



HAL
open science

Locality in music and syntax: a minimalist analysis of modulation

Diego Pescarini

► **To cite this version:**

Diego Pescarini. Locality in music and syntax: a minimalist analysis of modulation. Quaderni di Linguistica e Studi Orientali / Working Papers in Linguistics and Oriental Studies, 2020, 6, pp.161-171. hal-03094866

HAL Id: hal-03094866

<https://hal.science/hal-03094866>

Submitted on 4 Jan 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Public Domain

Locality in music and syntax: a minimalist analysis of modulation

Diego Pescarini

CNRS, Université Côte d'Azur, BCL – diego.pescarini@univ-cotedazur.fr

Abstract: The article provides an analysis of *tonicization* and *modulation* in western tonal music within the framework of minimalist syntax. In the spirit of Katz & Pesetsky's 2011 *Identity Thesis for Language and Music*, I argue that syntactic notions such as *Agree* and (Phase) *Impenetrability* may shed light on some aspects of music theory involving dependencies within local domains.

Keywords: music, syntax, agree, phases, locality

Short title: Locality in music and syntax

1. Introduction

This article elaborates on some parallelisms between music theory and formal syntax, a line of inquiry inaugurated by Lerdahl & Jackendoff 1983. I will focus on *tonicisation* (Schenker 1906/1954: 256) and *modulation*, i.e. the harmonic processes whereby the *tonal centre* changes from one key to another. I will show that tonicisation and modulation hinge on syntactic-like *dependencies* that are constrained by *locality conditions*.

In syntax, locality conditions constrain syntactic dependencies such as agreement, *wh*- movement, binding, etc. For example, reflexive pronouns like *himself* must be bound by an antecedent belonging to the same clause, see (2)a vs (2)b. Roughly speaking, (2)b is impossible not because there are too many words between the reflexive and its antecedent, but because the dependency between the two crosses a structural barrier that impedes binding. Locality conditions are therefore sensitive to syntactic constituency (e.g. clause boundaries), while they are independent from processing issues such as short-term memory capacity.

- (1) a. John_i is impressed with *himself*_i
- b. * John_i asked Mary to help *himself*_i

In highlighting similarities between music and syntax, I intend to support Katz & Pesetsky's 2011 thesis in (2), although I will depart from their analysis of tonicisation and modulation.

(2) *Identity Thesis for Language and Music*

All formal differences between language and music are a consequence of differences in their fundamental building blocks (arbitrary pairings of sound and meaning in the case of language; pitch-classes and pitch-class combinations in the case of music). In all other respects, language and music are identical.

The article is organized as follows: §2 overviews some properties of tonal music; §3 reviews Katz & Pesetsky's analysis of *cadence*, *tonicisation*, and *modulation*; §4 suggests a revision of the analysis. §5 concludes.

2. Some features of tonal music

Music perception relies on the categorisation of pitch events. In this respect, musical systems exhibit universal properties (Brown & Jordania 2011) such as:

- (3) a. Use of discrete pitches rather than slides/portamentos.
- b. Octave equivalence = unison choral singing in octaves.
- c. Use of pitch sets = musical scales.

Hence, in all musical systems octaves are segmented into discrete intervals, yielding *scales* of pitch events (*notes*) ordered by fundamental frequency. The set of notes forming a scale is called *key* or *tonality*

In the next sections, we will see that western tonal music allows *key change*: musical pieces can be therefore decomposed into *key domains* headed by a local tonic.

3. Cadence, Tonicisation, and modulation

A musical phrase is a string of pitch events that is perceived as an autonomous unit. A phrase is formed by subconstituents (*cells*) and it may be part of a larger *period*. Several factors contribute to defining musical phrases, including rhythm, melody, and harmony. With respect to harmony, musical phrases usually end with a *cadence*: a progression in which a chord conveying tension (e.g. V) resolves into a chord giving a sense of stability (e.g. I).

- (8) a. [Phrase ... V I] ^{cadence}
 b. [Phrase ... V I ...]

Notice that, to be perceived as a cadence, a V-I progression must occur at the *edge* of the phrase: schematically, V-I is a cadence in (8)a, but not in (8)b. In the following subsections I will introduce Katz & Pesetsky's 2011 analysis of the cadence. In §§3.2-3 I will elaborate on the two related components that yield cadence: tonicisation and key-domains.

3.1 Katz & Pesetsky's 2011 analysis

Katz & Pesetsky 2011 argue for a parallelism between *head movement* in natural language and the cadence in western tonal music. In current syntactic theory, head movement is a kind of displacement resulting when a lexical head is moved without displacing the phrase it belongs to. For instance, the Italian verb *mangio* 'I eat' in (9) is the head of the Verb Phrase containing the object *piselli* 'peas'; in simple tenses, the verbal head is moved before the adjoined adverb *sempre* 'always', yielding the order

- (9) *mangio sempre* [VP ~~*mangio*~~ *piselli*]
 ↗

Verb movement results in incorporation of the verbal head to a functional head (dubbed T for Tense), which encodes inflectional features. In compound tenses, T is spelled out by an auxiliary verb (see (10)a), whereas in simple tenses V moves (above the adverb) to incorporate T's features, see (10)b:

- (10) a. [T [Adv [VP V NP]]]
 | | | |
ho sempre mangiato piselli 'I have always eaten peas.'
 b. [V+T [Adv [VP V NP]]]
 | | | |
mangio sempre piselli 'I always eats peas.'

Katz & Pesetsky argue for a parallelism between head movement and cadence. They claim that, in a cadence between a chord δ and a tonic τ , the relationship established between δ and τ is comparable to the one holding between the two heads V and T in (10)b. The parallelism is supported by the following similarities, some of which will be discussed in the following subsections:

- after head movement, the remnant phrase (e.g. the VP in (10)b) remains an independent phrase, which can be displaced autonomously regardless of the position of its head V; *mutatis mutandis*, the basic key domain – our metaphorical “VP” – and the cadence – which is our metaphorical T+V complex head – are not necessarily adjacent, but they can be separated by various temporary tonic centres (more on this in §3.2);
- head movement is obligatory; similarly, the participation of I in a cadence (e.g. V, I) is necessary to establishing the key (more on this in §3.3);
- once the head has undergone head movement, it is pronounced string-adjacent to the higher head; the two end up tightly coupled, like the V and I chords in the full cadence.

This conclusion, however, is not desirable as we perceive (14)b as a variant of (14)a. This amounts to saying that G is always interpreted as V in $T_{(C)}$ and no embedded key domain is established in (14)b. Instead, the altered chord in bar 2 is usually analysed as a *secondary chord* (noted as V/V), i.e. the V degree of the G chord, which in turn is the V degree of the basic tonality.

(16) [C ... IV V/V V I_{+TON}]

No embedded key domain is established in (16): the G chord acts as a temporary tonic (tonicisation, cf. §3.1), but G does not establish its own Key Domain.

Conversely, if we modulate from a tonality (e.g. $T_{(C)}$) to another (e.g. $T_{(G)}$) we must establish a new key domain and all harmonic functions in the new domain must be assigned in the new key. The mechanism is illustrated in (18): at the beginning, the base tonality is $T_{(C)}$; then, at the end of bar 6 an altered D chord occurs and, as in (14b)/(16), D is interpreted as V/V in $T_{(C)}$ via tonicisation of G; in bar 7, however, the D chord is repeated, this time within a cadential formula (i.e. at the edge of the musical phrase). The combination of tonicisation and cadence yields modulation, i.e. a change of tonality from $T_{(C)}$ to $T_{(G)}$ that is permanent: starting from bar 8, all harmonic functions are assigned in the tonality $T_{(G)}$.

(17) Clementi, Sonatina op. 36 n. 1 (bars 1-13)

V/V V(C) V(G)
Tonicisation Modu-

I(G) V(G)
-lation

This simple example provides a clear comparison between tonicisation, which occurs between bars 6 and 7 (and does not result in key change), and modulation, which occurs between bars 7 and 8 (at the edge of the musical phrase), establishing a new key domain. Both tonicisation and modulation yield tonic marking, which, however, is not a necessary condition for establishing a key domain, cf. (15). In order to establish a key domain (via modulation), tonic marking must occur at the edge of a constituent ending with a cadence.

In the light of this conclusion, let us focus on Katz & Pesetsky's 2011 formal analysis of the cadence. In particular, I will focus on the relationship between three related concepts: cadence, key domain, and tonic-marking. In the following quote (from their §5.2.3), Katz & Pesetsky

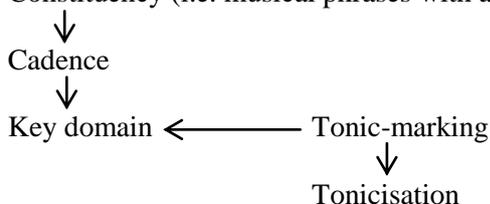
suggest that cadential δ -to- τ movement has the function of **tonic-marking** τ , i.e. assigning it the feature [+TON]. When a head τ in a structure K is tonic-marked [...], it has the consequence of allowing the terminal nodes of a particular subtree of K (determined by τ) to be understood as belonging to *the key of* τ .

According to the previous quote, the cadence assigns the feature [+TON] to a given pitch τ so that all others pitches belonging to the structure K are interpreted in the key $T_{(\tau)}$. However, this claim is too strong because also tonicisation assigns the feature [+TON] to a given pitch, but tonicisation is not a sufficient condition to establish a Key Domain. In Katz & Pesetsky's 2011 words in (18), being marked [+TON] is a necessary, but not sufficient condition to establish a key domain:

- (18) Key Domain
Optional: A node marked [+TON] is a key-domain.

In order to establish a key domain, a second condition must be met, namely that tonic-marking occurs in a cadence (recall that a cadence is a progression in which a chord conveying tension (e.g. V) resolves into a chord giving a sense of stability (e.g. I) at the edge of a phrase). The logical relationships between the concepts introduced so far is eventually schematized in (19): modulation results from two independent conditions, tonic-marking and cadence; the latter in turns depends on constituency. When tonic-marking takes place outside of a cadence, no key domain is established and tonicisation results (§3.2):

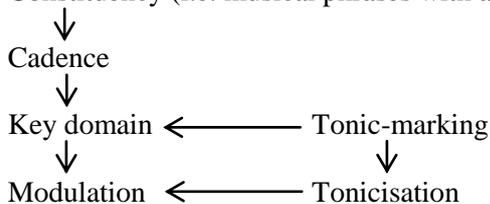
- (19) Constituency (i.e. musical phrases with an *edge*)



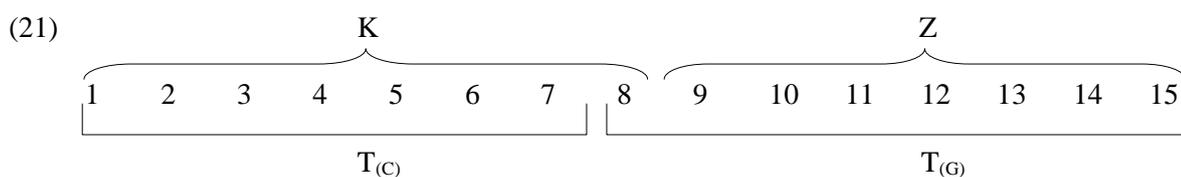
Following (19), the cadence *per se* does not have “the function of tonic-marking τ ”, although it has the power of establishing a key domain by promoting a node marked [+TON] to the role of tonic of a key-domain.

Given this state of affairs, we can define modulation as a process of tonicisation that takes place in the context of a cadence: if a new tonic is introduced at the edge of a phrase, the new tonic will become the centre of the newly established key domain:

- (20) Constituency (i.e. musical phrases with an *edge*)



The latter point is illustrated (21), which is an analysis of the excerpt (17). In (17), bars 1-8 form a phrase K, whereas bars 9-15 form another phrase Z. The first seven bars of K are in the tonality $T_{(C)}$; then the cadence between bar 7 and 8 establishes a new key domain – $T_{(G)}$ – which is the tonality of the following phrase Z:



What is crucial is that the key domain $T_{(G)}$ crosses the phrase boundary between K and Z. This contradicts (my understanding of) Katz & Pesetsky’s hypothesis, according to which the cadence determines the harmonic functions of the phrase *it belongs to*, namely K (see the above quote from K&P). Rather, the cadence yields a modulation that creates a key domain that is formed by the right edge of K and the following phrase Z. In my opinion, this misalignment between phrases and key domains requires a partial reformulation of Katz & Pesetsky’s analysis, which will be discussed in the next section.

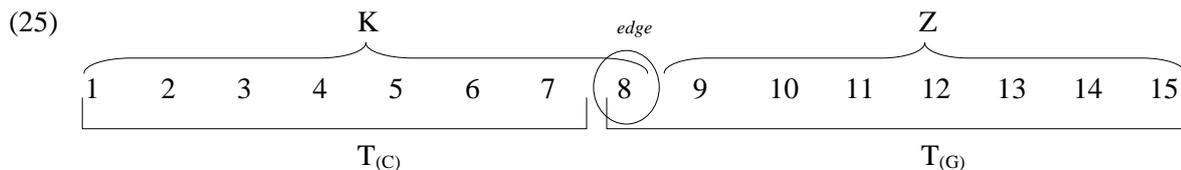
4. Towards a revision of Katz & Pesetsky’s account

This section aims to revise the analysis of tonicisation (§3.2) and modulation (§3.3) in order to meet two desiderata:

available for further computation, while its outer layer is still visible from the successive phase. This hypothesis is captured by the *Phase Impenetrability Condition* (PIC):

- (24) In a structure $[_{ZP} Z \dots [_{HP} \alpha [H YP]]]$, where Z and H are phase heads, the domain of H is not accessible to operations at ZP; only H and its edge are accessible to such operations

Let us suppose that musical structures, like syntactic structures, are organized into phases, which define impenetrable domains. If this analysis is on the right track, one can eventually suggest that notions such as key-domain and cadence are better analysed in terms of phasehood, which is independent from the algorithm building phrase structure/constituency. To illustrate the hypothesis, let us resume the analysis of Clementi's excerpt in (17): recall that the first 8 bars of Clementi's *sonatina* form a phrase K ending with a cadence; the *edge* of K (containing the cadence) forms a key domain in $T_{(G)}$ with the next phrase (bars 9-15).



This recalls Chomsky's discussion (1999: 10) concerning the spell-out domain in a structure of the following type:

- (26) $[_{ZP} Z \dots [_{HP} \alpha [H YP]]]$

Chomsky argues that "H and its edge α in (8) [= our (26)] belong to ZP for the purposes of Spell-out, under PIC". Thus, at least in its original formulation, Chomsky hints at the possibility that the edge of a phase forms a Spell-out domain with the superordinate phase ZP. It seems to me that the same intuition may provide a suitable account for the (mis)alignment between musical phrases and Key domains: a phrase ends with a cadence, which may establish a new key domain (to which the next phrase belongs). The analysis of cadences as edges, which is compatible with Katz & Pesetsky's 2011 analysis in terms of head movement, provides a promising account of the mapping between constituent structures ("phrases") and key domains ("phases").

Most importantly, the PIC in (24) provides a sound explanation of modulation: in fact, the key domain preceding the cadence becomes impenetrable from the successive phase. Thus, any chord belonging to Z in (25) will be interpreted with respect to the new tonic established in bar 8, while no probe-goal relation can be established with any chord belonging to the previous key domain.

5. Conclusions

The present paper has addressed the notions of *tonicization* and *modulation* in the framework of minimalist syntax. In the spirit of Katz & Pesetsky's 2011 *Identity Thesis for Language and Music*, I argued that syntactic notions such as Agree and Phase (Impenetrability) may shed light on some aspects of music theory involving dependencies within local domains.

I suggested a partial revision of Katz & Pesetsky's analysis by divorcing tonicisation from the cadence and by redefining the role of the cadence in establishing key domains. I argued that tonicisation consists of an Agree relation turning an uninterpretable chord into an interpretable pitch event by sharing the harmonic function of a nearby interpretable element. Lastly, I suggested that modulation results from a locality constraint reminiscent of Chomsky's 1999 *Phase Impenetrability Condition*, which prevents the interpretation of pitch events in a previous key if tonicisation takes place at the edge of a phase.

References

- Brown, S., & Jordania, J. (2013). Universals in the world's musics. *Psychology of Music*, 41(2), 229–248. <https://doi.org/10.1177/0305735611425896>

- Chomsky, Noam. 1999. Derivation by phase. In MIT Occasional Papers in Linguistics 18. MITWPL, Department of Linguistics and Philosophy, MIT, Cambridge, Mass.
- Chomsky, Noam. 2000. 'Minimalist inquiries' in *Step by step: Essays on minimalism in honor of Howard Lasnik*, ed. by Roger Martin, David Michaels, and Juan Uriagereka, 89-155. Cambridge (MA): MIT Press.
- Gill, Kamraan, & Purves, Dale (2009) A Biological Rationale for Musical Scales. PLoS ONE 4(12): e8144. doi:10.1371/journal.pone.0008144
- Katz, Jonah and David Pesetsky 2011. 'The Identity Thesis for Language and Music'. lingbuzz/000959
- Lerdahl, F., & Jackendoff, R. 1983. A generative grammar of tonal music. Cambridge (MA): MIT Press.
- Schenker, Heinrich (1906/1954). *Harmony* (English edition by Oswald Jonas). Chicago: University of Chicago Press.