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Tension paradigm and tonal syntax

Some cognitive and semiological implications

CHRISTOPHE GUILLOTTEL-NOTHMANN¹

Introduction

This paper aims to supply further explanations for one of the most outstanding characteristics of tonal harmonic language: the directional tendency of chord sequences, highlighted by Nicolas Meeüs' theory of harmonic vectors². In previous research, I made some observations based on contrapuntal rules³. While maintaining these explanations, I would like to examine the cognitive and semiological implications of the problem by raising the following questions: What is the reason for the privileged direction of chord sequences? When and why did it appear? How was it reinforced?

The theory of harmonic vectors was developed in the late 1980s by Nicolas Meeüs. It is based on a systematic classification of root motion and provides syntactic rules which constitute the embryo of a tonal grammar. Root motions are classified into two distinct groups each of which includes one "principal" and two "substitute" progressions (figure 1): root motions up a fourth, down a third and up a second are classified as dominant vectors while complementary chord progressions (down a fourth, up a third and down a second) belong to a subdominant vector category. Analysis carried out on large corpuses⁴ show that in tonal works dominant vectors are

	Dominant vectors	Subdominant vectors
Main progression	+4	-4
Substitutions	-3	+3
	+2	-2

Figure 1: Classification of root motions by the theory of harmonic vectors.

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² Cf. Nicolas MEEÛS, « Vecteurs harmoniques », *Musurgia* X (2003), p. 7-34, *Idem*, « Toward a Post-Schoenbergian Grammar of Tonal and Pre-tonal Harmonic Progressions », *Music Theory Online*, Vol. 6, 1 (January 2000) [<http://mto.societymusictheory.org/issues/mto.00.6.1/mto.00.6.1.meeus.html>].

³ Cf. Christophe GUILLOTTEL-NOTHMANN, *Dissonances et progressions harmoniques, Le cas du Tractatus augmentatus compositionis (c.1655-1659) de Christoph Bernhard*, Mémoire de Master II présenté sous la direction du Professeur Nicolas Meeüs, Paris IV: 2007. [<http://www.plm.paris-sorbonne.fr/Guillotel-Nothmann/M2Volume1a.pdf>], *Idem*, « Dissonance and Harmonic Progression. The impact of the *seconda pratica* on the advent of tonality », *2nd International Conference for PhD Music Students*, Department Of Music Studies, Aristotle University - Music-School of Arts, Culture & Environment, University of Edinburgh 2008, p. 34-42.

⁴ Bertrand DESBORDES, *Le langage harmonique des récitatifs simples mozartiens : une approche par les vecteurs harmoniques*, Thèse de doctorat sous la direction de Nicolas Meeüs, Paris IV : 2001. Claire, MEYER, *Les Sacri Conventus (1630-31) de Léonard Hodemont (c.1580-1636). Analyse et préparation à l'édition critique*, Thèse de doctorat préparée sous la direction de Nicolas Meeüs, Université de Paris-Sorbonne, Février 2009, inédite.

statistically much more frequent than subdominants vectors. This disparity, called the asymmetry of root progressions, is considered a decisive feature of harmonic syntax.

This paper is divided into two parts. In the first, the directed motion of chord progressions will be explained from a systematic point of view. The second part will consider the problem from a historical perspective. It will try to establish why the asymmetry of root progressions, which is only a secondary feature during the 16th century, increases significantly at the very end of the 16th century to become a central aspect of harmonic tonality.

Tension paradigm

Counterpoint and asymmetry of root progressions

According to Leonard B. Meyer, "in order for syntax to exist [...] successive stimuli must be related to one another in such a way that specific criteria for mobility and closure are established"⁵. These stimuli must meet two conditions in order to participate in syntactic organization: 1. they must constitute discrete units and 2. they must be subjected to a hierarchy⁶. In Western polyphony hierarchical organization is closely linked to the concept of tension and resolution which Sarah Fuller and Joseph P. Swain consider to be crucial for the musical syntax⁷. Sadaï draws attention to the tension paradigm that regulates the preparation and the resolution of dissonances⁸. This paradigm is reflected in the *clausula formalis* (figure 2) between the tenor part (in red) and the soprano part (in yellow) involving a suspension dissonance, prepared by a consonance and resolved by the least movement onto an imperfect consonance and then onto a perfect consonance.

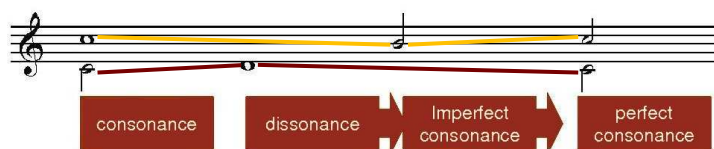


Figure 2: *Tensional paradigm*.

My approach consists of inserting the tenor and soprano part in a triadic context (figure 3). The different triads which contain these two lines simultaneously during their melodic movement are the different harmonizations of the intervallic sequence. The initial consonance C-C, which prepares the dissonance, may be harmonized by the triads on C, A and F (in black). The dissonance C-D can be harmonized by the triads

⁵ Leonard B. MEYER, *Style and Music: Theory, History, and Ideology, Studies in the Criticism and Theory of Music*, Philadelphia: University of Pennsylvania Press, 1989, p.14.

⁶ Cf. Benjamin BORETZ, « The Construction of Musical Syntax », *Perspectives of New Music* 9 (1970), p. 25.

⁷ Cf. Sarah FULLER, « Tendencies and Resolutions: The Directed Progression in Ars Nova Music », *Journal of Music Theory* 36 (1992), p. 229-258, Joseph P. SWAIN, « The Concept of Musical Syntax », *The Musical Quarterly*, vol. 79, No. 2 (1995), p. 281-308.

⁸ Yizhak SADAÏ, « De certains paradigmes pré-compositionnels dans la musique tonale », *Congrès européen d'analyse musicale*, Trento: Università degli studi di Trento. Dipartimento di storia della civiltà europea, cop. 1992, vol. 1, p. 127.

on *D*, *B* and *G* appearing in dark grey. The resolution onto the imperfect consonance can be correlated to the triads on *B* and *G* (in light grey). And finally, the resolution onto the perfect consonance *C-C* can be linked to the roots *C*, *A* and *F* appearing in black.

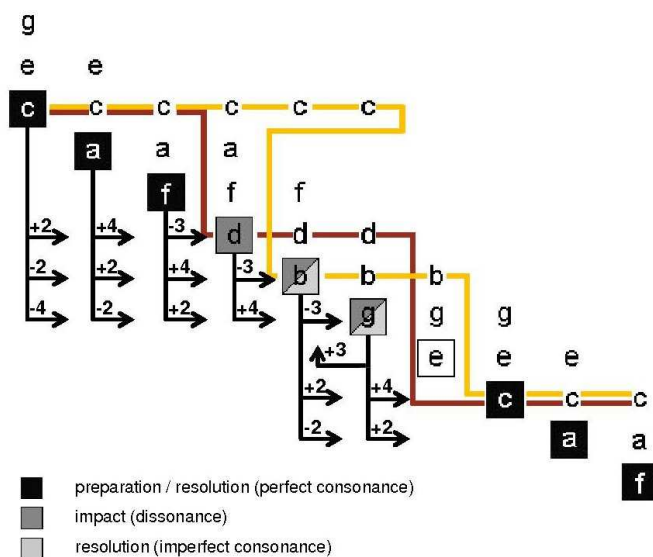


Figure 3: *Tensional paradigm and asymmetry of root progressions.*

Several observations can be made. Only the root *E* has no involvement in the functional cycle as contrapuntal lines exclude its use. The *F*, associated with the resolution on the final perfect consonance (*C-C*) has to be excluded. With the exception of the Phrygian cadence, modal theory prevents the harmonization of the final by the lower fifth. Finally, the tension paradigm implies a fall in the cycle of thirds between the different units of the intervallic chain. This fall corresponds to a directional tendency of chord sequences. If we indicate using arrows the harmonic progressions from the preparation of the dissonance (in black), to its impact (in dark grey) and its successive resolution on the imperfect and perfect consonance (respectively in dark grey and black), it becomes obvious that the dominant vectors (+4,-3,+2) are much more frequent than the subdominant vectors (-4,+3,-2). This is shown by the following histogram (figure 4) which summarizes the percentage of the vectors that are theoretically implied by the tension paradigm: 70% belong to dominant vectors and 30% to subdominant vectors.

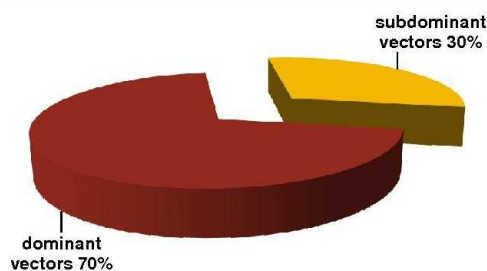


Figure 4: *Root progressions theoretically implied by the tensional paradigm*

1.2 Cognitive transitivity and harmonic syntax

In the cadence considered above (figure 2), the harmonic intervals involve a teleological tendency since the stability of the final consonance is accentuated by the relative instability of the dissonance and the imperfect consonance. Conversely, the relatively unstable intervals (i.e. the dissonance and the imperfect consonance) derive their justification from the relatively stable entities to their right in the intervallic chain. From a cognitive point of view, this relationship corresponds to the linguistic phenomenon of transitivity⁹ broadly defined by Sechaye as the incompleteness of a main idea requiring further constituents to acquire meaning¹⁰. Several cognitive models, developed by linguists such as DeLancey, Lakoff, Croft, Langacker and Desclés can be related to the harmonic syntax of Western music¹¹. I will focus here on Langacker's models because they show significant similarities but also important differences between verbal and musical syntaxes.

Langacker introduces two main models supposed to establish a cognitive grammar: the billiard-ball model and the stage model¹² (figure 5). These two models are closely interconnected. The billiard ball-model conceptualizes the energetic interaction between different objects in space-time. The objects are represented by circles, interactions are signified by lines connecting the objects and space-time is represented by the frame. The stage model symbolizes the archetype of the spectator watching, from the outside, interactions within a stable and limited setting. This outside perspective is represented by the letter V (view) pointing towards the billiard-ball model.

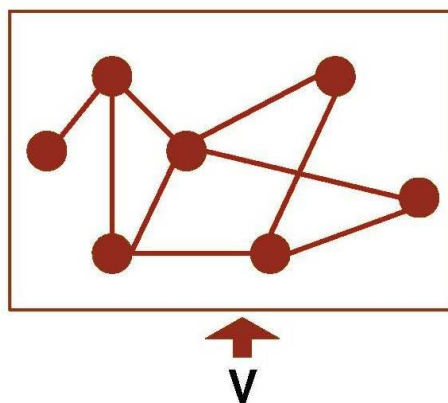


Figure 5: Billiard-ball model and stage model.

The chain of action (figure 6) is an essential key to Langacker's concept of transitivity. According to him, "an object transfers energy to a second object which in turn interacts with the following object until a participant is reached whose reaction does not imply any more energy transfer". This metaphor can be applied to harmonic

⁹ Nicolas MEEUS, « Une approche cognitive de la tonalité, transitivity, rection et fonctions tonales », *Analyse musicale* 26 (february, 1992), p. 26-29.

¹⁰ Albert SECHAYE, *Essai sur la structure logique de la phrase*, Paris, Champion, 1926, p. 80. Cited in Nicolas MEEUS (1992).

¹¹ For a description of these cognitive models cf. Jong-Seok SOH, *Transitivity sémantique et ses corrélats conceptuels*, Thèse de doctorat sous la direction de Jean-Pierre Desclés, Paris IV, 2002, p. 40 *sqq.* and Sang-Jun PARK, *Contribution à l'étude de la transitivity en français*, Thèse de doctorat sous la direction de Alain Lemaréchal, Paris, IV 2004, p. 31 *sqq.*

¹² Ronald W. LANGACKER, *Concept, Image, and Symbol. The Cognitive Basis of Grammar*. Berlin: Mouton de Gruyter, 1990, p. 209 *sqq.*

sequences submitted to the tension paradigm. The circles in the model correspond to the harmonic intervals whose tendency is indicated by the arrows. The chain of intervals leads through the relatively unstable intervals until the perfect consonance is reached which does not imply any continuation. In Langacker's model, the arrow to the right symbolizes the asymmetrical relationship between different objects. In the theory of harmonic vectors, the increased use of the right arrow, associated with dominant vectors, represents the asymmetry of root progression. These are two aspects of the same concept of transitivity.

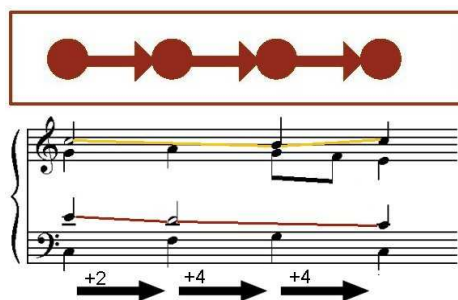


Figure 6: *Asymmetric interaction in verbal and harmonic syntax.*

Langacker conceptualizes several archetypal roles that strongly resemble the *cases* in Fillmore's semantic grammar¹³. Two of these roles find direct correspondence in musical syntax: the archetypes of the agent and the patient (A and P). In the cognitive model (figure 7), the agent occupies the head position in a causal chain and actively transmits energy via other participants to the patient (P). In music the same terminology is introduced by Artusi¹⁴ to characterize the suspension dissonance: the agent is associated with the note implying the dissonance whereas the patient is linked with the note subjected to the dissonance and providing the resolution. In a broader sense, the patient may be extended to the last link in the intervallic chain. The agent, however, is always associated with the dissonance that occurs after the preparation by a consonance. The latter would correspond in Langacker's conception to the absolute participant, located out of the flow of energy.

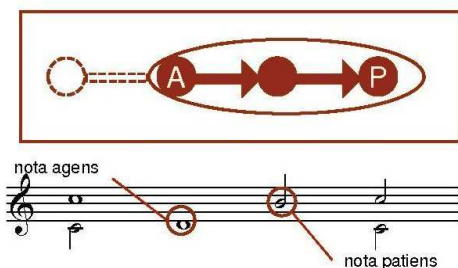


Figure 7: *Archetypes of the agent and the patient in verbal and harmonic syntax.*

The concept of energy, key to the cognitive model, deserves further consideration. Langacker grants objects a driving force which can act on other objects and modify their condition. This same energy cannot be associated *a priori* with discrete units of musical syntax because of their semantic indeterminacy. An unstable interval does not, by its nature, convey a goal intended motion. The teleology is due both to universal cognitive principles and arbitrary aesthetic paradigms. On the one hand, stepwise

¹³ Cf. Charles J. FILLMORE, « The Case of Case » Emmon Werner BACH (ed.), *Universals in Linguistic Theory*, New York: Holt, Rinehart and Winston, 1972, *Idem*, « Toward a modern theory of case », David A. REIBEL (ed.), *Modern Studies in English: Readings in Transformational Grammar*, New York: Prentice Hall, Englewood Cliffs, 1969, *Idem*, « The Case for Case Re-opened », Peter COLE, *Syntax and Semantics 8, Grammatical Relations*, New York: Academic Press, 1977.

¹⁴ Giovanni Maria ARTUSI, *Seconda parte dell'arte del contraponto*, Venetia, Vincenti, 1589, book 2, chapter 1, p. 27 sq.

melodic motion, belonging to universals in music, and ensuring a fluid connection between the discrete units¹⁵. On the other hand the ideal of a return to consonance, specific to Western polyphony and part of a cognitive principle of stability fundamental to musical syntax¹⁶. The contrapuntal rules of preparation and resolution of the dissonance¹⁷ and the stepwise and contrary motion from the imperfect to the perfect consonance¹⁸, derive from both of these principles. Via these rules, the unstable intervals are assimilated to musical syntax and acquire a teleological significance. This meaning is not absolute. It is cognitive¹⁹ in nature resulting from the particular context in which the intervals occur and how they follow each other.

Semiological implications

Langacker's models take-on a semantic understanding of transitivity. Also, I have used the notions of harmonic meaning and teleology several times. Therefore, this part of the paper will examine the links between the semiological implications of the tension paradigm and the accentuation of the asymmetry of root progressions. Jean-Jacques Nattiez defines the purpose of musical semiology as "to explain and describe the nature of referral phenomena which music involves"²⁰. According to Jakobson²¹, music has two referential options: *introversive semiosis* dealing with the internal meanings of music and *extraversive semiosis*, referring to external significations.

Extraversive semiosis

Nattiez divides extrinsic reference into three broad areas: the spatio-temporal, the kinetic and the affective²². The tension paradigm, as signifier, is primarily linked to this last field. As Combarieu notes, if music touches us, it is because "it incites us to be [literally] moved"²³. This concept is developed by Michel Imberty, who emphasizes the relationship between music listening, the gestural behavior that it induces and the

¹⁵ Perry R. COOK, *Music, cognition, and computerized sound: an introduction to psychoacoustics*, Cambridge; London: MIT press, cop. 1999, p. 119 sq.

¹⁶ Fred LERDAHL, « Cognitive Constraints on Compositional Systems », in *Generative Processes in Music: The Psychology of Performance, Improvisation, and Composition*, John SLOBODA (ed.), Oxford: Clarendon Press, 1988, p. 245.

¹⁷ Cf. Christophe GUILLOTEL-NOTHMANN, « Plus difficile à dénouer que le nœud gordien, la résolution descendante des dissonances », *Jardin de musique*, in preparation.

¹⁸ Cf. Klaus-Jürgen SACHS, *Der Contrapunctus im 14. und 15. Jahrhundert. Untersuchungen zum Terminus, zur Lehre und zu den Quellen*, Wiesbaden: Franz Steiner, 1974, p. 33 sqq., 61, 76 sqq., 103, 108, 112, 114 sqq.

¹⁹ Aniruddh D. PATEL, *Music, language and the brain*, New York: Oxford University press, 2008, p. 260.

²⁰ Jean-Jacques NATTIEZ, *Fondements d'une sémiologie de la musique*, Paris: Union générale d'éditions, 1976, p. 28.

²¹ Roman JAKOBSON, *Essais de linguistique générale*, translated into french by Nicolas Ruwet, Paris: Éditions du Seuil, 1970, p. 12.

²² Jean-Jacques Nattiez, *Music and Discourse. Toward a Semiology of Music*, translated into english by Caroline Abbate, Princeton: Princeton University Press, 1990, p. 118.

²³ Cited in NATTIEZ (1990), p. 104.

emotion that it implies²⁴. Accordingly, the tension paradigm instigates emotions because of its inherent teleology.

In the 6th book of madrigals by Monteverdi, the tension paradigm, and especially the suspension dissonance, is employed in two distinct expressive contexts. Either it is used to translate localized syntactic and semantic tensions or it is used more broadly in order to express a general affect.

The first case appears in the *Sestina Lagrime Amante al Sepolcro dell'Amata*. In the last verses of the first stanza, depicting the pain and anguish of the lover, the semantic tension is due to the syntactic constructions which place the subject, "Glauco", at the end of the sentence (example 1). The dynamics of the text are translated into music by the tension paradigm referring to both the syntactic construction and the referents *pain*, *complaint*, and *fire*. Here, the dissonances and their resolutions, used for discursive purpose, generate the root progressions +4, -3 and +2, which all correspond to dominant vectors in Nicolas Meeùs' theory. In this way a substantial link can be established between the extrinsic meaning of the tension paradigm and the directed motion of chord sequences.

Example 1: Monteverdi, 6th book of madrigals, *Sestina Lagrime d'Amante al Sepolcro dell'Amata*, *Incenerite spoglie*, bars 37-42.

The second case appears at the end of the madrigal *Zefiro torna*. After two verses which concern the advent of spring, the madrigal's last stanza depicts the narrator's suffering and melancholy as he mourns the death of his beloved (example 2). The last verse of the madrigal is set to music with a succession of numerous dissonances. By their extreme acerbity they reflect, not only the semantic fields *savage* and *cruel* in the immediate context, but also the melancholy and desolation of the entire last stanza.

These dissonances, have a considerable emotional impact and with two exceptions, involve dominant vectors (+4, -3, 2) exclusively. Once again, a direct link can be established between the use of dissonance for expressive purpose and the asymmetry of root progressions.

²⁴ Michel IMBERTY « Perspectives nouvelles de la sémantique musicale expérimentale », *Musique en jeu* 17 (1975), p. 95.

Example 2: Monteverdi, 6th book of madrigals, *Zefiro torna e'bel tempo rimena*, bars 120-123.

In both examples, the dissonances are clearly associated with the semantic fields of pain, sadness and violence. This link reflects the relationship between structural complexity and the nature of emotion that has been demonstrated in many cognitive studies²⁵. However, a direct or natural connection between the tension paradigm and extrinsic referents is not tenable. The tension paradigm is not used to refer to specific extrinsic semantics but rather in order to restore, through mimesis, emotions and passions that emerge from the poetic text.

Introversive semiosis

According to Jakobson, musical units have the particularity that they refer primarily to other musical units already heard or yet to come²⁶. *Introversive semiosis* can be generated by the tension paradigm since its discrete units refer to other units, implying teleology. The resulting chain, linked to the signified *cadence*²⁷ as intrinsic referent, may then interact with other similar referents. Thus, the need to organize the work into a coherent structure, built of independent sections, contributes, through the tension paradigm, to increase the asymmetry of root progressions. This correlation is evident in the *Toccata Quinta* from Frescobaldi's 2nd book of toccatas (example 3). The work is divided into 6 sections and is characterized by an extremely slow harmonic rhythm: harmonic progressions occur almost exclusively at the end of each section in cadential contexts. The end of section 4 does not imply any chord progression. The end of section 3 corresponds to the Phrygian cadence exception involving a subdominant vector. In contrast, at the end of sections 1, 2, 5 and 6, the tension paradigm, used here for structural purposes, implies root motions up a fourth corresponding to dominant

²⁵ Cf. Laura-Lee BALKWILL and William Forde THOMPSON, « A cross-cultural investigation of the perception of emotion in music: Psychophysical and cultural cues », *Music Perception* 17 (1999), p. 43-64.

²⁶ Roman JAKOBSON, op. cit., p. 12.

²⁷ Cf. Sabina SKRZYPCZAK, « Fifteenth-Century Cadential Formulae, a Problem for Twentieth Century Semiology of Music », *Miscellaneous Musicologica*, Adelaide Studies in Musicology, vol. 17 (1990), p. 14.

vectors. In this way a substantial link can be established between the intrinsic meaning of the tension paradigm and the directed motion of chord sequences.

1) 2) 3) 4) 5) 6)

dominant vectors
+4 : →
-3 : →
+2 : →
subdominant vectors
-4 : ←
+3 : ←
-2 : ←

Example 3: Frescobaldi, 2nd book of toccatas... *Toccata Quinta*, bars 7-9, 20-22, 34-36, 37-40, 54-57, 81.

According to Meyer, music can generate emotions when it does not satisfy the listener's expectations. Because these emotions are inextricably linked to dynamic processes inherent in music, they are part of *introversive semiosis* and not necessarily positively or negatively valenced. The writing technique used in the *Toccata Ottava* by Frescobaldi (example 4) is able to create the musical emotions which Meyer alludes to. Built entirely on suspension dissonances, it plays with the listener's expectations. Resolution of the dissonance almost always involves another dissonance which in turn requires a new resolution constantly delayed until the final cadence. The preparation and the resolution of dissonances, involving intrinsic referring, provokes, with one exception, dominant vectors. As a result, the musical affects, associated in Meyer's expressionist absolutist conception to intramusical meaning, are able to generate the asymmetry of root progressions when they are linked to the tension paradigm.

dominant vectors
+4 : →
-3 : →
+2 : →
subdominant vectors
-4 : ←
+3 : ←
-2 : ←

Example 4: Frescobaldi, 2nd book of toccatas... *Toccata Ottava*, bars 40-45.

Semiosis and tonal syntax

Extraversive and *introversive semiosis* are able to generate asymmetry of root progressions. Although many writers admit that music has both referring options, they give preference to one or other of the possibilities. Nattiez's position is interesting because it places the issue in a historical context: "[...] musicians and musicologists, following the tendencies of their age and their personal convictions are led to privilege one of the two semiological dimensions to the detriment of the other. These two semiological dimensions are always present in all music"²⁸.

I would argue that at single moments in the history of music both forms of *semiosis* may have contributed differently to asymmetry of root progressions that is inherent in harmonic tonality.

The following diagrams show the ratio of dominant to subdominant vectors in three isolated works: the madrigal *Ch'ami la vita mia* from Monteverdi's 1st book of madrigals, *Zefiro torna*, from his 6th madrigal book and the *Toccata Ottava* from Frescobaldi's 2nd book of Toccatas. As can be seen, dominant and subdominant vectors are equally present in the first madrigal, the asymmetry of root progressions is relatively marked in the second and is strongly developed in the instrumental work. If we isolate the asymmetry implied by the dissonances (emphasized by texture), we recognize a direct link between the frequency of dissonance and the asymmetry of root progressions. In *Ch'ami la vita*, the dissonance's frequency, and correspondingly, the asymmetry of root progressions, is almost non-existent. In *Zefiro Torna* the use of the dissonance referring to the text's discursivity has significant repercussions on harmonic syntax. Finally, in the toccata the tension paradigm implies a strong asymmetry by structuring the musical form and evoking emotions through *introversive semiosis*.

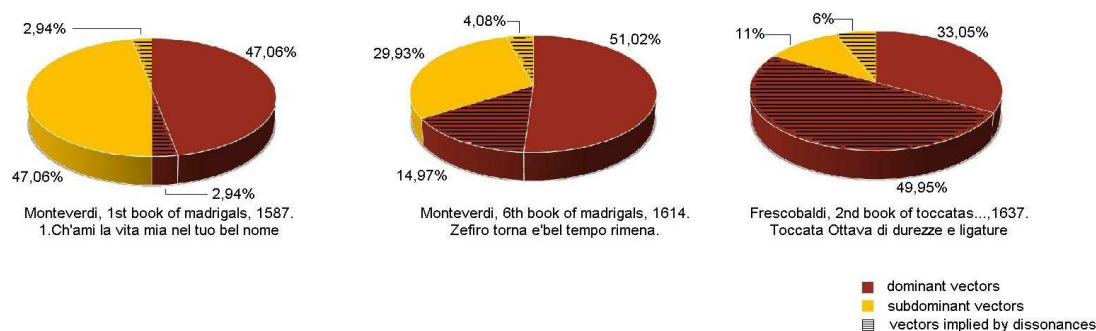


Figure 8: The ratio of dominant to subdominant vectors in *Ch'ami la vita mia*, *Zefiro torna* and the *Toccata Ottava*.

These analyses do not claim to be representative. They simply suggest that the semiological implications of the tension paradigm are able to affect harmonic syntax in different ways in different historical and aesthetic contexts. At the turn of the 17th century the move from a rational to an emotional understanding of the poetic text may have increased the privileged direction of chord sequences that is present in a latent

²⁸ Jean-Jacques NATTIEZ, *Music and Discourse. Toward a Semiology of Music*, op. cit., p. 118.

state in the 15th and 16th century. The advent, in the early 17th century, of pure instrumental music which derived its structure and its evocative power exclusively by intrinsic means may have contributed to reinforce the asymmetry of root progressions.

Conclusion

This paper has tried to establish that one of the main characteristics of harmonic tonality, the privileged direction of chord sequences, is due on the one hand to cognitive principles and, on the other, to aesthetic choices inherent in Western music. At the present stage of research, the tension paradigm governing cadential chains of intervals must be considered the cause of the asymmetry of root progressions. It ensues from an ideal of consonance and a tendency of imperfection towards harmonic perfection that emerges very early in contrapuntal rules. The teleology resulting from the tension paradigm can be related in part to the concept of cognitive transitivity modeled in Langacker's schemas. This paper does not claim that these schemas *explain* the asymmetry of root progressions. The only purpose of this comparison is to show that transitivity encountered in both verbal and musical semiological systems have clear analogies. Future research should establish whether the two phenomena have common origins.

Finally, the will to express emotions and the need to organize musical discourse in a consistent formal structure may have affected the directional tendency of root progressions. Thus, this paper argues that *extraversive* and *introversive semiosis*, insofar as they are linked with the tension paradigm, may have had considerable repercussions on tonal syntax according to historical eras, aesthetics and genres. The link between the text's discursivity and the asymmetry of root progressions, although prior to the 17th century, acquires great importance in the aesthetic conception of a *poesia per musica* commonly associated with the advent of the *seconda prattica*. In the instrumental music of the 17th century, the correlation between *introversive semiosis* and harmonic progressions may have played a significant role in strengthening and stabilizing the directed motion inherent in tonal syntax. It is not a question of reducing the operation of tonality to this single aspect and ignoring other aspects of harmonic tonality that could not be discussed here. My only purpose has been to demonstrate how a tension paradigm inherent in Western music, may have led, via its cognitive and semiological implications, to the advent of a fundamental characteristic of tonal syntax.