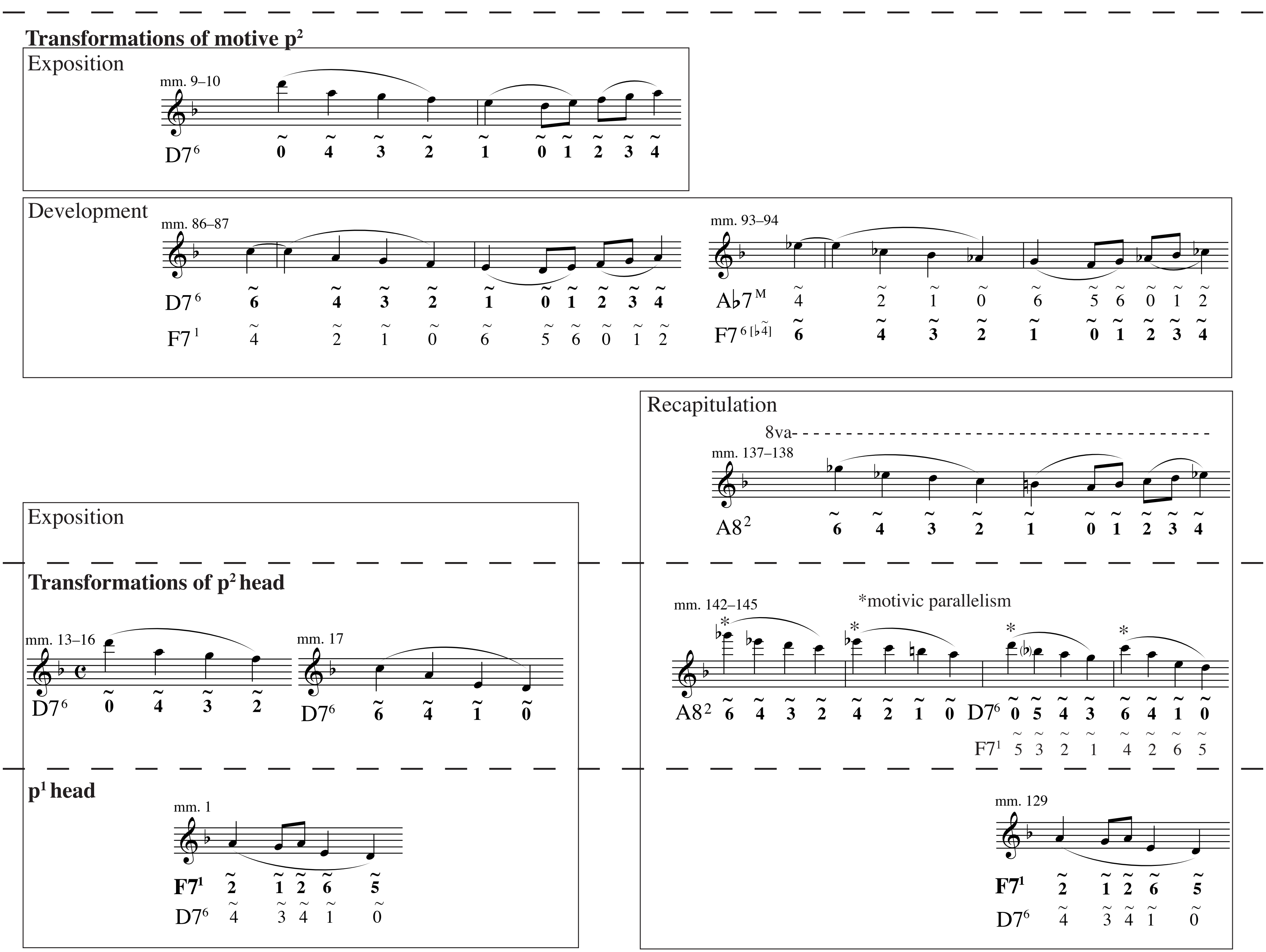




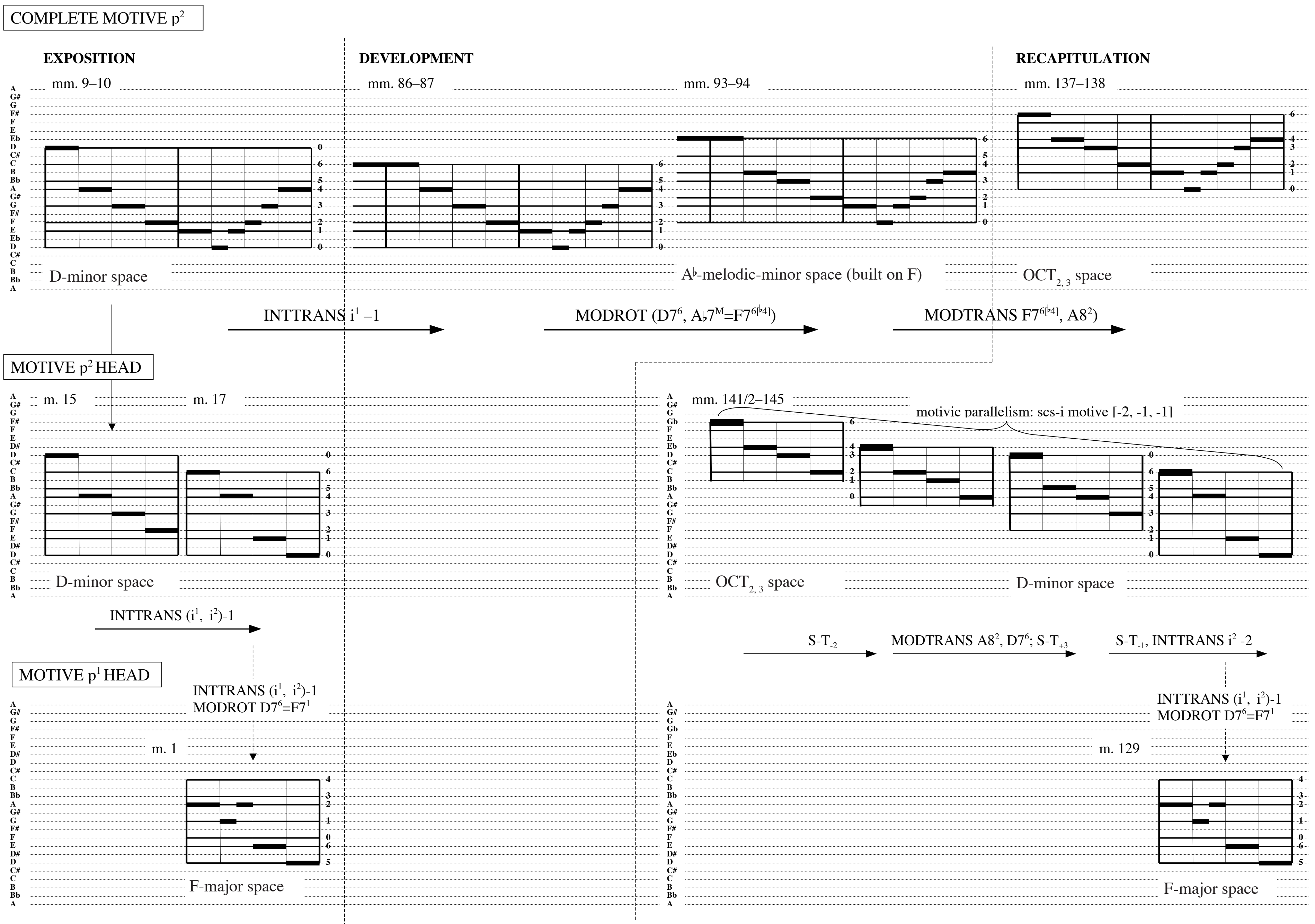
D-minor space

INTTRANS i^i -1

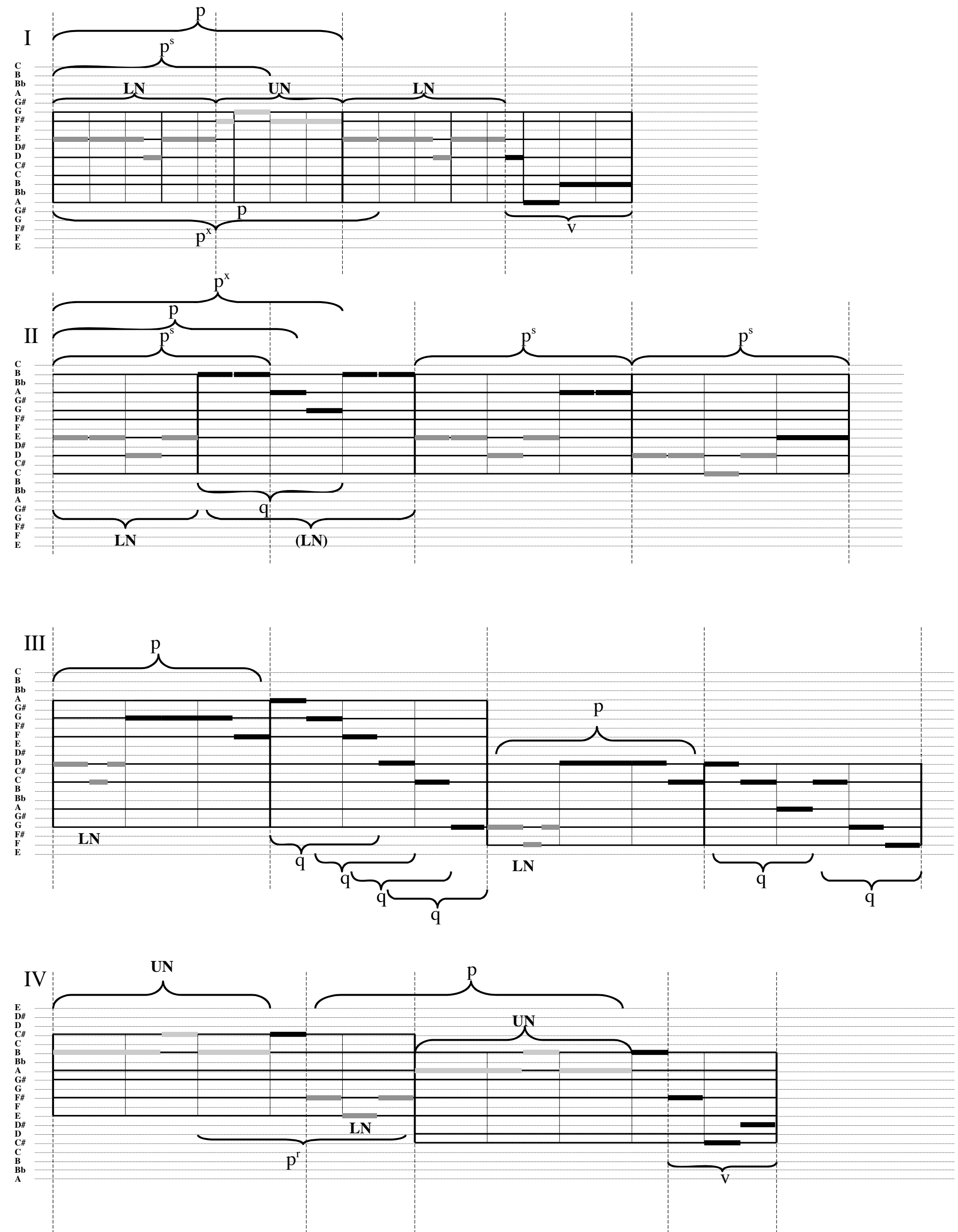
Example 3.18 Ravel, String Quartet, I: Transformations of motive p²



Example 3.18 continued: Graph of p^2 transformations



Example 3.19 Ravel, Piano Trio: Primary themes



Legend:

p	primary motive
pS	primary motive, shortened by one pitch
pX	primary motive, extended by one pitch
q	three-note descending motivic segment of pX
pr	primary motive in retrograde
v	cadential motive, scs-i motive [-3, +1]
LN	lower-neighbor segment
UN	upper-neighbor segment

Example 3.20 Glossary of symbols, abbreviations, and terms

Label	Term	Meaning	Is defined by…	Equivalents	For example,
mod	Modular Space	A (scalar) collection arranged in a closed module (visualized as a circle)	its cardinality and its successive interval array	collection	(mod)7 = diatonic collection
M	Cardinality of Modular Space	The number of elements (step-classes) in a collection or modular space			
M^n	Modulus	A specific order (rotation) of a modular space	its modular space M and order number n (the placement of step class 0)	ordered collection, mode	7^2 = second rotation of diatonic collection (Dorian)
L	Letter-name designation	Specific transposition of a modulus	its letter-name designation (the pc level of step class 0)	Specific, ordered pc collection, mode and"tonic"	$F7^2$ = F Dorian; $E8^1$ = $OCT_{1,2}$ beginning on E
L^x	Letter-name designation of M^x	Specific transposition of modulus x	its letter-name designation (the pc level of step class 0)	Specific, ordered pc collection mode and"tonic"	(as above)
I_M	Inversion Class M	All step-class inversions with the step-class index 0	the cardinality of M, which equals the step-class index 0	Analogue of pc I_0	For I_0 of $F7^2$, M = 7; for I_0 of $E8^1$, M = 8; etc.
I_{M+n}	Inversion Class M+n	All step-class inversions with the step-class index n	the cardinality of M and the specific index number n	Analogue of pc T_nI	For I_4 of $F7^2$, M = 11 (4 mod7); For I_4 of $E8^1$, M = 12 (4 mod8); etc.

Example 3.21 Summary of step-based motivic transformations

	Transformation	**Abbrev.**	**Function**	**Definition**
1	Step Transposition	S-T	Moves a motive to a different step location within the same collection/modulus (analogue of pitch-class transposition).	Given motive m^1 as an ordered group of steps s^1, s^2, s^3,... s^n within the modulus M^n, and motive m^2 as an ordered group of steps u^1,u^2, u^3, ... u^n within the same modulus, then S-T_n transposes the entire motive by the ordered step interval n, so that $u^1=s^1+n$, $u^2=s^2+n$, … $u^n=s^n+n$.
2	Modular Rotation	MODROT	Changes a motive's governing modulus by rotating step 0 ($\tilde{0}$) to a different location within the same modular space (same collection, different $\tilde{0}$; "relative approach").	Let us define MODROT as the operation that changes a modulus M^x to modulus M^{x+n} of the same modular space by rotating step 0 by n positions (with n being expressed as an ordered step interval). At the same time, the L designation for $\tilde{0}$ moves by n positions in the modular space. The modular space's pc collection remains identical.
3	Modular Shift	MODSHIFT	Changes a motive's governing modulus by shifting to a different modulus of the same cardinality while maintaining $\tilde{0}$ at the same pc level (same $\tilde{0}$, different collection; "parallel approach").	Let us define MODSHIFT as the operation that shifts modulus M^x to modulus M^y of the same cardinality with pc level L as the point of synchronization. If L^y of M^y is transposed, the difference between L^x and L^y is shown as transposition T_n (by the pc interval n), or by providing separate L labels for each M.
4	Step Inversion	S-I	Inverts a motive or musical entity around a *step axis* within a given modulus by mapping its steps onto their complements (analogue of pitch-class inversion). The index number expresses a step.	Let us define S-I as the inversion that maps each ordered step s^1, s^2, s^3,... s^n of motive m^1 within modulus M^x onto its ordered, modM-complement, step u^1,u^2, u^3, ... u^n of motive m^2 within modulus M^y of the same cardinality. When the inversion is not S-I_0, the interval of transposition shall be defined as the unordered step interval n and written as index number S-I_n.
5	Modular Transformation	MODTRANS	Transforms a motive's interval structure by mapping equivalent step classes from one modular space onto a second of a different cardinality.	Let us define MODTRANS (L^xM^x, L^yM^y) as a transformation that maps each step of a motive m in the modulus M^x onto a corresponding step in the modulus M^y, where L represents the pitch class of each modulus that is interpreted as $\tilde{0}$. *
6	Interval Mapping	INTMAP	Transforms a motive's interval structure by mapping its ordered step-class *intervals* from one modular space onto a second of a different cardinality.	Given the interval content of a motive m^1 as an ordered group of ordered step-space intervals x^1, x^2, x^3,... x^n within the modulus M^x, and the interval content of a motive m^2 as an ordered group of ordered step-space intervals y^1,y^2, y^3, ... y^n within the modulus M^y, then INTMAP maps each ordered interval (expressed as ordered step-space interval) from m^1 in M^x onto the same ordered interval (expressed as ordered step-space interval) of m^2 in M^y, with $\tilde{\tilde{0}}$ as the point of synchronization of the mapping.
7	Interval-Mapping Inversion	INTMAP-I	Inverts a motive or musical entity around a *step-class axis* shared by two different modular spaces by mapping the ordered inverted step intervals from one modulus onto the other. The *combined index number* is the sum of both moduli's cardinalities plus the interval of step-class transposition.	Let us define INTMAP-I (IMI) as the inversion within the destination modulus of an ordered segment of ordered step-space intervals that has been interval-mapped from its original modulus. $\tilde{\tilde{0}}$ shall serve as the point of synchronization; transpositions shall be indicated by the inversion's index number. Let us define all inversions at $\tilde{\tilde{\tilde{0}}}$ as the inversion class I_M, where M equals the cardinality of the modulus in which the motive resides.
8	Interval Transformation	INTTRANS	Transforms a motive or musical entity by changing a single interval.	Given the interval content of a motive m^1 as an ordered group of ordered step-space intervals x^1, x^2, x^3, ... x^n within the modulus M^x, and the interval content of a motive m^2 as an ordered group of ordered step-space intervals y^1,y^2, y^3, ... y^n within the modulus M^y, let us define INTTRANS as the interval transformation that changes an ordered step-space interval x^n of motive m^1 into the ordered step-space interval y^n of motive m^2 by the ordered step-space interval n (y^n–x^n).

*This definition slightly alters that of Santa: "Let us define MODTRANS (x, y, z) as a transformation that maps each step class of a musical entity in modular system *x* onto a corresponding step class in modular system *y*, where *z* represents the 'point of synchronization,' the pitch class in the starting modulus that is interpreted as step-class 0." [Santa, "Defining Modular Transformations," 202.] Unlike Santa, I indicate the location of step 0 for each modulus M^n separately with a letter-name designation (L) rather than giving the point of synchronization followed by a T label.

Example 3.21 continued

	Transformation	Path	Illustration	See Ex.
1	Step Transposition	$m^1 \xrightarrow{\text{S-T}_n \text{ (LM}^n)} m^2$	$m^1 \xrightarrow{\text{S-T}_{-1} \text{ (C7}^1)} m^2$	**3.9**
2	Modular Rotation	$m^1 \xrightarrow{\text{MODROT (L}^x \text{M}^x\text{=L}^{x+n} \text{M}^{x+n})} m^2$	$m^1 \xrightarrow[\text{MODROT (a: I, III)}]{\text{MODROT (A7}^6\text{=C7}^1)} m^2$	**3.10**
3	Modular Shift	$m^1 \xrightarrow{\text{MODSHIFT (LM}^{x,y})\text{T}_n} m^2$ *or* $m^1 \xrightarrow{\text{MODSHIFT (L}^x\text{M}^x\text{, L}^y\text{M}^y)} m^2$	$m^1 \xrightarrow{\text{MODSHIFT (D\#7}^{3,6}) \text{ T}_{11}} m^2$ *or* $m^1 \xrightarrow{\text{MODSHIFT (D\#7}^3\text{, D7}^6)} m^2$	**3.11**
4	Modular Transformation	$m^1 \xrightarrow{\text{MODTRANS (L}^x\text{M}^x\text{, L}^y\text{M}^y)} m^{2**}$	$m^1 \xrightarrow{\text{MODTRANS (E}\flat\text{7}^6\text{, A8}^2)} m^{2**}$	**3.12**
5	Interval Mapping	$m^1 \xrightarrow{\text{INTMAP (L}^x\text{M}^x\text{, L}^y\text{M}^y)} m^2$	$m^1 \xrightarrow{\text{INTMAP (B}\flat\text{12, B}\flat\text{7}^M)} m^2$	**pp. 93–95**
6	Step Inversion	$m^1 \xrightarrow{\text{S-I}_x \text{ (LM}^n)} m^2$	$m^1 \xrightarrow{\text{S-I}_0 \text{ (D7}^6)} m^2$	**3.13 3.14* 3.15 3.16***
7	Interval-Mapping Inversion	$m^1 \xrightarrow{\text{INTMAP-I}_{M+n} \text{ (M}^x\text{, M}^y)} m^2$	$m^1 \xrightarrow{\text{INTMAP-I}_0 \text{ (B}\flat\text{12, B}\flat\text{7}^M)} m^2$	**pp. 93–95**
8	Interval Transformation	$m^1 \xrightarrow{\text{INTTRANS i}^n \text{ n (LM}^n)} m^2$	$m^1 \xrightarrow{\text{INTTRANS i}^1 \text{ -1 (D7}^6)} m^2$	**3.17**

**Santa's "musical entity" is represented here as a motive (m), its consecutive forms numbered by superscript.

*In these examples, S-I is combined with MODTRANS

Example 4.1 Ravel, String Quartet, I: Type 3 sonata form, MC declined

mm. 1–83	***ROTATION 1*** ***Exposition***							
zones	*P*		*TR* ’	* *TR*		’	*S* /	*C*
sections	*A*	*B*	*A’* → MC	TR^1	TR^2	V-lock **MC**	**S** **EEC**	
rehearsal				**A**	**B**	**C**	**D**	**E**
measure	1	9	17 21	24 28 31	35 39	45 50	55 **63**	69 74 77 80
thematic material	**p^1**	**p^2**	**p^1** wth	**p^3** **p^1tra**	**p^1chr** wth	**p^1dom**	**s**	**s / p^1clos** **p^1end**
measure groups	**4 4**	**8**	**4 3**	**4 3 4**	**4 6**	**10**	**8 6**	**5 3 3 4**
n.-d. coll.			WT_1	$OCT_{0,1}$ $OCT_{1,2}$	$OCT_{1,2}$ $OCT_{0,1}$ $OCT_{1,2}$			
key areas RN: **F:** **d:**	F/d **I**/vi III/i	g C **ii V** iv VI	F/d [G] **I**/vi **V/V** III/**i V**	C [F] E [a] mod. **V I V/iii** V/iii V/v	c# c# dim. vii°/vi **vii°**	A V/vi **V**	d d vi **i**	WT_0 progression to d minor (elision w. development)
bass	F(scale)	G C	F(scale) G	Cped. Eped. E#G#	C# /E C#	A		**B♭ A♭ G♭ E** →
lin. n.-d. coll.					**37 $OCT_{0,1}$**			WT_0 progression
dynamics	*p pp*	*pp p f*	*p*	*pp pp/p mf p*	***pp ff*** *mf p*	*p mp p*	*pp*	*mf p mf pp*

mm. 84–128	***ROTATION 2*** ***Development***						
zones	*P-based*			*S-based*			*P-based*
sections			**trans.**			**trans.**	**climax + retransition**
rehearsal	**F**			**G**			**H**
measure	84	91	99	102	106	110	119 122 126
thematic material	**p^2**	**p^2**	wth	**s / p^2**	**s / p^2**	**sf** **p^1clim**	**p^1den** **p^1tra**
measure groups	**7.1** **e** 1.3 2.1 3.1	**8** **e** 1.3 2.1 4	**3** 3	**4.3** 4 .3	**3.1** 2.3 .2	**9** 3	**10** 2.2 7.2
n.-d. coll.				**$OCT_{2,3}$**		**$OCT_{2,3}$**	**$OCT_{0,1}$** **WT_0**
key areas RN: **F:** **d:**	d /F $I^{add.6}$ **i^7**	f^{o7}/a♭	F^9	$d\#^{o7}$	$d\#^{o7}$	$f\#^{o7}$	$F\#^{7\ \flat 5}$ Gr^{+6}/Fr^{+6} (=♭II!)
bass →	**D**	**F**	**F**	**D #**	**D #**	**D#/F# ↑ $OCT_{2,3}$**	**F# F#**
lin. n.-d. coll.						**$OCT_{2,3}$**	**!**
dynamics	*ppp pp*	*ppp pp*	*mp p*	*p*	*pp*	***p p ff***	***fff*** *f mf mp*

P = P-zone, primary theme zone
TR = transition
C = C-zone, closing zone
MC = medial caesura
TR^1 = first full module of continued TR
V-lock = dominant lock
S = S-zone, secondary theme zone
EEC = essential expositional closure
ESC = essential structural closure

p^1 = first P-theme
p^2 = second P-theme
p^3 = third P-theme
s = S-theme
sf = fragment of s
wth = waiting-third motive

p^1 tra = transitional transformation of p^1
p^1 dom = dominant transformation of p^1
p^1 clos = closing transformation of p^1
p^1 end = ending transformation of p^1
p^1 clim = climax transformation of p^1
p^1 den = denouement transformation of p^1

mm. 129–213	***ROTATION 3*** ***Recapitulation***								
zones	*P*		*TR* ’	* *TR*		’	*S* /	*C*	*coda*
sections	*A*	*B*	*A’* → MC	TR^1	TR^2	V-lock **MC**	**S** **ESC**	*eli-*	*sion*
rehearsal		**I**		**J**	**K**	**L**	**M**		
measure	129	137	145	152 156 159	163 167	173 180	184 **192**	198 204	209
thematic material	**p^1**	**p^2**	**p^1**	**p^3** **p^1tra**	**p^1chr** wth	**p^1dom**	**s**	**s / p^1clos**	**s / p^1end**
measure groups	**4 4**	**8**	**4 3**	**4 3 4**	**4 6**	**11**	**8 6**	**3 3 3 2**	**5**
n.-d. coll.		**$OCT_{2,3}$**	WT_1	[$OCT_{0,1}$] [$OCT_{1,2}$ $OCT_{0,1}$]					
key areas RN: **F:** **d:**	F/d **I**/vi III/i		F/d [G] **I**/vi **V/V** III/i V	C [F] E♭ [A♭] mod. **V I V/♭III**		C **V / i !**	**$F^{add.6}$** **I**	**F** **I** *eli-*	**F** **I** *sion*
bass	F(scale)	F/A♭/B C	F(scale) G	Cped. E♭ped. E,G	D♭/A♭ D♭	C G/C	**F** E♭ G C **F**	**C#** **B A G**	**F**E♭FG**F**
lin. n.-d. coll.								WT_1 progression	
dynamics	*p pp*	*pp p f*	*p*	*pp pp/p mf p*	***pp ff*** *mf p*	*p mp p*	*pp*	*mf p pp*	*pp*

Example 4.2 Ravel, String Quartet, I: Overview of themes

Example 4.3 Ravel, String Quartet, I: P-zone with themes p[1] and p[2]

Example 4.4 Ravel, String Quartet, I: MC^1 and TM^1/TR^1 with theme p^3

Example 4.5 Ravel, String Quartet, I: TM²/TR²

Example 4.6 Ravel, String Quartet, I: MC² and TM³/S

Example 4.7 Ravel, String Quartet, I: Type 3 sonata form with TMB

mm. 1–83	***ROTATION 1*** ***Exposition***							
zones	*P*		*TR* ’	*TMB*		’	/	*C*
sections	*A*	*B*	*A’* → MC	TM^1 (false S)	TM^2	V -lock **MC**	**TM^3 (true S) EEC**	
rehearsal				**A**	**B**	**C**	**D**	**E**
measure	1	9	17 21	24 28 31	35 39	45 50	55 **63**	69 74 77 80
thematic material	**p^1**	**p^2**	**p^1** wth	**p^3** **p^1tra**	**p^1chr** wth	**p^1dom**	**s**	**s / p^1clos** **p^1end**
measure groups	**4 4**	**8**	**4 3**	**4 3 4**	**4 6**	**10**	**8 6**	**5 3 3 4**
n.-d. coll.			WT_1	$OCT_{0,1}$ $OCT_{1,2}$	$OCT_{1,2}$ $OCT_{0,1}$ $OCT_{1,2}$			
key areas RN: **F:** **d:**	F/d **I**/vi III/i	g C **ii V** iv VI	F/d [G] **I**/vi **V/V** III/**i V**	C [F] E [a] mod. **V I V/iii** V/iii V/v	c# c# dim. vii°/vi **vii°**	A V/vi **V**	d d vi **i**	WT_0 progression to d minor (elision w. development)
bass	F(scale)	G C	F(scale) G	Cped. Eped. E#G#	C# /E C#	A		**B♭ A♭ G♭ E**
lin. n.-d. coll.					**37 $OCT_{0,1}$**			WT_0 progression
dynamics	*p pp*	*pp p f*	*p*	*pp pp/p mf p*	***pp ff*** *mf p*	*p mp p*	*pp*	*mf p mf pp*

P = P-zone, primary theme zone
TMB = trimodular block
C = C-zone, closing zone
MC = medial caesura
TM^1 = first module of TMB
V-lock = dominant lock
S = S-zone, secondary theme zone
EEC = essential expositional closure
ESC = essential structural closure

mm. 84–128	***ROTATION 2*** ***Development***						
zones	*P-based*			*S-based*			*P-based*
sections			**trans.**			**trans.**	**climax + retransition**
rehearsal	**F**			**G**			**H**
measure	84	91	99	102	106	110	119 122 126
thematic material	**p^2**	**p^2**	wth	**s/p^2**	**s/p^2**	**sf p^1clim**	**p^1den p^1tra**
measure groups	**7.1** **e** 1.3 2.1 3.1	**8** **e** 1.3 2.1 4	**3** 3	**4.3** 4 .3	**3.1** 2.3 .2	**9** 3	**10** 2.2 7.2
n.-d. coll.				**$OCT_{2,3}$**		**$OCT_{2,3}$**	**$OCT_{0,1}$ WT_0**
key areas RN: **F:** **d:**	d /F $I^{add.6}$ **i^7**	f^{o7}/a♭	F^9	$d\#^{o7}$	$d\#^{o7}$	$f\#^{o7}$	$F\#^{7\ \flat5}$ Gr^{+6}/Fr^{+6} (=♭II!)
bass	**D**	**F**	**F**	**D #**	**D #**	**D#/F# ↑ $OCT_{2,3}$**	**F# F#**
lin. n.-d. coll.						**$OCT_{2,3}$**	**!**
dynamics	*ppp pp*	*ppp pp*	*mp p*	*p*	*pp*	***p p ff***	***fff*** *f mf mp*

p^1 = first P-theme
p^2 = second P-theme
p^3 = third P-theme
s = S-theme
sf = fragment of s
wth = waiting-third motive

p^1 tra = transitional transformation of p^1
p^1 dom = dominant transformation of p^1
p^1 clos = closing transformation of p^1
p^1 end = ending transformation of p^1
p^1 clim = climax transformation of p^1
p^1 den = denouement transformation of p^1

mm. 129–213	***ROTATION 3*** ***Recapitulation***								
zones	*P*		*TR* ’	*TMB*		’	/	*C*	*coda*
sections	*A*	*B*	*A’* → MC	TM^1 (false S)	TM^2	V-lock **MC**	**TM^3 (true S) ESC**	*eli-*	*sion*
rehearsal		**I**		**J**	**K**	**L**	**M**		
measure	129	137	145	152 156 159	163 167	173 180	184 **192**	198 204	209
thematic material	**p^1**	**p^2**	**p^1**	**p^3** **p^1tra**	**p^1chr** wth	**p^1dom**	**s**	**s / p^1clos**	**s / p^1end**
measure groups	**4 4**	**8**	**4 3**	**4 3 4**	**4 6**	**11**	**8 6**	**3 3 3 2**	**5**
n.-d. coll.		**$OCT_{2,3}$**	WT_1	[$OCT_{0,1}$] [$OCT_{1,2}$$OCT_{0,1}$]					
key areas RN: **F:** **d:**	F/d **I**/vi III/i		F/d [G] **I**/vi **V/V** III/i V	C [F] E♭ [A♭] mod. **V I V/♭III**		C **V/i!**	**$F^{add.6}$** **I**	**F** **I** *eli-*	**F** **I** *sion*
bass	F(scale)	F/A♭/B C	F(scale) G	Cped. E♭ped. E,G	D♭/A♭ D♭	C G/C	**F** E♭ G C **F**	**C# B A G**	**FE♭FGF**
lin. n.-d. coll.								WT_1 progression	
dynamics	*p pp*	*pp p f*	*p*	*pp pp/p mf p*	***pp ff*** *mf p*	*p mp p*	*pp*	*mf p pp*	*pp*

Example 4.8 Ravel, String Quartet, I: C with s and p^1 fragments

Example 4.9 Ravel, String Quartet, I: Type 3 sonata form without C-zone

mm. 1–68	***ROTATION 1*** ***Exposition***						
zones	*P*		*TR* ’	*P*	*TR* ’		
sections	*A’* → MC	*A’* → MC	*A’* → MC	TM^1 (false S)	TM^2	V -lock **MC**	**TM^3 (true S) EEC**
rehearsal				**A**	**B**	**C**	**D**
measure	1	9	17 21	24 31	35 39	45 50	55 **63**
thematic material	**p^1**	**p^2**	**p^1** wth	**p^3** **p^1tra**	**p^1chr** wth	**p^1dom**	**s**
measure groups	**4 4**	**8**	**4 3**	**4 3 4**	**4 6**	**10**	**8 6**
n.-d. coll.			WT_1	$OCT_{0,1}$ $OCT_{1,2}$	$OCT_{1,2}$ $OCT_{0,1}$ $OCT_{1,2}$		
key areas RN: **F:** **d:**	F/d **I**/vi III/i	g C **ii V** iv VI	F/d [G] **I**/vi **V/V** III/**i V**	C [F] E [a] mod. **V I V/iii** V/iii V/v	c# c# dim. vii°/vi **vii°**	A V/vi **V**	d d vi **i**
bass	F(scale)	G C	F(scale) G	Cped. Eped. E#G#	C# /E C#	A	
lin. n.-d. coll.					**37 $OCT_{0,1}$**		
dynamics	*p pp*	*pp p f*	*p*	*pp pp/p mf p*	***pp ff*** *mf p*	*p mp p*	*pp*

mm. 69–128	***ROTATION 2*** ***Development***							
zones		*P-based*			*S-based*			*P-based*
sections	pre-core			**trans.**			**trans.**	**climax + retransition**
rehearsal	**E**	**F**			**G**			**H**
measure	69 74 77 80	84	91	99	102	106	110	119 122 126
thematic material	**s / p^1clos** **p^1end**	**p^2**	**p^2**	wth	**s / p^2**	**s/p^2**	**sf** **p^1clim**	**p^1den** **p^1tra**
measure groups	**5 3 3 4**	**7.1 e** 1.3 2.1 3.1	**8 e** 1.3 2.1 4	**3** 3	**4.3** 4 .3	**3.1** 2.3 .2	**9** 3	**10** 2.2 7.2
n.-d. coll.					**$OCT_{2,3}$**		**$OCT_{2,3}$**	**$OCT_{0,1}$** **WT_0**
key areas RN: **F:** **d:**	WT_0 progression to d minor (elision w. development)	d /F I$^{add.6}$ **i^7**	f^{o7}/a♭	F^9	d#^{o7}	d#^{o7}	f#^{o7}	F#$^{7\ \flat5}$ Gr^{+6}/Fr^{+6} (=♭II!)
bass	**B♭ A♭ G♭ E**	**D**	**F**	**F**	**D #**	**D #**	**D#/F# ↑ $OCT_{2,3}$**	**F# F#**
lin. n.-d. col.	WT_0 progression						**$OCT_{2,3}$**	**!**
dynamics	*mf p mf pp*	*ppp pp*	*ppp pp*	*mp p*	*p*	*pp*	***p p ff***	***fff f*** *mf mp*

mm. 129–200	***ROTATION 3*** ***Recapitulation***						
zones	*P*		*TR* ’	*P*	*TR* ’		
sections	*A’* → MC	*A’* → MC	*A’* → MC	TM^1 (false S)	TM^2	V-lock **MC**	**TM^3 (true S) ESC**
rehearsal		**I**		**J**	**K**	**L**	**M**
measure	129	137	145	152 156 159	163 167	173 180	184 **192**
thematic material	**p^1**	**p^2**	**p^1**	**p^3** **p^1tra**	**p^1chr** wth	**p^1dom**	**s**
measure groups	**4 4**	**8**	**4 3**	**4 3 4**	**4 6**	**11**	**8 6**
n.-d. coll.		**$OCT_{2,3}$**	W T_1	[$OCT_{0,1}$] [$OCT_{1,2}$ $OCT_{0,1}$]			
key areas RN: **F:** **d:**	F/d **I**/vi III/i		F/d [G] **I**/vi **V/V** III/i V	C [F] E♭ [A♭] mod. **V I V/♭III**		C **V / i !**	**F**$^{add.6}$ **I**
bass	F(scale)	F/A♭/B C	F(scale) G	Cped. E♭ped. E,G	D♭/A♭ D♭	C G/C	**F** E♭ G C **F**
lin. n.-d. coll.							
dynamics	*p pp*	*pp p f*	*p*	*pp pp/p mf p*	***pp ff*** *mf p*	*p mp p*	*pp*

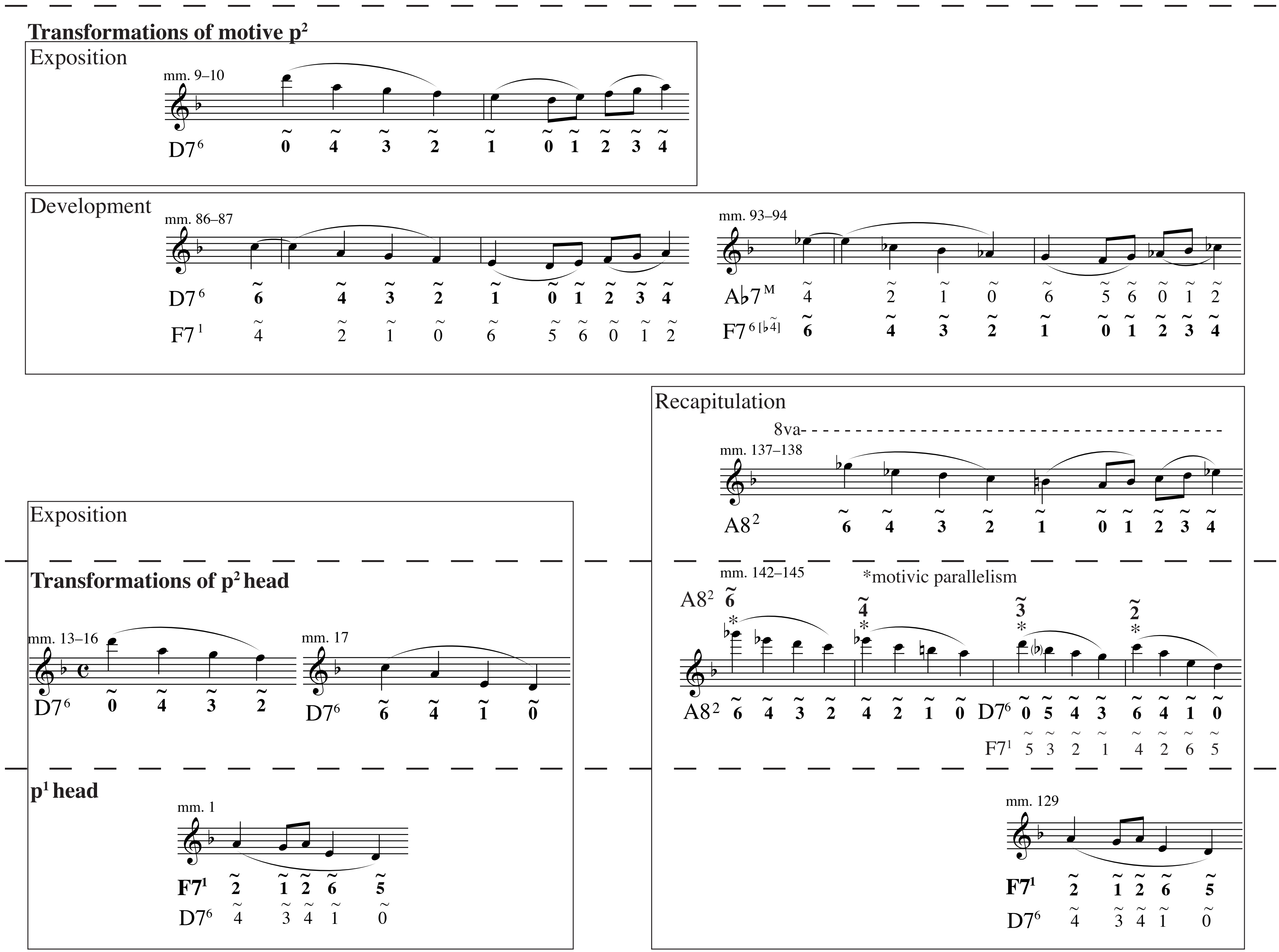
mm. 201–13	***Coda***	
zones		*codetta*
sections	*eli-*	*sion*
rehearsal		
measure	198 204	209
thematic material	**s / p^1clos**	**s / p^1end**
measure groups	**3 3 3 2**	**5**
n.-d. coll.		
key areas RN: **F:** **d:**	**F** **I** *eli-*	**F** **I** *sion*
bass	**C# B A G**	**FE♭FGF**
lin. n.-d. coll.	WT_1 progression	
dynamics	*mf p pp*	*pp*

P = P-zone, primary theme zone
TMB = trimodular block
C = C-zone, closing zone
MC = medial caesura
TM^1 = first module of TMB
V-lock = dominant lock
S = S-zone, secondary theme zone
EEC = essential expositional closure
ESC = essential structural closure

p^1 = first P-theme
p^2 = second P-theme
p^3 = third P-theme
s = S-theme
sf = fragment of s
wth = waiting-third motive

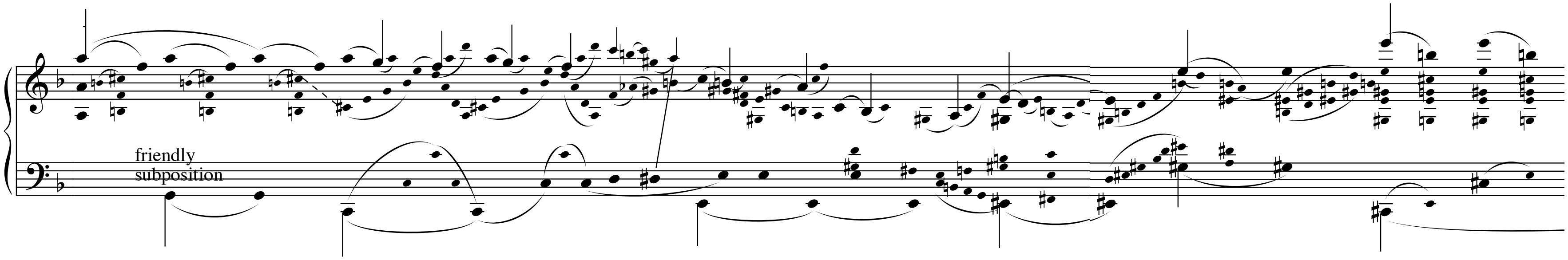
p^1 tra = transitional transformation of p^1
p^1 dom = dominant transformation of p^1
p^1 clos = closing transformation of p^1
p^1 end = ending transformation of p^1
p^1 clim = climax transformation of p^1
p^1 den = denouement transformation of

Example 4.10 Ravel, String Quartet, I: p^2 transformations



Example 4.11 Ravel, String Quartet, I: TM¹/TR¹ comparison

form	**MC¹**			**TM¹/TR¹**											**TM²/TR²**	
theme/motive				p³			p¹ chr	p³			p¹ tra				p¹ chr	
m.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36



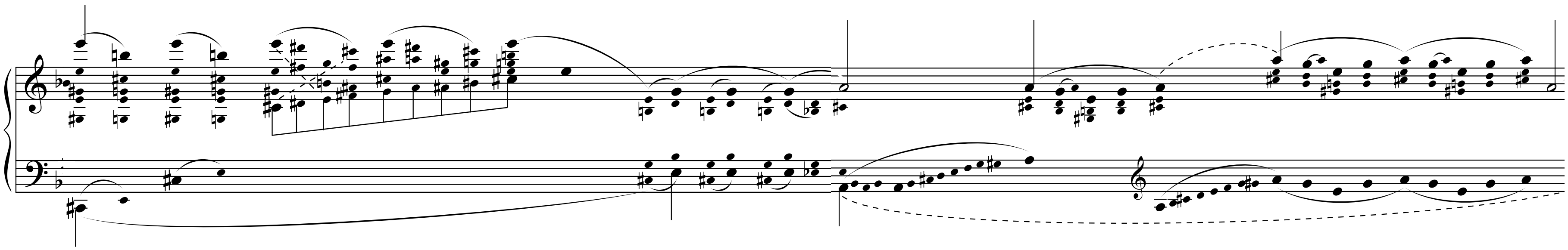
form	**MC¹**			**TM¹/TR¹**											**TM²/TR²**	
theme/motive				p³			p¹ chr	p³			p¹ tra				p¹ chr	
m.	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164

Example 4.12 Ravel, String Quartet, I: TM^2/TR^2 comparison

form **TM^2/TR^2** **dominant lock** **MC^2**

theme/motive p$^{1\ \mathrm{chr}}$ wth p$^{1\ \mathrm{dom}}$ p$^{1\ \mathrm{dom}}$

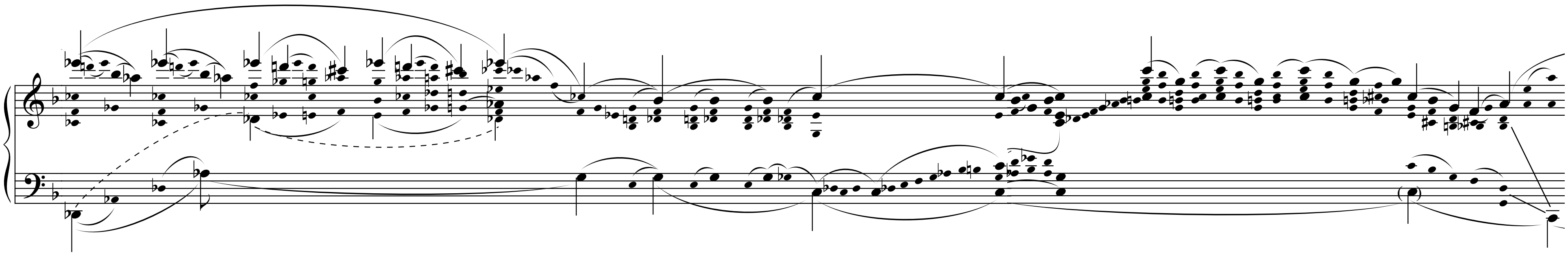
m. 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50



form **TM^2/TR^2** **dominant lock** **MC^2**

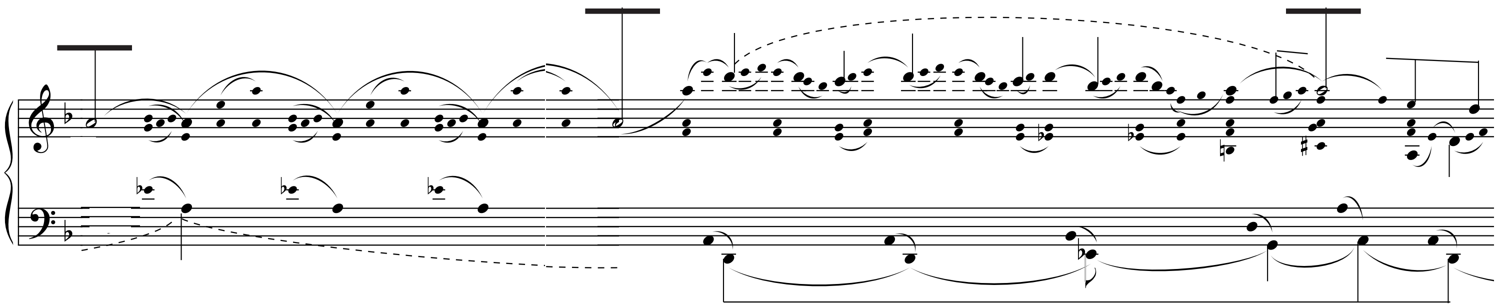
theme/motive p$^{1\ \mathrm{chr}}$ wth p$^{1\ \mathrm{dom}}$ p$^{1\ \mathrm{dom}}$ p$^{1\ \mathrm{den}}$

m. 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180

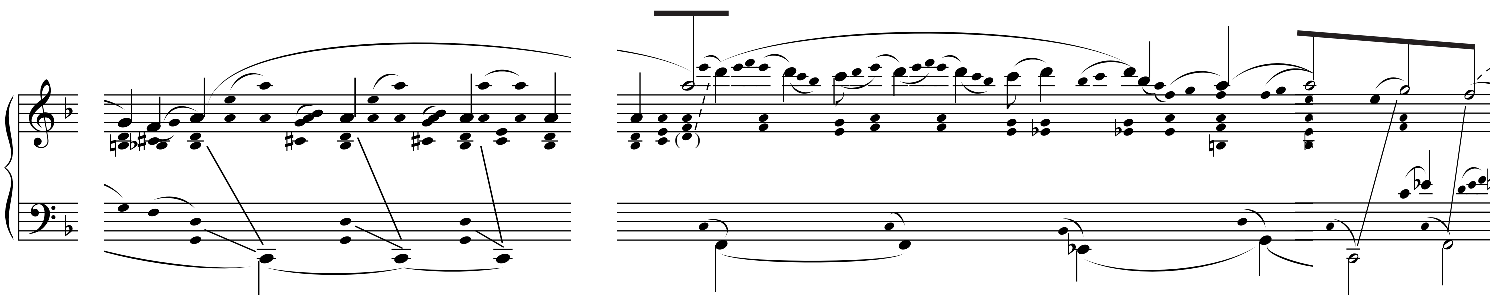


Example 4.13 Ravel, String Quartet, I: MC^2 and TM^3/S comparison

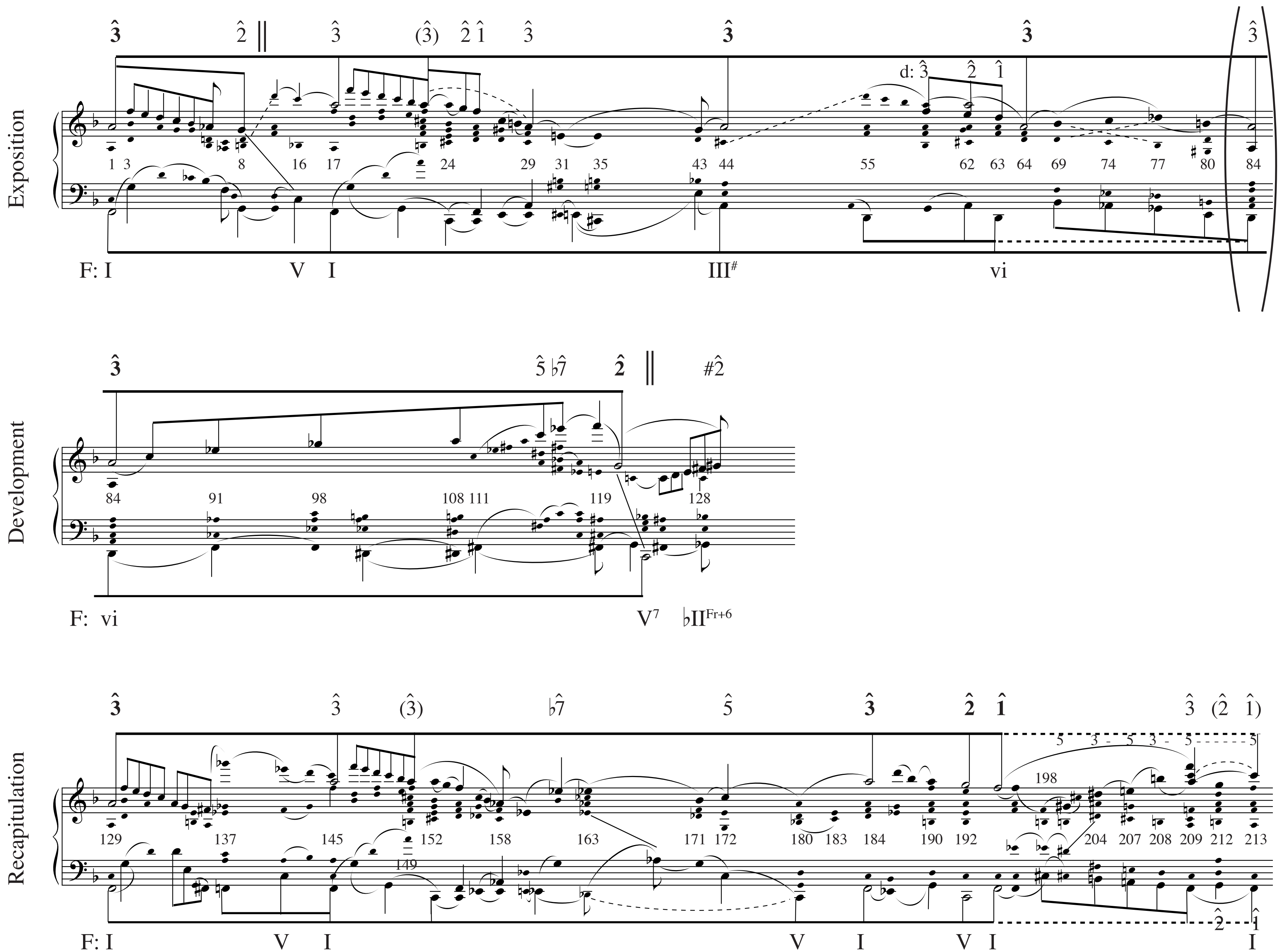
form **MC^2** **TM^3/S** **EEC**
theme/motive s
m. 50 51 52 53 54 55 56 57 58 59 60 61 62 63



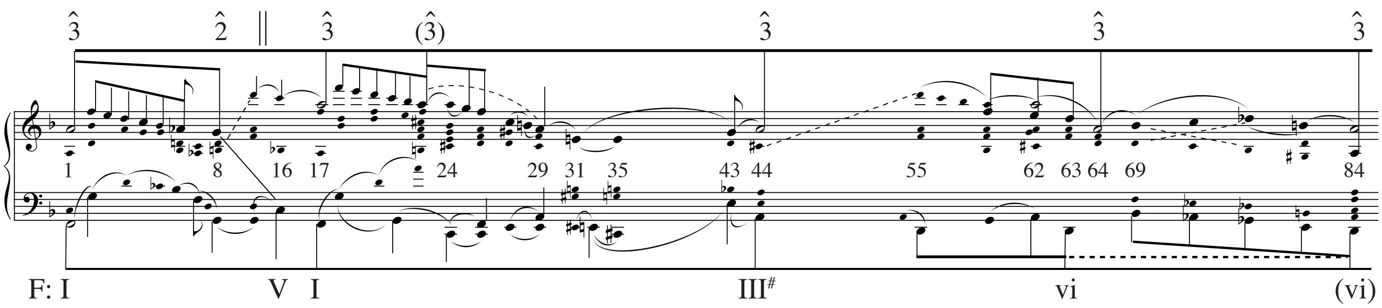
form **MC^2** **TM^3/S** **ESC**
theme/motive s
m. 180 181 182 183 183 184 185 186 187 188 189 190 191 192



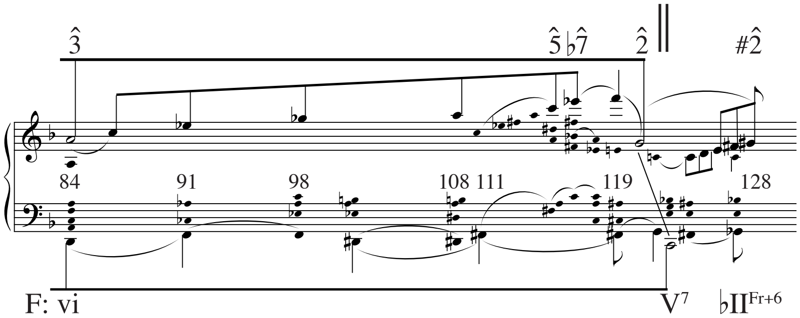
Example 4.14 Ravel, String Quartet, I: Background and deep middleground



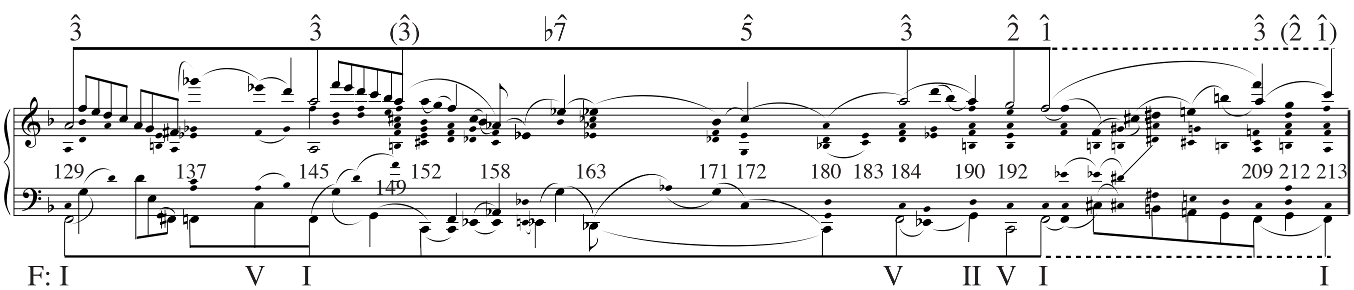
Example 4.15 Ravel, String Quartet, I: Middleground and sonata form



mm. 1–83	***Exposition***							
zones	*P*		*TR* ’	*TMB*		’	/	*C*
sections	*A*	*B*	*A’* → MC	TM^1 (false S)	TM^2	V -lock **MC**	**TM^3 (true S) EEC**	
rehearsal				**A**	**B**	**C**	**D**	**E**
measure	1	9	17 21	24 28 31	35 39	45 50	55 **63**	69 74 77 80
thematic material	**p^1**	**p^2**	**p^1** wth	**p^3** **p^1tra**	**p^1chr** wth	**p^1dom**	**s**	**s/p^1clos** **p^1end**
measure groups	**4 4**	**8**	**4 3**	**4 3 4**	**4 6**	**10**	**8 6**	**5 3 3 4**
n.-d. coll.			WT_1	$OCT_{0,1}$ $OCT_{1,2}$	$OCT_{1,2}$ $OCT_{0,1}$ $OCT_{1,2}$			



mm. 84–128	***Development***						
zones	*P-based*			*S-based*			*P-based*
sections			**trans.**			**trans.**	**climax + retransition**
rehearsal	**F**			**G**			**H**
measure	84	91	99	102	106	110	119 122 126
thematic material	**p^2**	**p^2**	wth	**s/p^2**	**s/p^2**	**sf** **p^1clim**	**p^1den** **p^1tra**
measure groups	**7.1** **e** 1.3 2.1 3.1	**8** **e** 1.3 2.1 4	**3** 3	**4.3** 4 .3	**3.1** 2.3 .2	**9** 3	**10** 2.2 7.2
n.-d. coll.				**$OCT_{2,3}$**		**$OCT_{2,3}$**	**$OCT_{0,1}$** **WT_0**



mm. 129–213	***Recapitulation***								
zones	*P*		*TR* ’	*TMB*		’	/	*C*	*coda*
sections	*A*	*B*	*A’* → MC	TM^1 (false S)	TM^2	V-lock **MC**	**TM^3 (true S) ESC**	*eli-*	*sion*
rehearsal		**I**		**J**	**K**	**L**	**M**		
measure	129	137	145	152 156 159	163 167	173 180	184 **192**	198 204	209
thematic material	**p^1**	**p^2**	**p^1**	**p^3** **p^1tra**	**p^1chr** wth	**p^1dom**	**s**	**s/p^1clos**	**s/p^1end**
measure groups	**4 4**	**8**	**4 3**	**4 3 4**	**4 6**	**11**	**8 6**	**3 3 3 2**	**5**
n.-d. coll.		**$OCT_{2,3}$**	W T_1	[$OCT_{0,1}$] [$OCT_{1,2}$ $OCT_{0,1}$]					

Example 4.16 Ravel, String Quartet, I: Motivic transformation and *Knüpftechnik* mm. 1–12

Example 4.17 Ravel, String Quartet, I: Rhythmic motives

Example 4.18 Ravel, String Quartet, I: The pitch motive A–G–E–D

Example 4.19 Ravel, String Quartet, I: p-motive derivations

Example 4.20 Ravel, String Quartet, I: Counter-p-theme

Example 4.21a Ravel, String Quartet, I:
Sonata form and thematic transformation, exposition

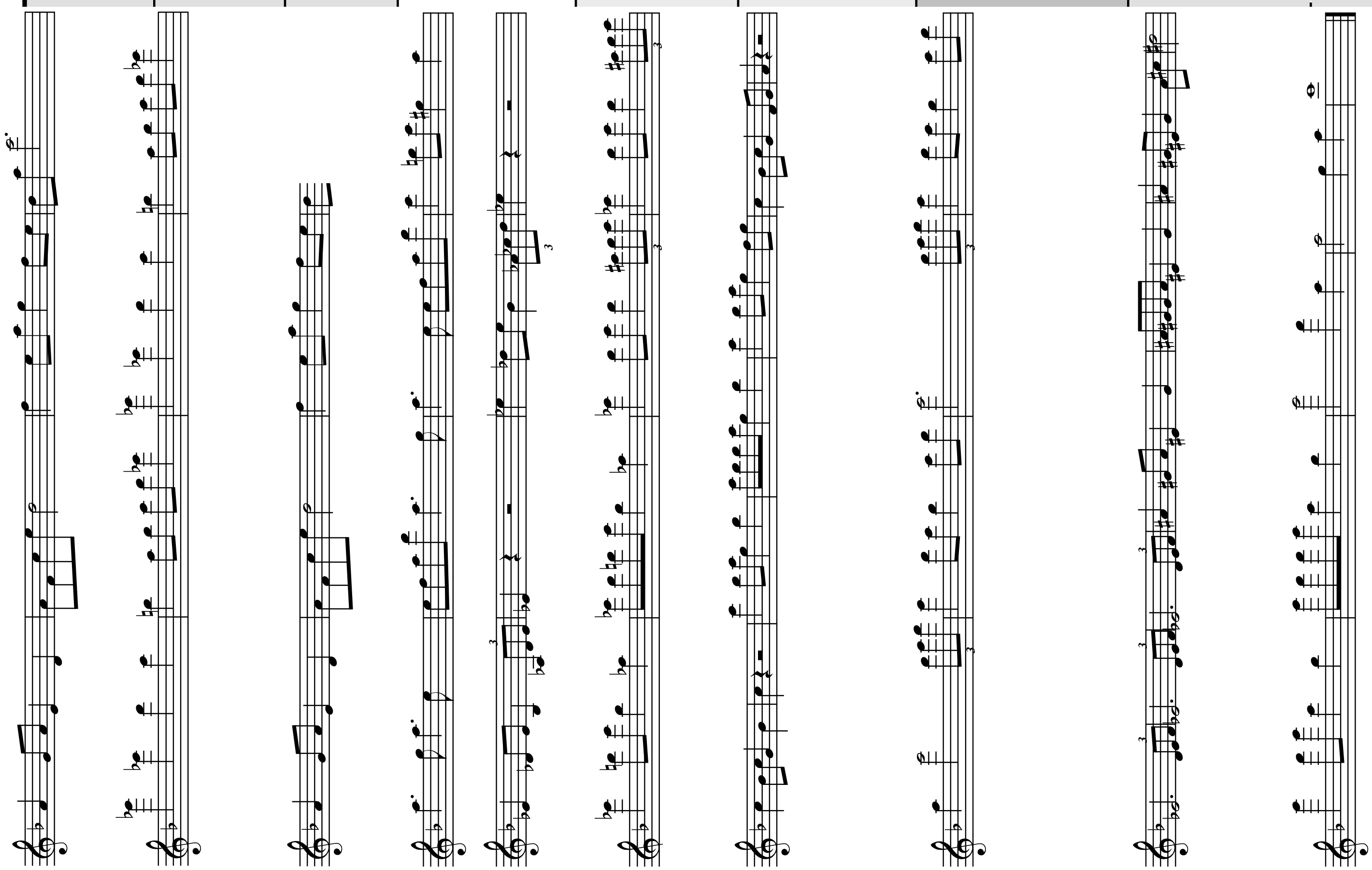
mm. 1–83	ROTATION 1 — *Exposition*							
zones	*P*		*TR* ’	*TMB*		’	/	*C*
sections	*A*	*B*	*A’* → MC	TM¹ (false S)	TM²	V-lock **MC**	**TM³ (true S) EEC**	
rehearsal				**A**	**B**	**C**	**D**	**E**
measure	1	9	17 21	24 28 31	35 39	45 50	55 **63**	69 74 77 80
thematic material	**p¹**	**p²**	**p¹** w th	**p³** **p¹tra**	**p¹chr** w th	**p¹dom**	**s**	**s / p¹clos** **p¹end**

Example 4.21b Ravel, String Quartet, I:
Sonata form and thematic transformation, development

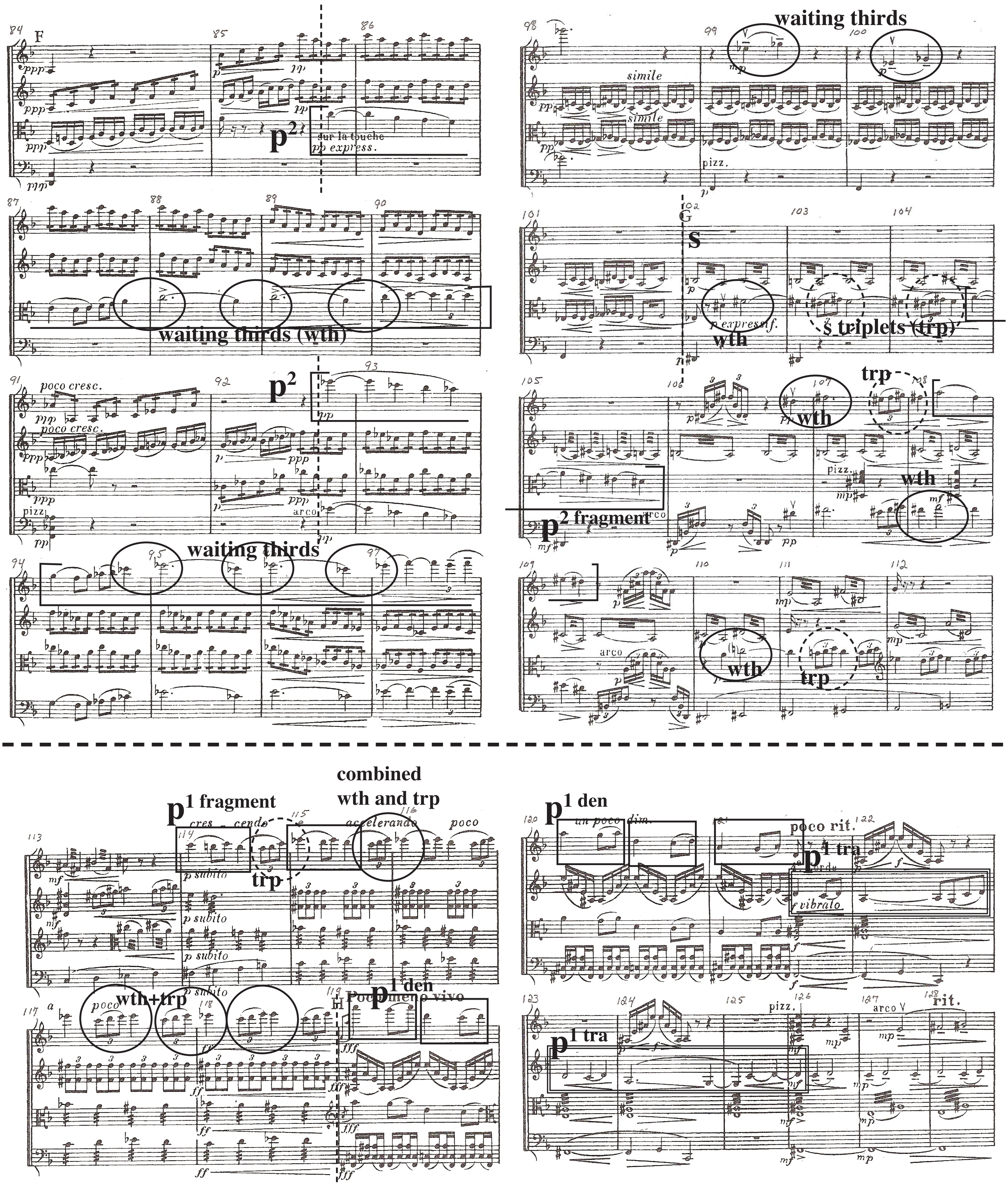
mm. 84–128	***ROTATION 2***						
	Development						
zones	*P-based*			*S-based*			*P-based*
sections			**trans.**			**trans.**	**climax + retransition**
rehearsal	**F**			**G**			**H**
measure	84	91	99	102	106	110	119 122 126
thematic material	**p^2**	**p^2**	wth	**s/p^2**	**s/p^2**	**sf** **p^{1}clim**	**p^{1}den** **p^{1}tra**

Example 4.21c Ravel, String Quartet, I:
Sonata form and thematic transformation, recapitulation

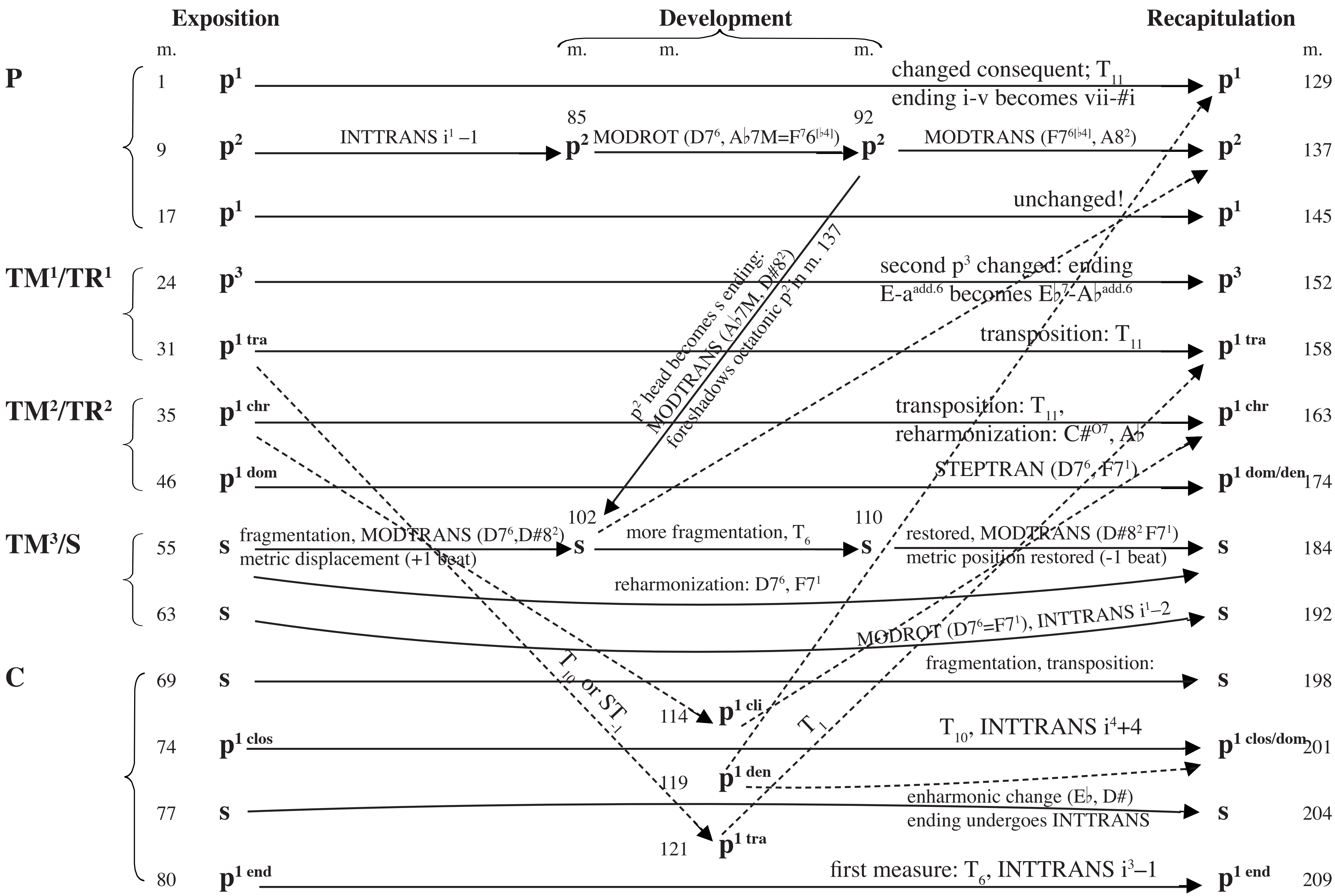
mm. 129–213	***ROTATION 3*** *Recapitulation*								
zones	*P*		*TR* ’	*TMB*		’	/	*C*	*coda*
sections	*A*	*B*	*A’* → MC	TM¹ (false S)	TM²	V-lock **MC**	**TM³ (true S) ESC**	*eli-*	*sion*
rehearsal		**I**		**J**	**K**	**L**	**M**		
measure	129	137	145	152 156 159	163 167	173 180	184 **192**	198 204	209
thematic material	**p¹**	**p²**	**p¹**	**p³** **p¹tra**	**p¹chr** wth	**p¹dom**	**s**	**s / p¹clos**	**s / p¹end**



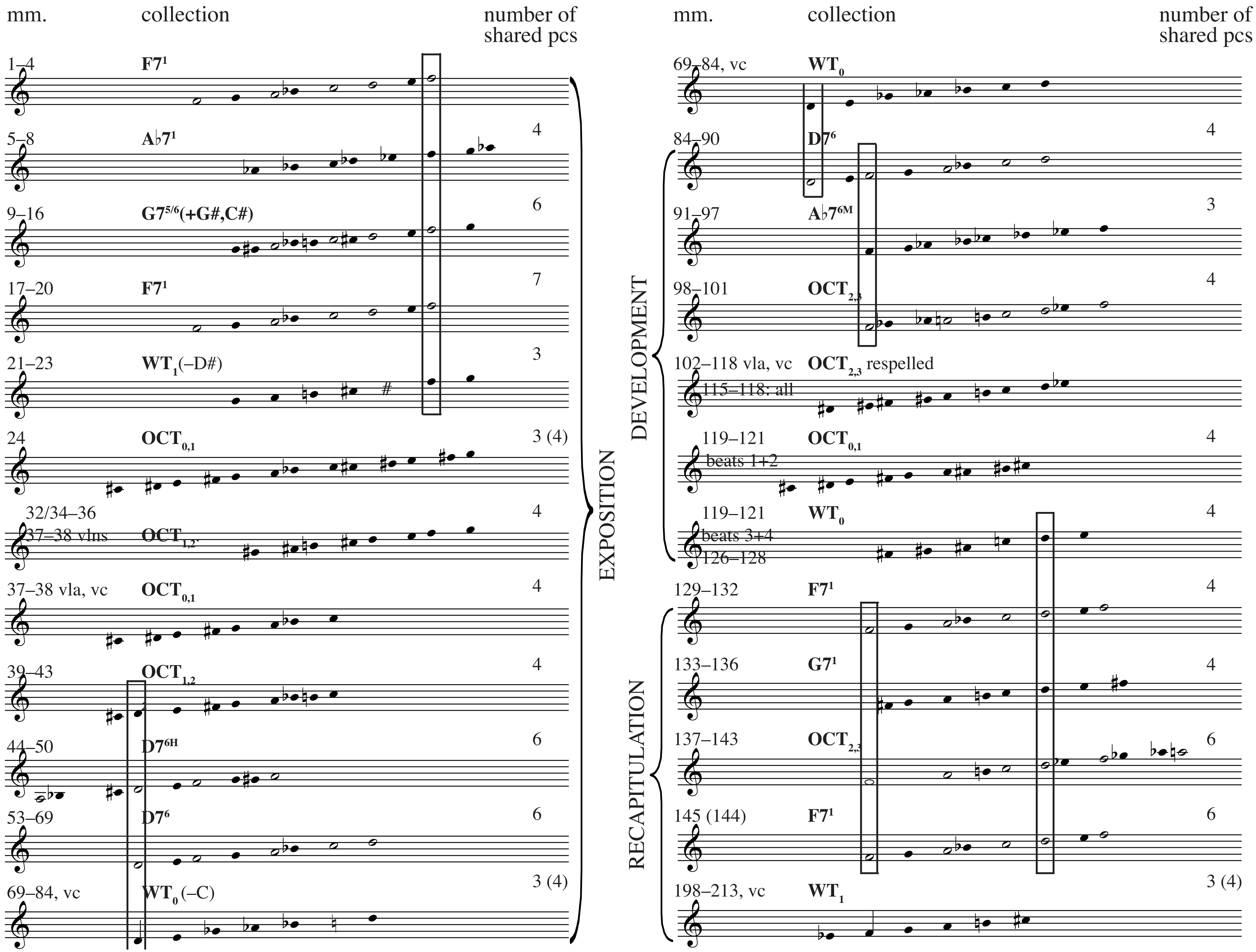
Example 4.22 Ravel, String Quartet, I: *Knüpftechnik* in the development



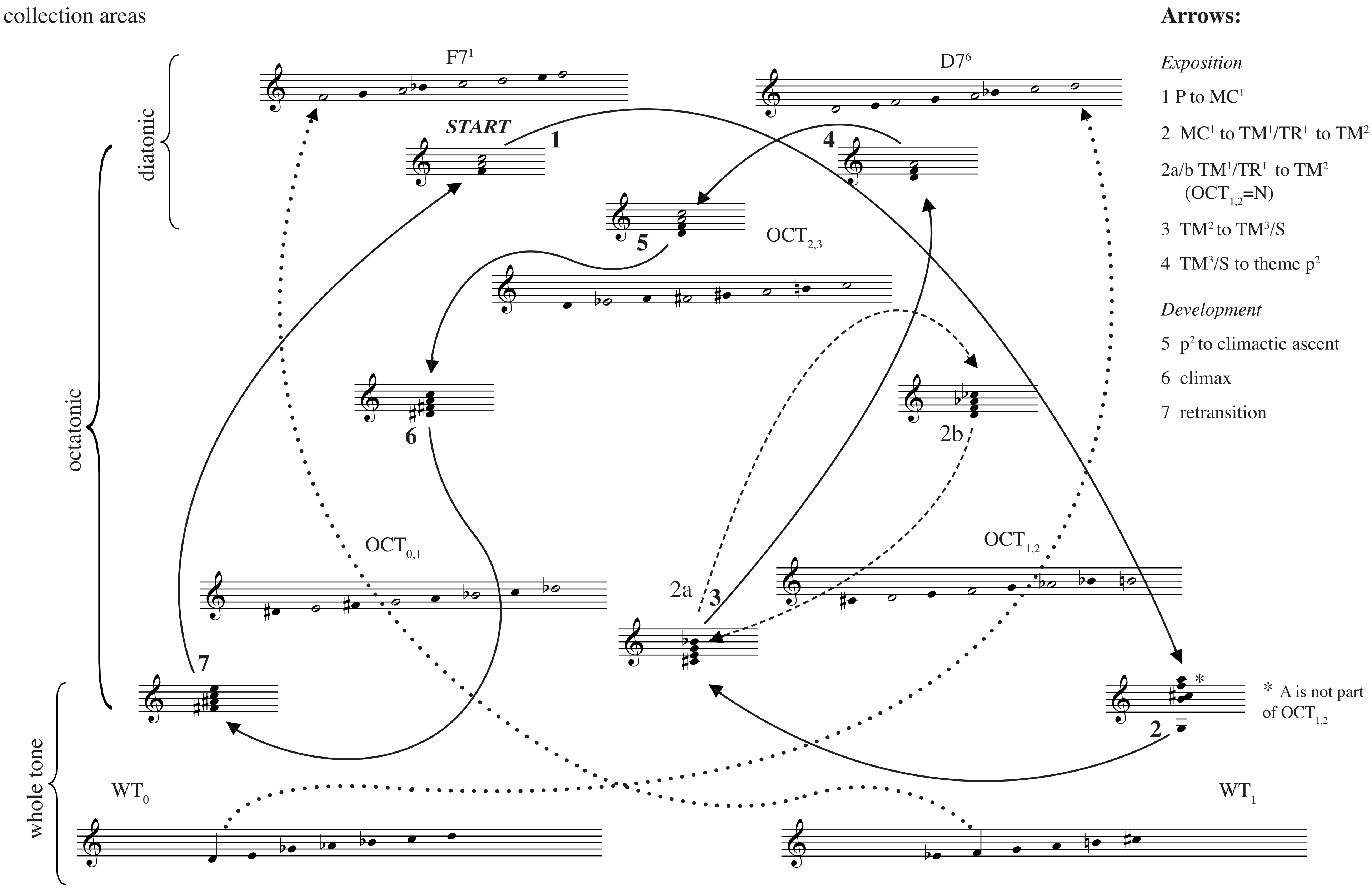
Example 4.23 Ravel, String Quartet, I: Thematic transformations and sonata form



Example 4.24 Ravel, String Quartet, I: Succession of referential collections and shared subsets



Example 4.25 Ravel, String Quartet, I:
The path through referential collections from exposition to recapitulation



Example 5.1 Basque *Zortziko* songs

a
Amorez eri nago II

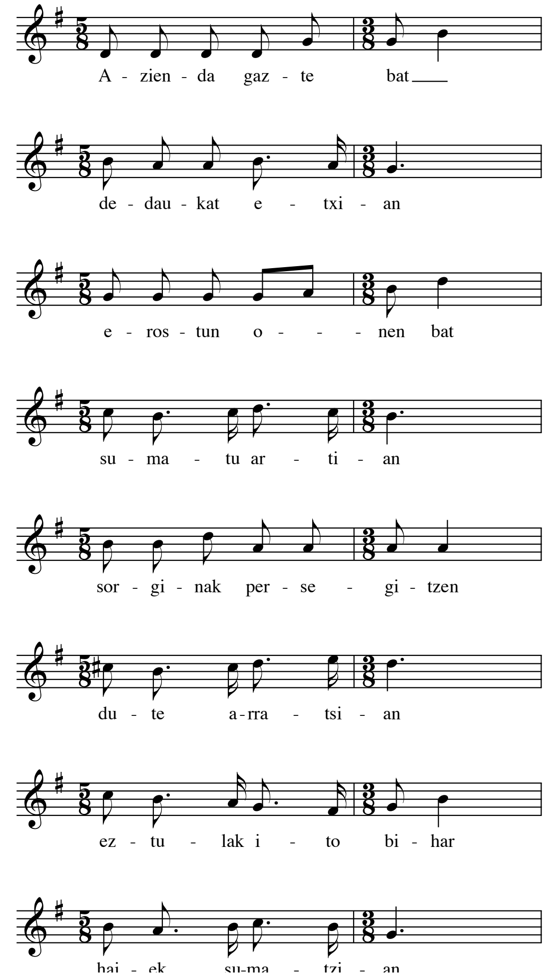
J.A. Santesteban,
Aires Vascongad, 75
(1870)

Source: www.bertsozale.com

b
Amodioa zer den

Aita Donostia,
Cancionero Vasco, vol. VI, 119,
(Gipuzkoa, 19th C)

c
Azienda gazte bat



Aita Donostia,
Cancionero Vasco, vol. VII, 548,
(Gipuzkoa, 19th C)

Example 5.2 Bordes, *Zortziko* from "Douze Chansons amoureuses"

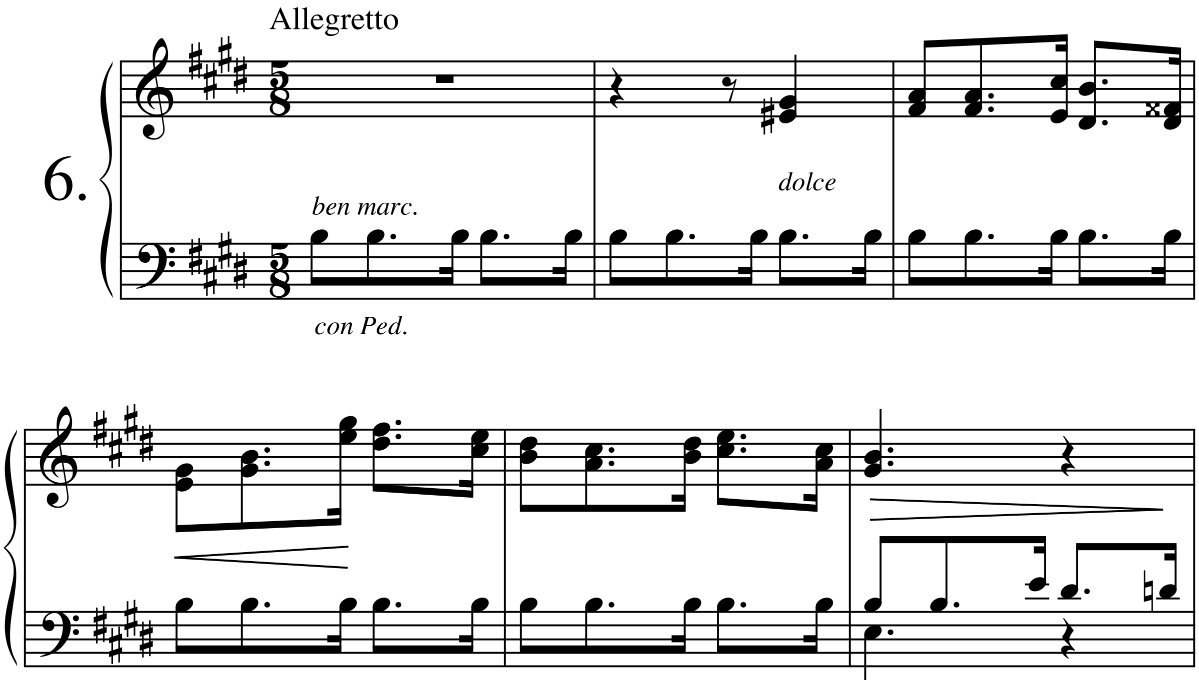
Based on: "Douze Chansons amoureuses du Pays Basque françaises" recuellies et harmonisées par Charles Bordes

ARCHIVES DE LA TRADITION BASQUE

12 CHANSONS D'AMOUR

CHORI ERRESIÑOULA, HOTS EMAK ENEKIN

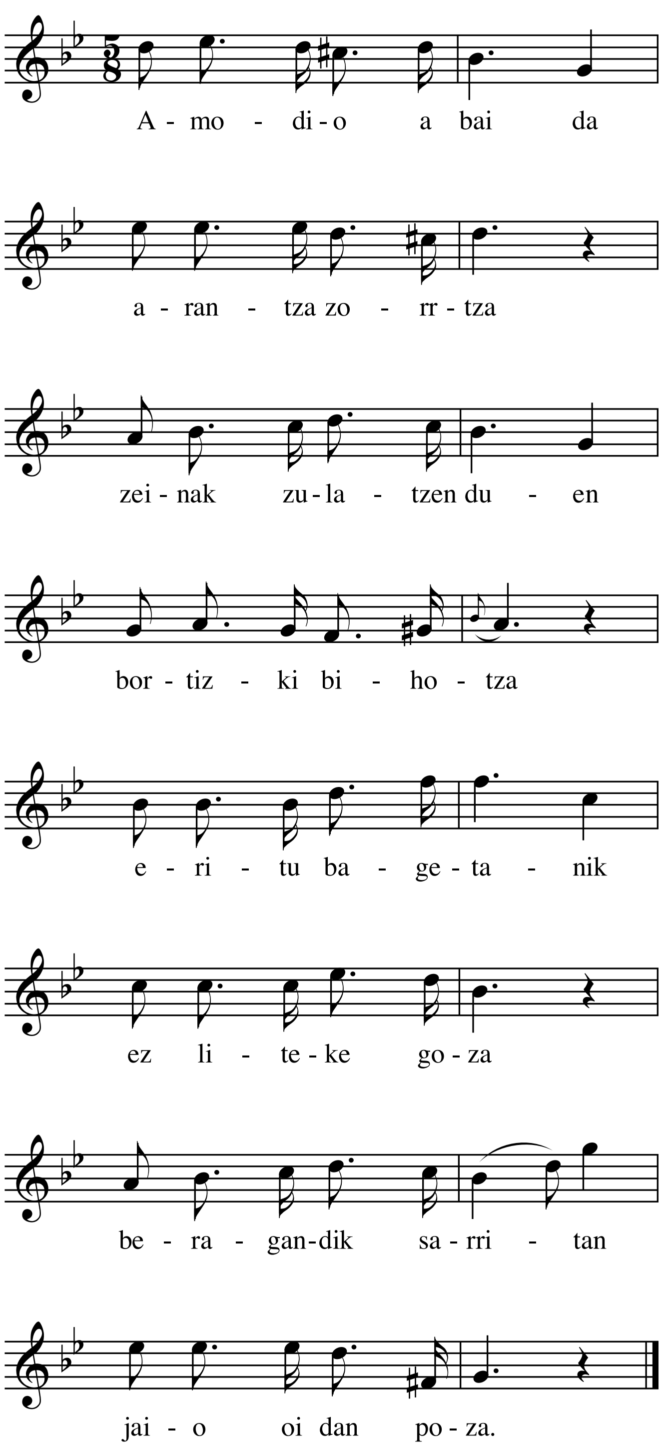
Example 5.3 Albeniz, *Zortziko*, *España*, No. 6 (excerpt)



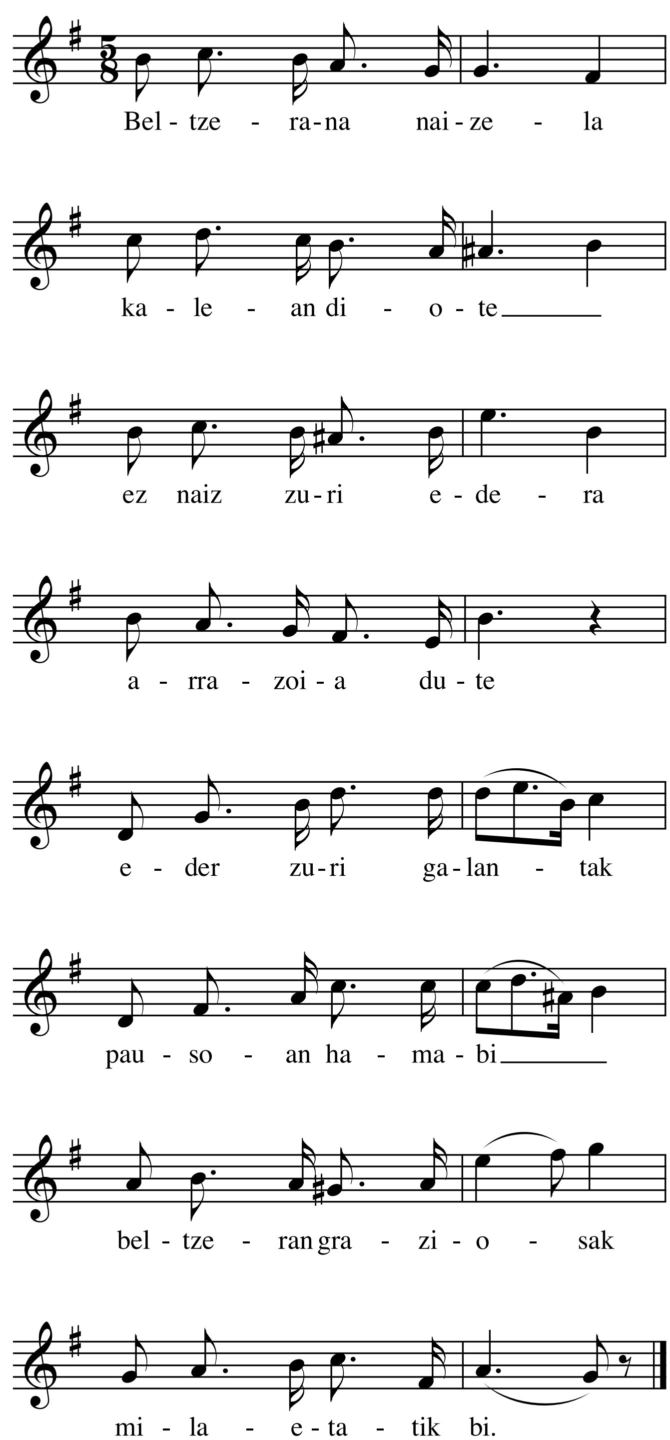
Example 5.4 Saint-Saëns, *Zortziko*, Piano Trio in E minor, op. 92, II (excerpt)

Example 5.5 Basque Songs with the poetic meter of *Zortziko txikia*

a
Amodio abaida



b
Beltzerana naizela



Example 5.6 Ravel, Piano Trio, I: *Zortziko txikia* structure of P-zone

Amodioa Baida

Amodioa baida
arantza zorrotza
zeinak zulatzen duen
bortizki bihotza
eritu bagetanik
ez liteke goza
beragandik sarritan
jaio oi dan poza.

Example 5.7 Basque song "Adios, izar ederra" (excerpt)

Based on Jean-Dominique-Julien Sallaberry, *Chants Populaires du Pays Basque* (Bayonne: Imprimerie de Veuve Lamaignêre, 1870), 214.

Example 5.8a Ravel, Piano Trio, I: Comparison of rotations in the Type 2 sonata form

	ROTATION 1																	
form	***Exposition***																*(Development)*	
zones	***P***		***TR***						**’** ***CF***	***S***				**/**	***C***			
segments	***P***		TR^1		*Climax*	*Den.*	TR^2	V *lock*	***link***	S^1			S^2	***EEC***	P_C			
reh. no.			**1**		**2**		**3**			**4**			**5**		**6**		7	
m.	1–4	5–8	9–12	13–16	17–19	20–23	24–27	28–31	32–34	35–37	38–41	42–45	46–49	50–51	52–55	56–59	60–63	64–67
measure groups	**4**	**4**	**4**	***4***	**3**	***4***	***4***	***4***	**3**	**3**	**4**	**4**	**4**	**2**	**4**	**4**	4	4
bass	**E**	**A**	A-G	G F	C#	C#F#B	B	E	**E**	**A**	D?	AGF	**E**	**A**	**A**	**A**	D#	D#
RN	**i**	**i**	i	VI	#iii	V/II	ii	**V**	**V**	**i**			**V**	**i**	i	i		

	ROTATION 2															
form	***Development***								***Tonal Resolution***							*(Coda)*
zones			***TR***						S^1			**/**	***C***			
segments	P_C		TR^1		*Climax*	*Den.*		***link***	***S***		S^2	***ESC***	P_C			
reh. no.	**7**		**8**		**9**				**10**		**11**		**12**			
m.	60–63	64–67	68–71	72–73	74–76	77–79	80–81	82-84	83-85	86–89	90–93	94–95	96–99	100–103	104–107	
measure groups	**4**	**4**	**4**	***2***	**3**	***3***	***2***	**3***	**3***	**4**	**4**	**2**	**4**	**4**	**4**	(4+4+2)
bass	D#	D#	**C#**	**B** etc	B♭	**A**-D	D (A)	**D**	**D!**	G	**G**	**C**	**C**	**C**	**C**	
RN							a:iv/C:ii	ii	**ii**	**V**	**V**	**I!**	**I**		**I**	

* This overlap of two three-measure groups takes the time of four actual measures

form	***Coda***		
zones			
segments	***P***		
reh. no.	**13**		
m.	108–111	112–115	116–117
measure groups	**4**	**4**	***2***
bass	**C**	C	**C**
RN	**I**		**I**

Example 5.8b Ravel, Piano Trio, I: Proportions of the Type 2 sonata form

59 m.	***ROTATION 1***															
form	***Exposition***															
zones	***P***		***TR***						***’ CF***	***S***				***/***	***C***	
segments	***P***		***TR^1***		*Climax*	*Den.*	***TR^2***	V *lock*	***link***	***S^1***			***S^2***	***EEC***	***P$_C$***	
reh. no.			**1**		**2**		**3**			**4**			**5**		**6**	
m.	1–4	5–8	9–12	13–16	17–19	20–23	24–27	28–31	32–34	35–37	38–41	42–45	46–49	50–51	52–55	56–59
measure groups	**4**	**4**	**4**	***4***	**3**	***4***	***4***	***4***	**3**	**3**	**4**	**4**	**4**	**2**	**4**	**4**
bass	**E**	**A**	A-G	G F	C#	C#F#B	B	**E**	**E**	**A**	D?	AGF	**E**	**A**	**A**	**A**
RN	**i**	**i**	i	VI	#iii	V/II	ii	**V**	**V**	**i**			**V**	**i**	i	i

58 m.	***ROTATION 2***																	
form	***Development***								***Tonal Resolution***							***Coda***		
zones	***P***		***TR***						***S***			***/***	***C***					
segments	***P$_C$***		***TR^1***		*Climax*	*Den.*		***link***	***S^1***		***S^2***	***ESC***	***P$_C$***			***P***		
reh. no.	**7**				**9**				**10**		**11**		**12**			**13**		
m.	60–63	64–67	68–71	72–73	74–76	77–79	80–81	82-84	83-85	86–89	90–93	94–95	96–99	100–103	104-107	108–111	112–115	116-17
measure groups	**4**	**4**	**4**	**2**	**3**	***3***	***2***	**3***	**3***	**4**	**4**	**2**	**4**	**4**	**4**	**4**	**4**	***2***
bass	**D#**	D#	**C#**	**B…**	B♭	**A**-D	D	D	**D!**	**G**	**G**	**C**	**C**	**C**	**C**	**C**	C	**C**
RN						a: iv	C: ii	ii	**ii**	**V**	**V**	**I!**	**I**		**I**	**I**		**I**

* Overlap of two three-measure groups = four actual measures

Example 5.9 Ravel, Piano Trio, I: P-zone, beginning

P

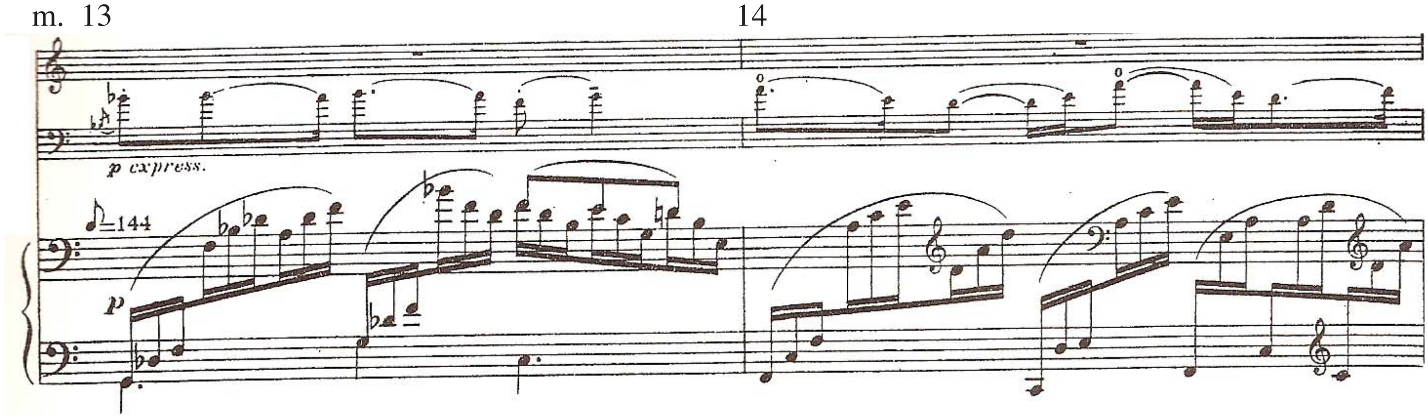
m. 1 2 3 4

Example 5.10 Ravel, Piano Trio, I: TR-zone, beginning

P-based TR

m. 9 10 11 12

m. 13 14



Example 5.11 Ravel, Piano Trio, I: Beat groupings mm. 28–34

Example 5.12 Ravel, Piano Trio, I: S-zone, module S[1]

Example 5.13 Ravel, Piano Trio, I: S-zone, module S[2]

Example 5.14 Ravel, Piano Trio, I: Link and C-zone

Example 5.15 Ravel, Piano Trio, I: DTC and RMS

Example 5.16 Background structures and the double-tonic complex

a: 3-line, major mode

b[1]: 5-line, minor mode

b[2]: uninterrupted 5-line

c: DTC, from i to III (I)

DTC and Interruption

d: DTC, interruption at $\hat{2}$

e: DTC, interruption at $\hat{2}$

f: DTC, interruption at $\hat{2}$

g: DTC, interruption at $\hat{4}$

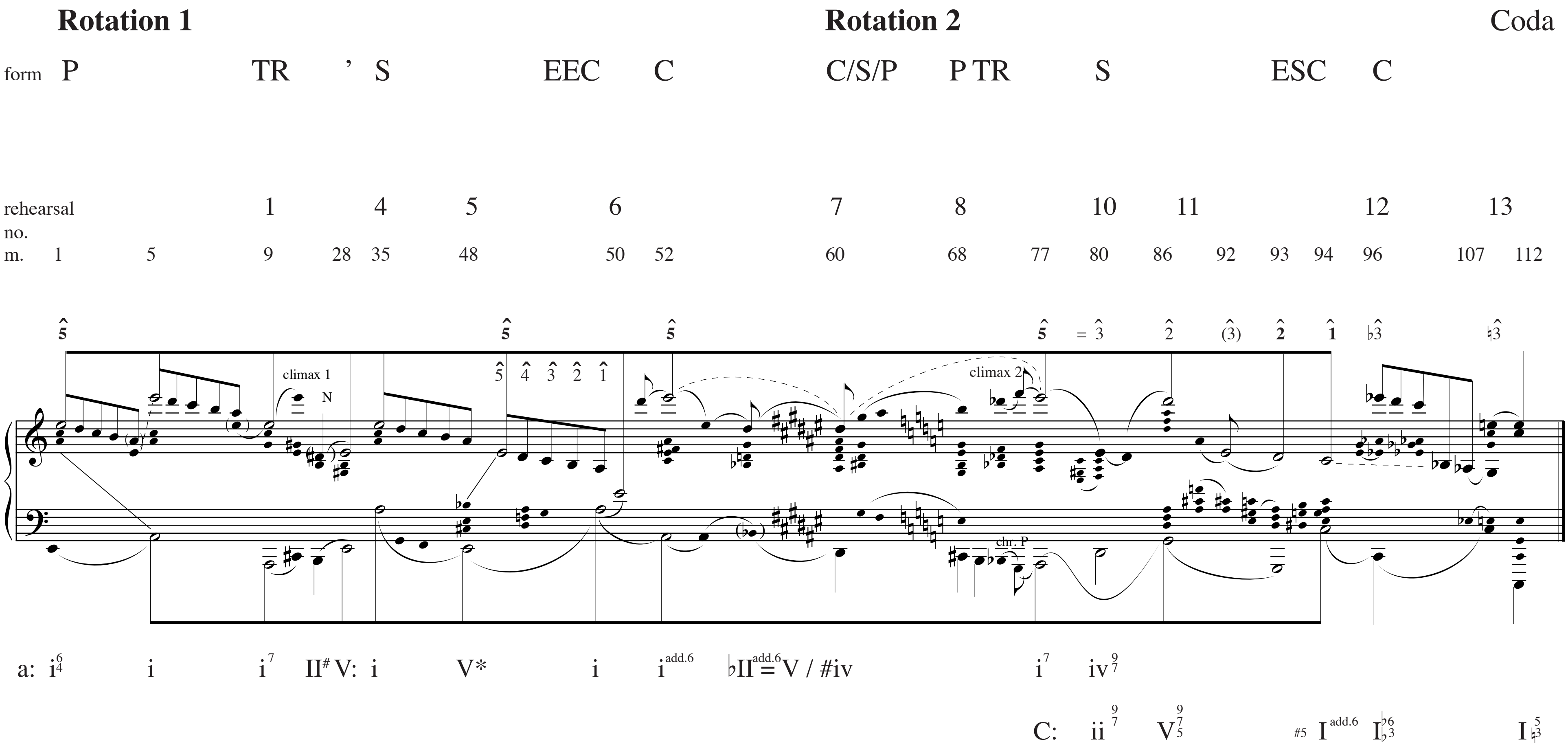
Completed Descents

h: d completed

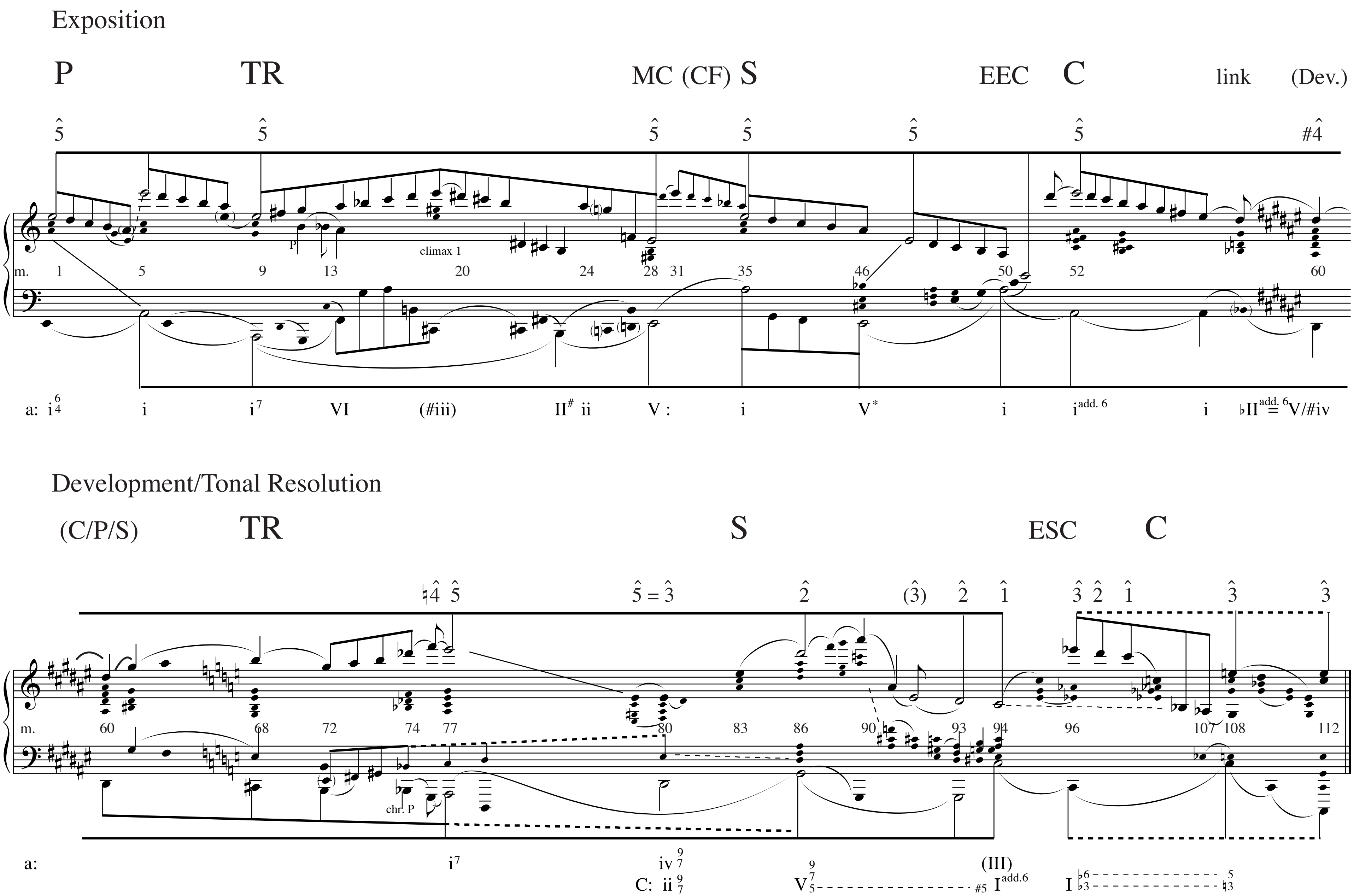
i: e completed

j: f completed

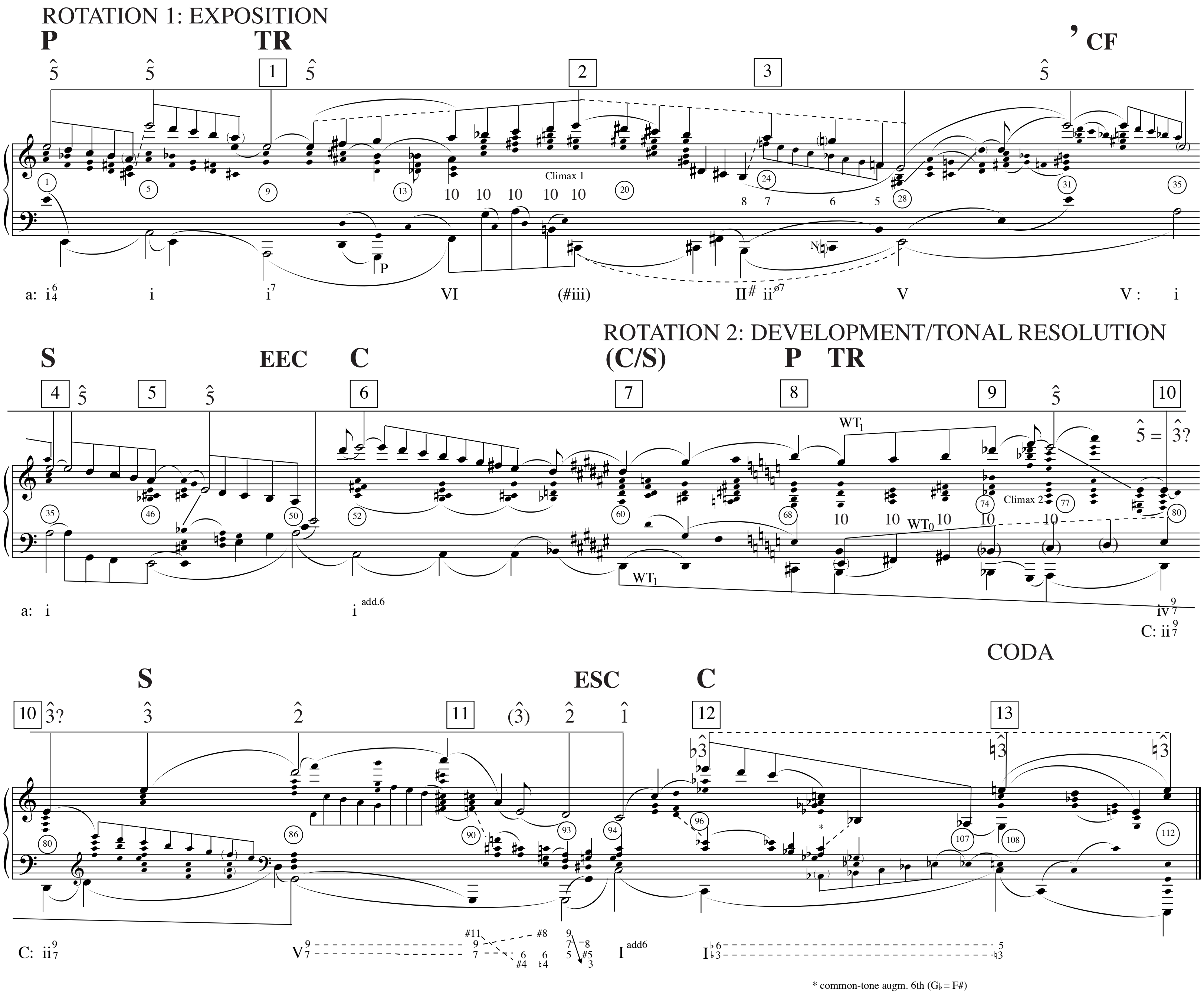
Example 5.17 Ravel, Piano Trio, I: Background and deep middleground



Example 5.18 Ravel, Piano Trio, I: Middleground 1 (aligned with Type 2 sonata form)



Example 5.19 Ravel, Piano Trio, I: Middleground 2



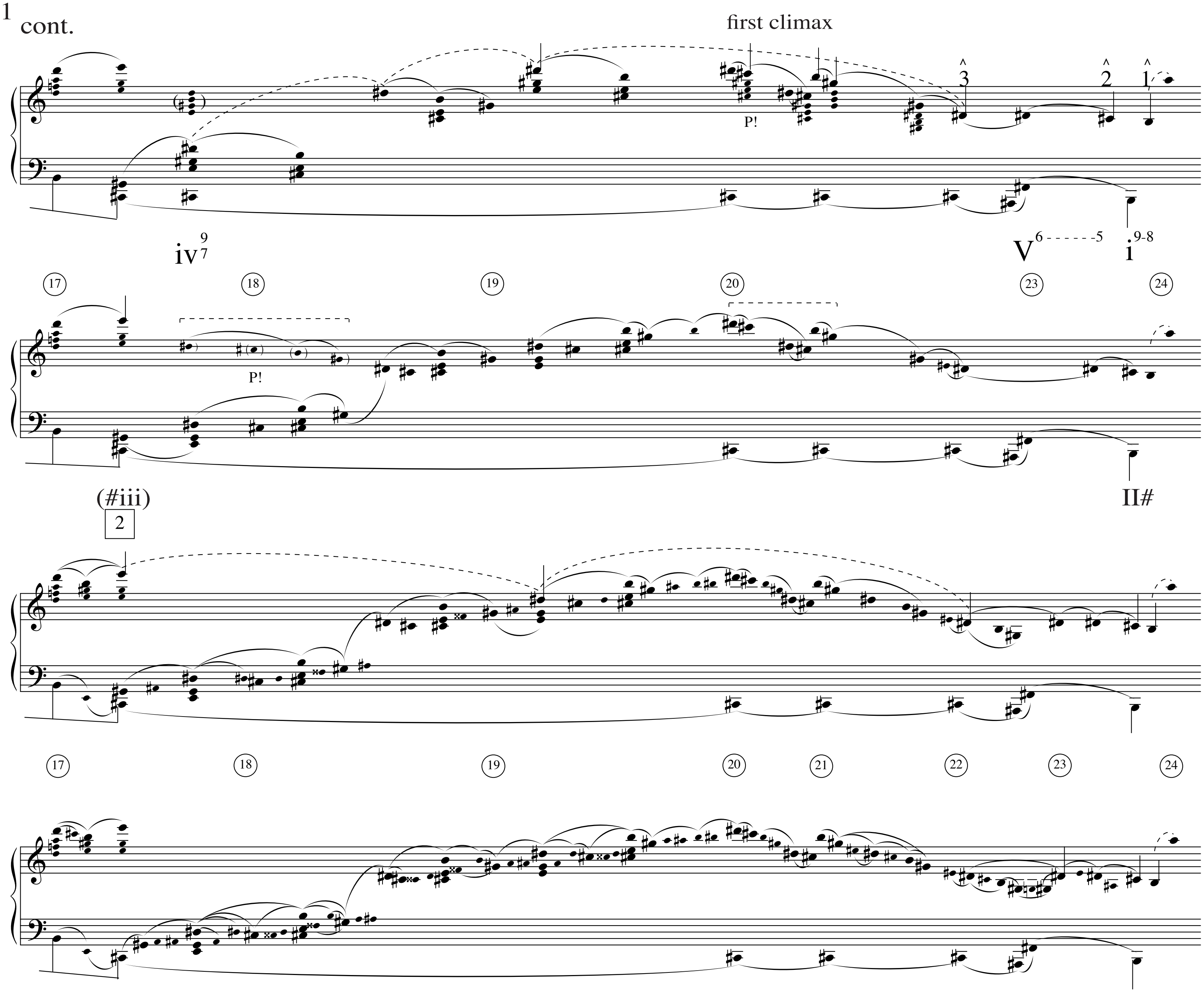
Example 5.20 Ravel, Piano Trio, I: Foreground

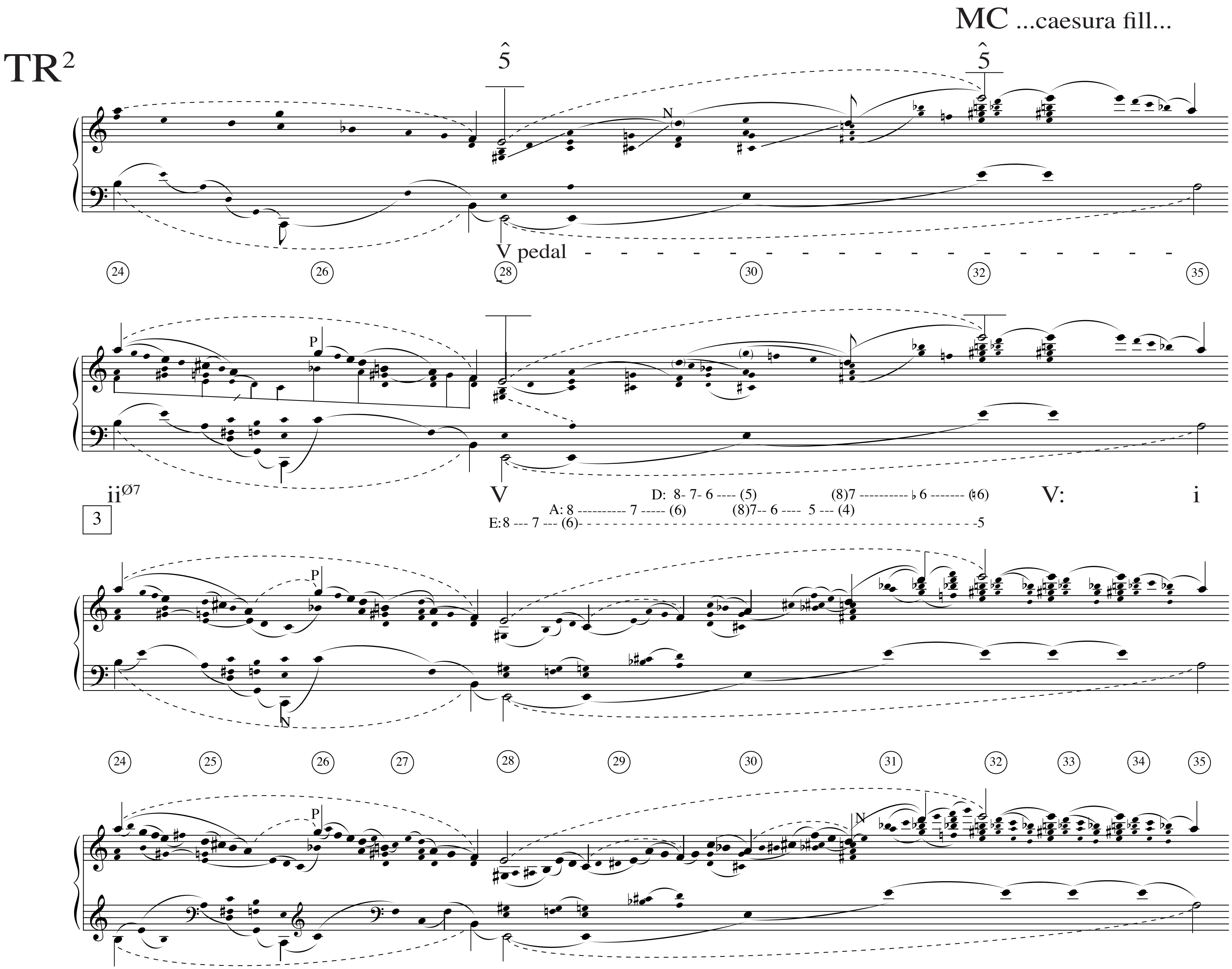
ROTATION I: EXPOSITION

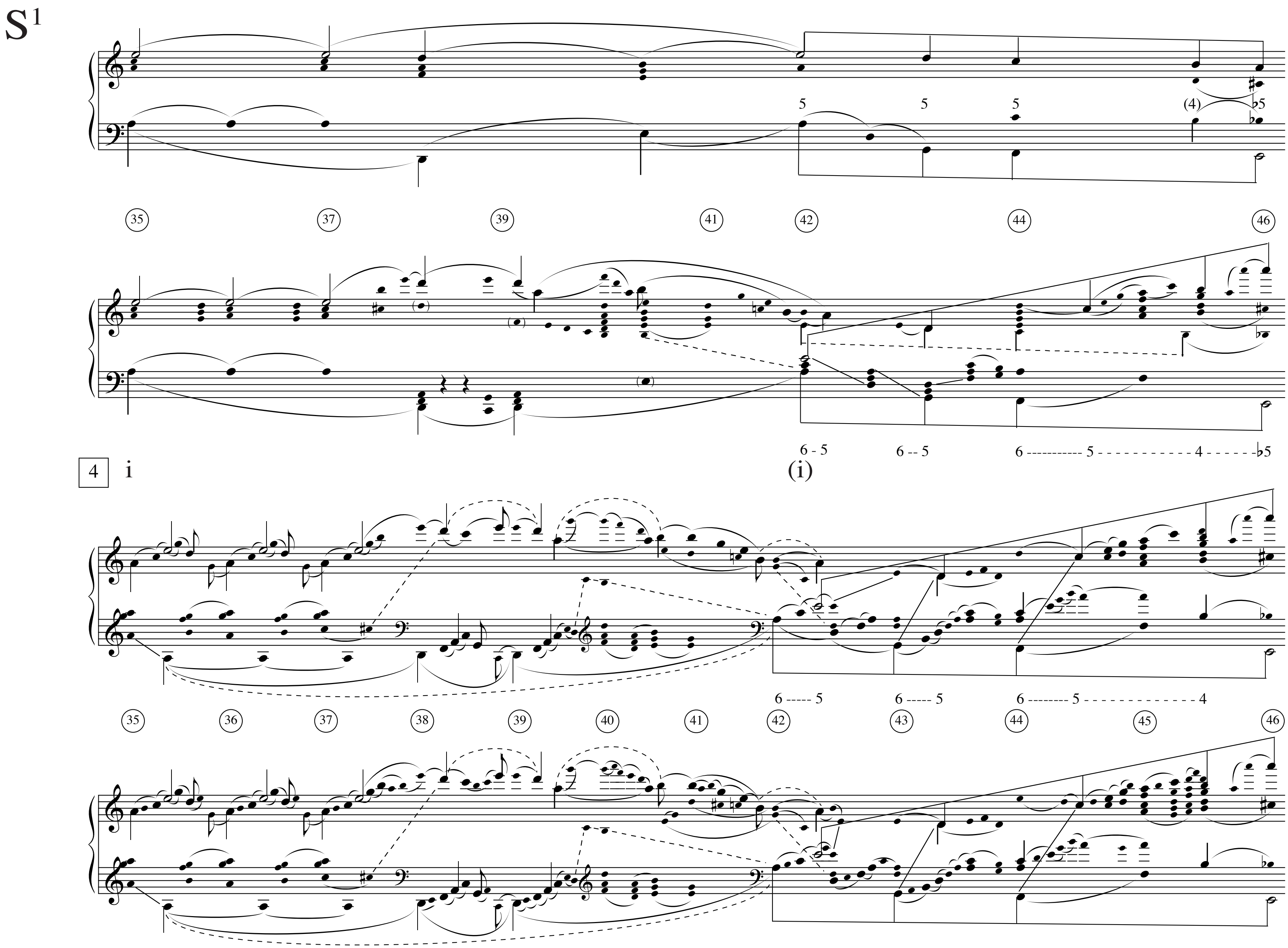
P

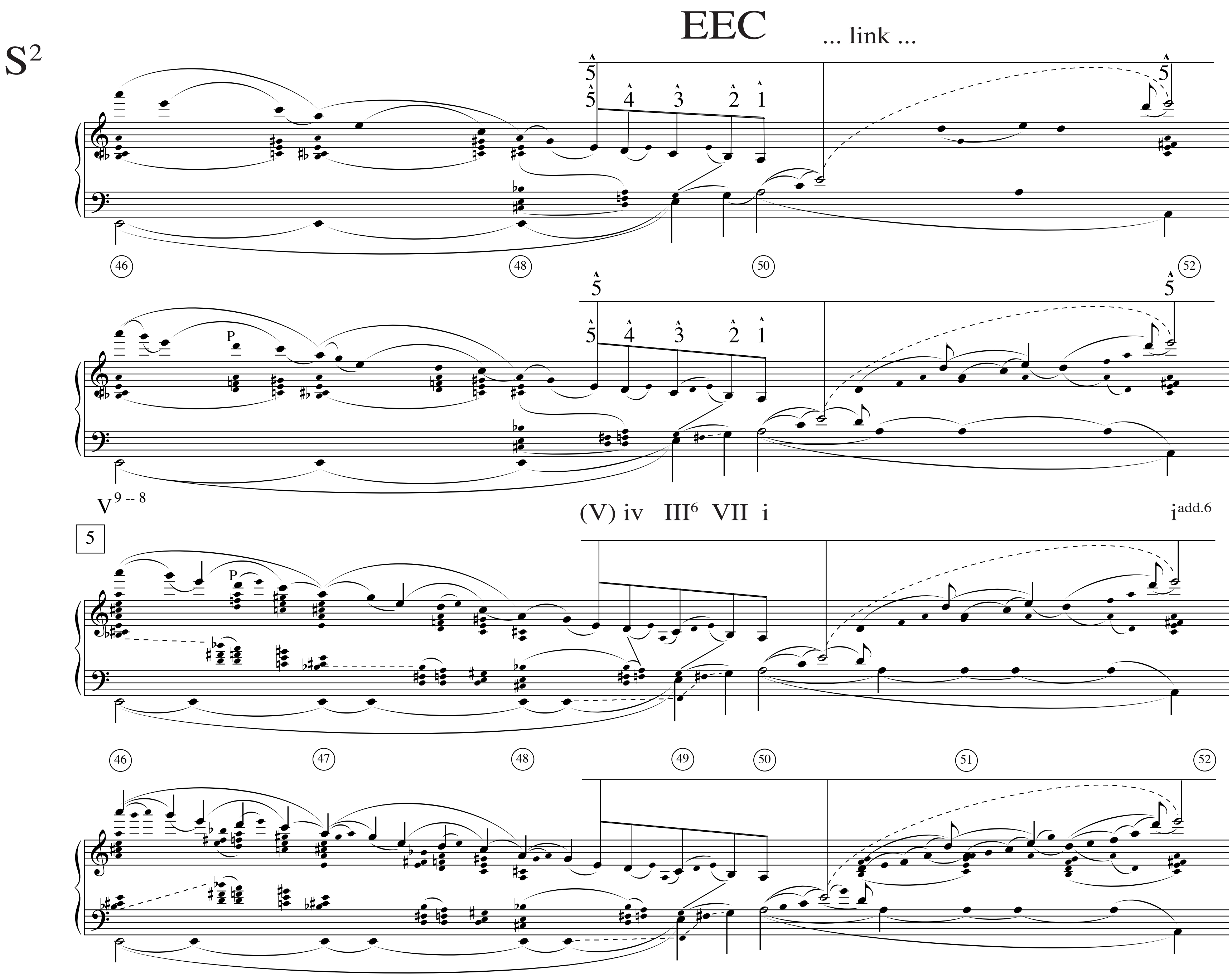
Example 5.20 page 2

TR[1] cont.

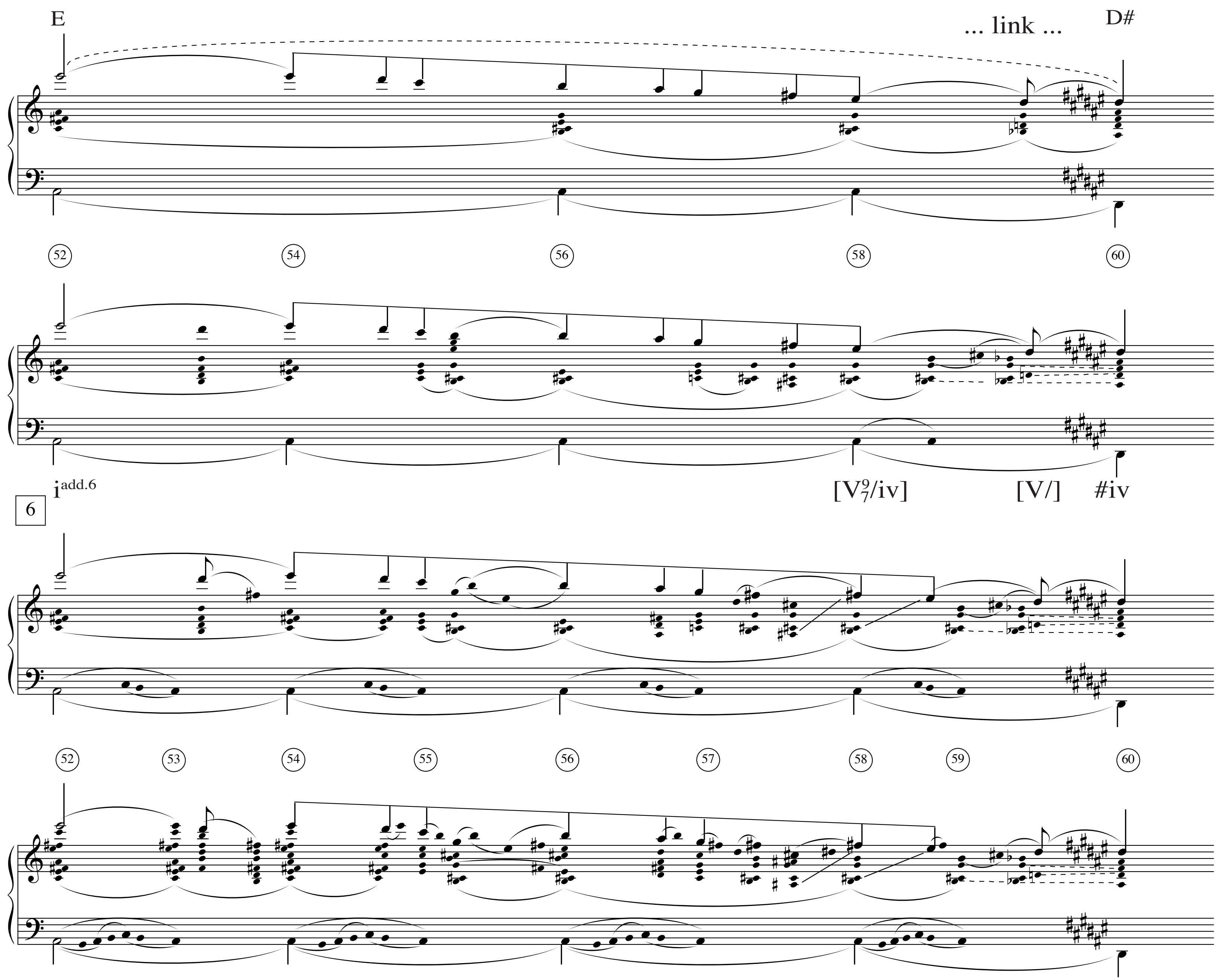

first climax
P!
3̂
2̂
1̂
iv 9 7
V 6-----5
i 9-8
17
18
19
20
23
24
P!
(#iii)
2
II#
17
18
19
20
21
22
23
24


MC ...caesura fill...
TR²
5̂
5̂
N
V pedal
24
26
28
30
32
35
P
ii^ø7
3
V
D: 8- 7- 6 ---- (5)
(8)7 ----------- ♭6 -------- (♮6)
V:
i
A: 8 ---------- 7 ----- (6)
(8)7-- 6 ---- 5 --- (4)
E: 8 --- 7 --- (6)--5
P
N
24
25
26
27
28
29
30
31
32
33
34
35
P
N


S1
5 5 5 (4) ♭5
35 37 39 41 42 44 46
6 - 5 6 -- 5 6 5 4 ♭5
4 i (i)
6 5 6 5 6 5 4
35 36 37 38 39 40 41 42 43 44 45 46


EEC
... link ...
S²
5̂ 5̂ 4̂ 3̂ 2̂ 1̂
5̂
46
48
50
52
5̂
5̂ 4̂ 3̂ 2̂ 1̂
5̂
P
V 9 -- 8
(V) iv III6 VII i
i add.6
5
P
46
47
48
49
50
51
52

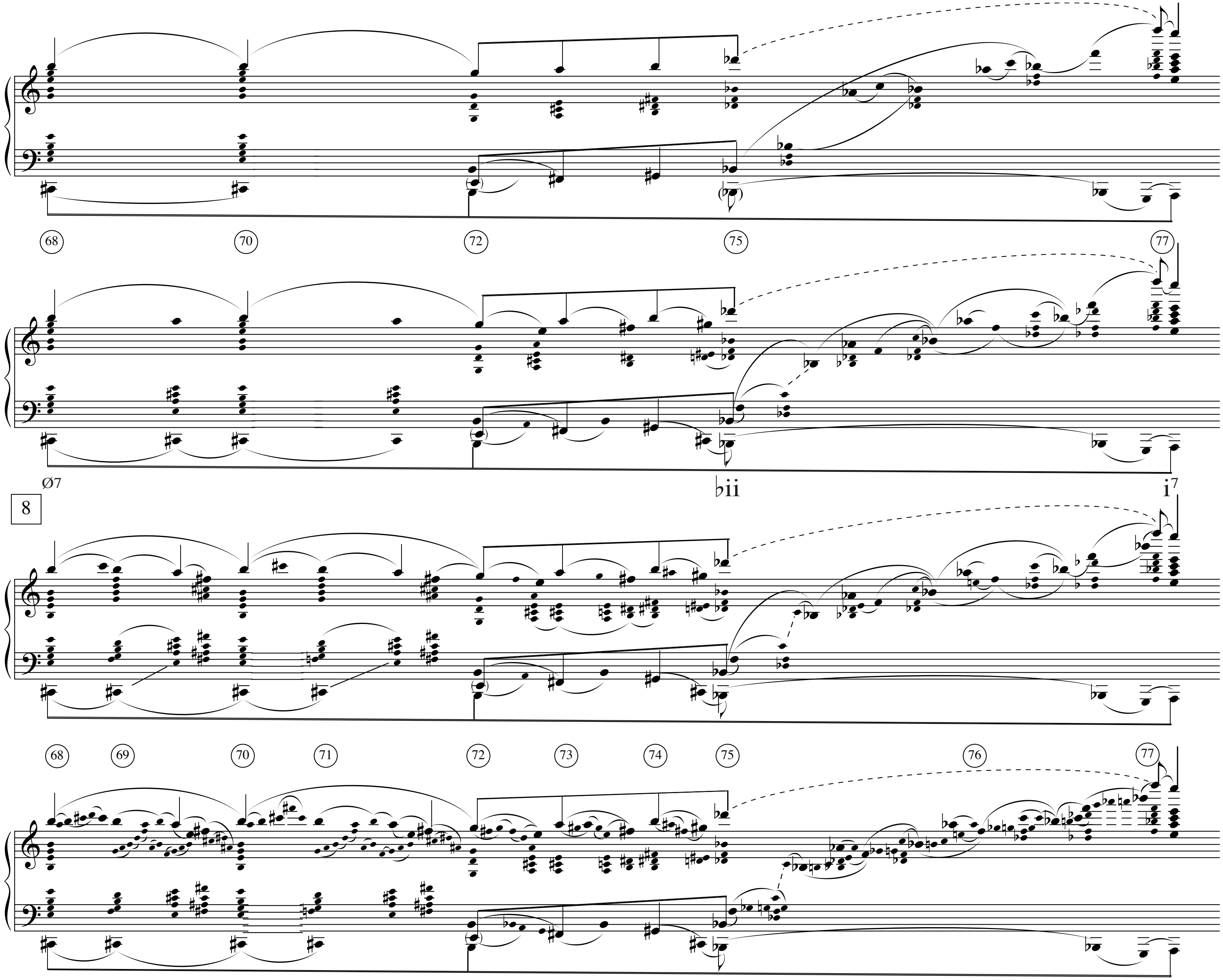
C

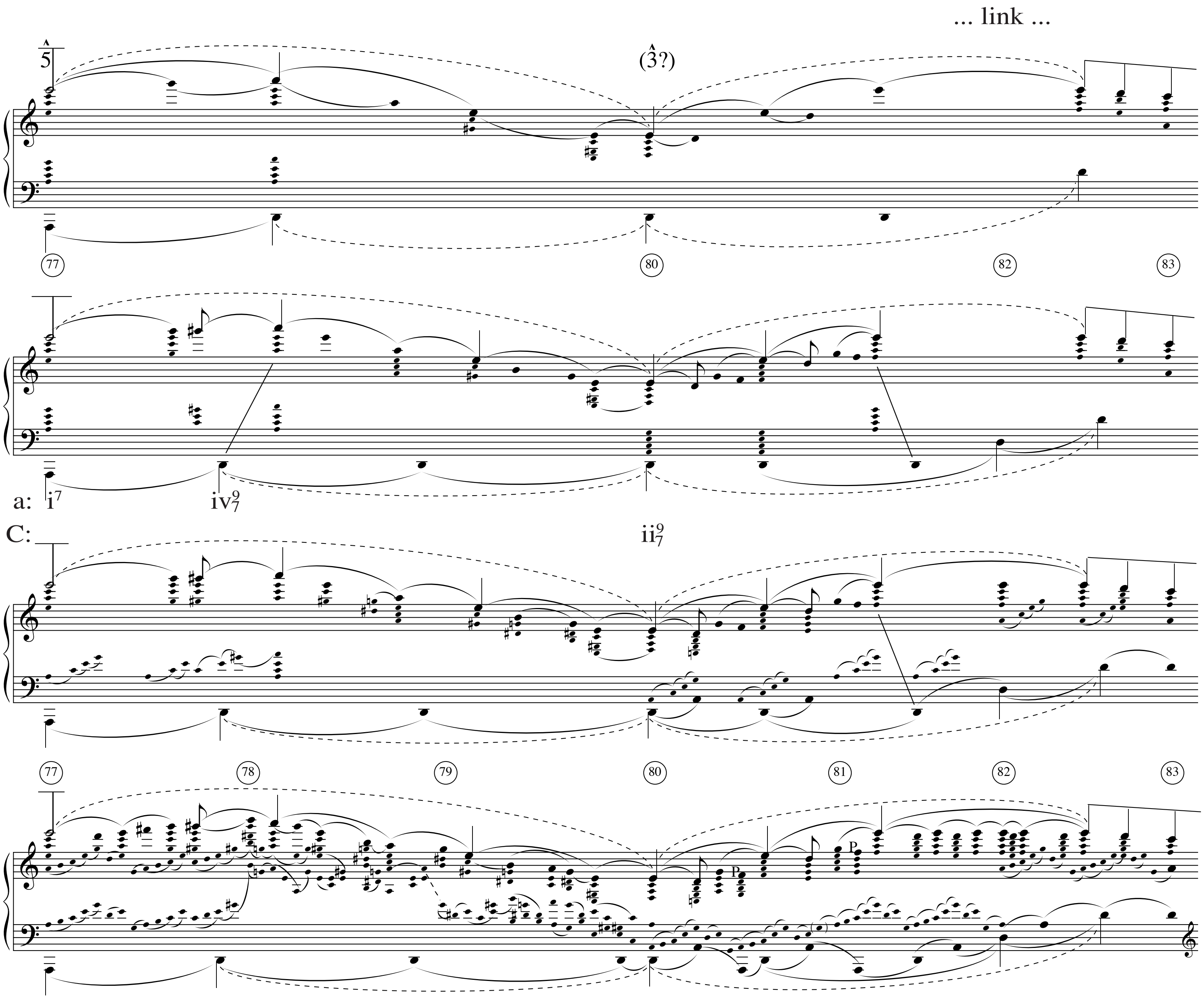


C-based theme + S accompaniment

P-based theme + S accompaniment

second climax

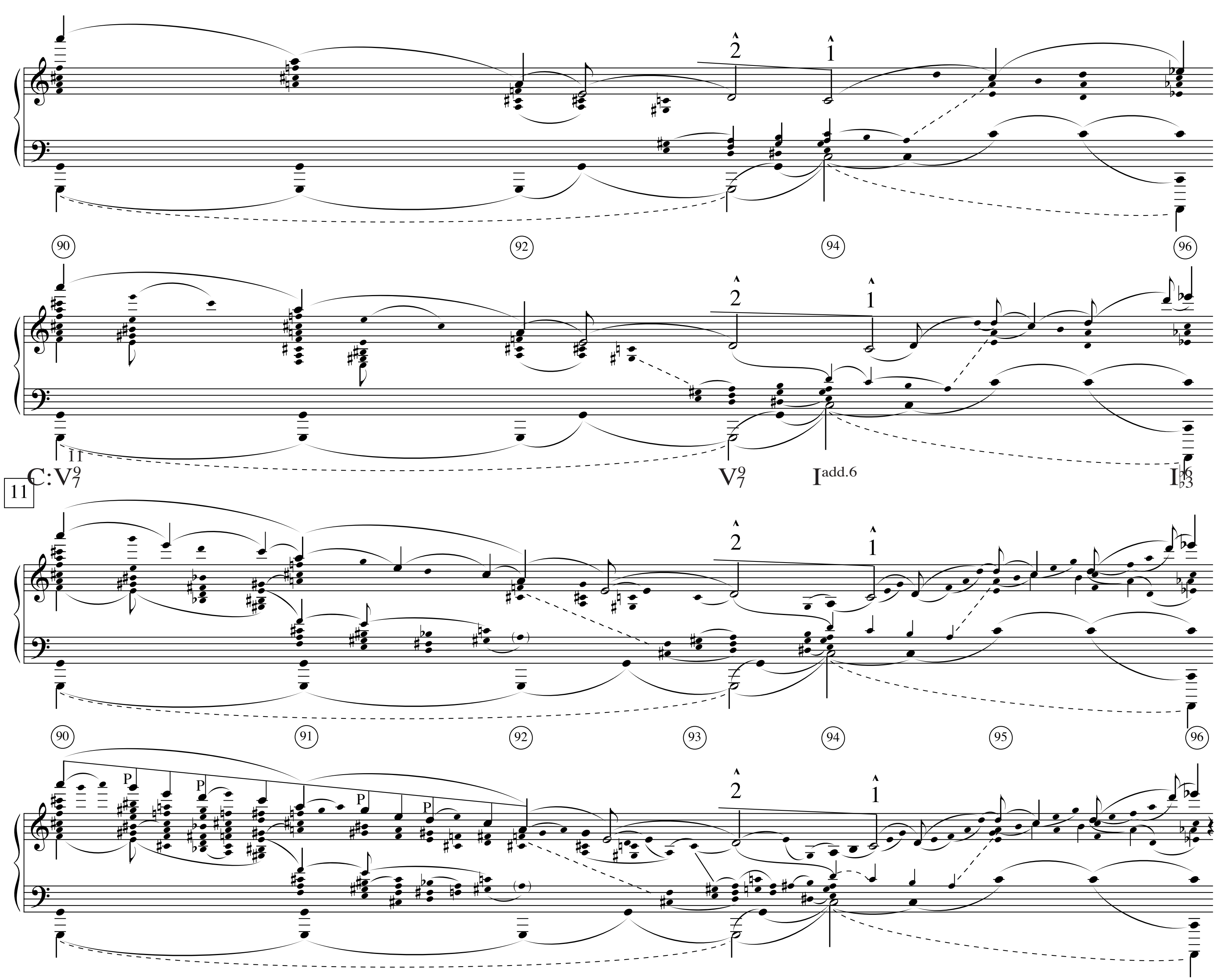



... link ...
5̂
(3̂?)
77
80
82
83
a: i7
iv9 7
C:
ii9 7
77
78
79
80
81
82
83
P
P

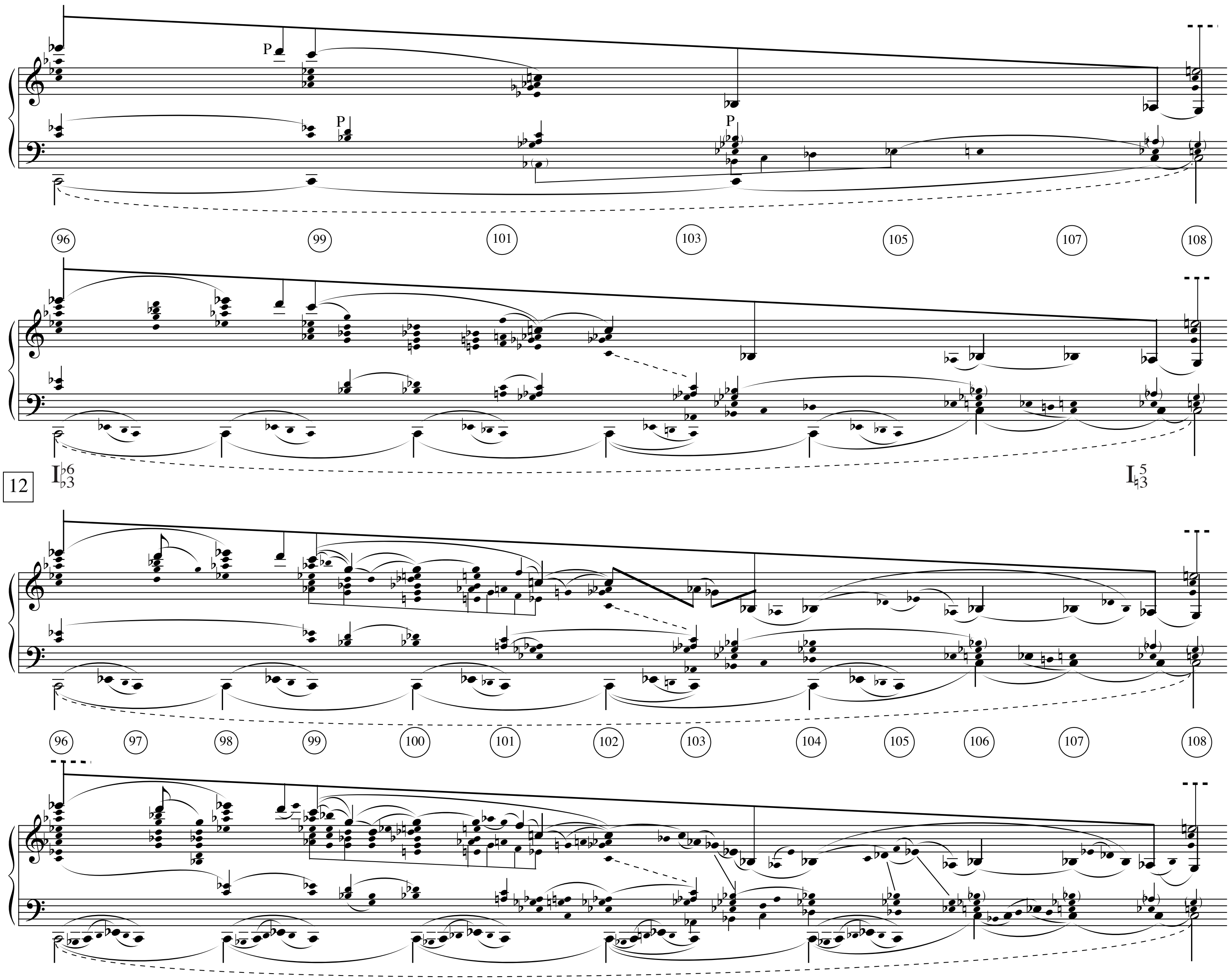
S1
3̂
2̂
P
N
C: ii9 7
V9 7
11 V9 7
10
83
86
88
90
E
84
85
87
89
D
F
G
A

ESC

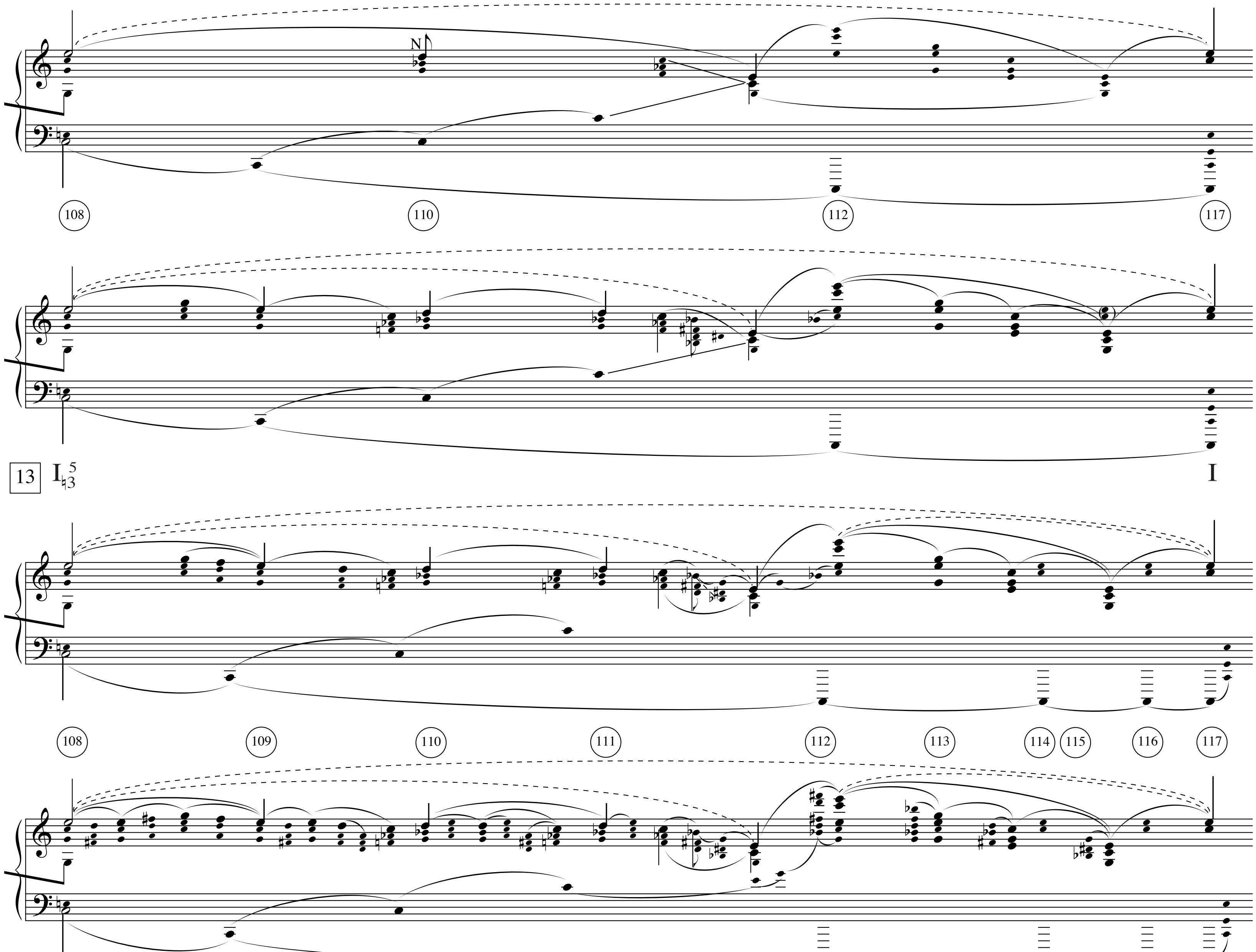
S²



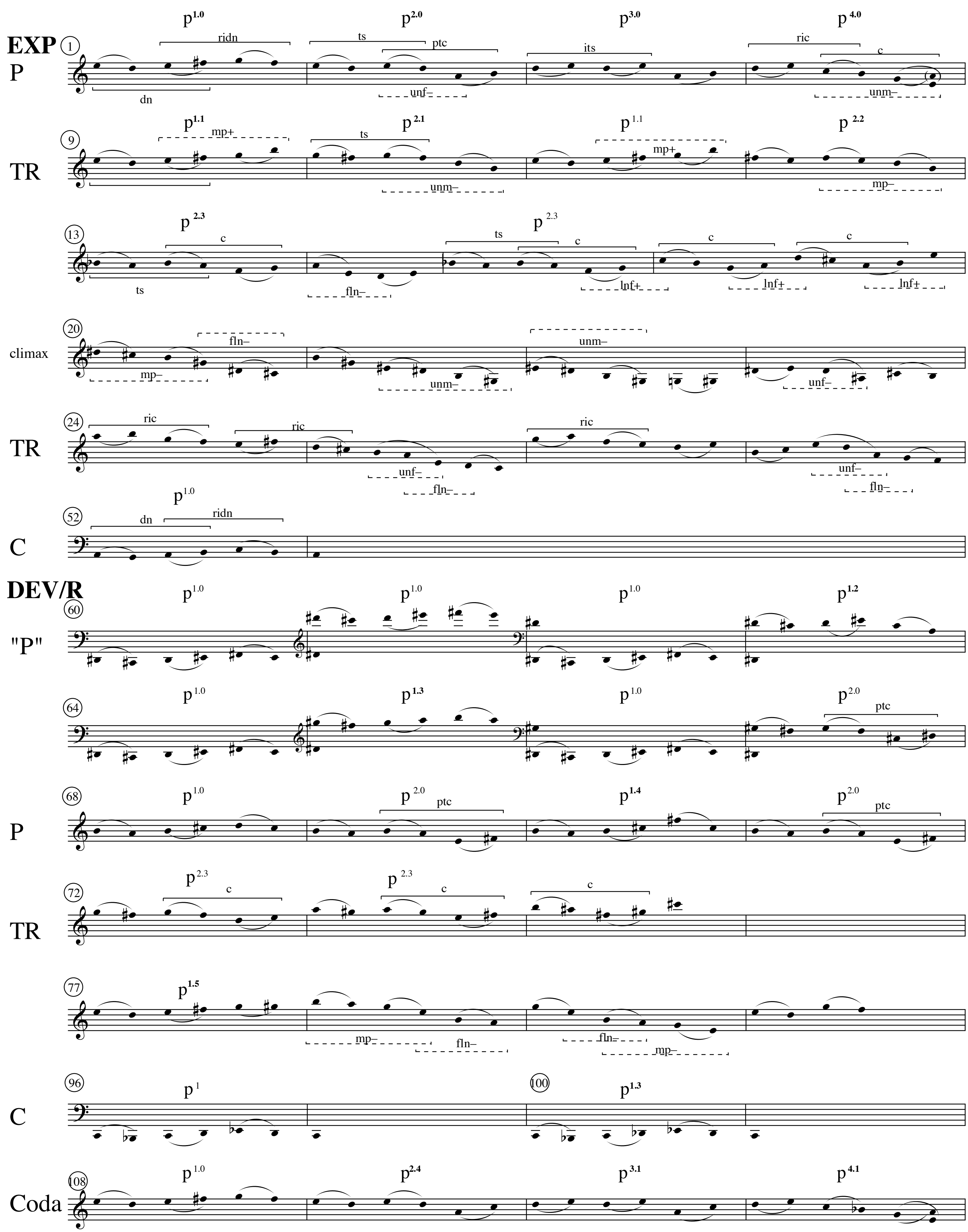
C


P
P
96
99
101
103
105
107
108
12
96
97
98
99
100
101
102
103
104
105
106
107
108

Coda



Example 5.21a Ravel, Piano Trio, I: P-theme motives



Example 5.21b Ravel, Piano Trio, I: Three- and four-note motive labels

- Slurs connect dyads (with the exception of line 5)
  - Downward facing slurs: descending dyads
  - Upward facing slurs: ascending dyads

- Brackets indicate 3 and 4-note motives
  - Solid brackets: cambiata-type motives (combinations of up and down)
  - Dotted brackets: unidirectional motives (+ and – show ascending or descending direction)

- Larger fonts indicate segments of the P- and S-themes
  - p^2 : second segment of P-theme
  - s^1 : first segment of S-theme

- Superscripts show consecutive variants of p and s segments
  - $p^{1.2}$: second variant of first p segment
  - $s^{1.1}$: first variant of first s segment

- The labeling of motives uses abbreviations based on a motive's interval structure.

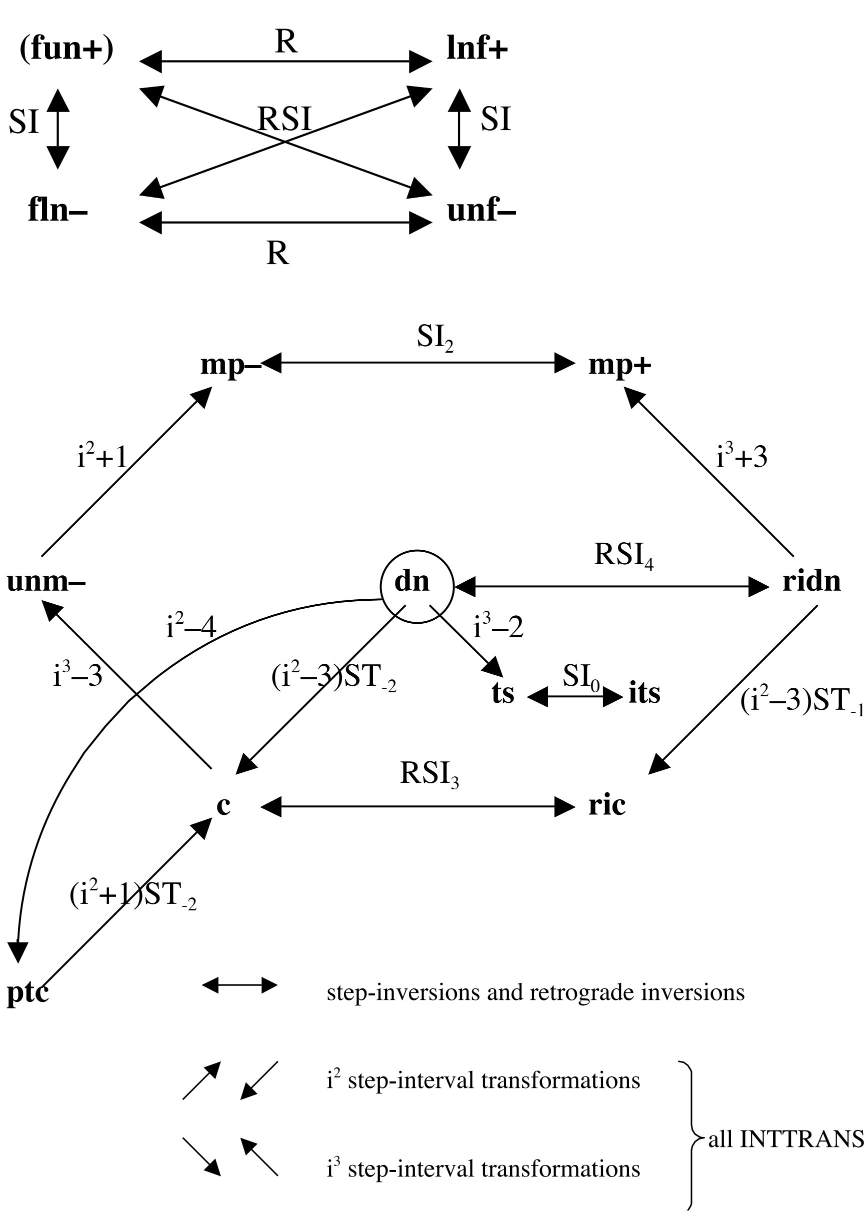
  NEIGHBOR-NOTE MOTIVES:
  - dn: double neighbor (lower+upper)
  - ridn: retrograde-inverted double neighbor
  - ts: twin seconds
  - its: twin seconds inverted

  CAMBIATA-TYPE MOTIVES:
  - c: cambiata figure (e.g. C-B-G-A)
  - ptc: pentatonic cambiata (the central interval a fourth, e.g., E-D-A-B)
  - ric: retrograde inverted cambiata (e.g. D-E-C-B)

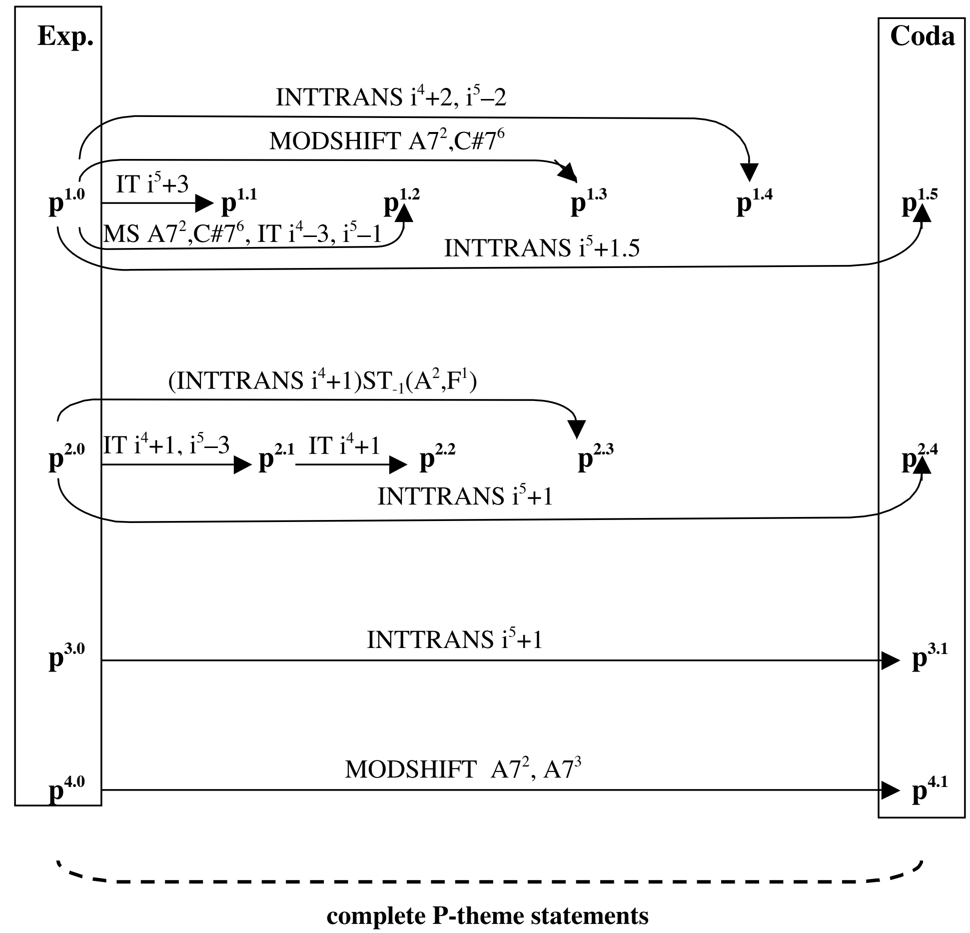
  UNIDIRECTIONAL MOTIVES
  - un: upper neighbor
  - ln: lower neighbor
  - f: fourth
  - unf: upper neighbor followed by fourth
  - lnf: lower neighbor followed by fourth
  - fln: fourth followed by lower neighbor
  - m: minor triad
  - unm/unM: upper neighbor followed by minor/major triad
  - mp/Mp: minor/major triad with passing tone filling out first third
  - lnm: lower neighbor followed by minor triad

Example 5.22 Piano Trio, I: P-segment transformations (synchronic)

a: Three- and four-note motives



b: Complete P-segments



IT = INTTRANS = INTERVAL TRANSFORMATION
MS = MODSHIFT = MODULAR SHIFT
ST = STEP TRANSPOSITION

Example 5.23 Ravel, Piano Trio, I: Consecutive P-segment transformations (diachronic)

a

Form	Section	Theme	mm.	p^1	p^2	p^3	p^4
Exposition	**P**	**P**	1–4, 5–8	$p^{1.0}$	$p^{2.0}$	$p^{3.0}$	$p^{4.0}$
	TR[1]	P^T	9–12	$p^{1.1}$	$p^{2.1}$	$p^{1.1}$	$p^{2.2}$
			13–16	$p^{2.3}$	p^F	$p^{2.3}$	$p^{2.3-}$
		clim/den	20–23	p^D	p^D	p^{D-}	
	TR[2]		24–27	$p^{4.0}$ $p^{4.0}$		$p^{4.0}$	
	C	P^C	52–55 56–59	**ǁ:** $p^{1.0}$		$p^{1.0}$	**:ǁ**
Developm./ Tonal Res.	**“P”**	P^C	60–63	$p^{1.0}$	$p^{1.0}$	$p^{1.0}$	$p^{1.2}$
		P^C /P	64–67	$p^{1.0}$	$p^{1.3}$	$p^{1.0}$	$p^{2.0}$
	TR	P^T	68–71	$p^{1.0}$	$p^{2.0}$	$p^{1.4}$	$p^{2.0}$
		P^T	72–74	$p^{2.3}$	$p^{2.3}$	$p^{2.3-}$	
		P/clim/den	77–80	$p^{1.5}$	p^D	p^D	p^D
	C	P^C	96–99, 100–103	**ǁ:** $p^{1.0}$	**:ǁ**	**ǁ:** $p^{1.3}$	**:ǁ**
Coda		**P**	108–111	$p^{1.0}$	$p^{2.4}$	$p^{3.1}$	$p^{4.1}$

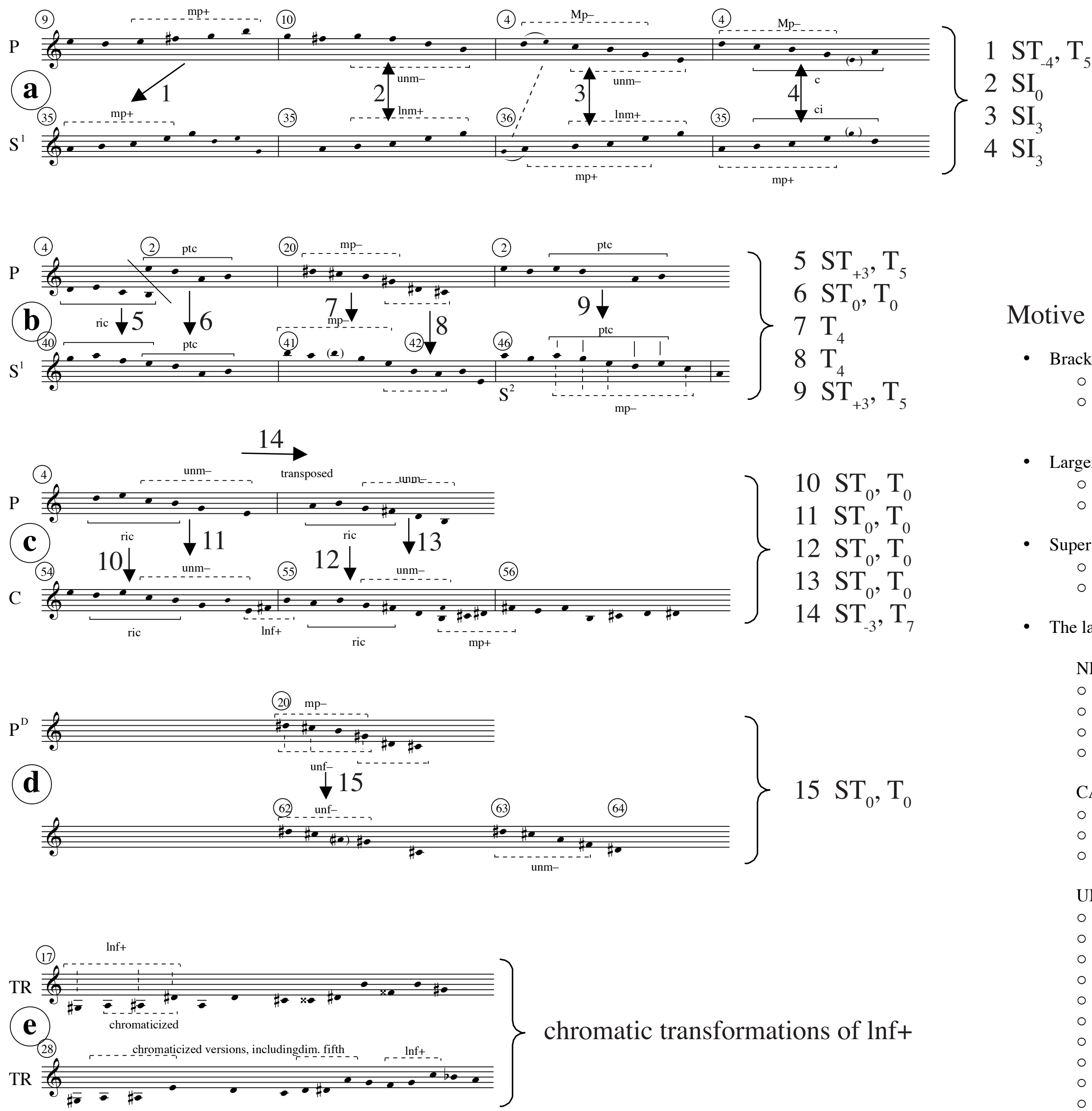
b

SONATA SECTION	MOTIVE	STEP-MOTIVE	ORDERED STEP I.	TRANSFORMATIONS
Exposition, P	$p^{1.0}$	A^2(4, 3, 4, 5, 6, 5)	[–1, +1, +1, +1, –1]	INTTRANS
Exposition, TR	$p^{1.1}$	A^2(4, 3, 4, 5, 6, 1)	[–1, +1, +1, +1, +2]	T, MODROT, INTTRANS
Development, P	$p^{1.2}$	D#^{6}(0, 6, 0, 2, 6, ♮4)	[–1, +1, +1, –2, –2.5]	T, MODROT, INTTRANS
Development, P	$p^{1.3}$	E^1(2, 1, 2, 3, 4, 3) **	[–1, +1, +1, +1, –1]	MODSHIFT, ST, INTTRANS
Development, P	$p^{1.4}$	E^2(4, 3, 4, 5, 1, 5)	[–1, +1, +1, +3, –3]	T, INTTRANS
Tonal Resolution,* C	$p^{1.5}$	A^2(4, 3, 4, 5, 6, #6)	[–1, +1, +1, +1, +0.5]	
Exposition, P	$p^{2.0}$	A^2(4, 3, 4, 3, 0, 1)	[–1, +1, –1, –3, +1]	ST, INTTRANS
Exposition, TR	$p^{2.1}$	A^2(6, 5, 6, 5, 3, 1)	[–1, +1, –1, –2, –2]	ST, INTTRANS
Exposition, TR	$p^{2.2}$	A^2(5, 4, 5, 4, 3, 1)	[–1, +1, –1, –1, –2]	MODROT, ST, INTTRANS
Exposition, TR	$p^{2.3}$	F^1(3, 2, 3, 2, 0, 1)	[–1, +1, –1, –2, +1]	MODROT, ST, INTTRANS
Coda	$p^{2.4}$	A^2(4, 3, 4, 3, 0, 2)	[–1, +1, –1, –3, +2]	
Exposition	$p^{3.0}$	A^2(3, 4, 3, 4, 0, 1)	[+1, –1, +1, –4, +1]	INTTRANS
Coda	$p^{3.1}$	A^2(3, 4, 3, 4, 0, 2)	[+1, –1, +1, –4, +2]	
Exposition	$p^{4.0}$	A^2(3, 4, 2, 1, 6, 0/4)	[+1, –1, +1, –4, +2]	MODSHIFT
Coda	$p^{4.1}$	A^3(3, 4, 2, 1, 6, 0/4)	[+1, –1, +1, –4, +2]	

* The term “Tonal Resolution” refers to the second half of the second rotation of the Type 2 sonata, which includes the S- and C-zones.

** C#6 (4, 3, 4, 5, 6, 5) or G#2 (0, 6, 0, 1, 2, 1). (1) The first interpretation is the most global: the underlying B-major V6/5 chord functions as a dominant to E (the collection suggests E major, but the resolution in m. 68 sounds in the minor mode). (2) In the context of the V4/3 chord on D#, to which the motive resolves in m. 66, the motive belongs to C# minor (though only the C# bass sounds in m. 68). 3. A G#-phrygian interpretation applies only locally to the motive by itself.

Example 5.24 Ravel, Piano Trio, I: Motivic relationships among P, TR, S, and C themes



Transformation Arrows

Transposition   Inversion

Motive Labels

- Brackets indicate 3- and 4-note motives
  - o Solid brackets: cambiata-type motives (combinations of up and down)
  - o Dotted brackets: unidirectional motives
    (+ and – show ascending or descending direction)

- Larger fonts indicate segments of the P- and S-themes
  - o p^2 : second segment of P-theme
  - o s^1 : first segment of S-theme

- Superscripts show consecutive variants of p and s segments
  - o $p^{1.2}$: second variant of first p segment
  - o $s^{1.1}$: first variant of first s segment

- The labeling of motives uses abbreviations based on a motive's interval structure

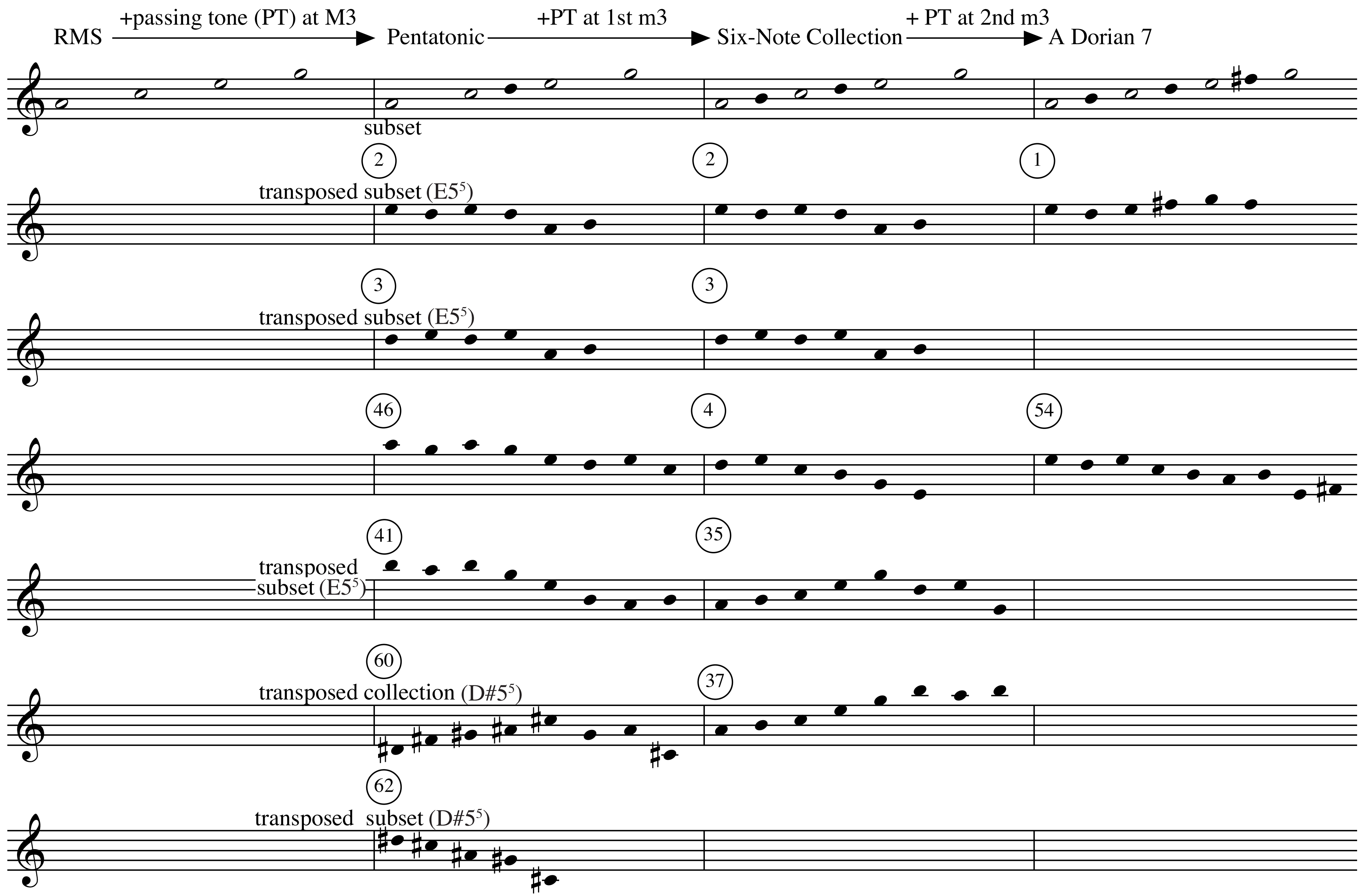
NEIGHBOR-NOTE MOTIVES:
- o dn: double neighbor (lower+upper)
- o ridn: retrograde-inverted double neighbor
- o ts: twin seconds
- o its: twin seconds inverted

CAMBIATA-TYPE MOTIVES:
- o c: cambiata figure (e.g. C–B–G–A)
- o ptc: pentatonic cambiata (the central interval a fourth, e.g., E–D–A–B)
- o ric: retrograde inverted cambiata (e.g. D–E–C–B)

UNIDIRECTIONAL MOTIVES
- o un: upper neighbor
- o ln: lower neighbor
- o f: fourth
- o unf: upper neighbor followed by fourth
- o lnf: lower neighbor followed by fourth
- o fln: fourth followed by lower neighbor
- o m: minor triad
- o unm/unM: upper neighbor followed by minor/major triad
- o mp/Mp: minor/major triad with passing tone filling out first third
- o lnm: lower neighbor followed by minor triad

Example 5.25 Ravel, Piano Trio, I: Subset relationships

The top system lists the consecutive transformations from one referential set to the next. Each referential set is a subset of the set to its right. In each column, the motives below the referential set are based on direct or transposed subsets of the collection at the top.



Example 5.26 Ravel, Piano Trio, IV: Type 3 sonata form (first option)

	ROTATION 1: EXPOSITION					
section	**P**			**TR** ⇒ **FS** climactic ascent		**C**$^{\text{pre-EEC}}$
theme	**a**	**b**^{1}	**a**	**b**^{2}	**b**^{2} fragments	**c**
rehearsal no measure no	 1	1 7	 12	2 17	3 26	4 30
measure- groupings meter	**6** prefix+sentence 1 + (2 + 3) 5/4	**5** sentence-like 2 + 3 7/4 5/4	**5** sentence 2 + 3 5/4	**9** model sequence 4 + 5 7/4	**5** fragmentation 5/4	11 3 + 3 + 2 + 1 + 2 5/4 7/4 5/4
collection	A7^1		A7^1	OCT$_{1,2}$ E7^6 OCT$_{2,3}$ B♭7^1	OCT$_{1,2}$	F♯7^1
key areas	**A major**	modulating	A major→E major	e b E♭/A♭ B♭-F		**V**$^6_4$ **F♯ major**
bass	A-pedal	A-pedal	A-pedal **E: PAC**	E	D B♭ E♭ G♯ C♯	C♯-pedal F♯

	EEC/**ROTATION 2: DEVELOPMENT**					
section	**P-based**		**TR-based**		climactic ascent	climax/retransition
theme	**a** fragm. **b**^{1} fragm.	**a** fragm. **b**^{1} fragm.	**b**^{2}	**b**^{2}	**b**^{2} stretto **+ c'**	**c'**
rehearsal no measure no	5 42	 46	6 50	7 54	8 59 62 64 66	 69
measure- groupings meter	**4** 2 + 2 5/4	**4** 2 + 2 5/4 (7/4)	**4** 1+2+1 7/4	**5** 1+2+1 +1 7/4	**5** **5** 3 + 2 3 + 2 (6/4) 7/4 5/4	**4** 5/4
collection	F♯7^1 WT$_0$ →OCT$_{2,3}$	D♯7^1 WT$_0$ →OCT$_{2,3}$	OCT$_{0,1}$	G7^4	OCT$_{1,2}$	
key areas	**F♯**	D♯	C		linear WT$_0$ in bass	linear WT$_0$ in bass cont.
bass	**F♯**	D♯	C A♭ F D	B G E C♯	B♭ G **E**A**D**G**C**F**B♭**	E♭ (=D♯) **= "V"**

	ROTATION 3: RECAPITULATION					
section	**P** (false start I)	(false start II)	**P**	**TR** ⇒ **FS**	climactic ascent	**C**$^{\text{pre-ESC}}$
theme	**a** fragm. **b**^{1} fragm.	**a** fragm. **b**^{1} fragm.	**a**	**b**^{1} **b**^{1} fragments	**b**^{1} **b**^{1} fragments	**c**
rehearsal no measure no	9 73	 79	10 84	 89	11 94	12 101
measure- groupings meter	**6** prefix 1 + (2 + 3) 5/4	**5** 2 + 3 5/4	**5** sentence 2 + 3 5/4	**5** 2 + 3 7/4 5/4 7/4	7 2 + 2 + 3 7/4 5/4 4/4	 (2/4) 5/4
collection						
key areas	linear WT$_0$ in bass cont.	linear WT$_0$ in bass cont.	**A major**	A$^{\text{add.6}}$		D$^{\text{dd.6}}$ C♯… E$^{\sharp 11}$**=V**
bass	**G♯**-pedal	**F♯**-pedal	**E**-pedal no PAC!	E-pedal	E-pedal	D C♯ F♯ B E-pedal

	ESC/**CODA**	
section	**P-based**	**C-based**
theme	**a** stretto	c
rehearsal no measure no	13 112	14 118
measure- groupings meter	**6** 3 + 3 5/4	**7** 3 + 4 5/4
collection	A7^1 A7^3	
key areas	**A major**/phrygian	**A major**
bass	**A** G FEDCB♭ A	**A**-pedal

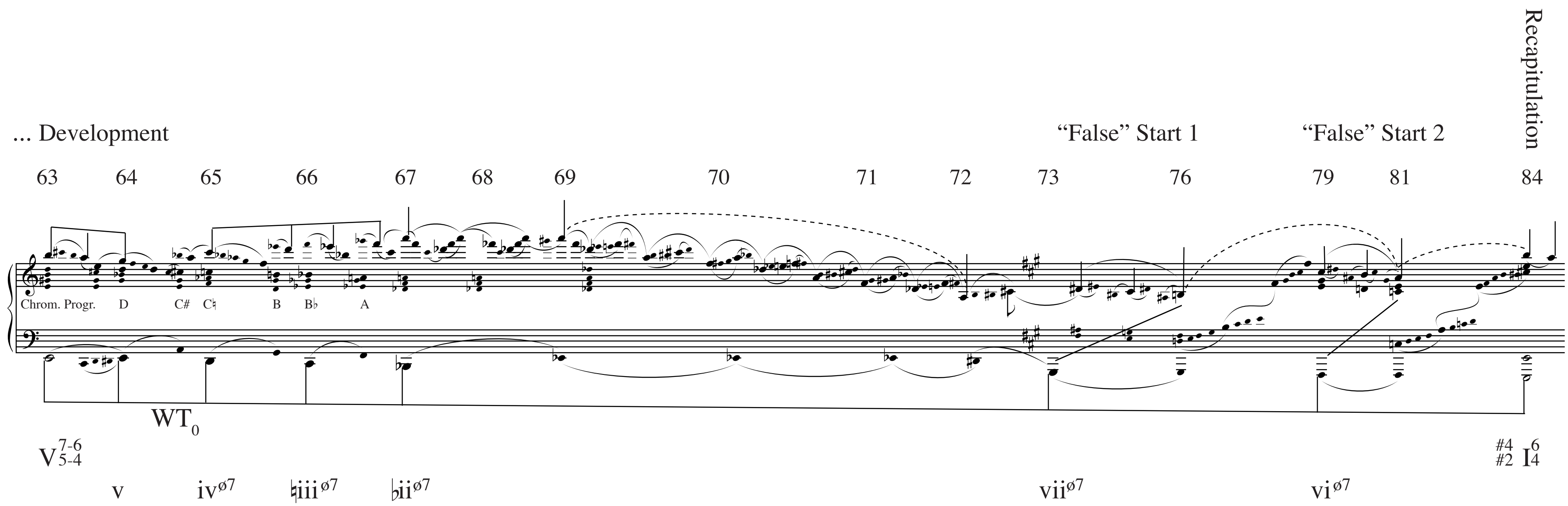
Example 5.27 Ravel, Piano Trio, IV: Alternative form diagram (with two-part exposition)

	ROTATION 1: EXPOSITION					
section	**P**			**TR**	climactic ascent **’**	**S**^{C}
theme	**a**	**b**^{1}	**a**	**b**^{2}	**b**^{2} fragments	**c**
rehearsal no measure no	 1	$\boxed{1}$ 7	 12	$\boxed{2}$ 17	$\boxed{3}$ 26	$\boxed{4}$ 30
measure-groupings meter	**6** prefix+sentence 1 + (2 + 3) 5/4	**5** sentence-like 2 + 3 7/4 5/4	**5** sentence 2 + 3 5/4	**9** model sequence 4 + 5 7/4	**5** fragmentation 5/4	11 3 + 3 + 2 + 1 + 2 5/4 7/4 5/4
collection	A7^{1}		A7^{1}	$OCT_{1,2}$ E7^{6} $OCT_{2,3}$ B♭7^{1}	$OCT_{1,2}$	F♯7^{1}
key areas	**A major**	modulating	A major→E major	e b E♭/A♭ B♭-F		**V**$^{6}_{4}$ **F♯ major**
bass	A-pedal	A- pedal	A- pedal **E: PAC**	E	D B♭ E♭ G♯ C♯	C♯-pedal F♯

	EEC/ROTATION 2: DEVELOPMENT						**False Recapitulation**		
section	**P-based**		**TR-based**		climactic ascent	climax/retransition	**P** (false start I)	(false start II)	section
theme	**a** fragm. **b**^{1} fragm.	**a** fragm. **b**^{1} fragm.	**b**^{2}	**b**^{2}	**b**^{2} stretto **+ c’**	**c’**	**a** fragm. **b**^{1} fragm.	**a** fragm. **b**^{1} fragm.	theme
rehearsal no measure no	$\boxed{5}$ 42	 46	$\boxed{6}$ 50	$\boxed{7}$ 54	$\boxed{8}$ 59 62 64 66	 69	$\boxed{9}$ 73	 79	rehearsal no measure no
measure-groupings meter	**4** 2 + 2 5/4	**4** 2 + 2 5/4 (7/4)	**4** 1+2+1 7/4	**5** 1+2+1 +1 7/4	**5** **5** 3 + 2 3 + 2 (6/4) 7/4 5/4	**4**	**6** prefix 1 + (2 + 3) 5/4	**5** 2 + 3 5/4	measure-groupings meter
collection	F♯7^{1} WT_0 →$OCT_{2,3}$	D♯7^{1} WT_0 →$OCT_{2,3}$	OCT $_{0,1}$	G7^{4}	$OCT_{1,2}$				collection
key areas	F♯	D♯	C		linear WT_0 in bass	linear WT_0 in bass cont.	linear WT_0 in bass cont.	linear WT_0 in bass cont.	key areas
bass	F♯	D♯	C A♭ F D	B G E C♯	B♭ G **E**A**D**G**C**F**B♭**	E♭ (=D♯) **= “V”**	**G♯**- pedal	**F♯**- pedal	bass

ROTATION 3: RECAPITULATION				ESC/CODA		
P	**TR**	climactic ascent **’**	**S**^{C}	**P-based**	**C-based**	section
a	**b**^{1} **b**^{1} fragments	**b**^{1} **b**^{1} fragments	**c**	**a** stretto	c	theme
$\boxed{10}$ 84	 89	$\boxed{11}$ 94	$\boxed{12}$ 101	$\boxed{13}$ 112	$\boxed{14}$ 118	rehearsal no measure no
5 sentence 2 + 3 5/4	**5** 2 + 3 7/4 5/4 7/4	7 2 + 2 + 3 7/4 5/4 4/4	 (2/4) 5/4	**6** 3 + 3 5/4	**7** 3 + 4 5/4	measure-groupings meter
						collection
A-major	A$^{add.6}$		D$^{dd.6}$ C♯… E$^{\sharp 11}$**=V**	**A major**/Phrygian	**A major**	key areas
E- pedal no PAC!	E- pedal	E- pedal	D C♯ F♯ B E- pedal	A G FEDCB♭ A	A- pedal	bass

Example 5.28 Ravel, Piano Trio, IV: Retransition with whole-tone progression



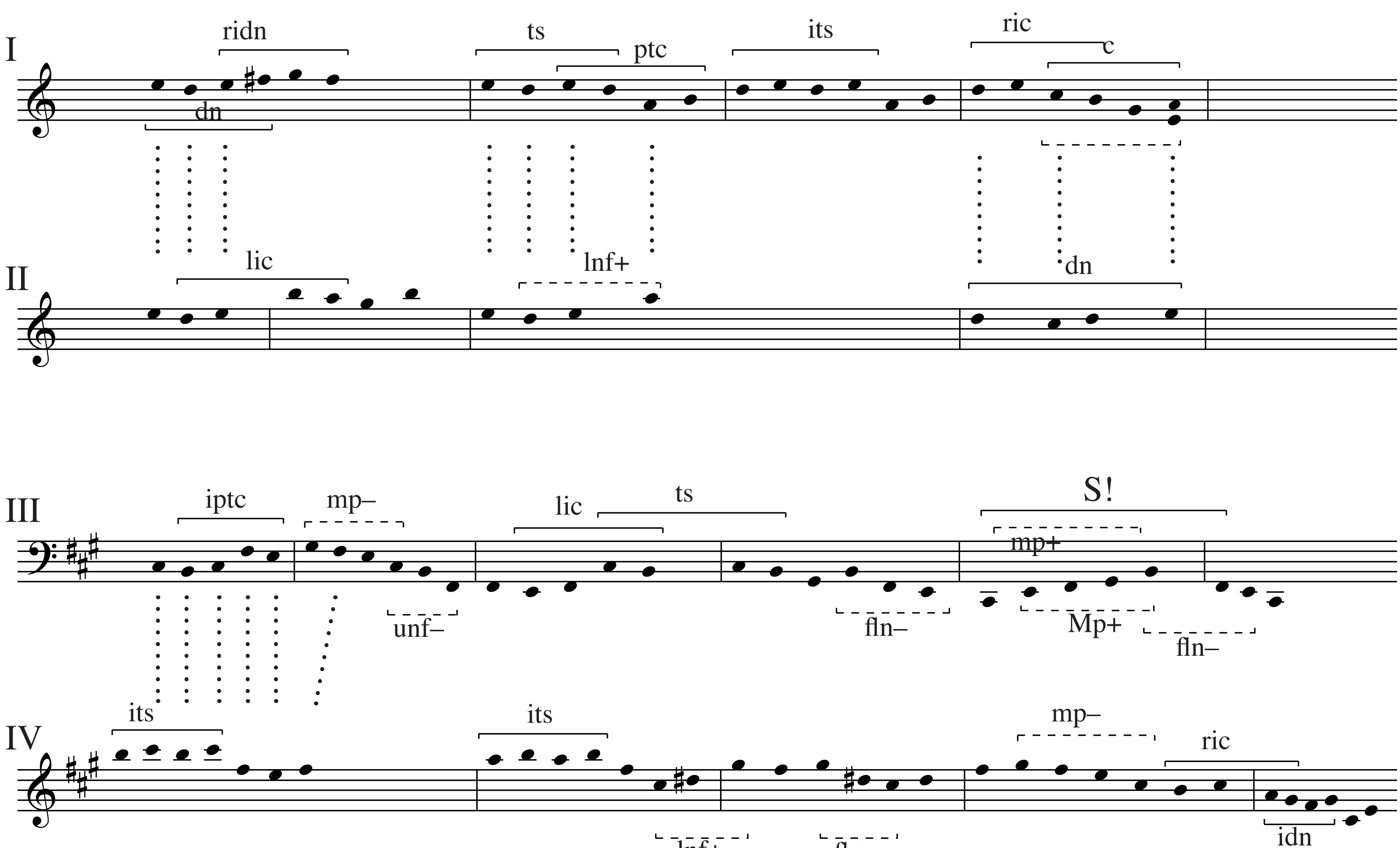
Example 5.29 Ravel, Piano Trio, IV: Type 3 sonata form (second option)

	ROTATION 1: EXPOSITION					
section	**P**			**TR** transitional	**⇒ FS** climactic ascent	**S^{C} / $C^{\text{pre-EEC}}$**
theme	**a**	**b^{1}**	**a**	**b^{2}**	**b^{2}** fragments	**c**
rehearsal no measure no	 1	[1] 7	 12	[2] 17	[3] 26	[4] 30
measure-groupings meter	**6** prefix+sentence 1 + (2 + 3) 5/4	**5** sentence-like 2 + 3 7/4 5/4	**5** sentence 2 + 3 5/4	**9** model sequence 4 + 5 7/4	**5** fragmentation 5/4	11 3 + 3 + 2 + 1 + 2 5/4 7/4 5/4
collection	$A7^{1}$		$A7^{1}$	$OCT_{1,2}$ $E7^{6}$ $OCT_{2,3}$ $B♭7^{1}$	$OCT_{1,2}$	$F♯7^{1}$
key areas	**A major**	modulating	A major→E major	e b E♭/A♭ B♭-F		**V^{6}_{4} F♯ major**
bass	A-pedal	A- pedal	A- pedal **E: PAC**	E	D B♭ E♭ G♯ C♯	C♯-pedal F♯

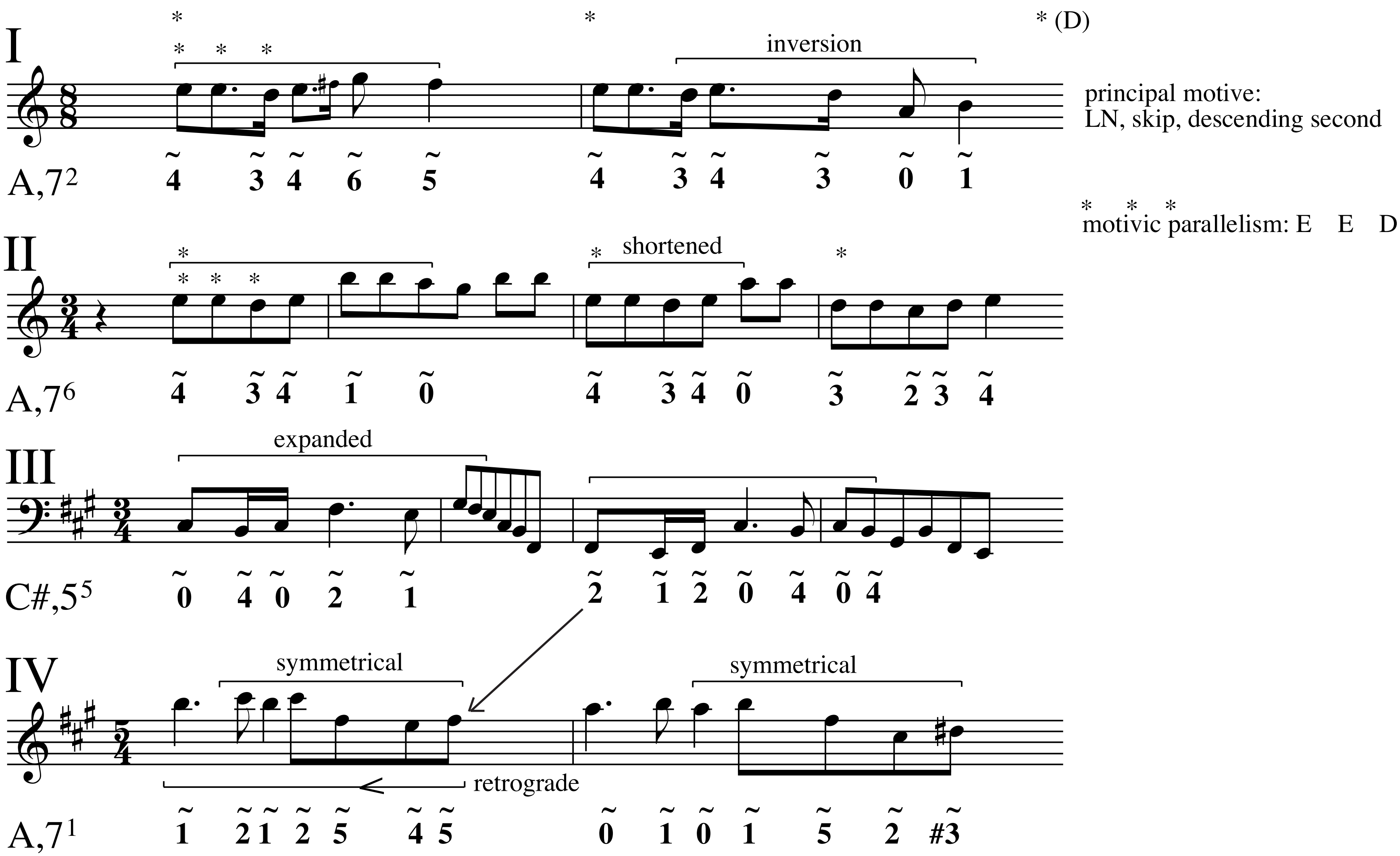
	EEC/ROTATION 2: DEVELOPMENT						**False Recapitulation**		
section	**P-based**		**TR-based**		climactic ascent	climax/retransition	**P** (false start I)	(false start II)	section
theme	**a** fragm. **b^{1}** fragm.	**a** fragm. **b^{1}** fragm.	**b^{2}**	**b^{2}**	**b^{2}** stretto **+ c'**	**c'**	**a** fragm. **b^{1}** fragm.	**a** fragm. **b^{1}** fragm.	theme
rehearsal no measure no	[5] 42	 46	[6] 50	[7] 54	[8] 59 62 64 66	 69	[9] 73	 79	rehearsal no measure no
measure-groupings meter	**4** 2 + 2 5/4	**4** 2 + 2 5/4 (7/4)	**4** 1+2+1 7/4	**5** 1+2+1 +1 7/4	**5** **5** 3 + 2 3 + 2 (6/4) 7/4 5/4	**4**	**6** prefix 1 + (2 + 3) 5/4	**5** 2 + 3 5/4	measure-groupings meter
collection	$F♯7^{1}$ WT_{0} →$OCT_{2,3}$	$D♯7^{1}$ WT_{0} →$OCT_{2,3}$	$OCT_{0,1}$	$G7^{4}$	$OCT_{1,2}$				collection
key areas	F♯	D♯	C		linear WT_{0} in bass	linear WT_{0} in bass cont.	linear WT_{0} in bass cont.	linear WT_{0} in bass cont.	key areas
bass	F♯	D♯	C A♭ F D	B G E C♯	B♭ G **EADGCFB♭**	E♭ (=D♯) **= "V"**	**G♯**-pedal	**F♯**-pedal	bass

ROTATION 3: RECAPITULATION				**ESC/CODA**		
P	**TR ⇒ FS**	climactic ascent	**S^{C} / $C^{\text{pre-ESC}}$**	**P-based**	**C-based**	section
a	**b^{1}** **b^{1}** fragments	**b^{1}** **b^{1}** fragments	**c**	**a** stretto	c	theme
[10] 84	 89	[11] 94	[12] 101	[13] 112	[14] 118	rehearsal no measure no
5 sentence 2 + 3 5/4	**5** 2 + 3 7/4 5/4 7/4	7 2 + 2 + 3 7/4 5/4 4/4	 (2/4) 5/4	**6** 3 + 3 5/4	**7** 3 + 4 5/4	measure-groupings meter
						collection
A-major	$A^{\text{add.6}}$		$D^{\text{dd.6}}$ C♯… $E^{♯11}$**=V**	**A major**/Phrygian	**A major**	key areas
E-pedal no PAC!	E-pedal	E-pedal	D C♯ F♯ B E-pedal	A G FEDCB♭ A	A-pedal	bass

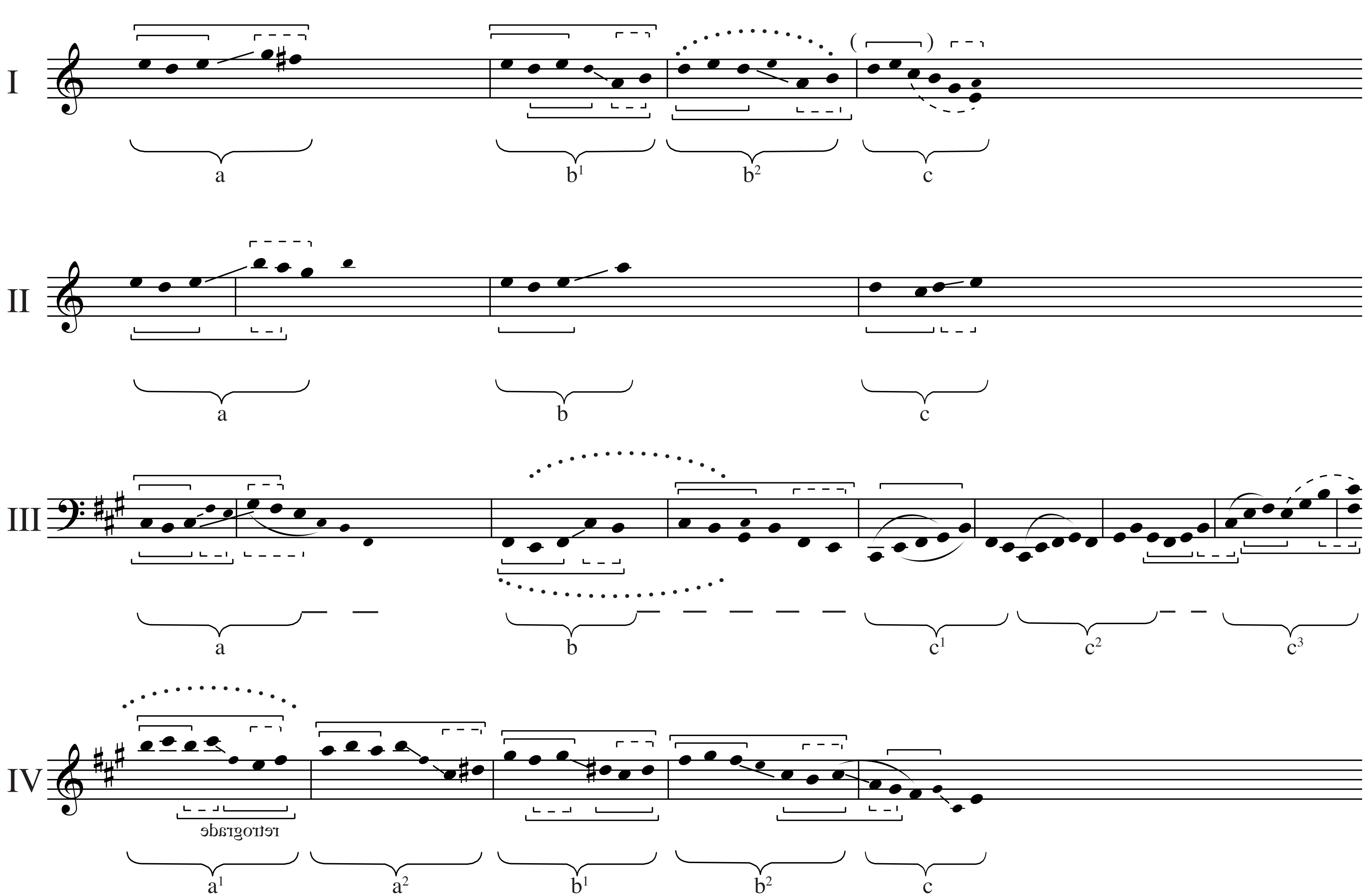
Example 5.30 Ravel, Piano Trio: Three- and four-note motives in all four P-themes



Example 5.31 Ravel, Piano Trio: Inter-movement connections among P-themes (1)

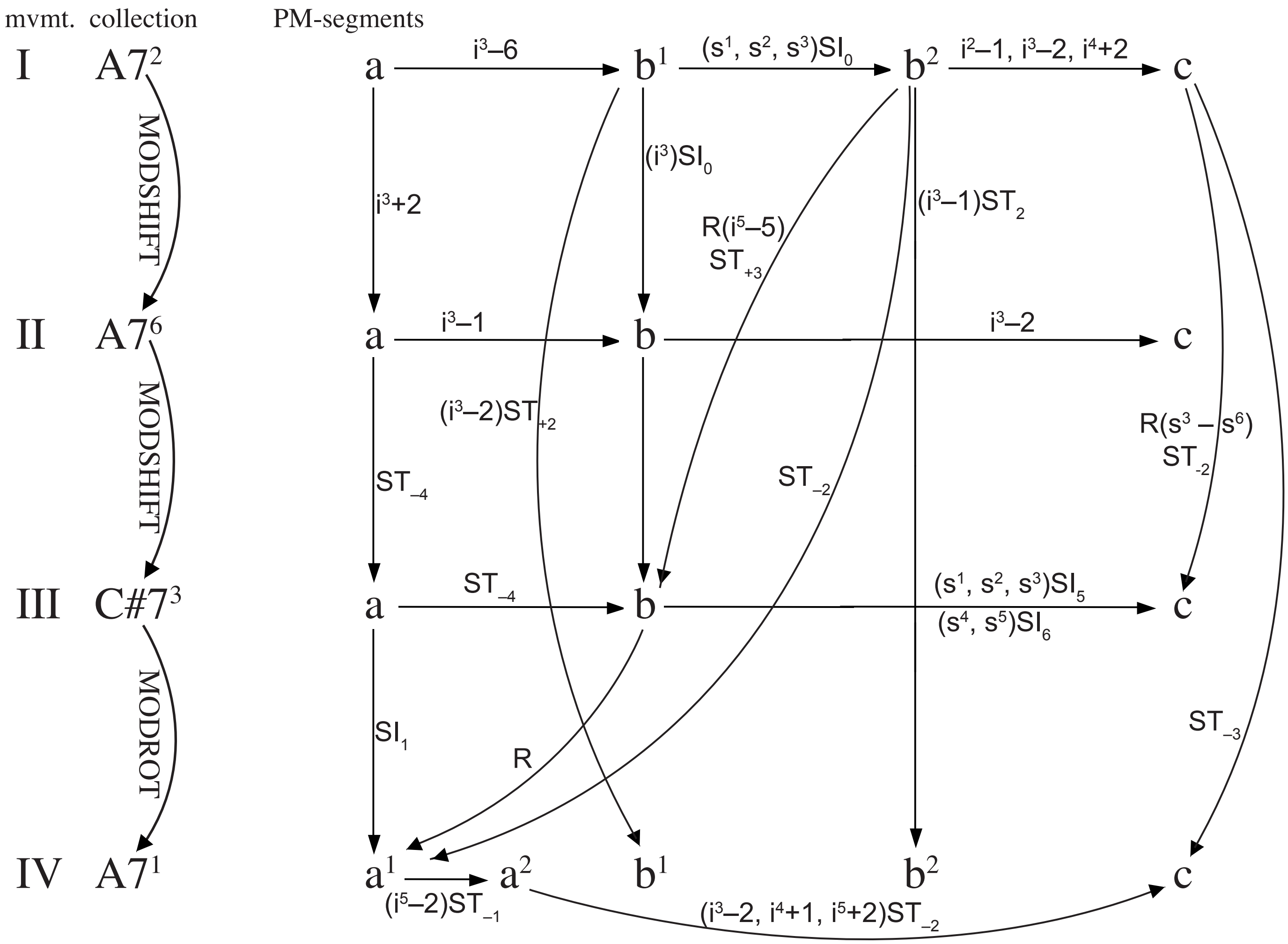


Example 5.32 Ravel, Piano Trio: Inter-movement connections among P-themes (2)



Example 5.33

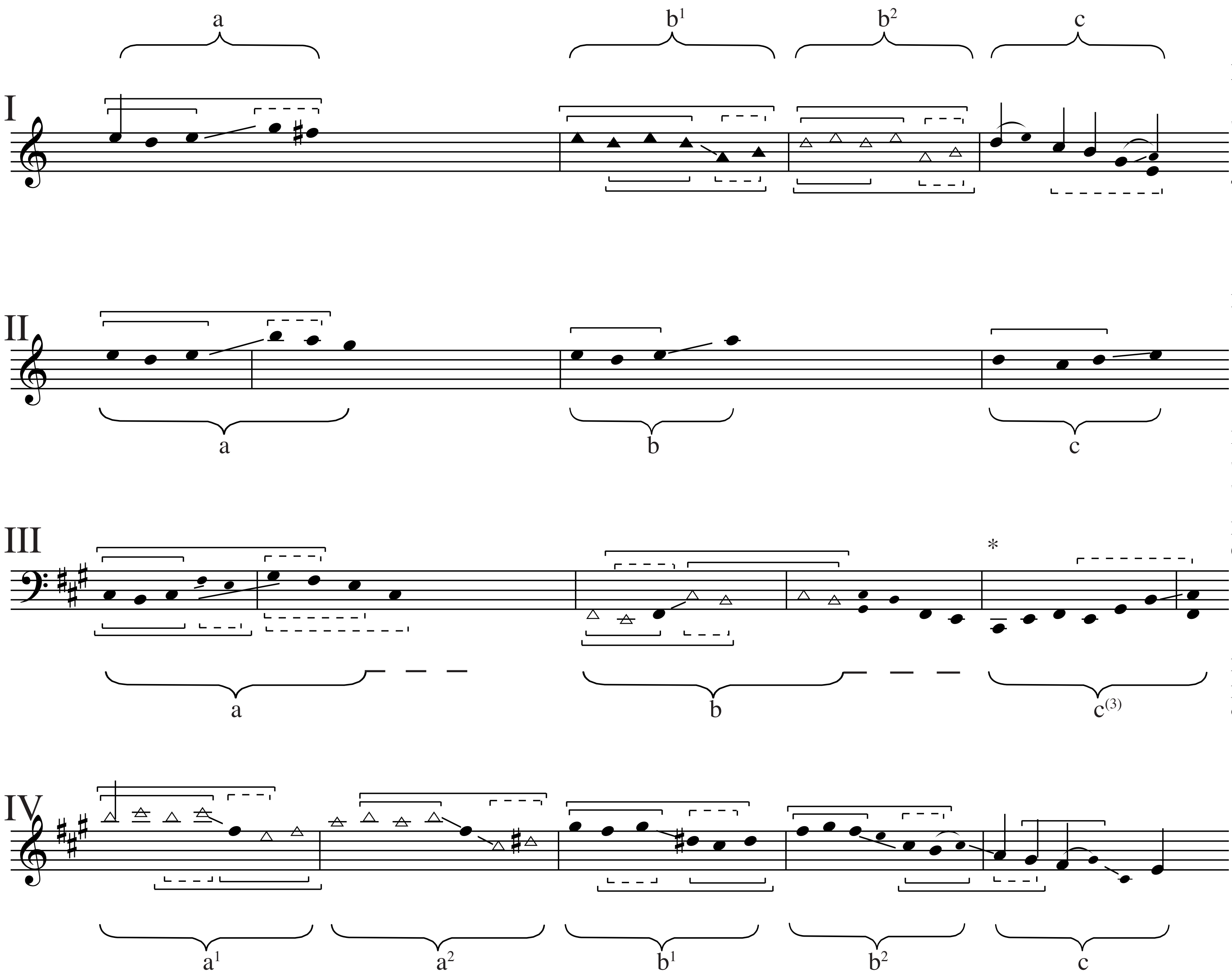
Ravel, Piano Trio: Inter-movement connections among P-themes (3)



Mvmt.	PM segments	Intervals			Notes
		N	Skip	2nd	
I	**a**	–1 +1	+2	–1	w/o passing F# between s^3 and s^4
	b^1	–1 +1	–4	+1	w/o D between s^3 and s^4
	b^2	*+1 –1*	*–3*	*+1*	w/o E between s^3 and s^4
	c	*+1* **–2**	*–1, –2*	*+1*	w implied A (variants w or w/o G and E)
II	**a**	–1 +1	+4	–1	
	b	–1 +1	+3	-	
	c	–1 +1	+1	-	
III	**a**	–1 +1	+4	–1	w/o inserted F# E (w: –1,+1,+3,–1)
	b	–1 +1	+4	–1	
	c^{2X}	–1 +1	+2	+1	
	c^3	*+1 –1*	*+4*	*+1*	w/o C# and G# (variant: last 4 pitches)
IV	**a^1**	*+1 –1*	*–4*	*+1*	w/o small note heads (w: +1–1**+1,–3–1**,+1)
	a^R	–1 +1	+3	–1	
	a^1	*+1 –1*	*–5*	*+1*	
	b^1	–1 +1	–3	–1 (+1)	
	b^2	*+1 –1*	*–4*	*+1*	w/o E and C# between s^3 and s^4
	b^{2R}	–1 +1	+3	–1	
	c	*+1 –1*	*–4*	*+1*	variant, descending tetrachord, as in I c

X=extension, R=retrograde

Example 5.34 Ravel, Piano Trio: Inter-movement connections among P-themes (4)



Legend:

Stemmed Notes: Descending 5 line

Triangular Noteheads: DN motive
Black Triangles: LN twice
White Triangles: UN twice

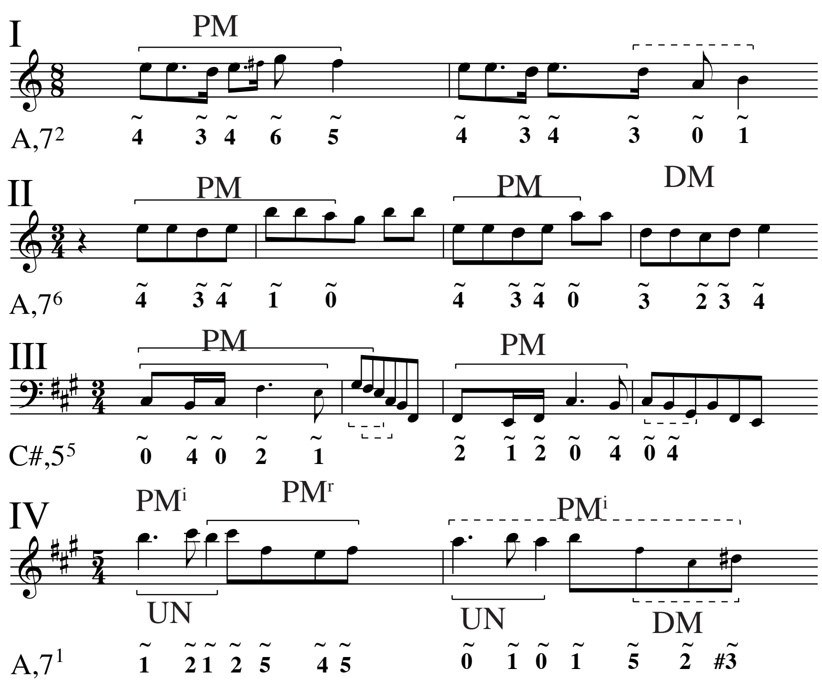
Diagonal Line: Skip

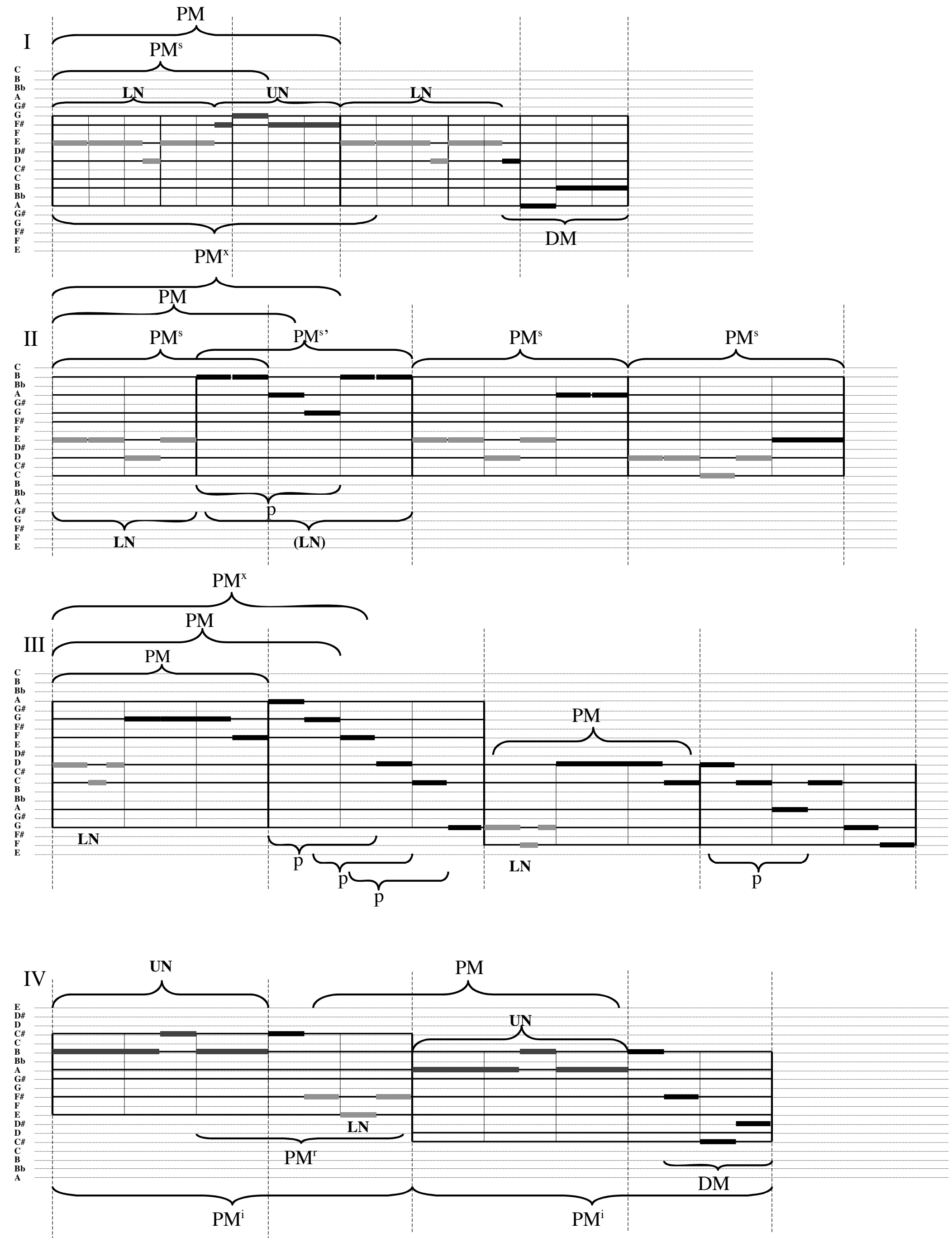
Brackets:
Small Solid: Neighbor Figure (N)
Small Dashed: Step

Nested Brackets: N, Skip, and Step
Curly Brackets: PM Segments

* NOTE: The third-movement theme has been reduced by its three-measure phrase expansion; c is represented only by its last measure.

Example 5.35 Ravel, Piano Trio, P-themes: Metric placement and grouping comparison

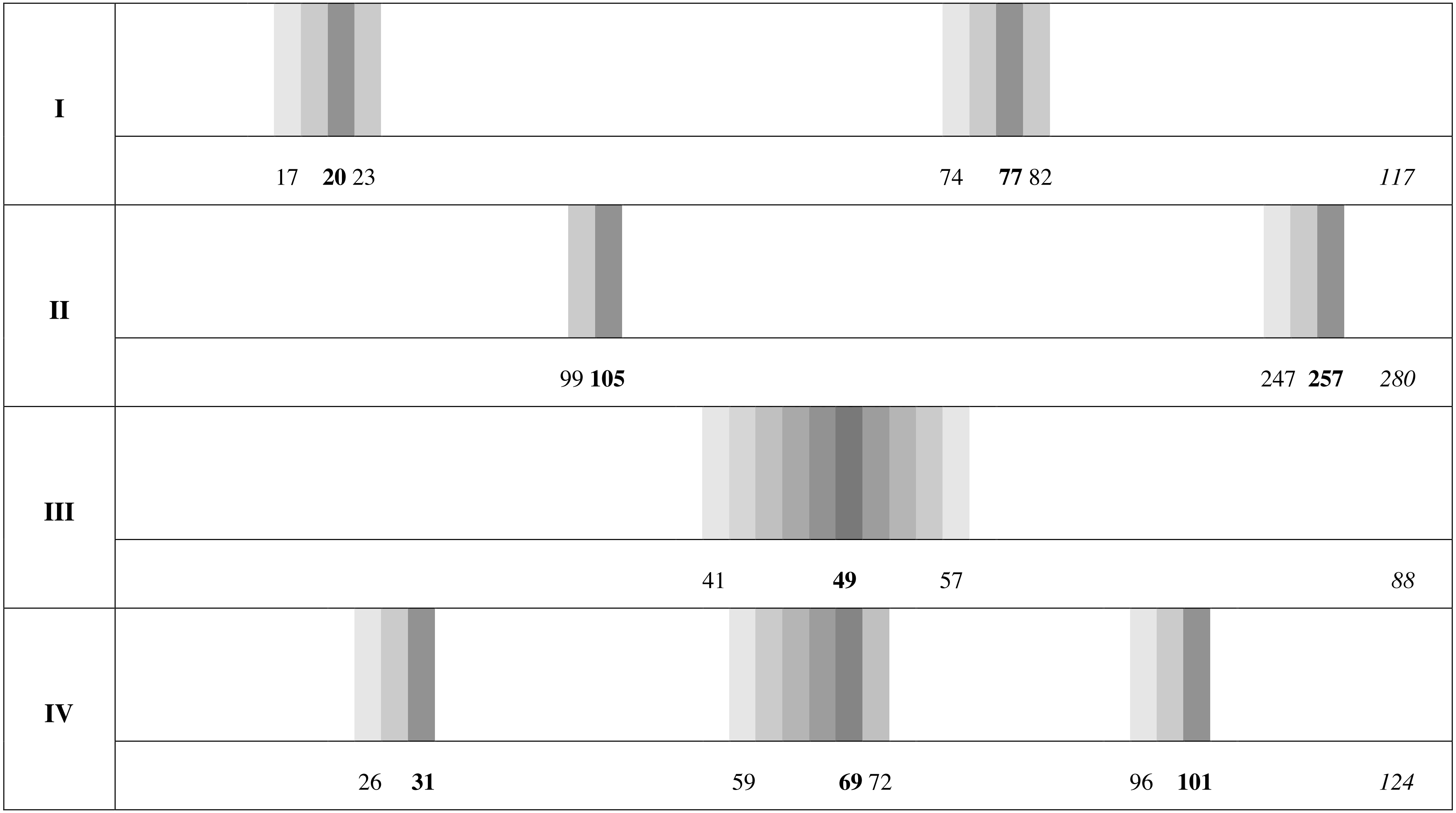




Legend:

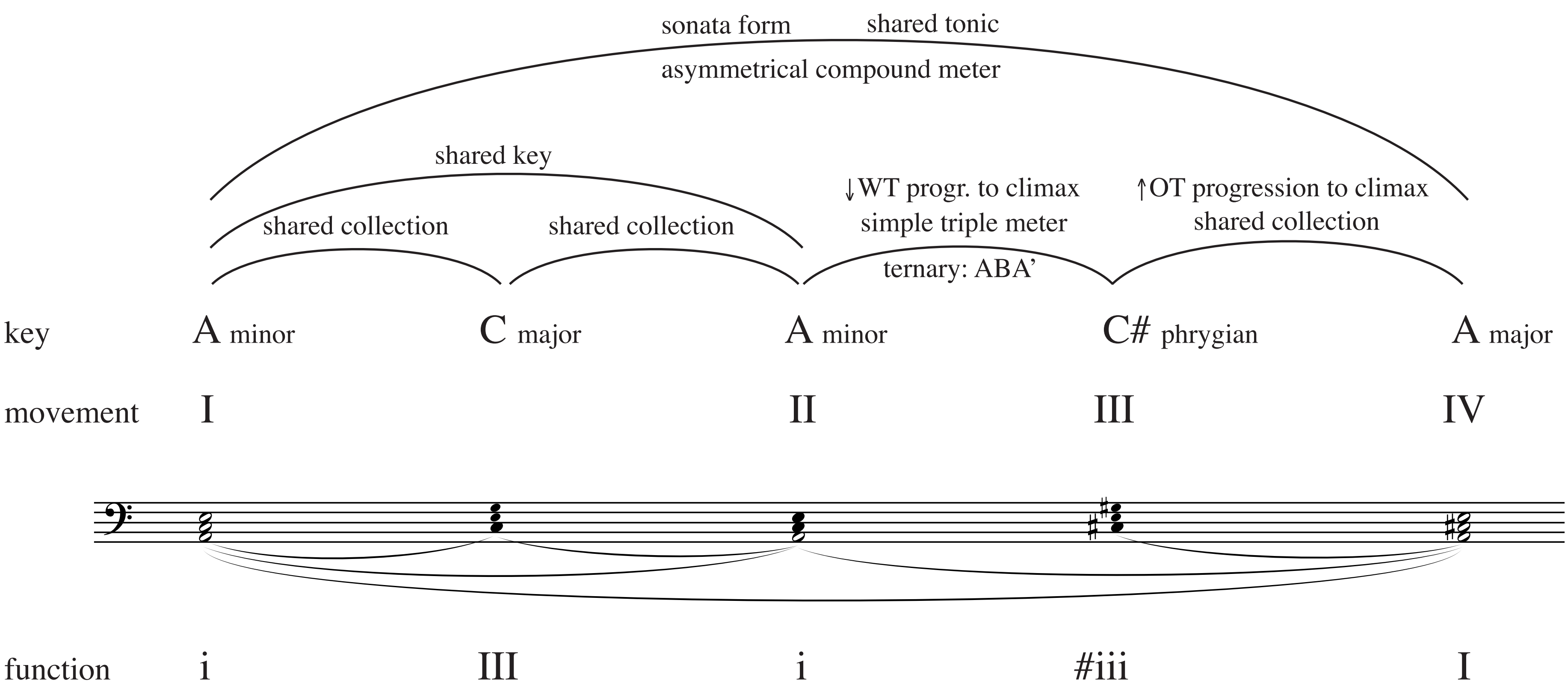
PM	principal motive
PM^S	principal motive, shortened by one pitch
PM^X	principal motive, extended by one pitch
p	three-note descending motivic segment of PM^X
PM^r	principal motive in retrograde
PM^i	principal motive inverted (w/o pitches 4 and 5)
DM	dominant motive, scs-i motive [-3, +1]
LN	lower-neighbor segment
UN	upper-neighbor segment

Example 5.36 Ravel, Piano Trio: Comparison of climax placements



Example 5.37 Ravel, Piano Trio: Comparison of climax preparations

Example 5.38 Ravel, Piano Trio: Tonal plan and shared features among movements



Example 6.1 Comparison of descending whole-tone progressions