A Generative Tool for Schenkerian-Caplinian Form Analysis:

Analysis of Beethoven's Op. 7, mvt.i

ABSTRACT

Since the early 20th century, Schenkerian analysis has emphasized the hierarchical organization of musical compositions. Although Schenkerian analysis predates generative theories in music and linguistics, advancements in these fields offer new ways to clarify relationships between layers by identifying long-distance dependencies. This paper bridges music theory and generative grammar, focusing on the hierarchical structures in Beethoven's Op. 7, Mvt. I. Three analytical approaches are combined into a novel method using binary trees and bracket analysis, based on the "Bare Structure" concept from minimalist linguistics. The analysis begins with Caplinian form theory, mapping hierarchical formal units using bracket structures. Schenkerian principles are then applied to reveal contrapuntal layers. Finally, generative grammar concepts—specifier, adjunct, and complement—are adapted to distinguish compulsory and optional elements in the composition's reduction process. This interdisciplinary method has several implications. It illustrates hierarchical formal units in Caplinian theory and provides a tool for analyzing contrapuntal layers with long-distance dependencies in Schenkerian analysis. Moreover, bracket analysis addresses issues in studies like Lerdahl and Jackendoff's Generative Theory of Tonal Music and minimalist approaches by Pesetsky, Katz, and Mukherji, offering a consistent way to represent musical phrases through binary operations. By combining these approaches, this study advances the integration of music theory and generative grammar.

LIST OF FIGURES

Figure 1 : Sonata Form (General Organization)

Figure 2 : Op.7, mvt.i (General Organization)

Figure 3 : General Organization of Exposition in Op.7, mvt.i

Figure 4 : Hierarchical Organization of Exposition in Op.7, mvt.i

Figure 5 : Merge 1 (First two chords in thematic introduction)

Figure 6 : Merge 1 and the string of the third chord (First three chords in thematic introduction)

Figure 7 : Merge 1 and the string of the third and four chords (First Four chords in thematic introduction)

Figure 8 : Merge 2 (First five chords in thematic introduction)

Figure 9 : Merge 3 and 4 (Intro motive and thematic Introduction) Triangle

Figure 10 : Basic Idea and Statement of Response

Figure 11 : Fragmentation and Cadential Idea

Figure 12 : Continuation

Figure 13 : Presentation

Figure 14 : Verb Phrase Shell (VP Shell)

Figure 15 : Sentence

Figure 16 : Chords of the continuation=>cadential

Figure 17 : Continuation=>Cadential

Figure 18 : Merge (Sentence and Continuation=>Cadential)

Figure 19 : Main Theme

Figure 20 : The Main Theme, Op.7.mvt.i

Figure 21 : The Main Theme (Overall Representation)

Figure 22 : Realization

Figure 23 : Alignment (analytical notation and rhythmic notation)

Figure 24 : Middle ground with a Form Analysis

Figure 25 : Background

Figure 26 : Controlling the Middle ground

Figure 27 : Controlling the Pre-Background Analysis

Figure 28 : Controlling the Background Analysis

Figure 29 : X-Bar Representation

Figure 30 : Flat Representation

Figure 31 : X-Bar Projections

Figure 32 : Adjunct

Figure 33 : Specifier

Figure 34 : Specifier, Adjunct, and Complement

Figure 35 : Sentence Analysis (Verbal)

ABBREVIATIONS

P	**:**	Phrase
‘	**:**	Bar
IntM	**:**	Intro Motive
TI	**:**	Thematic Introduction
BI	**:**	Basic Idea
SoR	**:**	Statement of Response
Fr	**:**	Fragmentation
Cad	**:**	Cadential
C	**:**	Continuation
Pr	**:**	Presentation
PrP Shell	**:**	Presentation Phrase Shell
VP Shell	**:**	Verb Phrase Shell
S	**:**	Sentence
MT	**:**	Main Theme
N	**:**	Noun
D	**:**	Determiner
Adj	**:**	Adjective
P	**:**	Preposition

In this paper, I present an analytical method that combines elements of Caplinian form theory, Schenkerian analysis, and generative approaches in music, the latter inspired by the principles and parameters approach in linguistics. This method is applied to the main theme of Beethoven's Op. 7, Mvt. I, one of his early sonata works. The analysis follows a hierarchical approach to demonstrate how smaller units merge to form larger sections. Schenkerian graphs are used to reveal the contrapuntal design of these units. Using a bottom-up approach, smaller parts are merged into larger structures, following the "merge" operation central to the minimalist program in linguistics. Through the "bare structure" method, I propose a descriptive model for analyzing music, reflecting the mental processes of experienced listeners. Caplin's formal units, such as basic ideas, models, and continuations, are treated as lexical items within this framework. This method also integrates hierarchical relations from Schenkerian analysis, employing graphs to control the transition from foreground to background layers. To enhance the analysis, I extend functions such as specifier, complement, and adjunct, along with relational terms like mother, sister, and daughter, to develop a computational model for reduction processes. Figure 1 illustrates the hierarchical structure of the sonata form. At the base of the branches, the syntactic order of sections is presented from left to right, while the vertical binary branches represent their hierarchical relationships. The exposition is the superior section, as it introduces the primary materials in the home key, establishing stability. The recapitulation dominates the development section, resolving its harmonic progressions, and it also governs the coda, which extends and concludes in the home key.

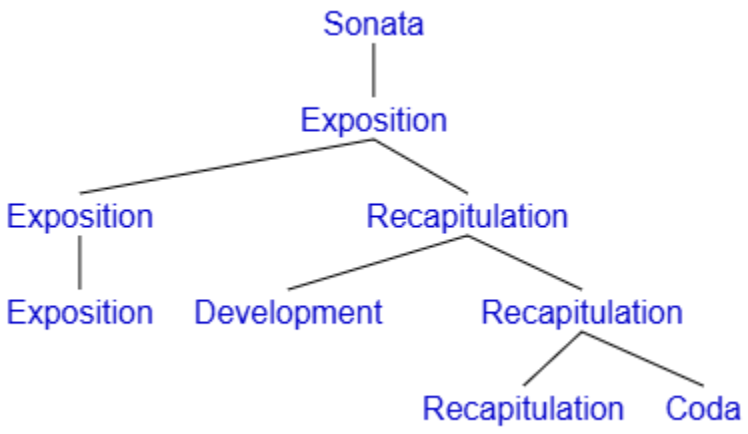


Figure 1 Sonata Form (General Organization.)

In the general outline of the sonata form, Figure 2 illustrates the main sections of Beethoven's Op. 7, Mvt. I, with measure numbers and tonal regions. The Exposition spans mm. 1–136 and encompasses three tonal

areas with four key changes. It begins in the home key of E♭ major, transitions to the dominant key (B♭ major) in m. 29, and remains there for 50 measures. Between mm. 79–90, it briefly shifts to the submediant (C major) before returning to B♭ major, which leads directly into the Development.

The Development section, between mm. 137–188, is relatively short and features three tonal regions. Most notably, it begins unconventionally with the dominant of the submediant minor (C minor), lasting 23 measures (mm. 137–160). After a brief passage in the mediant major (G major) from mm. 160–167, the section concludes in the raised subdominant minor (A♭ minor) between mm. 167–187.

The Recapitulation occurs from mm. 189–270 and consists of two tonal regions with three key changes. It begins in E♭ major (home key), continuing from mm. 187–261, and includes a brief interruption in the supertonic major (F major) between mm. 261–270. From m. 261 onward, the tonal structure stabilizes, prolonging the home key harmonies through the Coda, which spans mm. 312–361.

This structure reflects the traditional organization of a sonata form. Following this outline, I will now focus on the subsidiary regions within the Exposition.

SECTIONS	MEASURES	TONAL REGIONS	
		LOCAL REGIONS	MEASURES
EXPOSITION	1-136	I (major)	01 - 29
		V (major)	29 - 79
		VI (major)	79 - 90
		V (major)	90 - 137
DEVELOPMENT	137-188	VI (minor)	137 - 160
		III (major)	160 - 167
		#IV (minor)	167 - 187
RECAPITULATION	189-312	I (major)	187 - 261
		II (major)	261 - 270
		I (major)	270 - 312
CODA	312-361	I (major)	312 - 361
Home Key: Eb (major)			

Figure 2 Op.7, mvt.i (General Organization)

EXPOSITION

Figure 3 outlines the subsections of the exposition in Beethoven's Op. 7, Mvt. I, while Figure 4 presents a hierarchical representation of its syntactical structure. The main theme is the most superior unit, dominating the subordinate theme, while the transition connects and resolves harmonic structures between these themes. The harmonic framework transitions from the home key (I) to the local key (V) for the subordinate themes.

The exposition opens with the main theme, lasting 17 measures, which merges with a two-part transition. The first part of the transition begins at m. 17, modulating from I to V, leading into the second part, spanning 18 measures. This second transitional part overlaps with the first subordinate theme, creating a seamless fusion. The second subordinate theme emerges with a brief modulation from V to VI, concluding the exposition in V major by m. 136.

The following sections delve deeper into the main theme, establishing the hierarchical and harmonic organization of the exposition.

Main Theme

In a composition, harmonic and melodic progressions in time demand careful attention to their structural function. When an experienced listener hears the first prolonged chord with rhythmic motives, they may attempt to categorize it. According to Caplin, the opening may consist of a "basic idea," a short thematic introduction, or even "before the beginning" material. The opening chord of Op. 7, Mvt. I—E♭ major in root position with soprano voice "G4"—does not immediately clarify its function. Figure 5a represents this initial chord in a binary tree structure. The subsequent chord, also E♭ major, shifts "G4" to the alto and introduces "E4" in the soprano, as illustrated in Figure 5b. These two chords merge to form a new phrase, as shown in Figure 5c.This "merge" operation reflects a core principle of the minimalist program, where smaller components combine to form larger units. The second chord dominates the first due to the tension-resolution principle: the first chord acts as an adjunct to the second. This relationship is visually represented

in the tree as the first chord being "sister" to the bar-level node of the second chord.

In this hierarchy, the second chord is essential, while the first chord can be considered redundant and omitted in a reductive analysis. This structural representation highlights the hierarchical and syntactical relationships underpinning the main theme's opening gestures.in a reduction process.

SECTIONS		MEASURES	TONAL REGIONS
MAIN THEME		1-17	I (major)
TRANSITIONS	Part I	17-41	I (major) and V (major)
	Part II	41-59	V (major)
SUBORDINATE THEMES	Theme I	41-59	V (major)
	Theme II	59-136	V (major) and VI (major)

Figure 3 General Organization of Exposition in Op.7, mvt.i

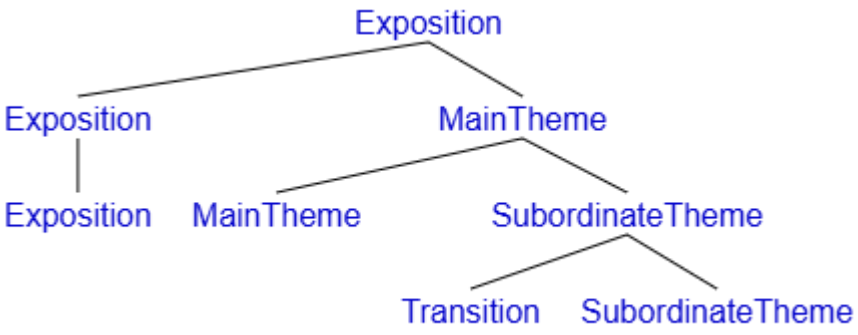


Figure 4 Hierarchical Organization of Exposition in Op.7, mvt.i

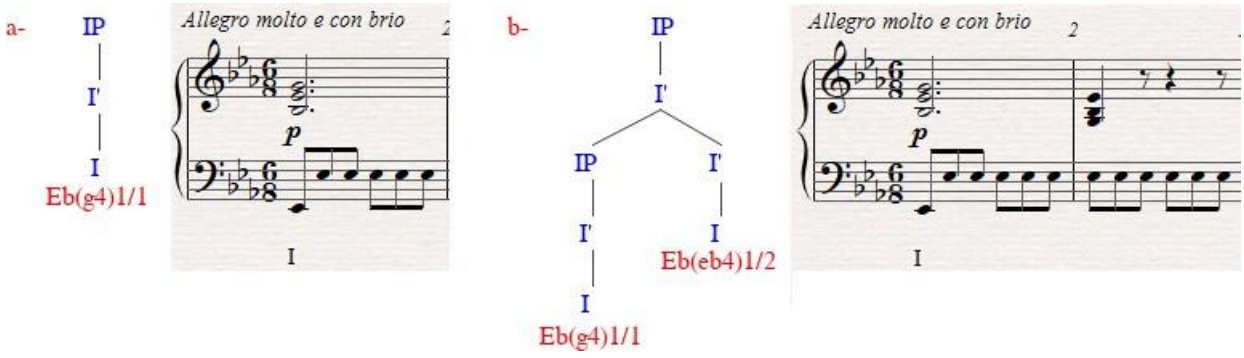


Figure 5 Merge 1 (First two chords in thematic introduction)

All the process comes into play in 1.894 second, and listeners might hesitate to decide if the continuum represents a basic idea, a thematic introduction, or a slow movement.

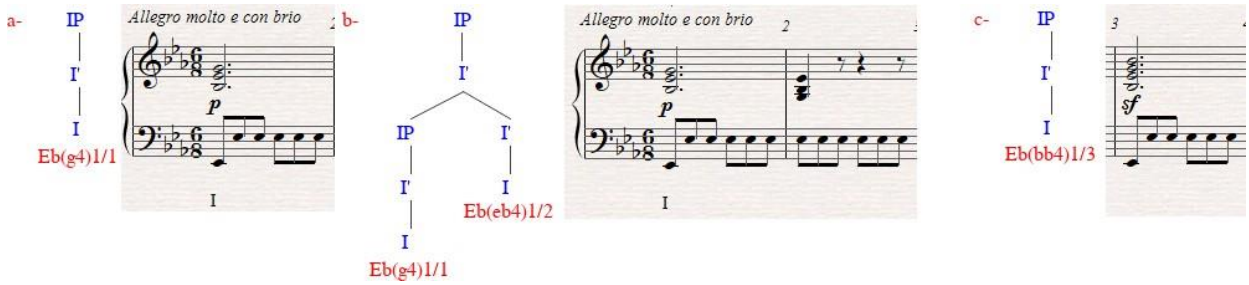


Figure 6 Merge 1 and string of the third chord (First three chords in thematic introduction)

The second chord, then, appears in the continuum, the fig.6b is the whole phrase that has been generated so far, and the fig.6c represents the third chord.

As it is seen, the chord represented in fig.6c is not bound by the preceding chord that is more stable than the third chord, and this fact doesn't give a license for "I" in mm. 2 dominates the "I" in mm.3. This is because tension – resolution principle that human mind expects that the unstable chords are supposed to be bound by stable chords. This last principle brings about one of the most important features of the musical harmonies that the relations between the harmonies are always "head final" over the musical continuum. "Head final" is an extension of a language phenomenon that determines the most dominant variable a syntactical order comes at the end of an order.

In terms of the decision process, this point might start to give a thought that the basic idea and slow movement might be eliminated in options, since these two thematic units demand a motive of a basic idea, however, repetitive nature of the motive on the tonic chord implies being a thematic introduction that the next two chords might ensure this argument.

For convenience following the present analysis, I duplicate the preceding figure with an addition of the fourth chord (fig.7d.) The fourth chord in fig.7c is less stable than the preceding chord, thus it is also supposed to be bound by a more stable chord at the left side in order.

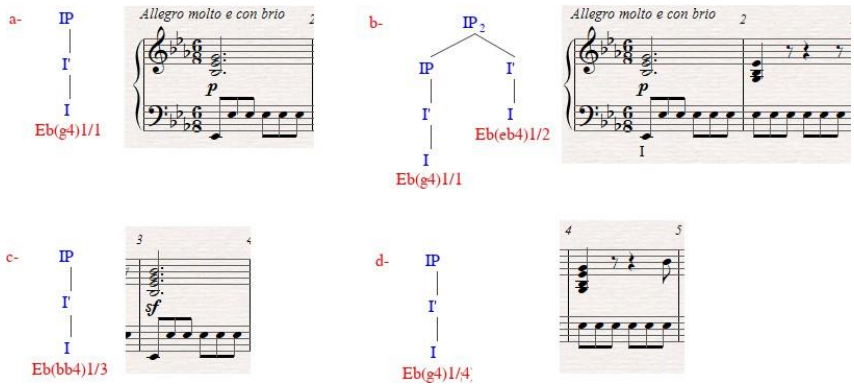


Figure 7 Merge 1 and the string of the third and four chords (First four chords in thematic introduction)

Finally, fig.8e represents the whole representation of the present unit. The stronger chord up to this point (fig8.d) binds all constituents represented in fig.8a, fig.8b, fig.8c, and these constituents are adjuncts of the "I" chord in the mm.5. The fig.8d further illustrates each constituent that is represented with three adjunct relations in the string of the "I" chord in mm.5. Accordingly, the first node is the phrase level represents maximal projection; and if the second node (first bar node) takes a binary branch as a sister, this branch is called a specifier. In this unit, there is not a specifier relation due to both all tonic and dominant chords, and predominant chords lead to a dominant are specifier with each other. The third node (second bar node) takes the first adjunct that is the "I" chord in mm.2 (fig.8a.) The fourth node (third bar node) is the second adjunct that is the "I" chord in mm.3 (fig.8b,) and the fifth node (fourth bar node) is the third adjunct that is the "I" chord in mm.4 (fig.8c.) The last node is the head level, and if it has a binary branch, it is called as complement of local or global maximal projections. There is not a complement relation in this unit, because the passing and neighboring chords to the head chord take this function that doesn't exist in the thematic introduction.

At this point, there are two operations more. The phrase in fig.9a is merged with a superior concept "intro motive (fig.9b ;)" the former is the specifier phrase of the latter; finally, this whole phrase turns to be the specifier of the maximal projection that the latter is the "thematic introduction" (fig.9c.) This operation is

illustrated in fig.9.

If I return to the subject how a listener constructs a semiotic process, in short, there were three options – basic idea, thematic introduction, slow movement- over the first 4 measures; the lexical items in the musical continuum (melodic-motivic content) narrowed down the related categories that bring the section to a thematic introduction.

As the last word for "X-Bar" notation (I use "X-Bar" and "bare structure method" interchangeably) and "thematic introduction," a triangle facilitates managing the magnitude of trees in a whole representation of larger sections. All branches that interact under this unit (fig.9d) can be hidden in a triangle (fig.9e.)

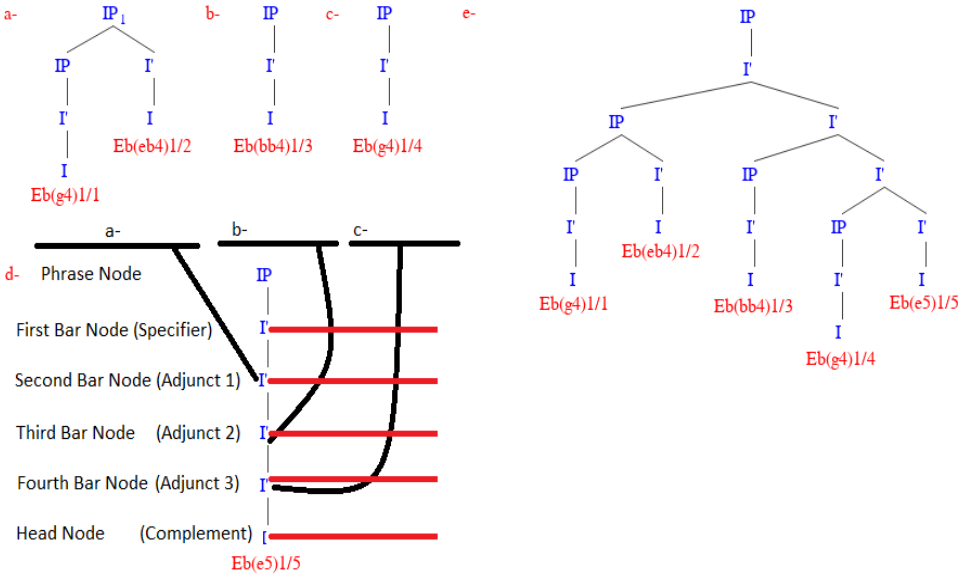


Figure 8 Merge 2 (First five chords in thematic introduction)

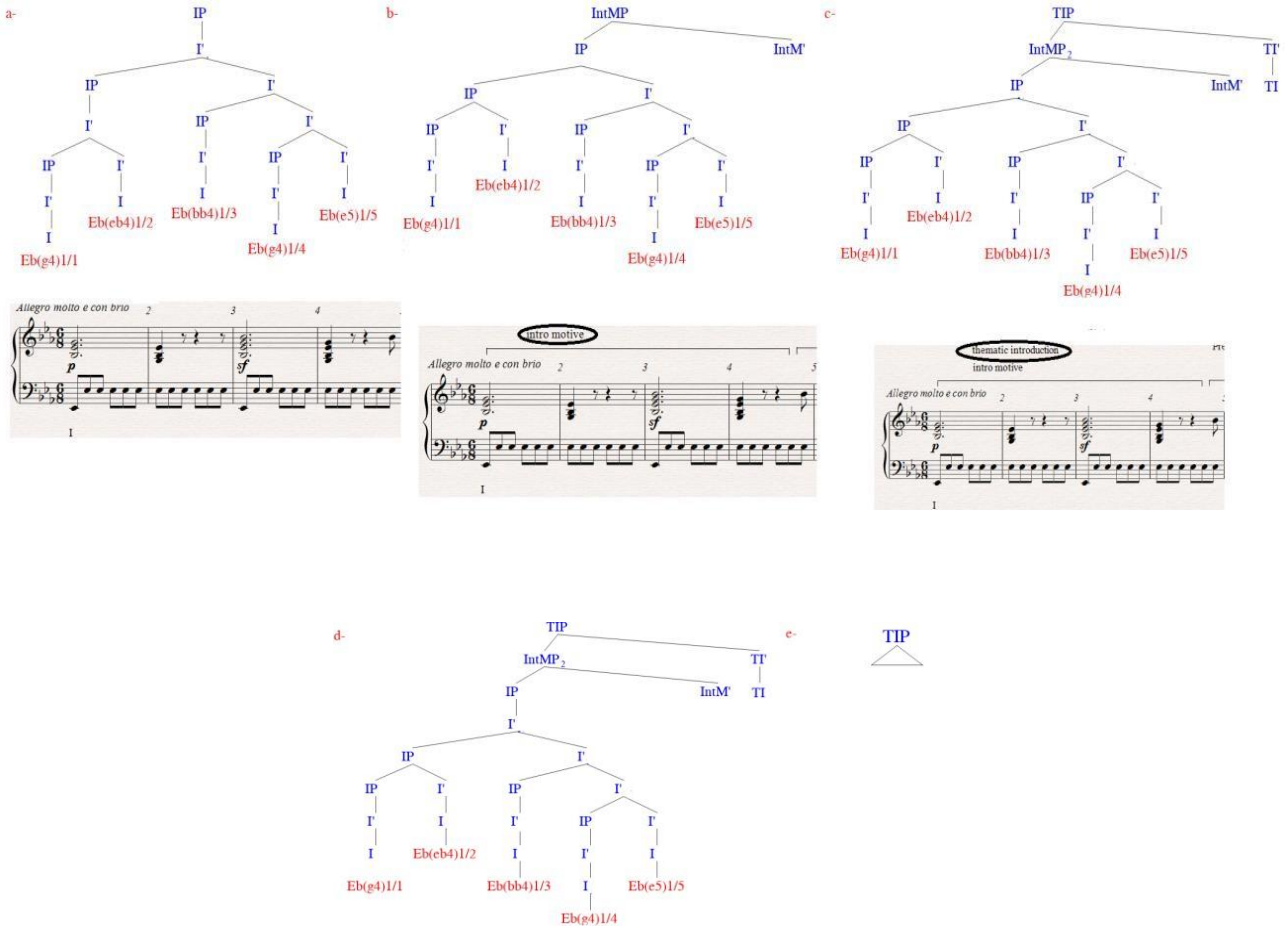


Figure 9 Merge 5 (Intro motive and thematic Introduction) and Triangle

Decision making process which was at work in the thematic introduction might partake in some different appearances in diverse larger units in a listening process. In m.5, three successive chords (I-VII^{6}-VI$^{6-4}$) with an 8th note motive brings the basic idea into the continuum of the piece, however, at this very moment, the listener might not decide on whether this is a sentence, period, compound or a hybrid theme. During this section, I will draw another scenario of how the lexical items of the piece might match to musical lexicon in the mind of a listener.

First, the "I" chord (fig.10a) which closes the preceding unit opens the new section though this chord dominates constituents in rather thematic section than the new unit. A "VII^{6}" as a passing chord (fig.10b) leads to the "VI7" chord (fig.10c.) Even if the latter might be interpreted as an I^{6}, a descending line from mm.6 to mm.6 (e5-d5-c5-) makes this interpretation reasonable. This chord series forms the basic idea as

the maximal projection at this point. Thus, the “IP” specifies this relation as the specifier position of the “Basic Idea Phrase” (BIP,) “VI7” is the complement of the same phrase, and “VII6” is the complement of the “VIIP” as a passing chord from specifier to the complement of position of “IP.”

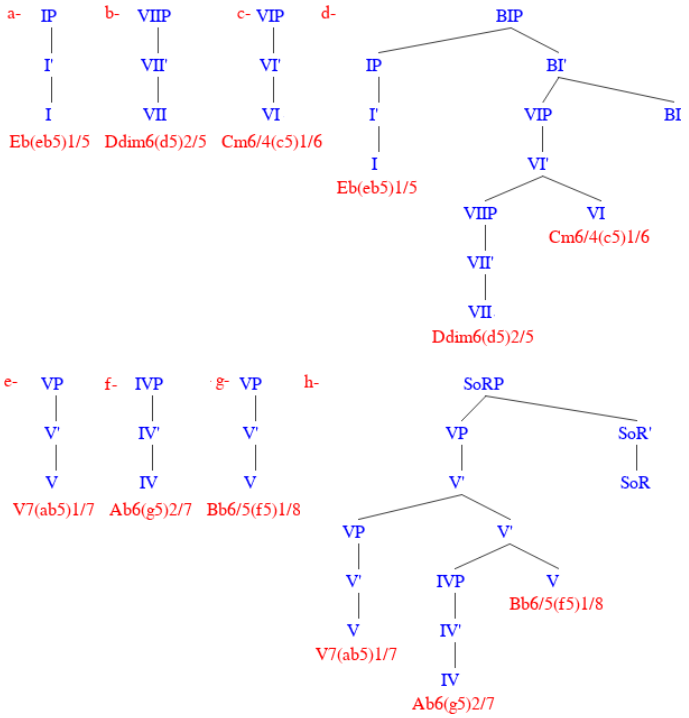


Figure 10 Basic Idea and Statement of Response

Having decided on the basic idea, a “V^{7}” forges the first notes of the “Statement of Response,” two options that the phrase might be an exact repetition or a statement of response, immediately fall into one by way of the distinct sonority of the dominant chord in mm.7 (fig.10e). Then, a “IV^{6}” chord (fig.10f) smoothly gives rise in “$Bb^{6\text{-}5}$” (fig.10g) that the latter indicates the region of the statement of response area. The fig.10h illustrates the relationships between these chords under the local maximal projection of the statement of response. Accordingly, the last chord “VP” in mm.8 specifies the unit with a complement, “IVP” in mm.7. The “V7” chord in the first beat of the mm.7 is a specifier of the statement

of response. All these harmonies perfectly answer the need of being a basic idea and statement of response though a listener might not decide on that if this is a presentation, antecedent, or compound basic idea that it requires listener to look forward to listening what features of following harmonic structures would be about, and deciding on retrospectively what unit specified the area where basic idea and statement of response take place.

In order to classify the rhythmic and motivic content into one of the aforementioned sections, musical continuum from mm.9 to mm.17 presents required musical lexical items operate a music semantic process. The mm.9 begins with the beginning of the basic idea in the preceding section with a "I" chord, that, at the first glance, seems to be an opening of a consequent phrase in a period. However, the "db" tonicization right after the third repetition of the eight note motive of the basic idea brings about a fragmentation unit. This melodic motive represented with a "I-VII^{6}-I$^{4-3}$" chord progression, due to tension-resolution principles, the second chord (fig.11b) leads to the third chord and the first chord (fig.11a) turns to be an adjunct statement of the third chord which is represented in the fig.11c. Finally, this motivic content is dominated by a fragmentation phrase (fig.11d.)

This motivic design of the composition strongly implies a "continuation" section that needs to have a tonic closure in the piece. The idea is then supported by a cadential progression with a brief "pre- dominant expansion" that is provided by a borrowing (mixture) dominant chord (V$^{6-3}$/IV.) This structural motive, the first string of the fig.11g, needs to have a particular consideration in tree representation. The chords that are out of the scope in a diatonic chord progression (I-ii-iii-IV-V-vi-vii^{0}-I) are always merged with head chords with an adjunct relation. The adjunct constituents by this point are represented as the repetitive chords in a context of diatonic chord series, in this sense, the modal mixture chord, V$^{6-3}$/IV, has the same relation though with a different function. While V$^{6-3}$/IV is dominated by its arrival chord, IV, (fig.11g,) as the essential pre-dominant chord of the progression, it is bound by a chord which has a dominant function, (I$^{6-4}$.) Another point that is worth noting, the dominant chords which precede another dominant chord

with a "I^{6-4}" chord are always specifier of the arrival dominant chord due to fact that its relation with the tonic chord as one of its inversions. Accordingly, fig.11g illustrates this function, finally, the chord series which represented so far, first of all, arrives to the essential dominant chord "V^7" as the specifier of the final destination, "I" chord in the beginning of the mm.13. All this progression from the second half of the mm.10 to beginning of the mm.13 brings about a superior meaning that is the cadential phrase (fig11.j.)

There are two more operations at this point for completing the continuation that first cadential phrase turns to be the subsection of continuation as its complement and the fragmentation is bound as a specifier by this local maximal projection (fig.12.)

Since all requirements constituting a sentence unit come into play, the meaning of this unit has been already generated in the continuum. At this point, the semantic attribution of the first part has retrospectively been clear, as a presentation unit. As a first operation though, it requires us to determine what the thematic introduction's relation is with basic idea phrase, presentation phrase or sentence phrase. A thematic introduction is a "before the beginning" material that shares this category with the slow introduction. However, these two structures are part company; while the former takes place in a short term, the latter shows almost same features with the maximal sections of a sonata form. Caplin says that

> "A thematic introduction resides on a hierarchical level comparable to that of a basic idea, contrasting idea, etc. This short unit is normally supported by a tonic prolongation and generally has no melodic profile (see Chap. 5, p. 133). Conversely, a slow introduction resides on a level comparable to that of an exposition, development, recapitulation, and coda, and it normally consists of one or more thematic units. (Caplin, 2013, p.552)

In as much as a thematic introduction is much like a basic idea, contrasting idea etc., it should be subsumed under subsections of a sentence, a period, and hybrid or compound themes. In the case of Op.7, mvt. i, the thematic introduction is dominated by the presentation phrase that fig. 13 illustrates.

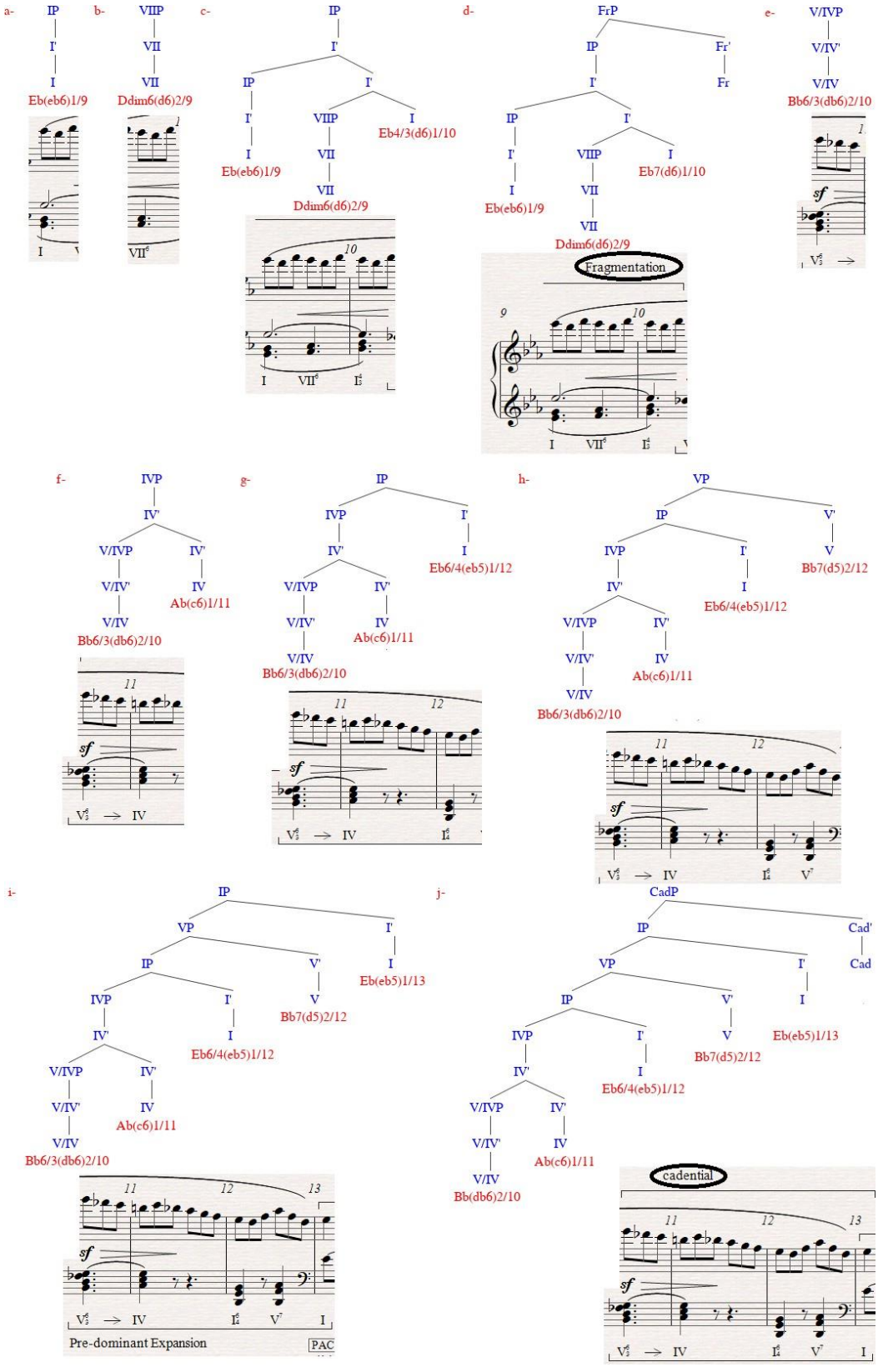


Figure 11 Fragmentation and Cadential Idea

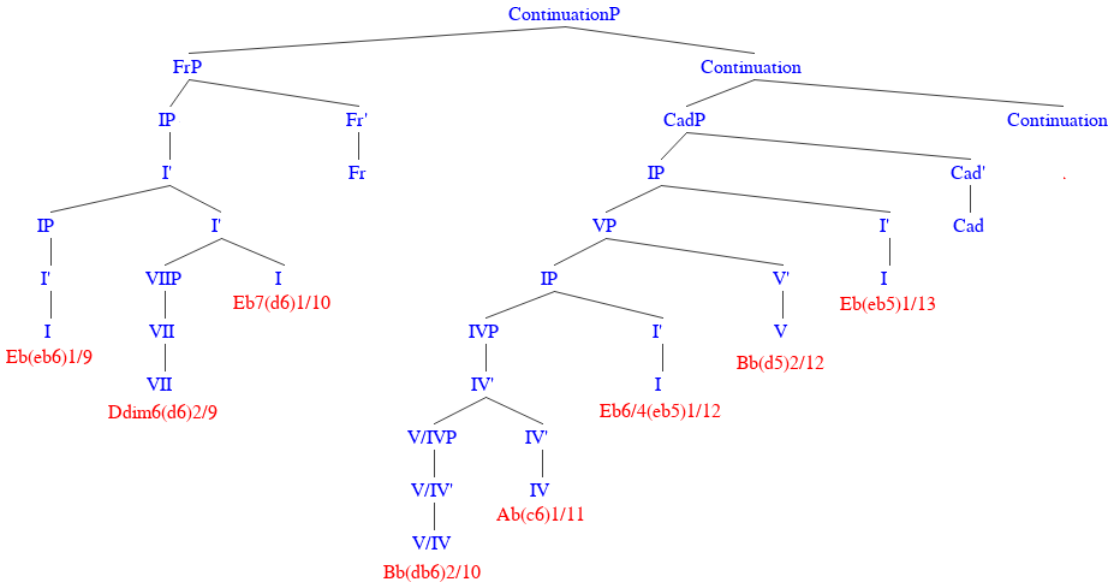


Figure 12 Continuation

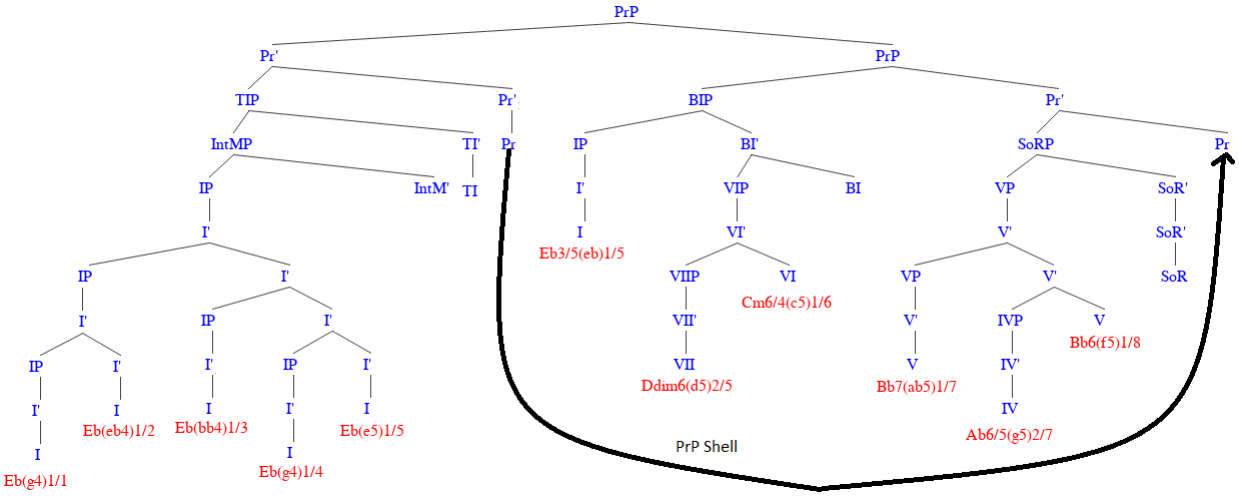


Figure 13 Presentation

When we look at the fig.13, the presentation phrase (PrP) as the maximal projection of representation dominates the Thematic Introduction (TIP) as the adjunct of the PrP since whole harmonic structure is a repetition of “I” chord. At this point, we encounter with a phenomenon in “before the beginning” units which might be called as (PrP Shell.) Before explaining how these structures come into play in musical statements, it requires to refer to original deployment of this unit in language structures.

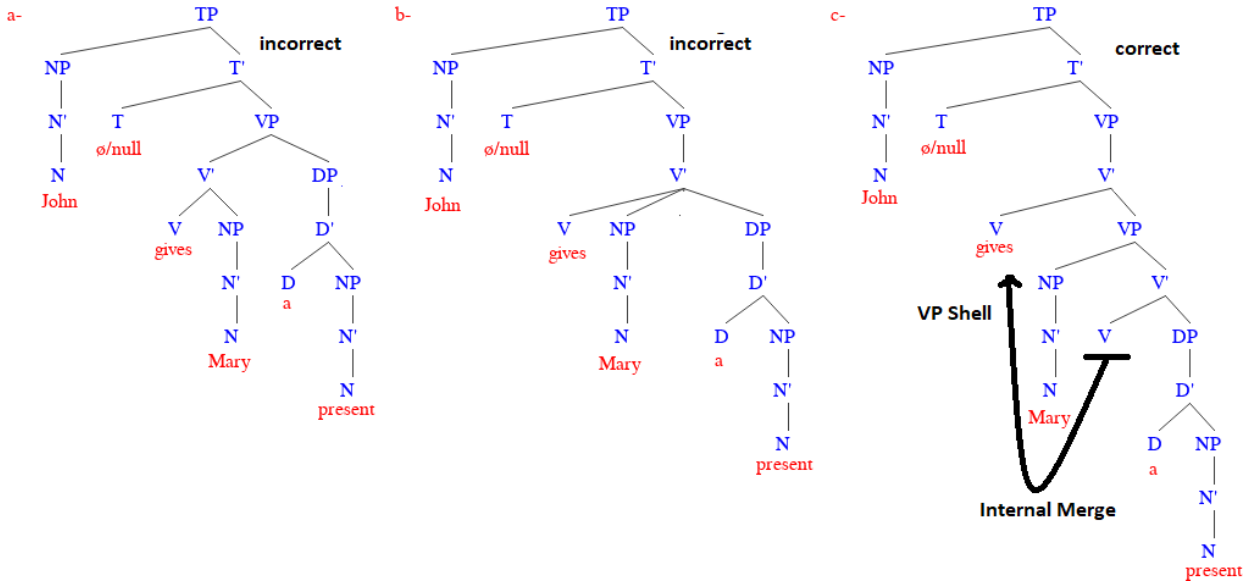


Figure 14 Verb Phrase Shell (VP Shell)

When we examine the sentence, "John gives Mary a present," the "VP" "give" takes two complements in the sentence that are "Mary" and "a present." Thus, sentence turns to be "John gives Mary, John gives a present." Because of another phenomenon which is called as "economy" in minimalist program, the last "VP" is not repeated before the "DP" "a present", in turn, this constituent is also dominated by the first "VP." Fig.14 illustrates three representations of this sentence in X-Bar theory.

In the first representation (fig.14a,) a "noun phrase" (NP) is the specifier of the "time phrase" (TP) – present simple tense- and verb phrase is the complement of the "TP." At this point, the first complement of the "VP" an "NP" "Mary" appears in the statement. Indeed, when we have closer look at the figure, this "NP" is bound by "VP" as a complement as the sister of the head node in "VP." The problem arose in the "DP" variable. Despite a complement, "DP" "a present" bound by "VP" as a specifier statement as is the neighboring node of the first bar node in the VP. Even if this is linearly a perfect representation in syntax, in terms of relations and hierarchies between the word categories, it turns out to be an incorrect analysis.

In fig.14b, NP is the specifier of TP and VP is a complement in TP. The tree represents a correct analysis up to this point, furthermore, NP "Mary" and "DP" "a present" are bound by VP complements; however, these

two variables are deployed in the same level that violate one of the principles in minimalist program that all constituents should be represented in binary branches, in contrast to this descriptive fact, this point illustrates a ternary structure in tree. Therefore, fig.14b is an incorrect analysis.

Fig.14c illustrates a correct analysis. NP is the specifier of the TP, and VP is the complement of the latter. At this point, another "VP" is bound by the first "VP" as a complement, and the "NP" "Mary" is attached to the first bar level of the latter as a specifier. Finally, "DP" is the complement in the second "VP." The second statement is a redundancy, and it accompanies with the first "VP" that the former moves back, and its branch turns to be a "null" statement. The last phenomenon is called as an "internal merge," and process is called as "VP shell." All operation by this point in preceding figures represent "external merge;" in this representation, the second VP moves back, and whenever there is a transformation in inner structures in statements, this operation is an instance of an "internal merge." It is worth noting that whether "VP Shell Hypothesis" is an internal operation in human mind, or is it a prerequisite to draw appropriate trees might be an excellent research question in terms of music and language relationships due to fact that the fig.13 raises the same question when the "TIP" is bound by "PrP" as an adjunct, and the head of the "PrP" moves to the end of the statement because its meaning is generated in the end of the rhythmic-motivic contents. This representation might be another instance that an internal merge might at work in musical statement, and I call this transformation as "Presentation Phrase Shell" (PrP Shell.)

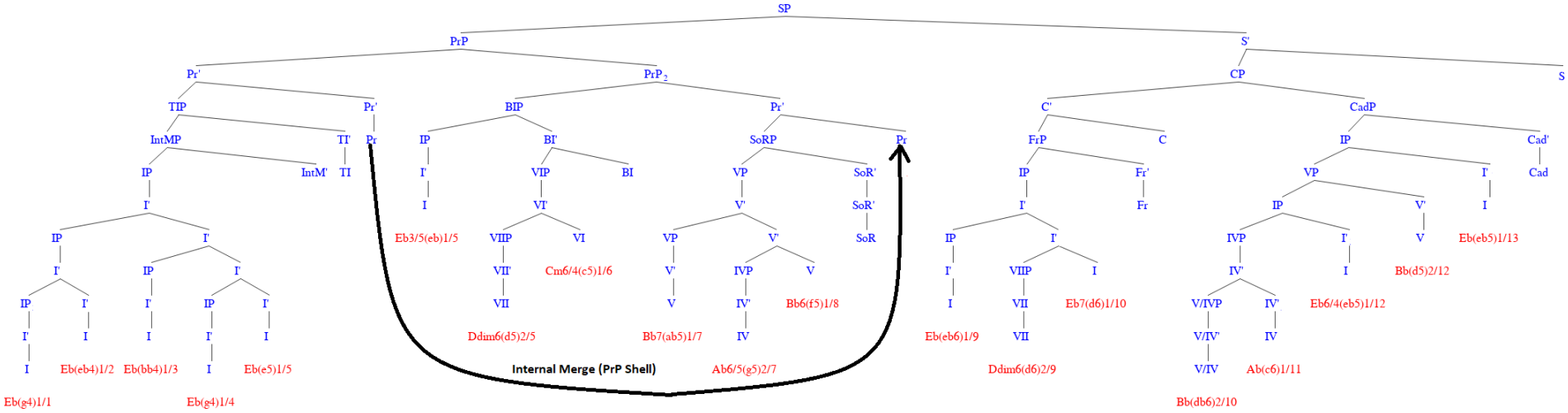


Figure 15 Sentence

Before completing this section, an extension of the present sentence phrase needs to have a particular consideration to represent this kind of structure in binary trees. By way of an elided cadence at the end of the mm.13, the same "I" chord specifies that a new section begins, at this very particular point, listener might have to decide on whether it is a beginning of a transition, an extension of the sentence phrase. At this point, the basic idea returns at the bass register, and accompaniment takes place at the upper parts, the first chord "I" (fig.16a) emphasizes on the "g5", and then a passing "IV^{6-4}" chord (fig.16b) leads to the next "I^{6-4}" chord, since the latter has a dominant, and the former has a pre-dominant function, "IV^{6-4}" is a complementary harmony of the "I^{6-4}" (fig.16c.) The latter chord is essentially an inversion of the tonic chord that is attested a dominant function though it is not the repetition of the next "V^7" chord but a suspension (9-8/4-3.) Thus, it is a specifier of the next "V^7" chord (fig.16d) due to all tonic harmonies are specifier of the dominant and vice versa. Finally, this last dominant chord turns to be a specifier of the closure of this section (fig.16e.)

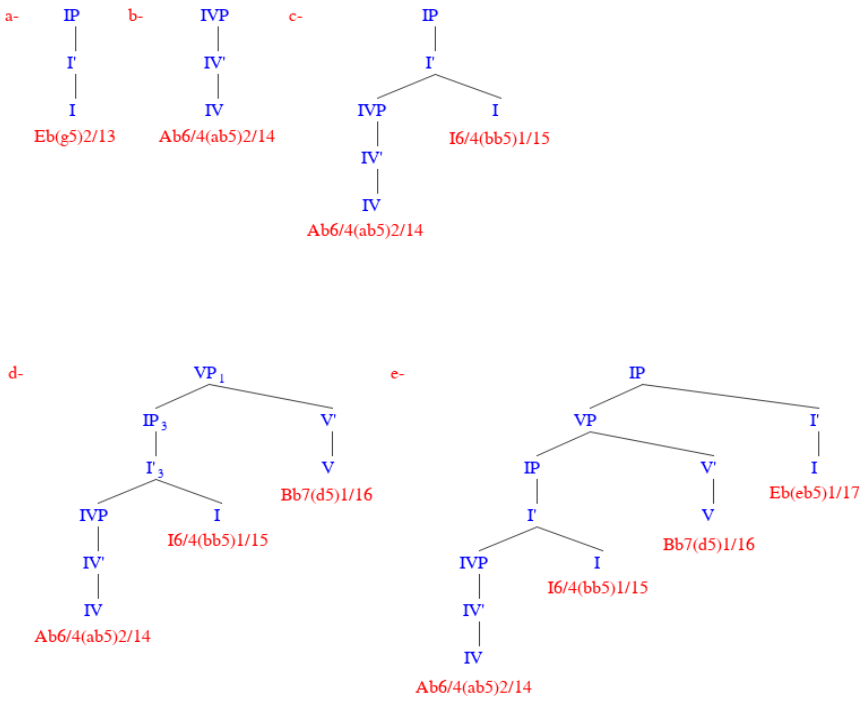


Figure 16 Chords of the continuation=>cadential

All progression signifies an expanded cadential progression (ECP,) therefore the continuation becomes cadential over this last section (fig.17.) While opening chord in mm.13 is the specifier of the section, "I" chord in mm.17, and the chords that are bound by this chord are the complement of the continuation=>cadential section.

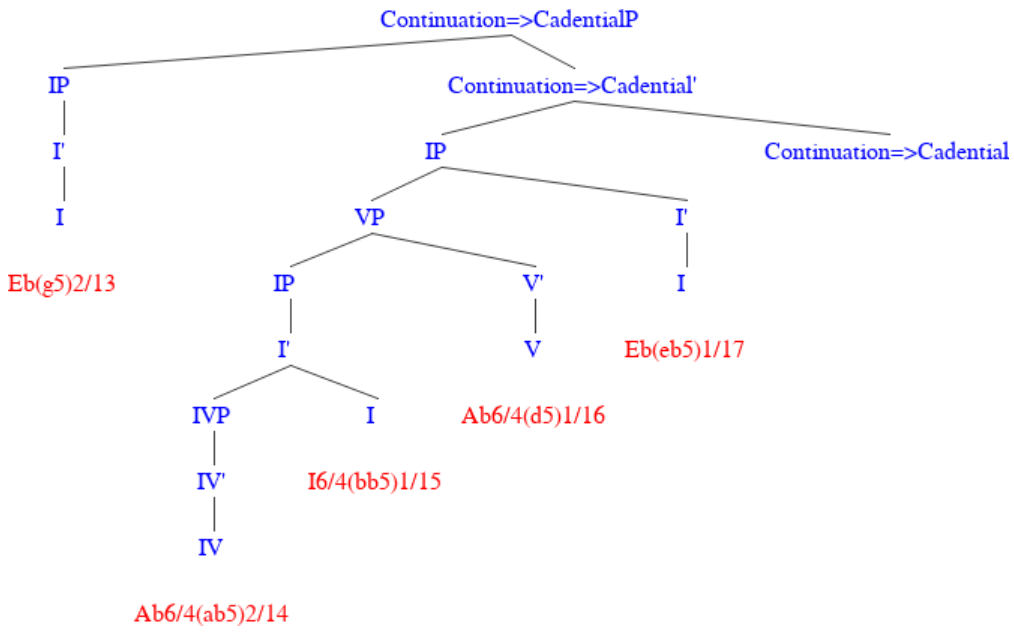


Figure 17 Continuation=>Cadential

Now, I will merge this last section with the overall picture; continuational=>cadential is essentially a cadential progression as a repetition of the preceding one. Since all repetitions are adjunct of the local maximal projections, overall representation in fig.17 is represented as an adjunct of the sentence phrase (fig.18.)

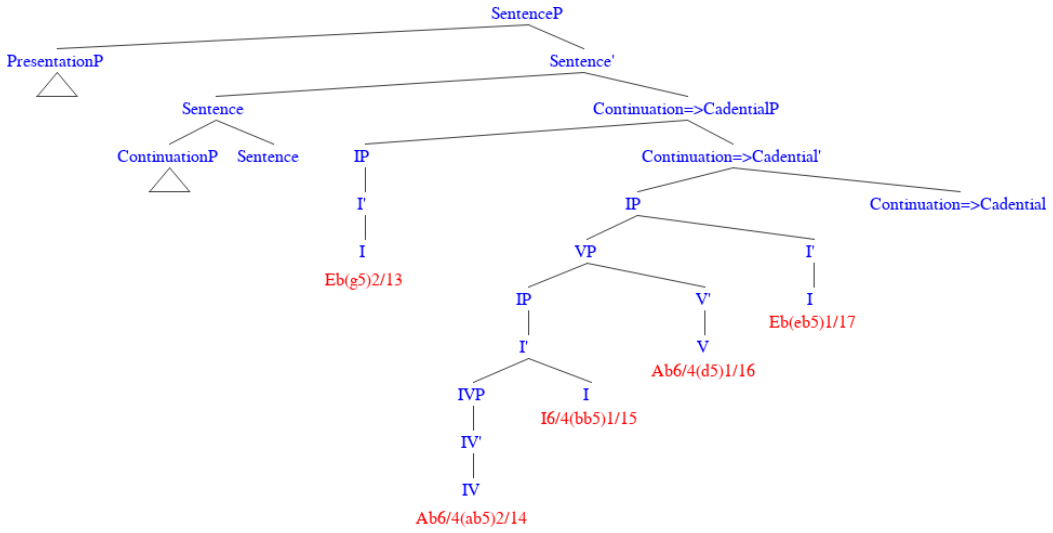


Figure 18 Merge (Sentence and Continuation=>Cadential)

From left to the right, there are two triangles that the first (fig.18) represents branches under the presentation phrase (fig.15) and second triangle (fig.18) denotes branches under the continuation phrase (fig.15.) Continuational=>cadential is the sister node of the second bar level of the sentence phrase at the left side, and it implies an adjunct function of the overall sentence statement.

Since all rhythmic-motivic contents have been completed, the sentence phrase generated by this point belongs to a higher category: main theme (mm.1-mm.17.) In fig.19, sentence phrase (mm.5-mm17) is the specifier of the main theme (MT;) while presentation phrase (mm.5-mm.8) is the specifier of the sentence phrase, continuation phrase (mm.9-mm.12) is the sister of the head node of the sentence phrases that implies of being a complement of the sentence phrase. Finally, continuational=>cadential section turns to be an adjunct of the sentence phrase as it is deployed next to the second bar level of the sentence phrase.

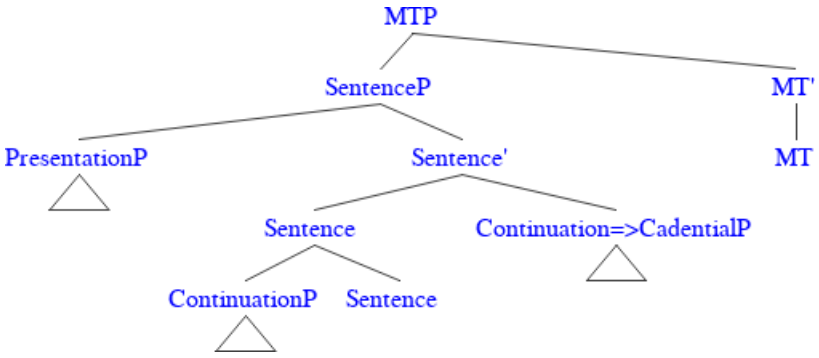


Figure 19 Main Theme

From this point on, I will apply this representation as a helping tool to analyze the main themes in Schenkerian graphs. As we will see, the functions which are specifier, adjunct, and complement, will be key concepts to indicate to interactions of the voice leading in representation of the middle and background analysis. Fig.20 is the score of the main theme in Op.7, mvt. I with a form analysis. Fig.21 represents the tree in the complete form that shows all interactions in the main theme from minimal units to larger sections in a hierarchical order.

Before applying the overall tree representation into Schenker graphs, I will outline the main theme in line with the fig.21. Chords, soprano voices and the place of the harmonies in measures are denoted in the realization of branches which are illustrated by red color (fig.22.)

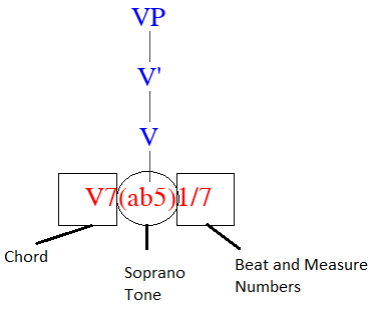


Figure 22 Realization

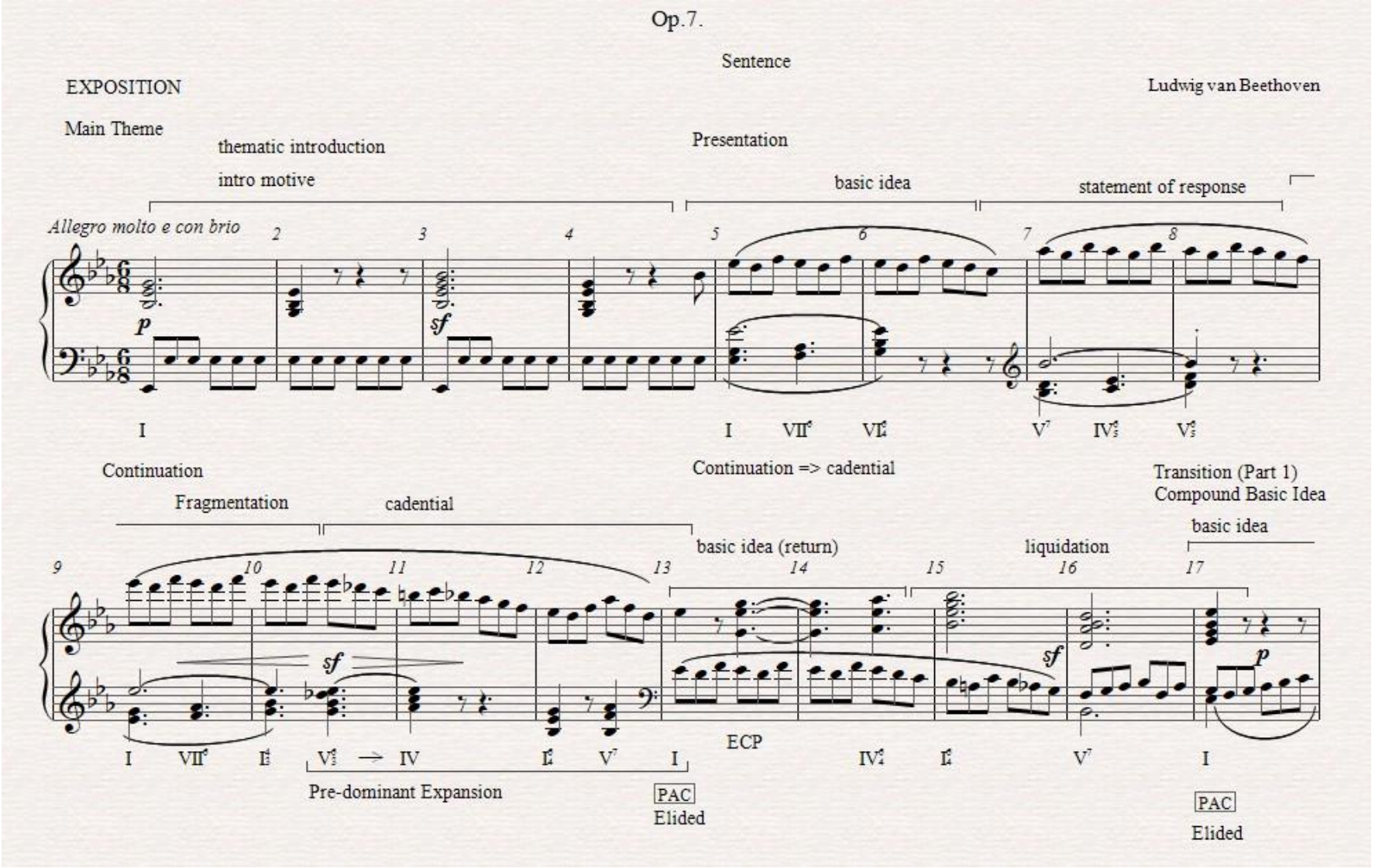


Figure 20 The Main Theme, Op.7.mvt.i

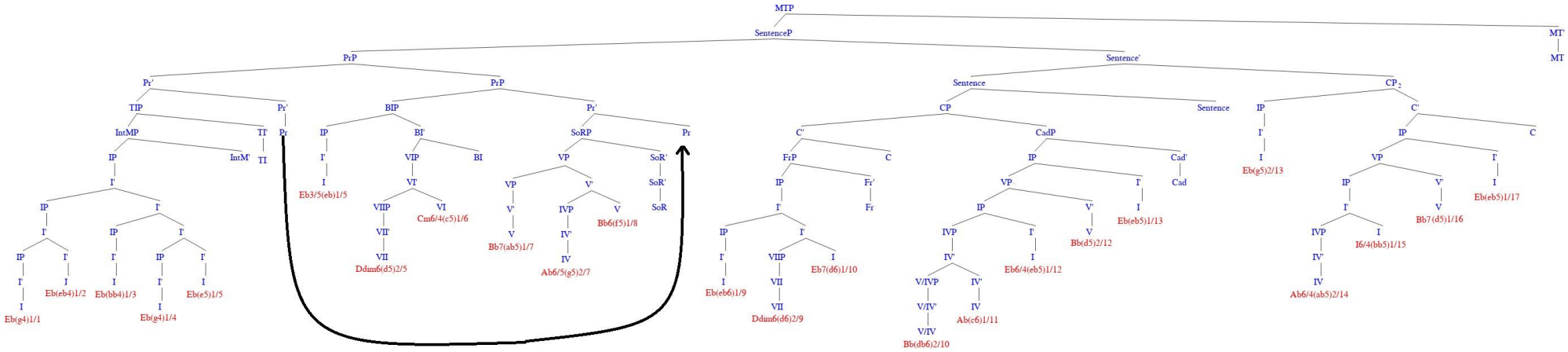


Figure 21 The Main Theme (Overall Representation)

The main theme consists of a specifier: a conventional theme type which is a “sentence phrase” (SP,) that usually includes one presentation and one continuation phrase; the latter is repeated between mm.13 and mm.17 in the case of Op.7, mvt.i.

The “presentation phrase” (PrP) begins with a “thematic introduction phrase” (TIP) (fig.21a) as an adjunct of the “PrP.” TIP includes “I” chord with changes in the soprano voices (g4-eb4-bb4-g4-e4,) second and fifth changes in the soprano voices indicate the curve of the tension-resolution pattern that the stable tone or chord is always dominating variable in the system. Since the repetition of the “I” chord in “TIP,” this unit is an adjunct part of the presentation section. A concept as extension of the “Verb Phrase Shell” (VP Shell) in linguistics is observed at this point of the analysis. Accordingly, a head final structure (PrP) binds the “TIP” as an adjunct, and moves to the end of the statement. This operation which is named as “internal merge” might be called as a “Presentation Phrase Shell” (PrP Shell.) Then, the essential unit of the “PrP,” having a basic idea phrase (BIP) appears in the continuum as the specifier of the “PrP”, a statement of response phrase enters into the system as the complement of the same unit. The “BIP” is supported with a local tonic prolongation, I-VII^{6}-VI^{6-4}, while the first chord is the specifier of the unit, VI^{6-4} is the complement in “BIP,” and the VII^{6} is the complement of the VI^{6-4} as a passing chord between I - VI^{6-4}.

The statement of response leads to the first “continuation phrase” (CP) as the complement in the “SP.” “CP” consists of a “fragment phrase” (FrP) and a “cadential phrase” (CadP.) Even if first two measures of the present unit (mm.9-mm.10) might be evaluated as the repetition of the basic idea, and whole section turns to be a consequent of an antecedent in a period, a tonicization with “db” in second beat in the mm.10 (2/10,) provides a harmonic acceleration with a V^{6-3}/IV pre-dominant chord as the beginning of the cadential phrase. While “FrP” is the specifier, “CadP” is the complement in the “CP.”

Finally, repetition of the continuation with an “ECP,” brings the closure of the sentence phrase into the

musical continuum. Unlike preceding form of the continuation, first chord is the specifier of the "CP," and IV^{6-4} is the complement of the I^{6-4}. While the last chord is the specifier of the V^7, it turns to be the specifier of the head chord of the main theme, "I" in mm.17. This closure indicates the boundary of the "main theme" as the maximal projection of the present analysis.

Analytical Notation in Schenkerian Analysis

In this part, the tree analysis will be aligned with the Schenker graphs; accordingly, the first step is to apply hierarchical structures in binary representation into the analytical notation. In this part, it is safe to present principles how to draw an analytical notation as refers to Allen Forte's "Introduction to Schenkerian Analysis."

> "The latter (analytical notation) concentrates on (but is not necessarily limited to) the outer voices, and starts with the symbols… stemless notehead, the stemmed filled note, and the slur. To these we add the beam for significant linear motions. Again, the more important notes (points of departure or resolution) are stemmed, and motions to or from these notes are indicated by slurs. Stemmed notes may themselves be beamed together, as appropriate In general and above all, there are no unattached notes, everything must be accounted for, whether by beam, slur, or tie." (Forte, 1982, p.136)

Forte, beside stemmed and stemless notes and slurs, introduces a new symbol, a diagonal line that aligns bass notes with a tone in the voice leading in one of the upper parts. Directions of the slurs depending on the departure and resolution are particularly important in terms of head final or head initial musical structures. In this paper, since tension-resolution principle in musical continuum demands that dissonances tend to be ended on a consonance tone in voice leading, relatively superior notes at the right-hand side will always be stemmed in the present analysis.

In Schenkerian analysis, slurs indicate the just preceding or following tones of voices that are marked on that point, and from foreground to background, stemless notes which are arrival or departure points of the music flow are eliminated depending on the fundamental line, above all this process is in order to find out what the Ursatz of the analyzed part of the piece. When we compare this process with the tree analysis, specifier, adjunct, and complement branches of the binary representation of the piece can show these layers. Furthermore, at each point of the analysis, the domination is not only indicated with the preceding or following notes but also illustrates what their relations in the overall context.

Another point, elementary harmonic analysis underlines analytical resolution of the I^{6-4} as a double appoggiatura resolves into the dominant harmony, while it is treated as a dominant chord in the present analysis, it is still classified as one of the essential inversions of the tonic chord, and thus it is treated in binary trees as a specifier of the “V” chord.

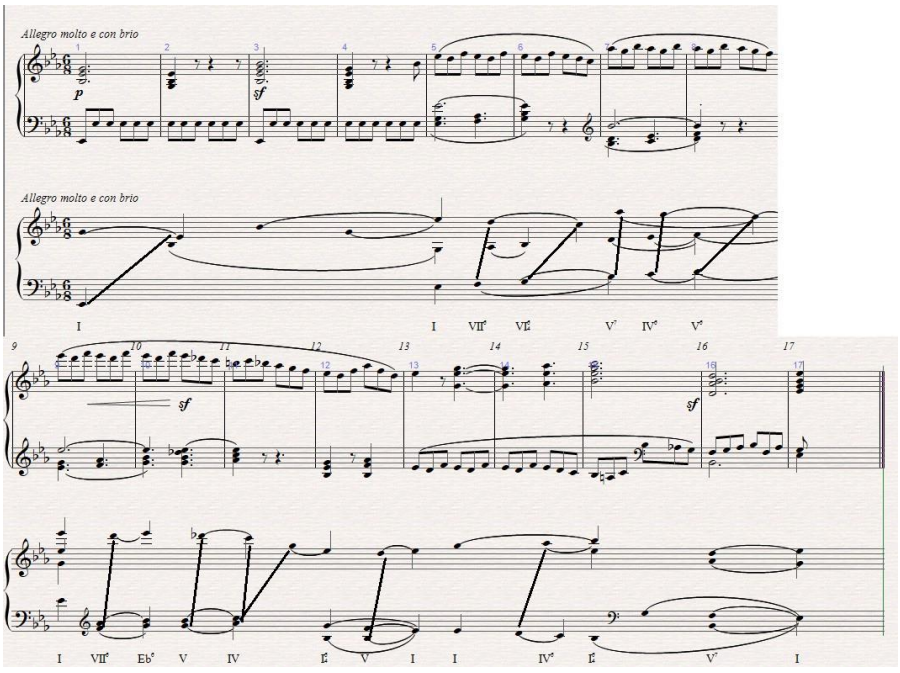


Figure 23 Alignment (analytical notation and rhythmic notation)

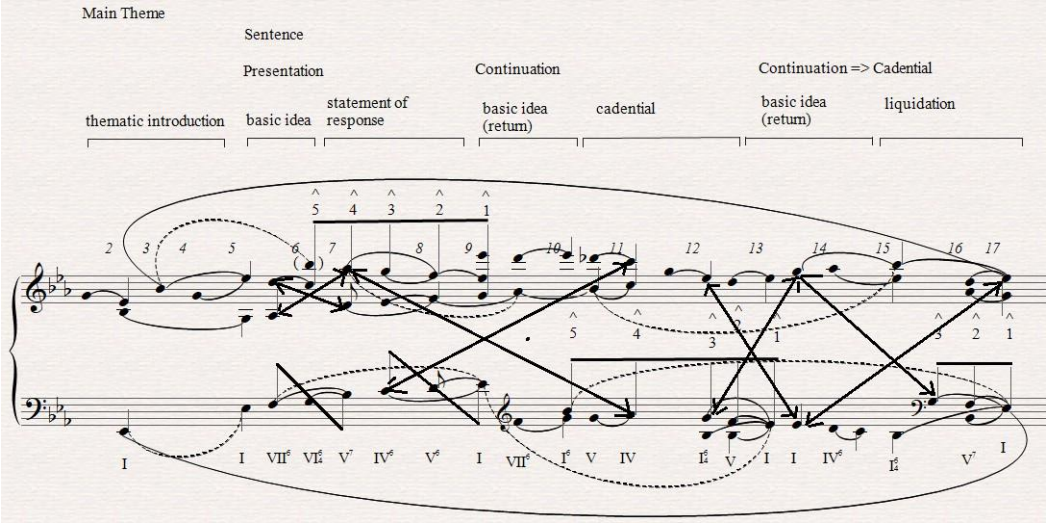


Figure 24 Middle ground with a Form Analysis

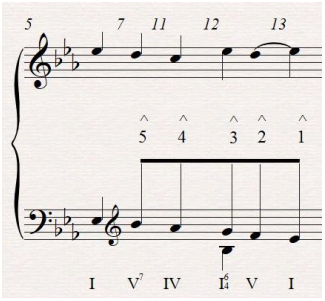


Figure 25 Background

Fig.23 illustrates the analytical notation of the main theme in Op.7, mvt.i. While diagonal lines align related outer voices with bass notes, the slurs are always directed to chords or tones at the right-hand side of an analyzed tone. Noteheads illustrate inferior notes that are bound by the superior stemmed notes. In the main theme, Op.7, mvt. I present an unconventional significant step wise line which is represented in the inner voices, namely in the tenor part of the piece. Thus, some chords are illustrated with three voice tones.

Fig.24 shows the foreground analysis with some additional symbols: Both a normal and a dashed slur that show long distance dependencies in coupling registers, and another symbol is a crosswise beam signifies local prolongations. Beams bind the significant stepwise motions. Finally, while a cross-arrow headline

illustrates the “voice exchange,” facing parenthesis encircle the “bb” in the mm.6 shows the “implied note.” The middle ground analysis is aligned with formal units that signify prolongations, when we compare and control hierarchies with the “bare structure method,” these significations will start to be important.

In the middle ground, a “5-4-3-2-1” motion is represented in the soprano, and then moves to the tenor from mm.10. A dominant chord is prolonged briefly between the second beat in mm.5 and m.7. This prolongation is specified by the tonic harmony in the beginning of the mm.5. From the rest of m. 7 to the beginning of the m.12, predominant harmonies are prolonged, and then it comes to an end with two dominant chords that the first one is double appoggiatura $I^{6\text{-}4}$ that resolves to the essential dominant V, finally this chord arrives to the essential closure of the sentence. The main theme continues with the second continuation, and a passing chord in mm.12 (V/IV) provides a transmission from the first. The V/IV chord is shown by an arrowhead as is conventional in Caplinian harmonic analysis. The three voice exchanges (two tonic and one internal dominant prolongation) illustrated by intersecting double-headed arrow ensure the tonic prolongation in the relevant time span.

The second graph illustrates the background of the main theme, accordingly the prolonged harmonies which are shown with intersecting double-headed arrow and crosswise beam to originate the background graph. That the most significant feature filtering the harmonies from the middle to background, thematic introduction, and the second continuations are eliminated from the surface as are the repetitions of the main music flow from mm.5 to mm.13. While a stepwise motion in the tenor part with an inner 5-4-3-2-1 stepwise line is the most significant character of the main theme, 5 and 4 degrees supported in the presentation area, and 3-2-1 degrees take place in the essential continuation in the sentence.

Controlling the Middle and Background Analysis

In this part, I use the "bare structure method" to control the data which is presented in the middle and foreground graphs in Schenkerian analysis. To compare the middle ground graph, fig.22 illustrates hierarchical relations of the chords in the Caplinian form theory. Fig.27 shows a color-coded analysis that signifies the specifier, adjunct, complement branches of the "bare structure" method. The green areas are the adjunct branches in the tree analysis; blue areas show the complement variables that are the complementary harmonies of the head chords and, red areas illustrate the head structures as the background of the piece.

When an adjunct variable is eliminated from the representation, the kernel structure of the whole section still stands as a meaningful unit that represents core of the musical statement in the section. However, whenever specifier and complement parts are removed from the surface, a significant error comes into play in terms of the interpretation. While specifier sections in the musical statements include formal units, and tonic and dominant harmonies that all of them are specifier with each other, complement harmonies represent helping voice leading structures e.g. neighbor or passing chords or tones. As for the verbal statements, elimination of the complement branches is not considerable. For example, "Mary visited to Istanbul in the last summer" is a statement that the proposition "in" is completed by the "determiner phrase" (DP) the last summer, if we remove this part from the sentence, it turns to be incomplete, and ungrammatical, however, the sentence is still meaningful and carries the essential information in the statement. In terms of the application of this system into the musical structures, the same phenomenon might be at work in musical statements.

When the green areas in fig.27 that are adjuncts are taken out from the surface, it doesn't arose ungrammaticality in the musical statement that doesn't have an impact on the harmonies of the presentation and continuation sections of the sentence. These green areas are eliminated since these parts are the repetition of the essential harmonies in the "before the beginning" and "after the end" sections in

formal units.

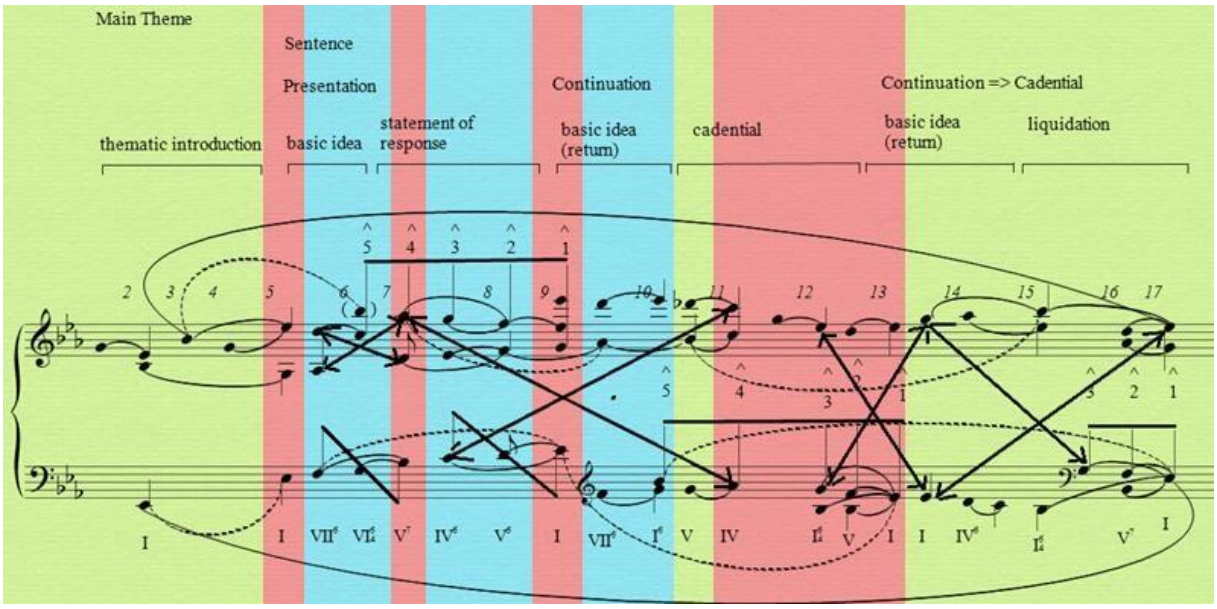


Figure 26 Controlling the Middle ground

After removing the adjuncts of the main theme, the middle ground graph turns into the pre background structure that is represented in fig.27. First of all, when we look at the formal structures, the kernel unit of the sentence stands where there is no any influence of the reduction process. The blue points represent passing chords as the complement of the formal units. The first blue area is the complement of the basic idea, second is the complement of the statement of response, and the third is the complement of the fragmentation of the basic idea. All red areas are the head branches in "bare structure." It is also worth noting that when we look at the cadential area, all the chords are specifier with each other, and the voice leading in these parts provides this feature in the representation.

Finally, merging of the specifier harmonies of the whole surface brings the background structure of the main theme (fig.28.) In the preceding graph, while the first step of the local fundamental line (5-4-3-2-1) comes into play in the mm.10, because it is eliminated from the pre-background representation due to its complementary function, the "bb" in the mm.7 acts this role at the background graph.

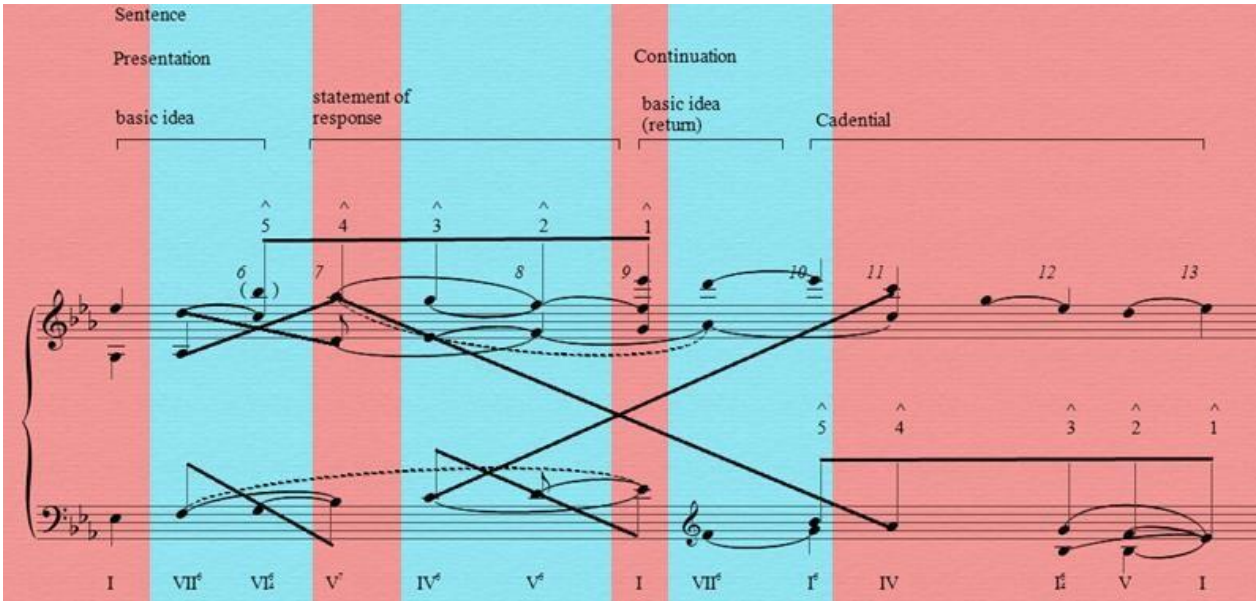


Figure 27 Controlling the Pre-Background Analysis

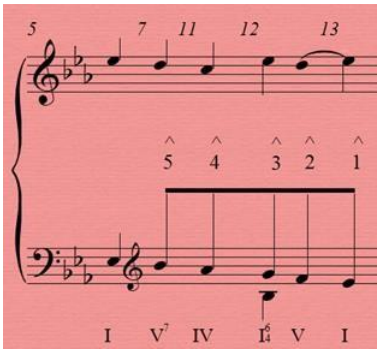


Figure 28 Controlling the Background Analysis

APPENDIX I

X-Bar Theory

X-Bar Theory is a module of grammar that is widely used in Generative Grammar in Linguistics with its revised form in minimalist program, “bare structure method.” In this approach, generative linguists present some descriptive rules for grammar to give a breakdown of interactions of constituents in languages e.g. noun phrases, verb phrases, prepositional phrases. X-Bar theory illustrates both hierarchical levels between these constituents in the mind of speakers and some functions e.g. specifier, complement, and adjuncts show that what nested groups of constituents in language are essential in sentences, and what ones are preferable, or what parts elaborate the statements as optional in the kernel structure.

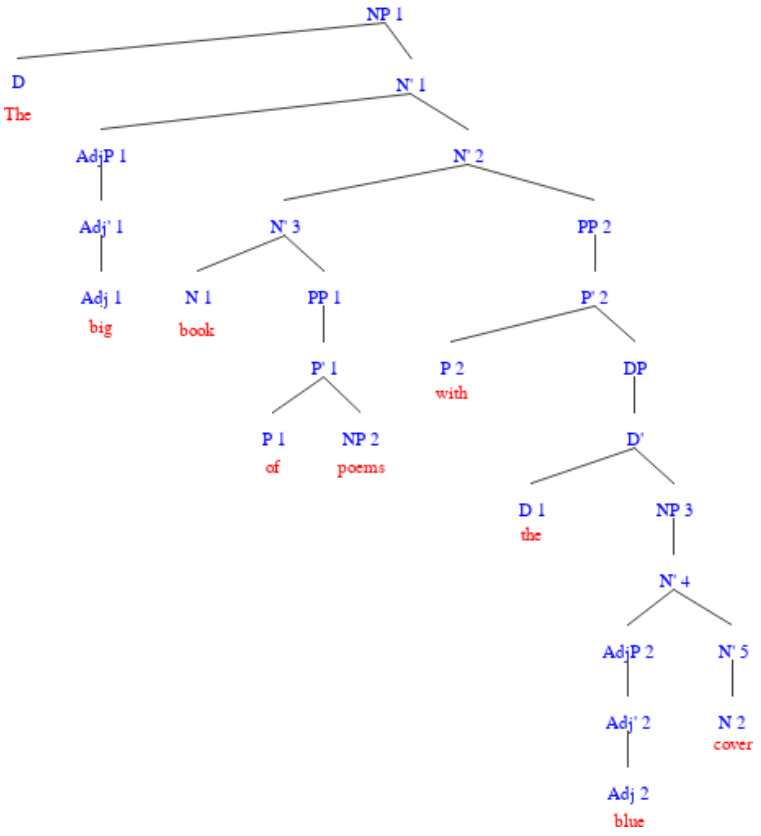


Figure 29 X-Bar Representation

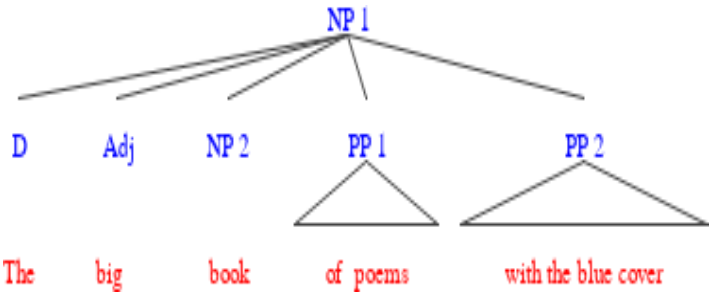


Figure 30 Flat Representation

In categorical representation of the grouping structure or lexical pairs in language, generative grammar has a principle that all sets or pairs must be represented in binary cases. Accordingly, fig.29 is an appropriate illustration of the language data, the fig.30 is not a viable representation. While the former is called as binary operation in X-Bar theory, the latter refers to inappropriate flat representation. To refer to a widely accepted textbook in linguistics, I take the figures from Andrew Carnie's syntax book, "Syntax: A Generative Introduction." The abbreviations NP, D, Adj, NP, and PP stands respectively for noun phrase, determiner, adjective, noun phrase and prepositional phrase. The triangle implies that there are further operations in X-Bar to represent that statement; thus, when we compare the two trees to find out the differences in the relevant parts namely "of poem" and "with the blue cover," these further processes can be observed in the fig.29.

As is observed in fig.29, the statement is much more elaborately analyzed, and it gives some structural information for the sentence which shows kernel and secondary nested grouping structure(s) which is (are) embedded into branches of the tree by way of both functions e.g. specifier, complement, adjuncts, and relations that are domination, precedence and command. For the ease of reading the present paper, I will account for the functions of X-Bar theory though the relations will be left for another enterprise to expand the scope of this paper. Though these relations are entirely observable in trees which I draw for representation of Op.7, i. As a method, rather than give an abstract definition of them here, in the case of

the chordal tree analysis I will illustrate these relations in analysis process. these structural relations explicate the linear (precedence,) vertical (dominance,) crossing (c-command) government relations that gives overall theory the first part of its title "government and binding theory," in terms of the binding parts, specifier, adjuncts, and complement are the constituents that provide the functions in the theory.

Fig.31 represents one string representation that includes some concepts: main projection (phrase level,) bars, head, and realization. I illustrate the following string with an "X" that might represent any kind of entity, movement or abstract "thing" that mediates between entities and movements defines them. In this very first part, having theoretically defines the functions; I will illustrate a cadential progression to illustrate these abstract X, Y, Q, etc imaginary entities.

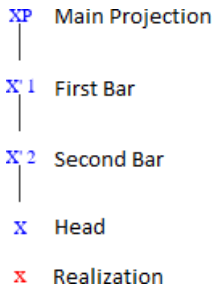


Figure 31 X-Bar Projections

The phrase level is the main projection of the string as the most dominant node, and in every string, there must be only one phrase level that must be placed at the top of most nodes. The abbreviation "P" stands for the phrase.

In the second and third level of the string, we see first and second bars of the representation. Bars prolong the impact of the phrase level on other phrases which are placed both next to them or lower layers under them as binary branches and depends on the which bar level they are embedded, they take their functions in the representation whether to be specifier, adjuncts, or complements. This point will be fully clear with the following figures. In terms of the bar concept, it is worth noting that bars provide recursivity, and

between phrase level and head level, there might be theoretically infinite numbers of bars. When we think of the recursivity in sentences, the following statement might be prolonged with prepositions and “wh” words (what, where, which, that etc.) In the following sentences, the statement “a” represents the kernel of the sentence. The statement “b” elaborates the kernel structure with more information. In the statement of “c,” previous sentence is enlarged with a preposition, and finally the “wh” word, “that,” prolongs the statement with its individual clause type constituent. The kernel sentence “John presented his paper” might be prolonged endlessly that bar concepts provide theoretical representation in linear and vertical order.

a. John presented his paper.

b. John presented his paper at the 40th conference.

c. John presented his paper at the 40th conference of SMT.

d. John presented his paper in the 40th conference of SMT that the paper was about music cognition.

Another important point for the adjunct functions, they are not compulsory elements of phrases, and freely move into different zones of the sentence. In the first statement, the adjunct part of the sentence that is “on Friday evening” is an elaboration of the central part in the sentence, and even if it moves to the beginning of the sentence, statement is still grammatical that let the adjuncts chunks of sentences immigrate to appropriate places in sentential zones. If the adjunct section of a sentence is eliminated, despite losing its elegance, the sentence keeps its grammatical structure.

a. John met Mary on Friday evening.

b. On Friday, John met Mary.

c. John met Mary.

As the last layer before the realization of a thought of entity in minds of speakers, the head level comes

into play. This is the terminal point of the string as it is a compulsory element in representation. After the head node, there must not be another node, if any, it turns to rather be a bar level than persist as the head of the string. In the same way as the phrase level, only one node in the strings is called a head. Finally, having been all these processes in milliseconds, the surface structure of thought as the signifier comes into existence with myriad external real or abstract world objects. Realizations are denoted with red color in strings.

Figure 32 illustrates the specifier function. Specifier is the string of a phrase which takes place next to the first bar level of a dominant phrase. The dominant phrase is taken place at the upper part(s) of other individual phrase(s.) Accordingly, "YP" is embedded to the first bar level of the dominant "XP" that is placed at the upper layer of the "YP." Specifier constituent is a compulsory preceding element for the XP. When they move into different zones in the sentences, they carry the dominant phrases to the regions they would take place. In the sentence "b," the prepositional phrase (PP) takes place at the beginning. In reference to the sentence "a," "PP" moves from the end of the sentence "a" to the beginning of the sentence "b." At this stage, the statement is still grammatical because the "NP" embedded in the "PP" takes its specifier "the" when it moves to starter of the sentence. As a note, determiner phrases "DP" are always the specifier of "NPs" in generative grammar. In contrast to preceding sentences, sentence while prepositional phrase takes its NP when migrates to the beginning, the specifier of the NP stays at the original place that leads way to an ungrammaticality in the sentence. Therefore, specifier part of a dominant phrase is always a compulsory element when it moves into somewhere else in sentential zones. An asterix (*,) at the starter of a sentence or clause, shows the following statement is ungrammatical as is observed in the sentence "c."

a. The painter studies a new work in his studio.

b. In his studio, the painter studies a new work.

c. *In the studio, the painter studies a new work on his.

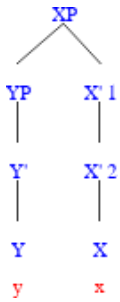


Figure 32 Adjunct

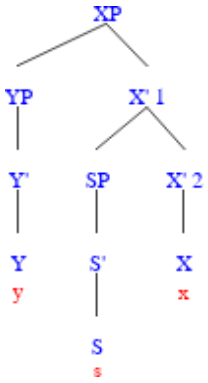


Figure 33 Specifier

Figure 5 illustrates adjunct function with “SP” branch in the tree. Three branches of the tree have different

functions in this representation that we have already seen the role of XP and YP. To assign an adjunct function to trees, the string was attached to the branches which are not first and last nodes of another string. “SP” that is the “sister” of the second bar level of the XP as its adjunct statement. We have already observed its features in the first and second sets of statements above.

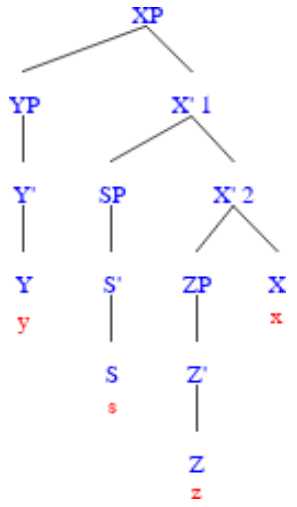


Figure 34 Specifier, Adjunct, and Complement

After looking at aspects of a complement function, I will illustrate these abstracts formulas in musical and verbal statements. In the figure 6, “ZP” represents complement function in the tree; accordingly, the string of nodes which is the sister of a head level in another string has a complement function. These two branches are complementary with each other, and when they move into the different regions of a sentence, they take their complementary pairs in trees.

In the following set of sentences, “PP” “about aspects of the topic” represented in the different zones of statements. An “NP” is always a complement of a “PP” in generative grammar. Thus, the “NP” “aspects” is the complement of the “PP” “about.” When it is intended to move this statement, this pair of words migrates together. In the sentence “b”, we can observe this principle at the beginning of the sentence as opposed to statement “c” that while the preposition “about” moves at

the beginning, its complement stands at the end of the sentence that makes it an ungrammatical statement.

a. The professor provides details on this aspect of the topic.

b. On this aspect of the topic, the professor provides details

c. *On of the topic, the professor provides details this aspect.

Now, I illustrate how these functions come into play in interactions of word categories in the following sentence.

John will visit his grandma in the summer.

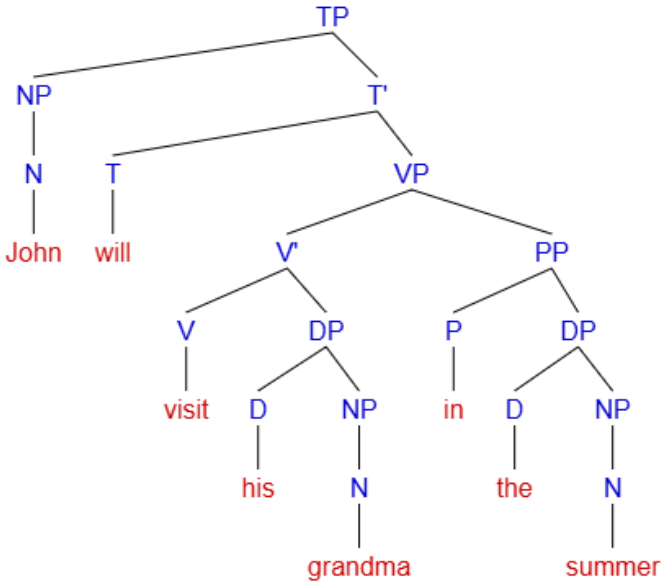


Figure 35 Sentence Analysis (Verbal)

The syntax tree diagram represents the sentence "John will visit his grandma in the summer" with its hierarchical grammatical structure.

At the top of the tree, TP (Tense Phrase) serves as the maximal projection, representing the sentence's tense. The TP node includes a specifier, NP (Noun Phrase) "John," on the left-hand side and a complement,

VP (Verb Phrase) "visit his grandma in the summer," on the right-hand side. The head of the TP, marked as "T," is the auxiliary verb "will," which expresses future tense. NP ("John") as Specifier of TP: The specifier NP "John" is at the left of the TP, directly linked to the head "T." This structure indicates that "John" is the subject of the sentence.

VP ("visit his grandma in the summer") as Complement of TP: The VP is the complement of the TP, as it completes the meaning of the sentence by providing the predicate (what John will do). The VP is the head of a complex structure, which contains:

A V (Verb) head: "visit."

A DP (Determiner Phrase) complement: "his grandma."

A PP (Prepositional Phrase) adjunct: "in the summer."

DP ("his grandma") as Complement of VP: Within the VP, the DP "his grandma" functions as a complement of the verb "visit." It provides the direct object of the verb, specifying who is being visited.

The DP includes: A D (Determiner): "his."

An NP (Noun Phrase): "grandma."

PP ("in the summer") as Adjunct of VP: The PP "in the summer" is an adjunct of the VP, providing additional information about the time of the action. Adjuncts are optional, meaning that removing this phrase ("in the summer") would not render the sentence ungrammatical.

The PP includes: A P (Preposition): "in."

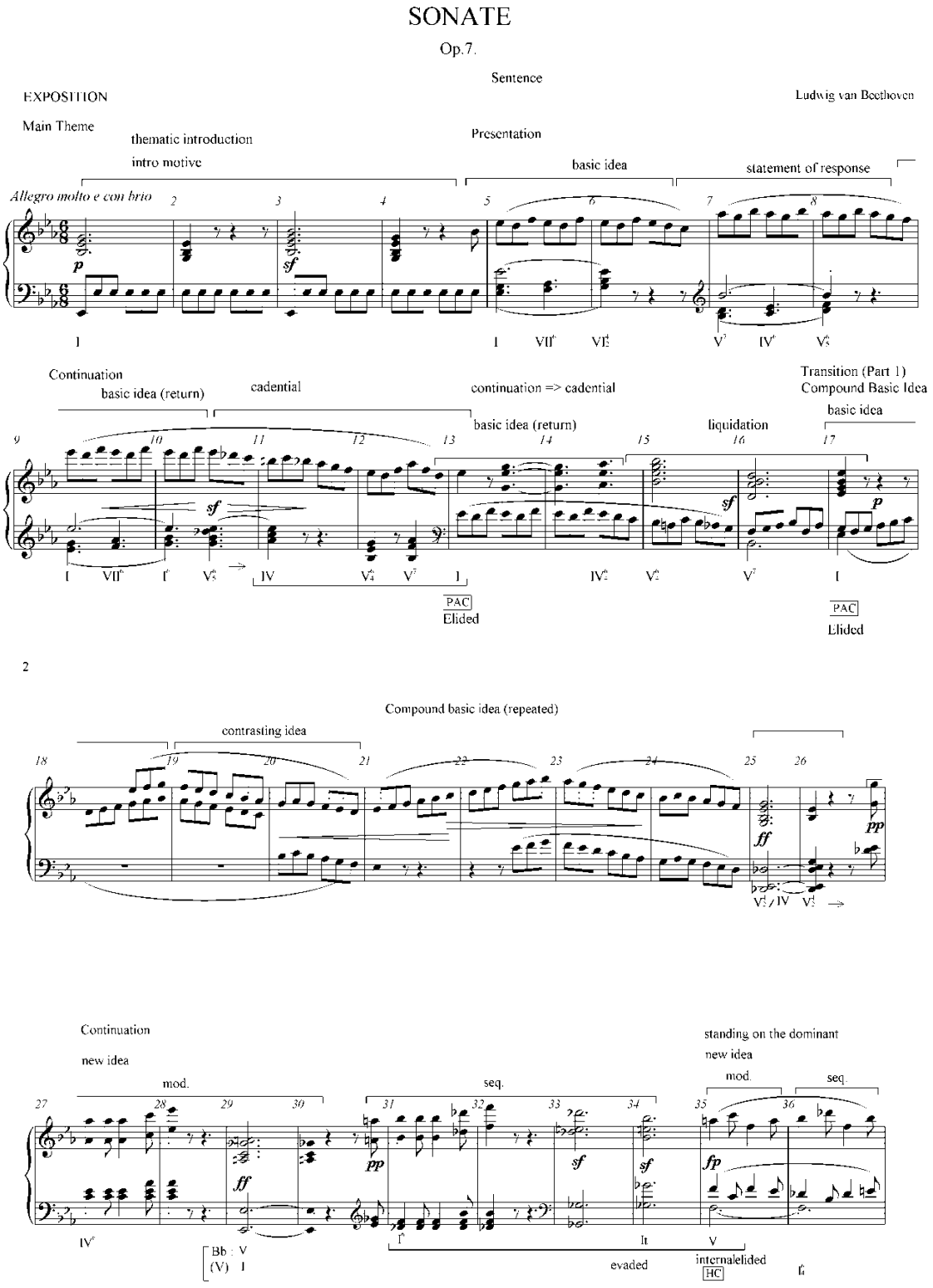
A DP (Determiner Phrase): "the summer."

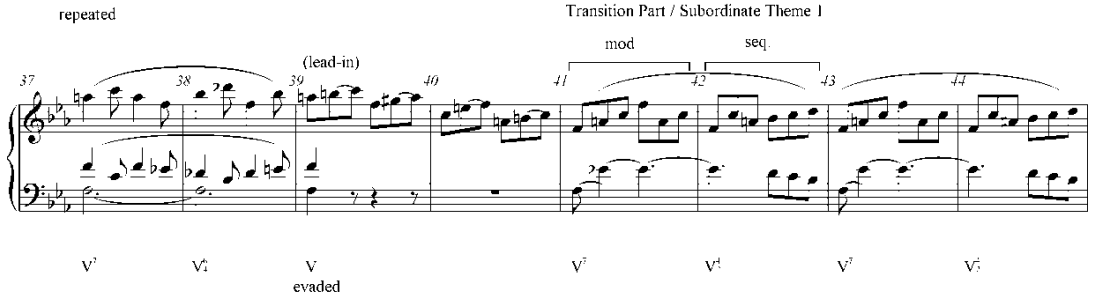
The DP includes: A D (Determiner): "the."

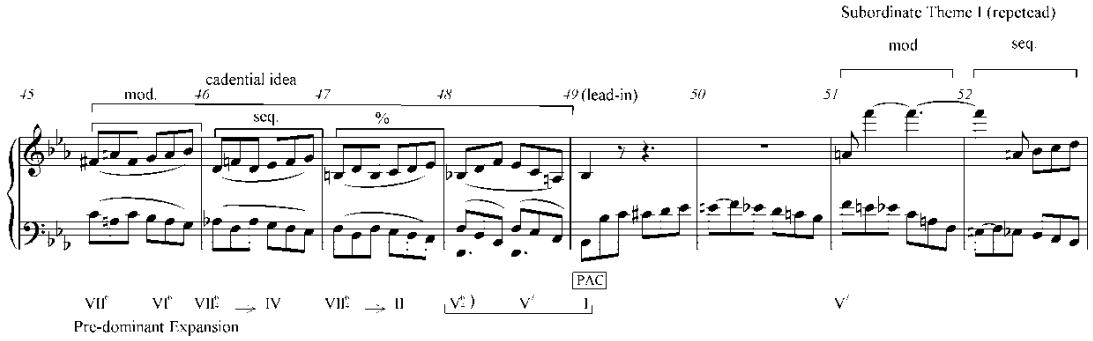
An NP (Noun Phrase): "summer."

The TP node governs the entire sentence structure and links the tense (future, marked by "will") to its specifier (NP "John") and complement (VP). The VP acts as the predicate, connecting the action (V "visit") to its object (DP "his grandma") and an additional temporal detail (PP "in the summer"). The hierarchical representation in the tree demonstrates how each syntactic component interacts, with specifiers, complements, and adjuncts clearly differentiated. Removing the adjunct PP "in the summer" does not affect grammaticality, as it is optional and only elaborates on the time of the event. Removing the complement DP "his grandma," however, would result in ungrammaticality, as the verb "visit" requires a direct object to complete its meaning.

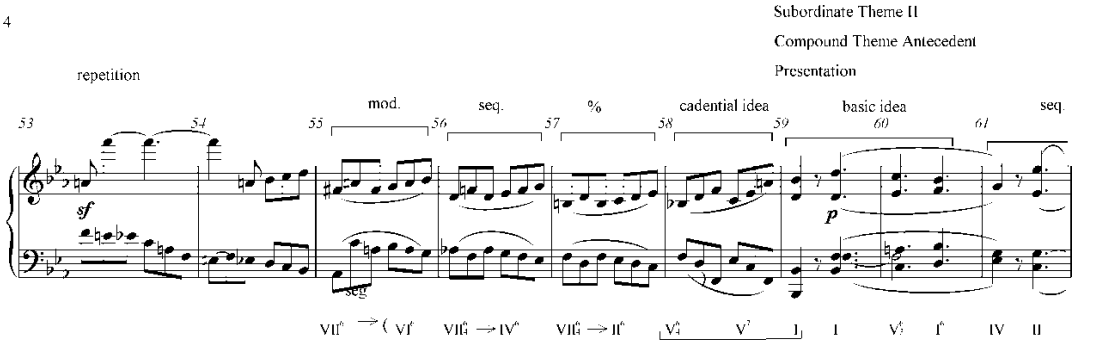
APPENDIX II FORM ANALYSIS Op.7,Mvt.i, L.v.Beethoven

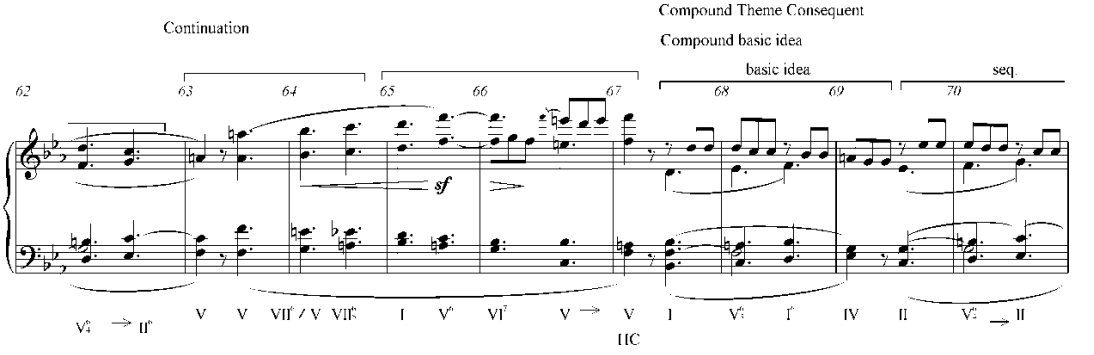


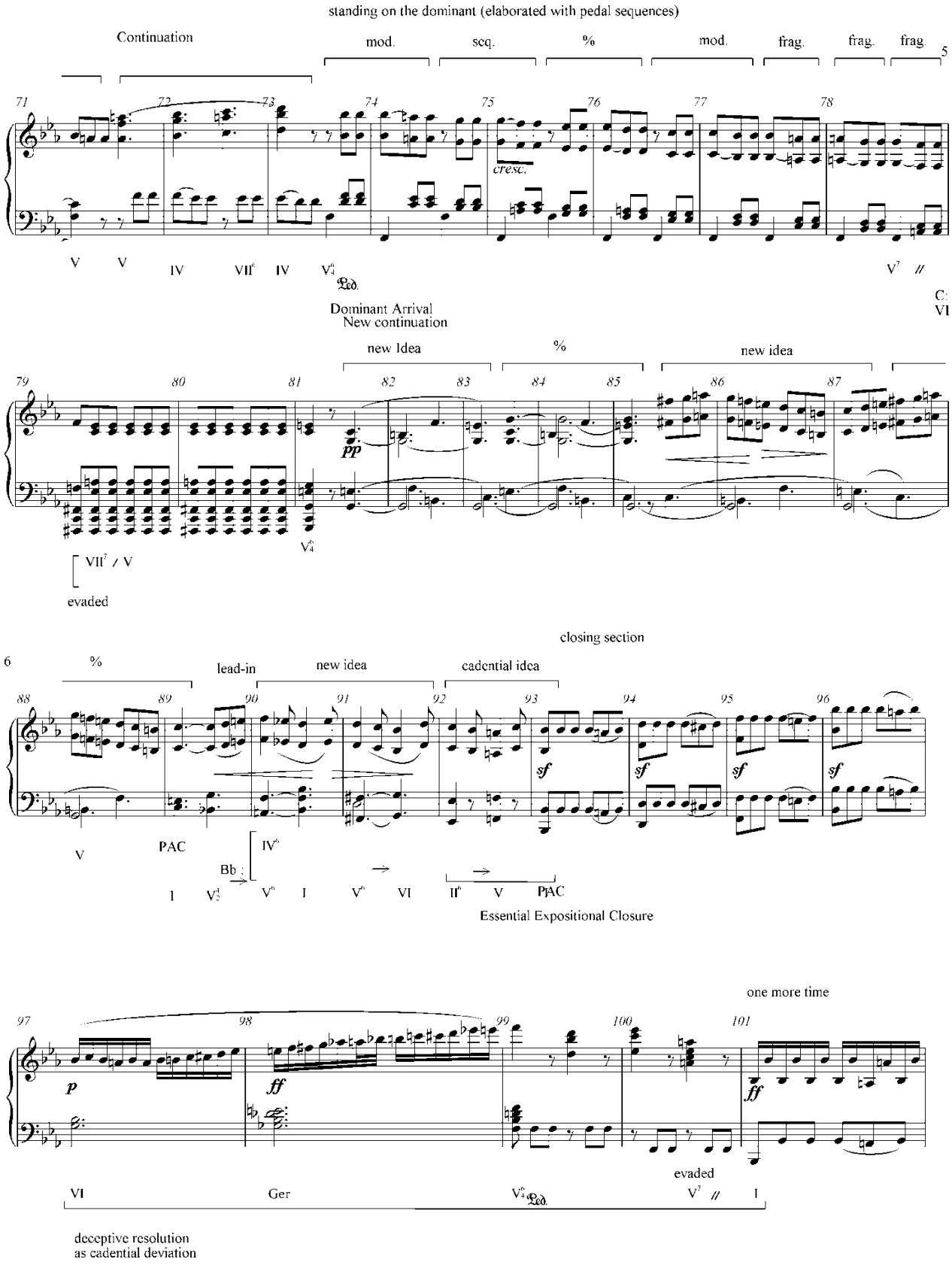

repeated
Transition Part / Subordinate Theme 1
mod
seq.
(lead-in)
37
38
39
40
41
42
43
44
V7
V4/2
V
evaded
V7
V4/2
V7
V4/2


Subordinate Theme 1 (repetead)
mod
seq.
cadential idea
mod.
seq.
%
45
46
47
48
49 (lead-in)
50
51
52
PAC
VII6
VI6
VII6
IV
VII6
II
V4/2
V7
I
V7
Pre-dominant Expansion

4

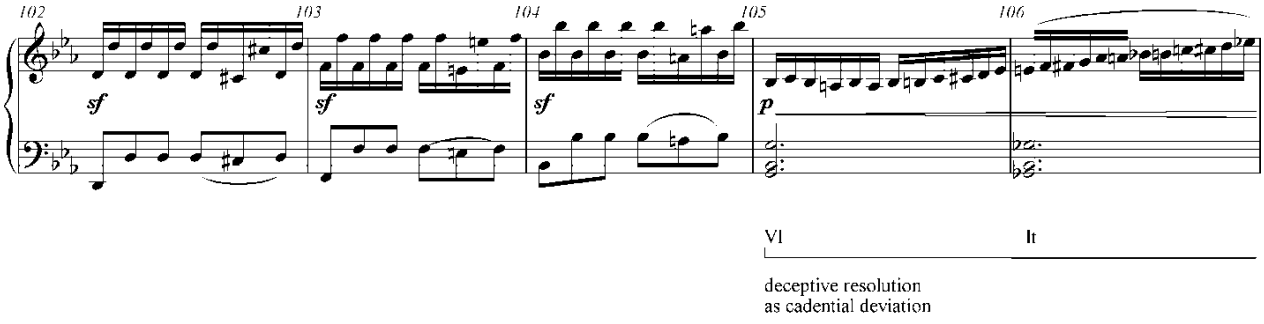

Subordinate Theme II
Compound Theme Antecedent
Presentation
repetition
mod.
seq.
%
cadential idea
basic idea
seq.
53
54
55
56
57
58
59
60
61
sf
p
seg.
VII6
VI6
VII6
IV6
VII6
II6
V4/2
V7
I
I
V4/3
I6
IV
II
PAC


Compound Theme Consequent
Compound basic idea
Continuation
basic idea
seq.
62
63
64
65
66
67
68
69
70
sf
V4/2
II6
V
V
VII6 / V
VII6
I
V6
VI7
V
V
I
V4/3
I6
IV
II
V4/2
II
HC


standing on the dominant (elaborated with pedal sequences)
Continuation
mod.
seq.
%
mod.
frag.
frag.
frag.
5
71
72
73
74
75
76
77
78
cresc.
V
V
IV
VII°
IV
V6
Ped.
V7
//
C:
VI
Dominant Arrival
New continuation
new Idea
%
new idea
79
80
81
82
83
84
85
86
87
pp
V6
VII7 / V
evaded
closing section
6
%
lead-in
new idea
cadential idea
88
89
90
91
92
93
94
95
96
sf
V
PAC
Bb :
IV°
I
V43
V°
I
V°
VI
II°
V
PAC
Essential Expositional Closure
one more time
97
98
99
100
101
p
ff
ff
evaded
VI
Ger
V6
Ped.
V7
//
I
deceptive resolution
as cadential deviation

closing section (continued)

7



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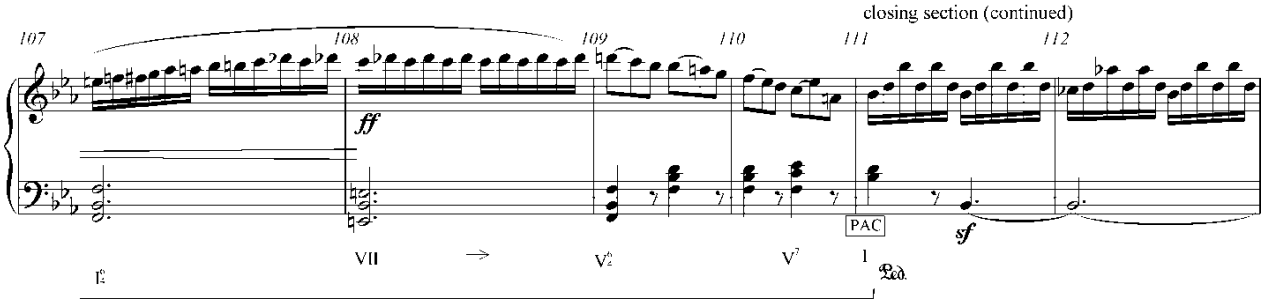

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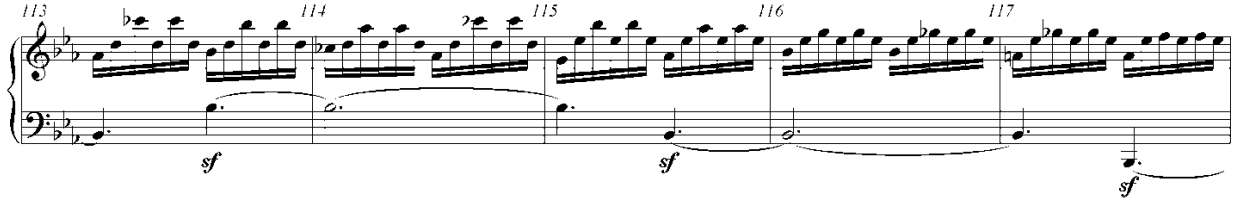
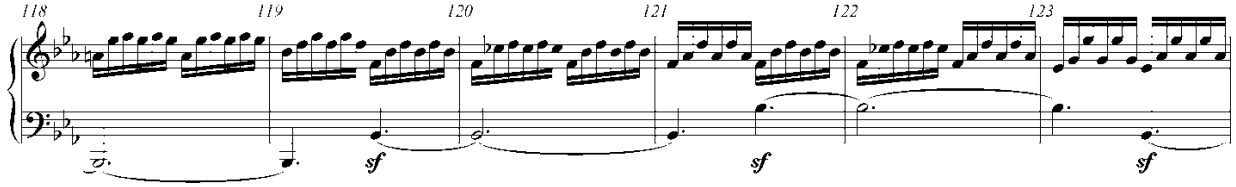
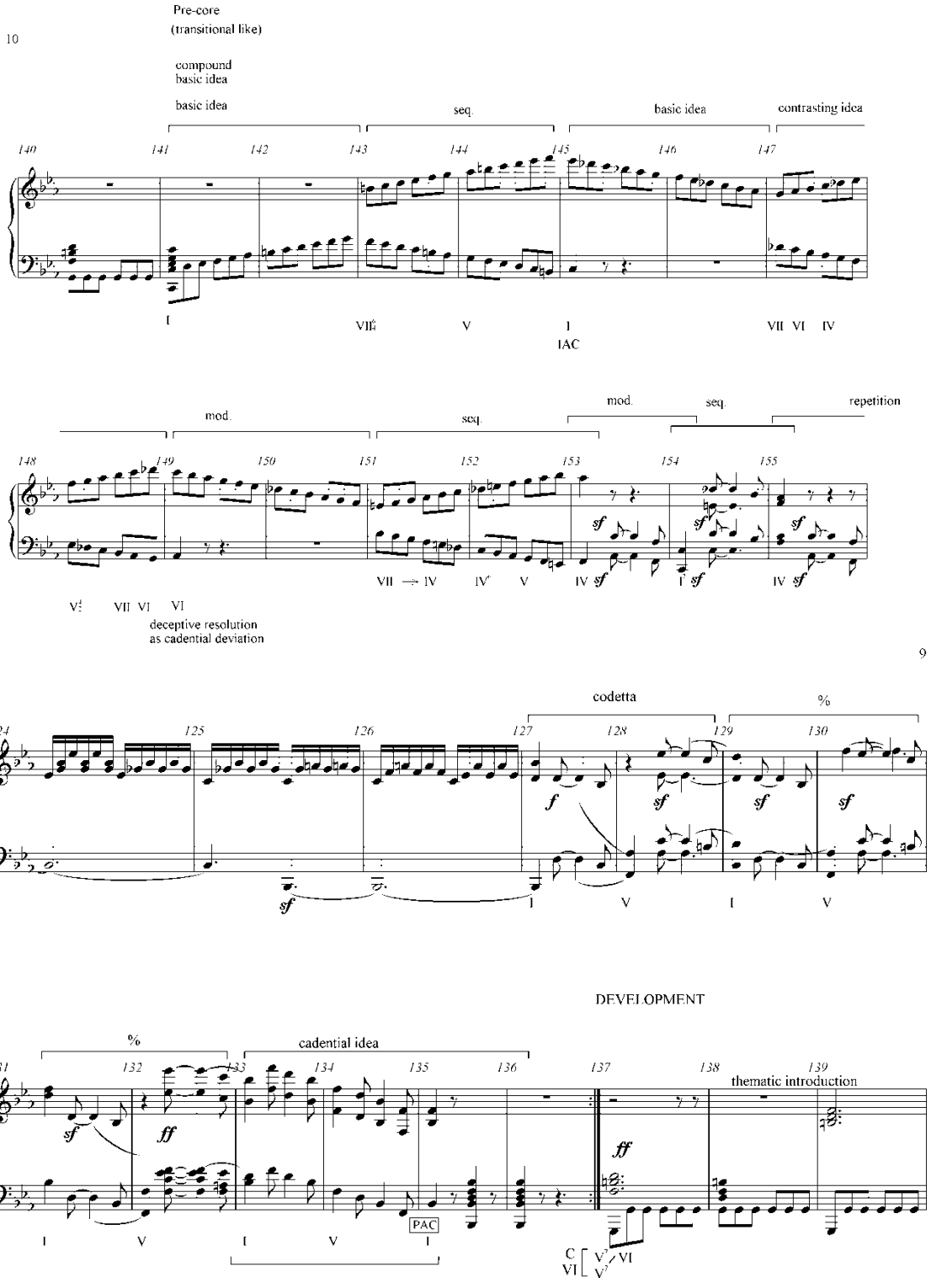
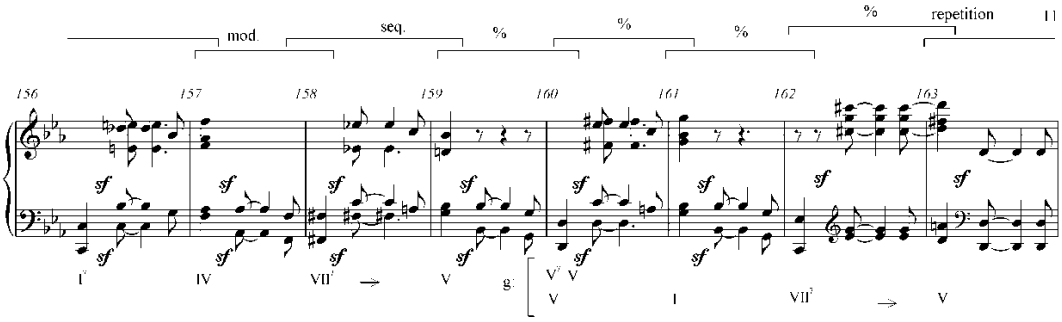


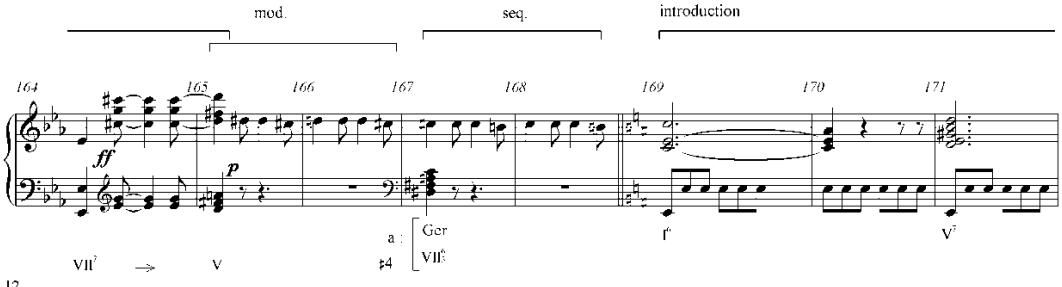



10
Pre-core
(transitional like)
compound
basic idea
basic idea
seq.
basic idea
contrasting idea
140
141
142
143
144
145
146
147
I
VII6
V
I
VII VI IV
IAC
mod.
mod.
seq.
seq.
repetition
148
149
150
151
152
153
154
155
V4/3
VII VI VI
deceptive resolution
as cadential deviation
VII → IV
IV6
V
IV sf
I sf
IV sf
9
codetta
%
124
125
126
127
128
129
130
f
sf
I
V
I
V
DEVELOPMENT
%
cadential idea
131
132
133
134
135
136
137
138
139
thematic introduction
sf
ff
ff
PAC
I
V
I
V
I
C
VI
V7
V7/VI

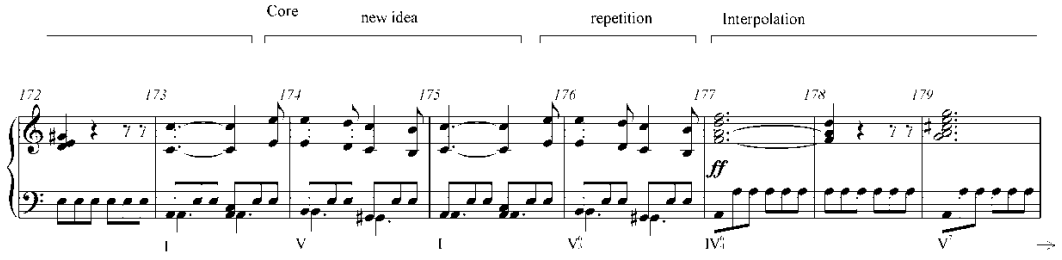


III

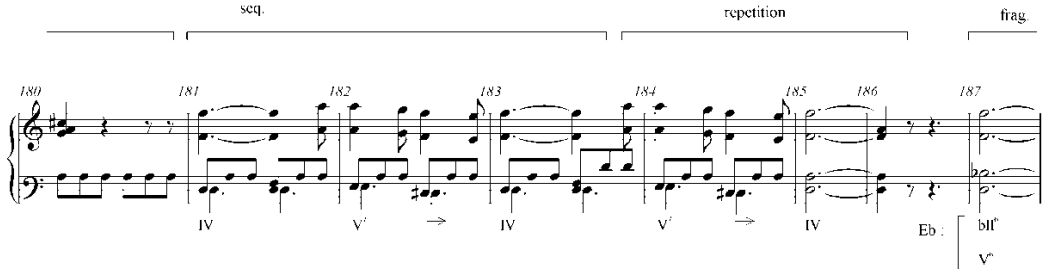
Dominant Arrival

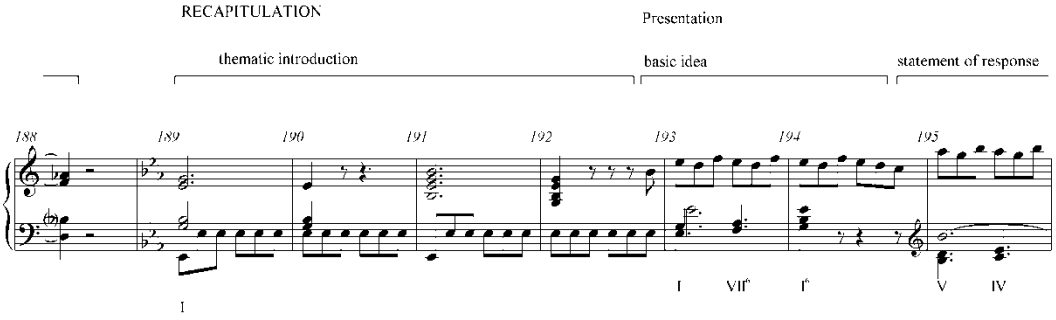


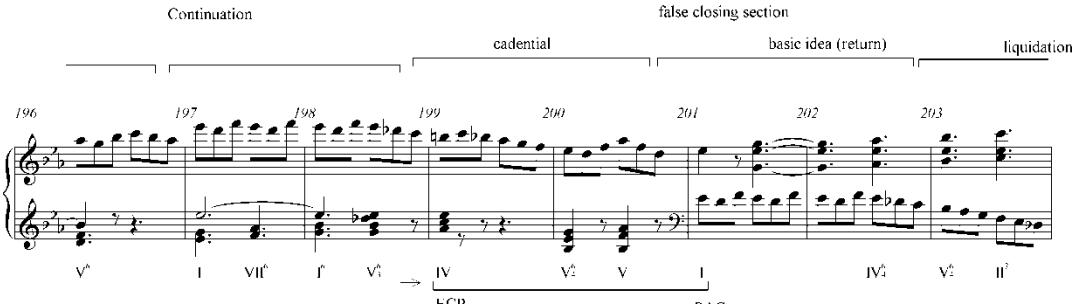
Local Tonic Prolongation



Local Sub-Dominant Prolongation

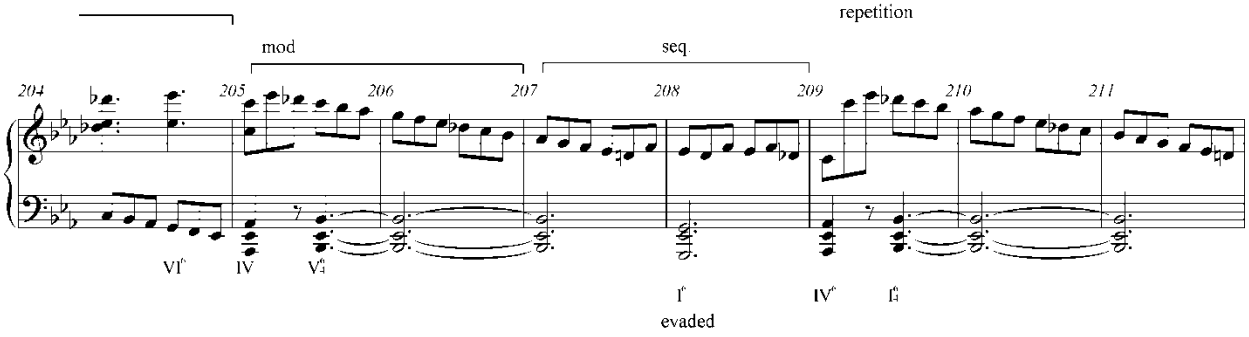


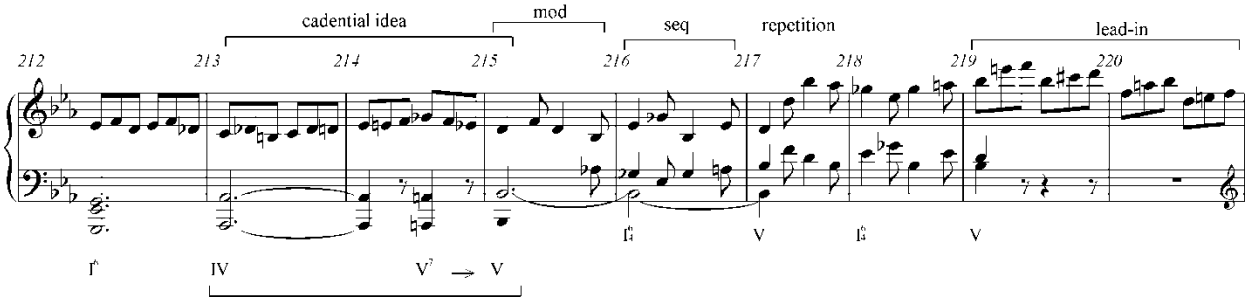


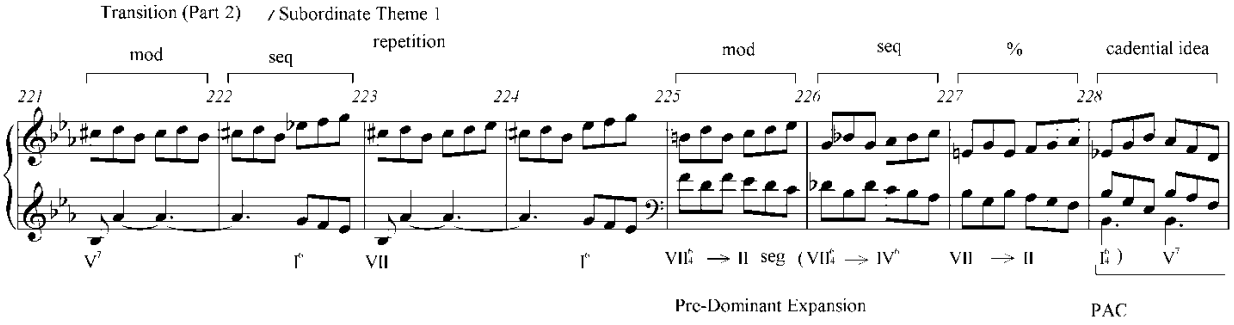


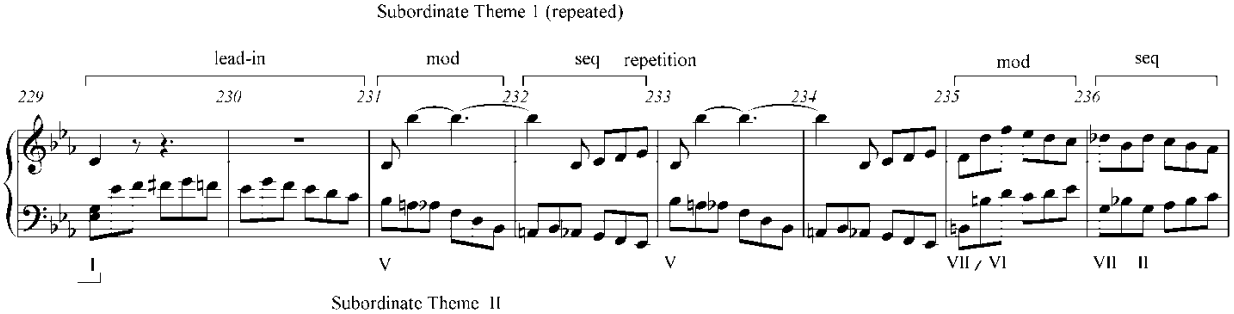
14

Transition (Part I)

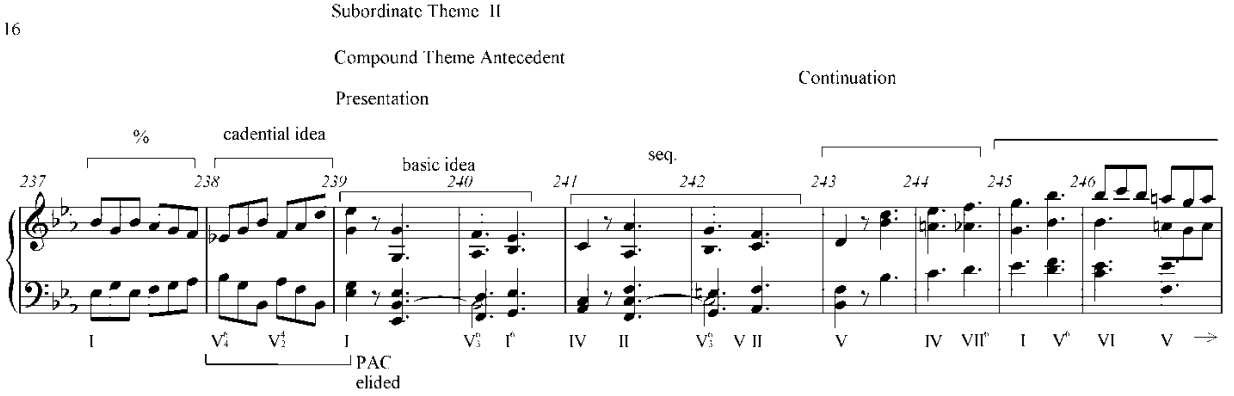


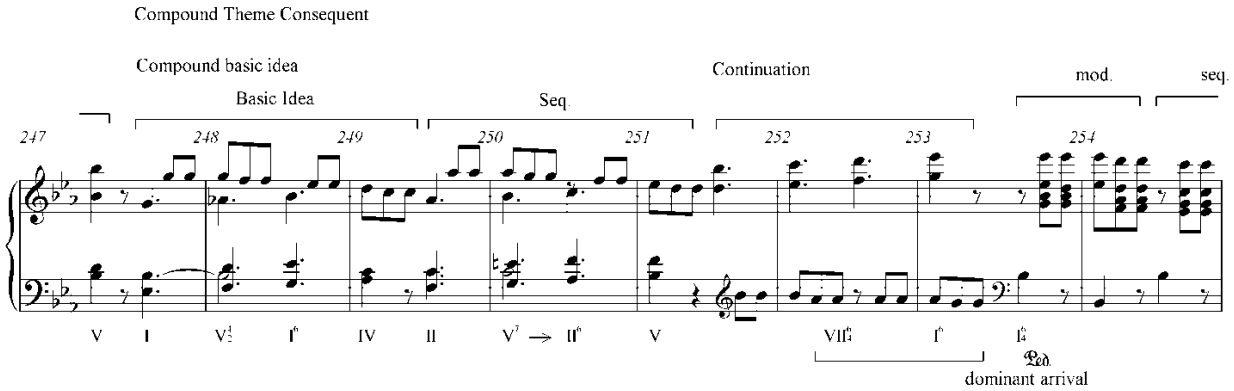



Transition (Part 2)
/ Subordinate Theme 1
mod
seq
repetition
mod
seq
%
cadential idea
221
222
223
224
225
226
227
228
V7
I6
VII
I6
VII6 → II seq (VII6 → IV6)
VII → II
I6)
V7
Pre-Dominant Expansion
PAC

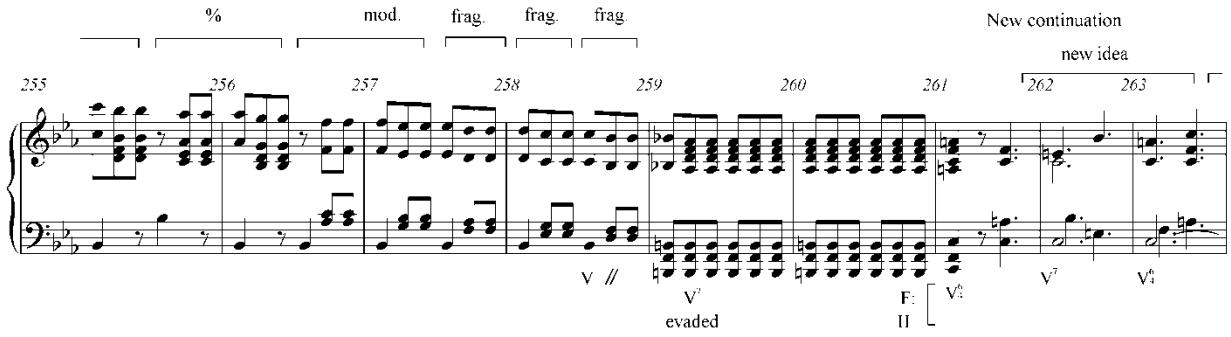

Subordinate Theme 1 (repeated)
lead-in
mod
seq
repetition
mod
seq
229
230
231
232
233
234
235
236
I
V
V
VII / VI
VII
II

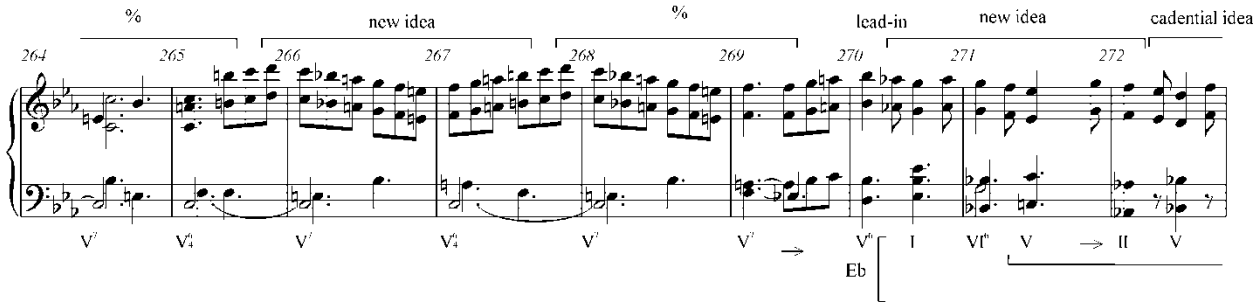
16


Subordinate Theme II
Compound Theme Antecedent
Presentation
Continuation
%
cadential idea
basic idea
seq.
237
238
239
240
241
242
243
244
245
246
I
V4 V2
I
V3
I6
IV
II
V3
V II
V
IV
VII6
I
V6
VI
V
PAC
elided


Compound Theme Consequent
Compound basic idea
Basic Idea
Seq.
Continuation
mod.
seq.
247
248
249
250
251
252
253
254
V
I
V2
I6
IV
II
V7 → II6
V
VII6
I6
I6
Ped.
dominant arrival

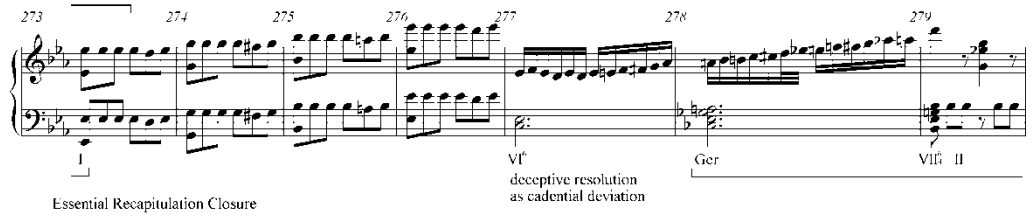
standing on the dominant (elaborated with pedal sequences)





closing section

18



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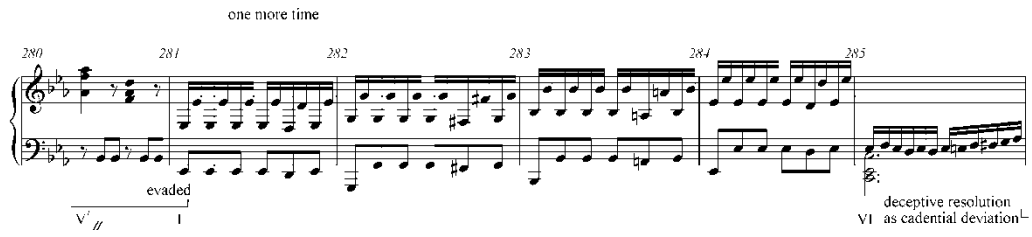

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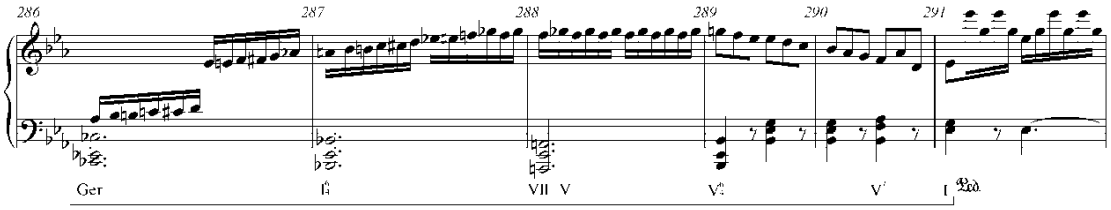

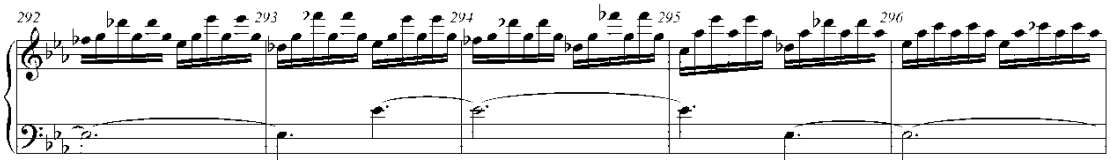

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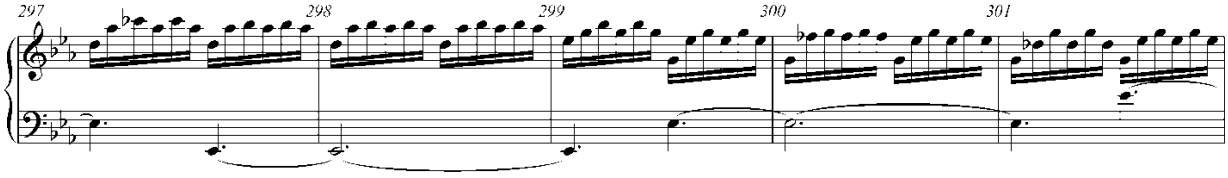
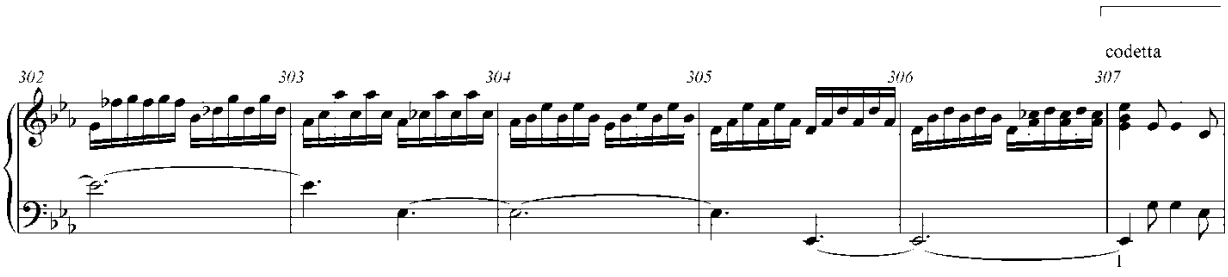
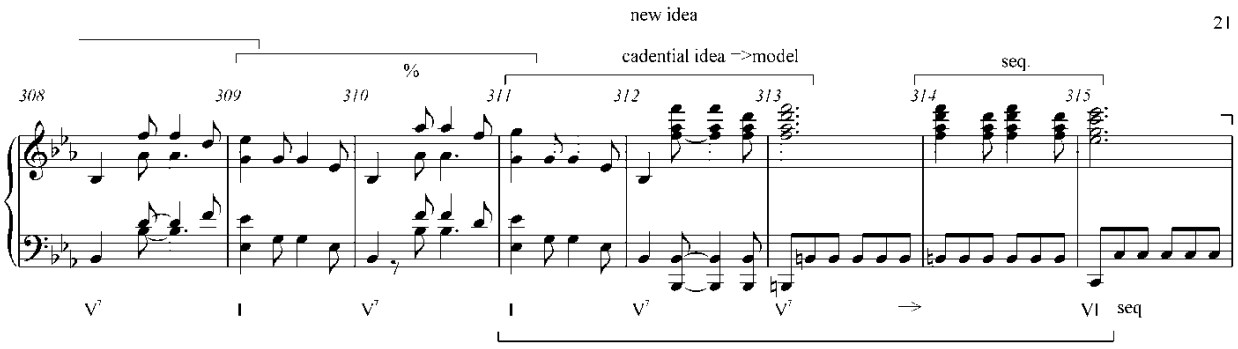
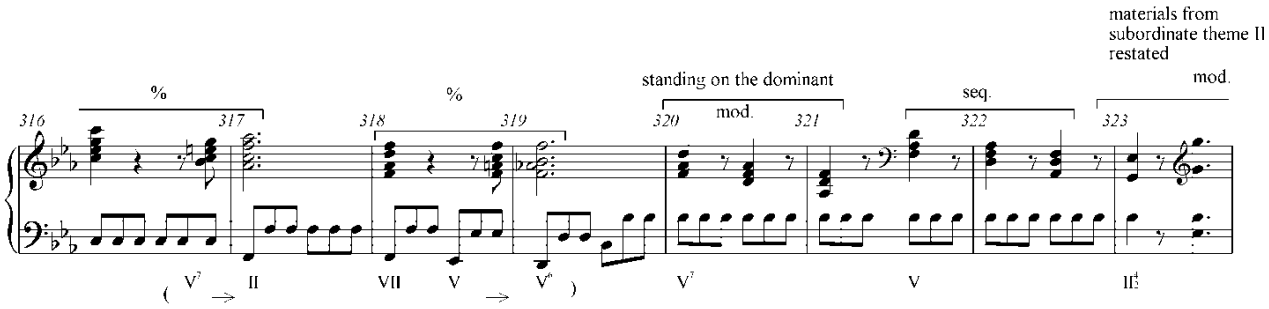
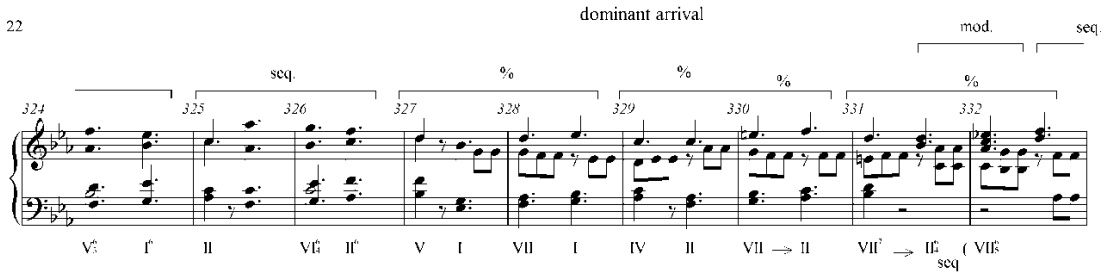


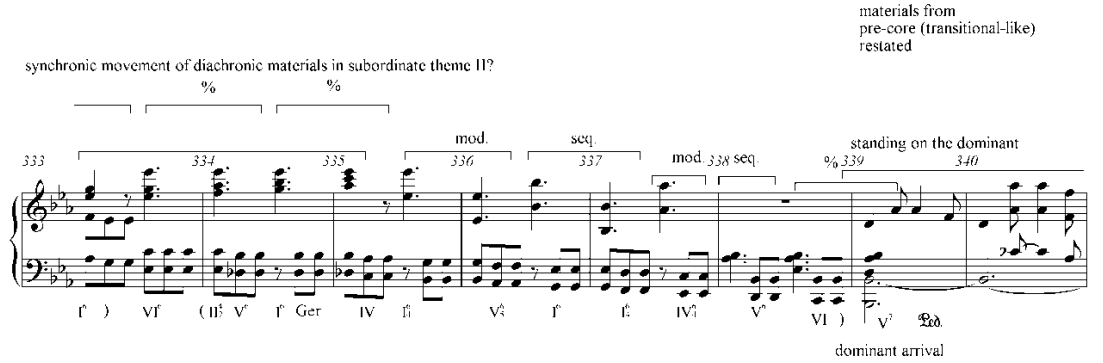


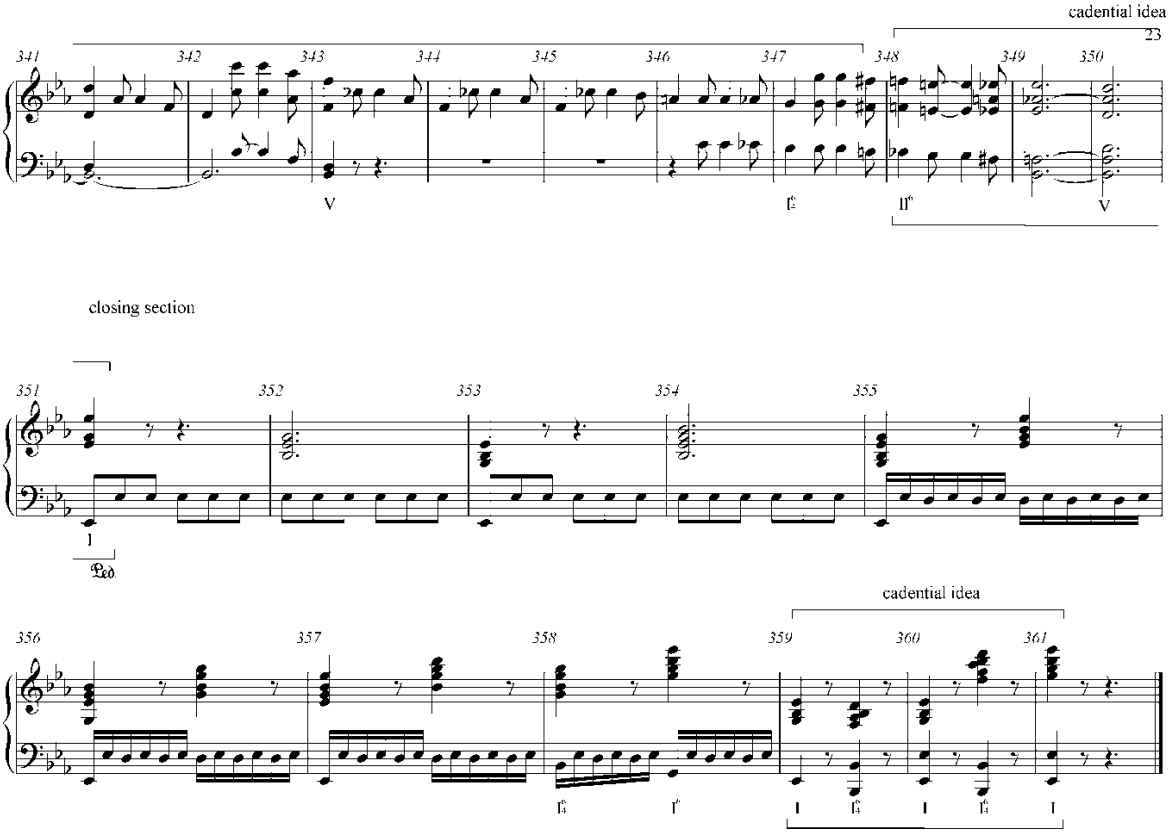
CODA


new idea
21
cadential idea –>model
seq.
%
308
309
310
311
312
313
314
315
V7
I
V7
I
V7
V7
VI
seq


materials from
subordinate theme II
restated
mod.
standing on the dominant
mod.
seq.
%
%
316
317
318
319
320
321
322
323
(V7 II VII V V°) V7 V II4 3


22
dominant arrival
mod.
seq.
seq.
%
%
%
%
324
325
326
327
328
329
330
331
332
V5 3 I6 II VI 5 3 II6 V I VII I IV II VII II VII7 II 5 3 (VII 5 3
seq


materials from
pre-core (transitional-like)
restated
synchronic movement of diachronic materials in subordinate theme II?
%
%
mod.
seq.
mod.
seq.
standing on the dominant
%
333
334
335
336
337
338
339
340
I6) VI6 (II4 3 V6 I6 Ger IV I6 V5 3 I6 I6 IV7 V6 VI) V7
dominant arrival


cadential idea
23
341
342
343
344
345
346
347
348
349
350
V
I⁶
II⁶
V
closing section
351
352
353
354
355
I
Ped
cadential idea
356
357
358
359
360
361
I⁶
I⁶
I
I⁶
I