AN OVERVIEW OF THEORIES
OF THE SYNTAX-PHONOLOGY INTERFACE*

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Abstract

This article is intended as a critical survey of the phonological theories of the syntax-phonology interface. These theories can be divided into two main groups, according to the role they attribute to syntactic representations in creating phonological domains. On the one hand there is the Direct Reference Theory, which claims that phonological operations are directly sensitive to syntactic information, in terms of relations of c-command or m-command (i.e., government) holding between the elements participating in phonological processes. On the other, there is the Prosodic Hierarchy Theory of Prosodic Phonology, which defends the view that syntactic and phonological representations are not isomorphic and that there is a distinct level of representation called Prosodic Structure which contains a hierarchically organized set of prosodic constituents. These constituents are built from syntactic structure by a finite set of parameterized algorithms, and phonological processes refer to prosodic constituents rather than to syntactic constituents. Elordieta (1997, 1999) proposes that certain phonological phenomena may be specified to apply in the domains or constituents formed by functional and lexical heads related by feature checking. Seidl's (2001) Minimal Indirect Reference Theory claims that syntactic relationships such as theta-domains determine phonological constituency at the phrasal level. Another important, more recent view is the one that maintains that spellout domains (that is, all the material included in a syntactic phase except for the head of the phase and elements in the specifier of that phase) are interpreted as phonological constituents in PF.

1. Introduction

The objective of this chapter is to provide a survey and critical review of the phonological theories that deal with phenomena whose domains of application are directly or indirectly determined by syntactic structure. These theories can be divided into two main groups, according to the role they attribute to syntactic representa-

tions in creating phonological domains. On the one hand there is the Direct Reference Theory, which claims that phonological operations are directly sensitive to syntactic information, in terms of relations of c-command or m-command (i.e., government) holding between the elements participating in phonological processes (cf. Manzini 1983, Kaisse 1985, Rizzi and Savoia 1993). On the other, there is the Prosodic Hierarchy Theory, which defends the view that syntactic and phonological representations are not isomorphic and that there is a distinct level of representation called Prosodic Structure which mediates between the syntactic and phonological components. This level contains a hierarchically organized set of prosodic constituents, built from syntactic structure by a finite set of parameterized algorithms of prosodic constituent formation. Phonological operations themselves do not refer to syntactic constituents, but to the already created prosodic constituents. Two main approaches have developed from this view: the End-Based approach (cf. Chen 1987, Selkirk 1986) and the Relation-Based Approach (cf. Nespor and Vogel 1982, 1986, Hayes 1989).

In another section of this article, I will present data from a dialect of Basque that constitutes a serious challenge to all these theories of the syntax-phonology interface. The problem lies in the behaviour of functional categories in Vowel Assimilation in Lekeitio Basque, in the sense that not all functional categories pattern the same way with regard to this phenomenon. The theories of the syntax-phonology interface proposed in the literature (whether they defend a direct or an indirect mapping from syntax) fail to capture the nature of such differences. Elordieta (1997) shows that this is a problem that can be found in other phenomena from other languages, such as French liaison, Irish Initial Consonant Mutation or ATR Harmony in Ìgbo, and argues that the differences in behaviour with respect to a given phenomenon among functional categories are determined by their different syntactic relationships with the lexical heads they are linearly adjacent to. Certain phonological phenomena may be specified to apply in the domains or constituents formed by functional and lexical heads related by feature checking. For reasons of limit of space, in this article only the data and analysis of Vowel Assimilation in Lekeitio Basque will be presented.

There are other more recent developments of these two general views of the syntax-phonology interface. On the side advocating for a direct mapping between syntax and phonology, there have been proposals building on the minimalist notion of a phase (cf. Chomsky 2001a) which claim that phases delimit phonological domains or constituents. Seidl's (2001) Minimal Indirect Reference Theory is one proposal along these lines. This theory also claims that other syntactic relationships such as theta-domains or domains where theta-roles are assigned determine phonological constituency at the phrasal level. Another important, more recent view is the one that maintains that spell-out domains (that is, all the material included in a syntactic phase except for the head of the phase and elements in the specifier of that phase) are interpreted as phonological constituents in PF (see, *inter alia*, Dobashy 2003, Ishihara 2003, 2007, Kahnemuyipour 2004, Kratzer and Selkirk 2007, Pak 2007, 2008, who present some differences in assumptions and implementations). On the side of the position advocating for an indirect mapping between syntactic and phonological constituents, the most noteworthy recent contribution has been Truckenbrodt's (1995, 1999) development of the End-Based Approach of the Prosodic Hierarchy Theory within the framework of Opti-

mality Theory. We will review all these proposals as well, after a presentation of the more classic models. Finally, Hayes's (1990) theory of Precompiled Phrasal Phonology tries to explain all phenomena of phrasal phonology that cannot be accounted for in terms of the Prosodic Hierarchy Theory in terms of allomorphic rules of phrasal phonology stored in the lexicon. According to this proposal, all phonological phenomena that apply in specific syntactic environments should be treated equally with phenomena that apply to specific morphemes or syntactic categories, such as the *a/an* alternation of the English indefinite determiner.

The article is structured as follows: sections 2-7 contain a critical overview of the most relevant theoretical approaches to phrasal and prosodic phonology, and section 8 contains a conclusion.

2. The Direct Reference Theory

At the outset of our review, it is necessary to clarify a confusing claim about the Direct Reference Theory (DRT henceforth). It is often reported in overviews of prosodic phonology that the basic postulate of DRT is the isomorphism between syntactic structure and phonological structure at the phrasal level. That is, that syntactic constituents are directly mapped into phonological constituents, in such a way that nominal phrases, verbal phrases, prepositional phrases and so forth would be transformed into phonological phrases where phonological processes may apply. The mapping operations would be as straightforward as the ones illustrated in (1) (where Φ is the label for a phonological phrase):

(1)   a.   NP   ⟶   Φ
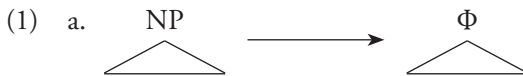
It is important to note that there have been no proponents of such a theory, at least not among the proponents of DRT.[1] Another false contention is that the first version of the DRT appears in the founding work of generative phonology, Chomsky and Halle (1968), and in Elisabeth Selkirk's (1972) pioneering work on the phrase phonology of English and French. We will briefly review the basic assumptions on the relationship between the syntactic and phonological components expressed in the early stages of generative phonology, which we will call the Boundary Theory.

2.1. The Boundary Theory

2.1.1. Chomsky and Halle (1968)

In *SPE* it was suggested that the syntactic component assigned to each sentence a "surface structure" that the phonological component had direct access to, determining the phonetic form of the sentence. It was claimed that at surface structure

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[1] As we will see later, this mapping algorithm is closer to what some versions of the Prosodic Hierarchy Theory defend, as ironic as it may sound.

words were separated by boundaries, as the result of the general convention formulated in (2):

(2)   The boundary # is automatically inserted at the beginning and end of every string dominated by a major category, i.e., by one of the lexical categories "noun," "verb," "adjective," or by a category such as "sentence," "noun phrase," "verb phrase," which dominates a lexical category. (Chomsky and Halle 1968: 366)

By this convention, a # is inserted at the left and right edges of every lexical terminal element as well as its maximal projection. Non-lexical categories are exempt from bracket insertion. Thus, the sentence in (3) would have the surface structure in (4) (cf. Chomsky and Halle 1968: 367-8):

(3)   The book was in an unlikely place

(4) $[_S$ # $[_{NP}$ # $[_D$ the$]_D$ $[_N$ # book #$]_N$ #$]_{NP}$ $[_{VP}$ # was $[_{PP}$ # $[_P$ in$]_P$ $[_{NP}$ # $[_D$ an$]_D$ $[_A$ # un $[_A$ # likely #$]_A$ #$]_A$ $[_N$ # place #$]_N$ #$]_{NP}$ #$]_{PP}$ #$]_{VP}$ #$]_S$

It is subsequently claimed that a word is a constituent of the form [# W #], that is, a constituent surrounded by left and right # boundaries and category labelling brackets. According to this definition, the sentence in (4) is composed of three words:

(5)   a. # the # book #   b. # was # in # an # un # likely #   c. # place #

As illustrated by (5), all non-lexical elements which do not qualify as independent words are incorporated into the word closest to them in terms of structure. This is an instantiation of the general pattern of non-lexical elements, which becomes a recurrent theme in all research in prosodic phonology. The most important conclusion is that this view of word segmentation recognizes the non-isomorphism between syntactic constituency and phonological constituency; the word *was in an unlikely* does not correspond to a syntactic constituent. There is also the explicit mention of the mismatch between syntactic and intonational structure illustrated by the following example:

(6)   a. This is [the cat that caught [the rat that stole [the cheese]]]
        b. [This is the cat] [that caught the rat] [that stole the cheese]

(6a) corresponds to the syntactic structure of the sentence, and (6b) illustrates the division of the sentence into intonational phrases.

This is all *SPE* says about the interaction of syntax and phonology. Elisabeth Selkirk (1972) was the first author to build on these preliminary ideas and argue that word and phrase boundaries of the sort devised in *SPE* were fundamental in delimiting the place of application of phonological rules of external sandhi, that is, rules altering the segmental structure of words in a phrase. We proceed to review her work in what follows.

2.1.2. *Selkirk (1972)*

Although Selkirk has been claimed to be one of the first proponents of the DRT, with Chomsky and Halle (1968), it is important to understand that she does not maintain that syntactic constituents (heads, maximal projections) are mapped into

the phonological component as isomorphic phonological constituents. In this regard, Selkirk is very clear. This is what she states regarding external sandhi rules, those processes occurring across words and affecting the segments at the extremities of juxtaposed words:

(7)   These rules operate between words and are strictly local in application. They depend only on the boundaries and the composition of the segments in the immediate environment of the segment(s) being affected by them. They do not appeal to phrase structure. The number and kind of boundaries separating words in a string may have been determined by readjustment rules which are sensitive to phrase structure (...), but the external sandhi rules mention only sequences of segments and boundaries in their structural descriptions. (Selkirk 1972: 10)

The boundaries Selkirk refers to are those introduced by the *SPE* convention stated in (2) above. This author notes also that implicit in *SPE* is another convention which manipulates the boundaries inserted by the first convention, the readjustment rule in (8):

(8)   In a sequence $W\#]_X \#]_Y Z$ or $W_Y[\# _X[\#Z$, where $Y \neq S'$, delete the "inner" word boundary.

This rule has the effect of deleting "superfluous" word boundaries. Selkirk illustrates the application of the conventions stated in (2) and (8) to the sentence in (9a). (9b) represents the application of (2), and (9c) represents the application of (8) (cf. Selkirk 1972: 13):

(9)   a. His illustrious boss was buying gifts for her good friends

       b. $\bar{N}[_{S'} \# [_S \# [_{N''} \# [his] [_{A''} \# [_{A'} \# [_A \# \text{illustrious} \#]_A \#]_{A'} \#]_{A''} [_{N''} \# [_N \# \text{boss} \#]_N \#]$ $_{N''} \#]_{N''} [_{V''} \# [was] [_{V''} \# [_V \# \text{buying} \#]_V [_{N''} \# [_{N'} \# [_N \# \text{gifts} \#]_N \#]_{N'} \#]_{N''} [_{PP} \# [\text{for}]$ $[_{N''} \# [\text{her}] [_{A''} \# [_{A'} \# [_A \# \text{good} \#]_A \#]_{A'} \#]_{A''} [_{N''} \# [_N \# \text{friends} \#]_N \#]_{N'} \#]_{N''} \#]_{PP} \#]_{V'} \#]$ $_{V''} \#]_S \#]_{S''}$

       c. $[_{S'} \# [_S \# [_{N''} [\text{his}] [_{A''} \# [_{A'} [_A \text{ illustrious }]_A]_{A'} \#]_{A''} [_{N''} \# [_N [\text{boss }]_N]_{N''} \#]$ $_{N''} [_{V''} \# [was] [_{V''} \# [_V \text{buying} \#]_V [_{N''} \# [_{N'} [_N \text{gifts}]_N]_{N'} \#]_{N''} [_{PP} \# [\text{for}][_{N''} \# [\text{her}]$ $[_{A''} \# [_{A'} [_A \text{good}]_A]_{A'} \#]_{A''} [_{N''} \# [_N \text{friends}]_N]_{N'}]_{N''}]_{PP}]_{V'}]_{V''} \#]_S \#]_{S''}$

As a result of the operation of (8) no more than two word boundaries are ever found in sequence in a sentence, and thus the distinction # vs. ## is sufficient for rules of phrasal phonology to refer to. The convention in (2) already predicts that non-lexical items may exhibit a different phonological behavior from lexical items. Between two lexical items, two word boundaries will always appear; a non-lexical item and a lexical item will be separated by a single #, and between two non-lexical items no # will intervene. Selkirk utilizes these distinctions in boundary strength to give an account of phrasal phonology phenomena in English and French.

For instance, Selkirk formulates the observation that monosyllabic function words become unstressed when they precede another syntactic element in its phrase in the following Monosyllable Rule:

(10)   A monosyllabic dependent loses its stress when it precedes its head or a co-dependent in surface structure.

Selkirk defines a dependent of a head as a non-lexical category which is dominated by the same node that dominates its head and is not separated by any non-dependents (i.e., other lexical elements) from it. This is illustrated in the following examples, where we indicate unstressed words with a smaller font:

(11) a. They were in a collective.
     b. We were glad that your people came to the SDS convention.
     c. Who has Otto Hecker been talking to?
     d. They stayed till the cops came.

Selkirk follows the *SPE* stipulation that non-lexical words are not supplied with word boundaries, and suggests that the Monosyllable Rule applies across a maximum of one word boundary. She formalizes this rule as follows:

(12) V -> [-stress] / [#W[C_0 ___ C_0] [(#) X V Y (#)] Z #]

Condition: X ≠ T# #U

[C_0 ___ C_0] is the affected monosyllabic dependent, [(#) ... V ... (#)] is either its head or a co-dependent. The condition on X assures that no non-dependent intervenes between the monosyllable and its head or co-dependent. The strings in (11) fulfill the structural description of the rule, as shown in (13):

(13) a. They[$_{VP}$ #[were] [$_{PP}$ #[in] [$_{NP}$ #[a] [#collective#]#]#]#].
     b. We were glad [$_{CP}$ # [that] [$_{NP}$ # [your] [#people#]#] came to the SDS convention.
     c. [$_{CP}$ #[Who] [has] Otto Hecker been talking to?
     d. They stayed [$_{PP}$ # [till] [$_{NP}$ # [the] [#cops#]#] came.

Also, Selkirk observes that nasals assimilate in place to the following consonant not only morpheme-internally, but also across a prefix boundary, across members of a compound and between a non-lexical category and a following word (examples from Selkirk 1972: 183-5):

(14) a. congress   [ŋg]   (15) a. pancake   [ŋk]
     b. compare   [mp]   b. tenpence   [mp]

(16) a. in Colorado   [ŋk]   d. I'm coming   [ŋk]
     b. in Boise   [mb]   e. I'm disappointed [nd]
     c. some tea   [nt]

However, it is much more difficult to assimilate the final nasal of a lexical word to the consonant that follows (the contexts we are interested in illustrating are underlined in the examples):

(17) a. Joh<u>n b</u>anked at the Chase Manhattan   ?[mb]
     b. Would they loa<u>n C</u>arnegie ten million?   ?[ŋk]
     c. Mary gave the ha<u>m t</u>o Paul   ?[nt]

Selkirk analyzes these facts stating that nasal place assimilation occurs across one # boundary, but not across ##. That is, non-lexical items do not have #s surrounding them, whereas lexical items do:

(18) a. [[con]-[#gress#]]   [ŋg]   c. [in] [#Boise#]   [mb]
    b. [#[#pan] [#cake#]#]²   [ŋk]   d. [..['m] [#coming#]   [ŋk]

(19) a. [#John#] [#banked#]   ?[mb]   b. [#loan#] [#Carnegie#]   ?[ŋk]

Selkirk also gives an account of morphophonological processes which are specific to certain non-lexical items along the same lines. This is the case of cliticization in English. Only non-lexical categories such as negation, the auxiliary verbs *have* and *be,* the infinitival particle *to,* or weak object pronouns can cliticize to the preceding word in their phrase. Negation cliticizes to a modal or auxiliary that it follows, e.g., *isn't, haven't, mustn't, won't, can't, aren't,* etc. Selkirk formulates the rule of *not*-cliticization as follows:

(20) X [$_{V''}$ { Modal } *not* Y $_{V''}$] Z
        { Aux }
        1   2   3 4   ⇒   1 2 # 3 4   (Selkirk 1972: 96)

The constituents [$_M$ [$_M$ Modal $_M$] not $_M$] or [$_{Aux}$ [$_{Aux}$ Aux $_{Aux}$] not$_{Aux}$] would be the output of this rule.

The auxiliary verb *have* cliticizes to the preceding word in the verb phrase, i.e., a modal, as the pronunciation for *have* indicates:

(21) a. would have ->   [əv]   b. should have ->   [əv]

Selkirk provides the following rule, similar to (20):[3]

(22) X [$_{V''}$ [Modal] *have* Y $_{V''}$] Z
      1   2   3 4   ⇒   1 2 # 3 4   (Selkirk 1972: 101)

Next is an analysis of vowel reduction in unstressed object pronouns following verbs. We indicate unstressedness with small font and vowel reduction is indicated by the pronunciation of the pronouns in square brackets:

(23) a. She really let him have it.   [ɪm, m], [ɪt]
    b. What did he lend you?   [juw, jə]

Note that the Monosyllabic Rule will not destress the pronoun, since it is last in its phrase, that is, it is not followed by a lexical head or a co-dependent. This is why Selkirk posits the cliticization rule for object pronouns (cf. p. 135):

(24) X [$_V$ Verb $_V$] [$_{N''}$ [+PRO] $_{N''}$] Y ⇒   X [$_V$ [$_V$Verb] [+PRO] $_V$] Y
    1   2   3   4   1   2#3   4

The common characteristic shared by the elements that can be cliticized is their function word status, their not being lexical elements. Cliticization is an operation that applies only to elements which are separated from their hosts by a maximum of

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² Selkirk posits a Compound Readjustment Rule by which the two #s that according to *SPE* separate the two members of a compound would be reduced to one #. This would be a postcyclic rule, operating after the cyclic Compound Stress Rule (cf. Selkirk 1972: 184).
³ It is not that *have* selects modals as hosts. Selkirk specifies that *have* cliticizes to elements in the verb phrase, adverbs excluded. But this leaves only modals as possible hosts.

one # boundary. Based on the same hypothesis, Selkirk goes on to analyze French liaison, a phenomenon in which the underlying final consonants of a certain class of words get pronounced when that word immediately precedes a vowel-initial word. The consonant becomes the onset for the following vowel. When a consonant-initial word follows, those consonants do not get pronounced. The following examples illustrate this phenomenon in *Conversation Familière*, the stylistic variety in which the basic liaisons of French are found. More liaison contexts are found in more formal, non-conversational styles of speech, the *Conversation Soignée* and the style of *Lecture* or *Discours*. The more elevated the style, however, the less agreement there is about the facts, because the elevated styles are not common in everyday life by all speakers of French. They are taught at school and are considered to be artificial and normative. It is only at the conversational level that native intuitions are found and where liaison rules can be found. The _ symbol between two words in the examples in (25) indicates that liaison has occurred, and the double slash between two words in the examples in (26) indicates that the consonant is not pronounced, i.e., that liaison has not taken place:

(25) a. *les_amis*   f. *très_incommode*
        the friends   very uncomfortable

     b. *ton_écriture*   g. *est_amoreux*
        your writing   is   in love

     c. *aucun_officier*   h. *ont_acheté*
        any   officer   have bought

     d. *dans_une salle   publique*   i. *les _   ai   vus*
        in   a room public   them(cl.) have seen

     e. *grand_effort*
        big   effort

(26) a. *extrêmement // amusante*   c. *une maison // en pierre*
        extremely amusing   a   house   of stone

     b. *un endroit // obscur*   d. *Il cherchait // Albert*
        a place obscure   he was looking for Albert

Selkirk's analysis of French liaison is that it occurs when just one word boundary separates one word from the next. This analysis is based on previous suggestions by Milner (1967), Schane (1968) and Dell (1970). Assuming a consonant deletion analysis, the rule could be expressed as follows:[4]

(27) C -> ø / ___ # C
                   { # }

That is, a word-final consonant gets deleted when followed by another consonant or by two word boundaries, i.e., # #. Selkirk concludes her work reminding the reader that the phonological rules she posits does not refer to the syntactic informa-

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[4] See Morin and Kaye (1982) for an alternative analysis in terms of consonant insertion.

tion enclosed within the labelled structures. Only the number of boundaries separating words is crucial:

> The information contained in labelled bracketings is not required by any of the phonological rules operating on surface structures. What is essential is only the information about how many #'s separate two words in surface structure, and, with that, all that's necessary is a distinction between one and two word boundaries, # vs. # #. In sum, a string consisting of sequences of segments and one or two #'s provides all the information required by the phonological rules. (Selkirk 1972: 379)

Thus, Selkirk does not advocate a direct relationship between syntax and phonology, one in which all syntactic information could potentially matter to phonological rule application. Although word boundaries are a reflection of syntactic structure, external sandhi rules are blind to labelled bracketing or syntactic structure. Only boundary elements, along with distinctive feature matrices and other boundary elements comprise the terminal string to which sandhi rules apply. This is the same position maintained in Selkirk (1974), which deals with the most elevated style of French.
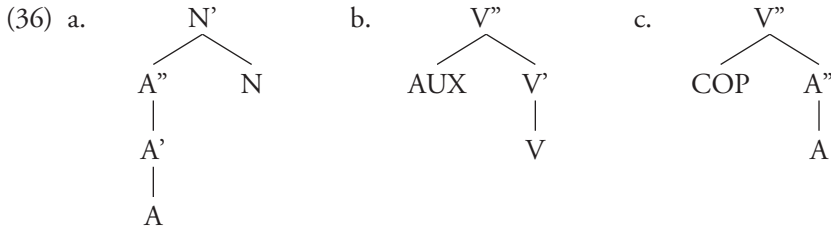
Selkirk's use of boundary theory to account for phonological processes of external sandhi was severely criticized by other researchers, both on conceptual and empirical grounds. It was argued that boundaries did not express the aspects of tree geometry which were really and truly relevant to the proper functioning of phonological rules, and that boundary effects were predictable from phrase structure (cf. Kaisse 1977, Clements 1978, Rotenberg 1978, Napoli and Nespor 1979). We review Rotenberg's (1978) criticisms and proposals next.

2.1.3. Rotenberg (1978)

Rotenberg deemed boundaries as superfluous items in the surface structure of a sentence. He noted that boundaries could not be phonological units like segments or feature matrices, because they could not be manipulated in the same way as these could. For instance, one could not transform a + boundary into a # boundary, or viceversa, and rules adding or deleting boundaries were extremely rare compared to rules adding or deleting feature matrices or segments. He suggested a new approach to phrasal phonology based not on terminal strings but on pre-terminal information in phrase structure. What had been and could be treated as "boundary phenomena" were direct reflections of constituency at the various level of structure. Phonological rules could be seen as applying at the syllable level, within and across morphemes, at the word level, at the phrase level, and at the sentence level. Thus, it made sense to speak of *domains of application*, and to refer to *edges of domains* in order to separate domains at each level. Edges of domains were given by the tree geometry at each level, and substituted for boundaries. This would explain why rules manipulating boundaries were so rare; because one cannot delete, add or change the nature of a left or right edge, just as one cannot delete an N' or an adjectival phrase.

Empirically, Rotenberg shows the inability of boundary theory to account for morphophonological processes such as the *a/an* alternation of the indefinite determiner in English, or French liaison. Assuming that the process is *n*-insertion rather than *n*-deletion, Rotenberg argues that *n* is inserted between an indefinite deter-

miner and a following vowel-initial word within its phrase. An analysis in terms of boundaries would involve positing a rule such as (28):

(28) a -> an / ___ (#) V

Examples such as the ones in (29), however, prove that this rule cannot work:

(29) a. an I can't tell you how silly idea   c. an it's incredible how silly idea
      b. an I don't know how silly idea

According to the *SPE*-conventions for boundary insertion, the clause following the determiner would be encoded with one # boundary on its left edge, by virtue of being a S', and another # by virtue of being part of the adjective phrase, A" (Rotenberg 1978: 56-7 shows that these clauses are not parentheticals). Thus, at least two # boundaries would separate the determiner from the following vowel-initial element, and *a* would be predicted to occur, not *an*. According to his assumptions, however, the right results are predicted, because the determiner and the next word abut a single w-juncture, i.e., they are linearly adjacent in the same phrase. This shows that boundaries are not only dispensable but also incorrect.

Rotenberg also raises criticisms against Selkirk's treatment of French liaison. He points out that a readjustment rule is needed to delete the word boundaries of prenominal adjectives, in order to be consistent with the claim that only a maximum of one # boundary can separate two words in order for them to be in a liaison context (cf. (25e), repeated here as (30)). Since lexical categories are assigned one word boundary (on their left and right edges), prenominal adjectives would be separated from the following nouns by two # boundaries. Selkirk (1972) in fact stipulates a rule deleting the # boundaries that are to the right of a prenominal adjective, as illustrated in (31):

(30) *grand_effort*
      big   effort

(31) $[_{N''}\# \ X \ [_{A'}\# \ Y \ [_{A}\#[_{A}\#Adjective\#_{A}]\#_{A'}]\#_{A''}] \ [_{N'} \# \ [_{N'}\#Noun\#_{N}] \ Z \ \#_{N'}]\# _{N''}]$
      $\Rightarrow$ $[\# \ X \ [\# \ Y \ [\# \ [\#Adjective \ ] \ ] \ ] \ [\# \ [\#Noun\# \ ] \ Z \ \# \ ]\# \ ]$

Rotenberg also notes that Selkirk cannot account for the lack of liaison between a prenominal adjective and a conjunction, when two prenominal adjectives are conjoined:

(32) a. *Un bon_oignon*   b. *Un bon // et   gros oignon*
          a good onion   a good and big onion

(33) a. *Un intelligent_ami*   b. *Un intelligent // et intéressant ami*
          a intelligent friend   a intelligent and interesting friend

Also, Selkirk cannot explain why auxiliaries and copulas trigger liaison when followed immediately by a participle, but not when an adverb follows:

(34) a. *ont_avoué*   b. *ont // astucieusement avoué*
          have confessed   have cunningly   confessed

(35) a. *est_absurde*   b. *est // absolument absurd*
          is absurd   is   absolutely absurd

On the basis of these problematic data, Rotenberg suggests abandoning the boundary theory as a framework for analyzing phenomena of phrasal phonology, and suggests a different approach. He claims that the problems that a boundary theory has to face are solved after paying attention to the phrasal configuration in which the potential liaison participants occur. Rotenberg assumes the following configurations for the (a) examples in (32)-(35):

(36) a.
```
        N'
      /    \
    A"       N
    |
    A'
    |
    A
```
b.
```
        V"
      /    \
   AUX       V'
             |
             V
```
c.
```
        V"
      /    \
   COP       A"
             |
             A
```

Rotenberg follows the assumption that the first prenominal adjective and the conjunction in (32b) and (33b) are in different constituents, and for (34b)-(35b) he posits the following configuration:

(37) a.
```
        V"
      /    \
   AUX       V'
            /\
```
b.
```
        V"
      /    \
   COP       A"
            /\
```
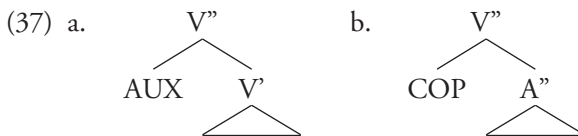
Thus, the proper liaison context can be formalized as in (38):

(38) X ($_f$ Y w w) Z

(38) states that the word to the right must end a constituent that also contains the word to the left. The subscript f stands for 'phrase', i.e., constituent. The two words involved in liaison must c-command each other, and the word on the right has to end the constituent which contains both words. Rotenberg assumes the standard definition of c-command: A c-commands B if and only if the first branching node dominating A dominates B. As we see in the diagrams in (36), the prenominal adjective c-commands and is c-commanded by the noun, the same as the auxiliary c-commands and is c-commanded by the verb and the copula c-commands and is c-commanded by the predicative adjective. In (37), on the other hand, these conditions are not satisfied: the first word to the right of the auxiliary and the copula does not end the constituent which contains them (i.e., V"), and thus mutual c-command between the auxiliary or the copula and this word is not fulfilled either. As for conjoined prenominal adjectives, if the assumption that the first adjective does not form a constituent with the conjunction is correct, it would account for the absence of liaison between the adjective and the conjunction (cf. examples (32b) and (33b)).

These structural limitations on liaison are not observed across the board, however. Non-lexical words always trigger liaison on the following word, regardless of whether it ends a constituent or not. Let us consider demonstratives, for instance:

(39) a. *ces_arbres*
     those trees

  b. *ces_arbres énormes*
     those trees huge

  c. *ces_espèces d'arbre*
     those species of tree

  d. *ces_anciens arbres*
     those ancient trees

  e. *ces_assez gros arbres*
     those rather big trees

Rotenberg assumes that the structures corresponding to these examples would be:

(40) a.

```
              N''
             /   \
          DET     N'
           |      |
          ces     N
                  |
                arbres
```

b.

```
              N''
             /   \
          DET     N'
           |      /  \
          ces    N    A''
                 |    |
              arbres  A'
                      |
                      A
```

c.

```
              N''
             /   \
          DET     N'
           |      /  \
          ces   A''   N
                 |
                 A'
                 |
                 A
                 |
              anciens
```

d.

```
              N''
             /   \
          DET     N'
           |      /  \
          ces   A''   N
                /  \
              A''   A'
               |    |
               A'   A
               |
             assez
```
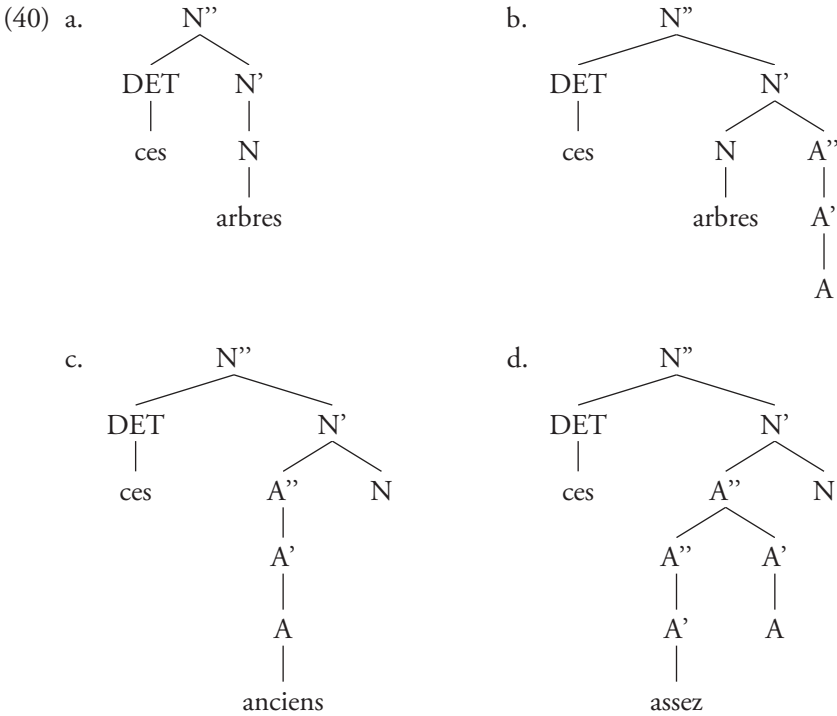
The same observations apply to determiners, possessives, degree modifiers, and clitic pronouns.[5] These elements always trigger liaison, without regard to the structure to their right. Thus, two types of liaison contexts must be distinguished in conversational French: one in which the word on the left is a non-lexical word, where liaison is always triggered, and one in which the word on the left is not a non-lexical word (Rotenberg considers auxiliaries and copulas as verbs, not as non-lexical items).

Rotenberg claims that a sequence of a non-lexical item plus a lexical item forms a unit, called *clitic group*. Then, liaison would be a c-level rule, that is, liaison occurs

---

[5] Rotenberg also includes prepositions in this group, but as Selkirk (1972) shows, only monosyllabic prepositions trigger obligatory liaison. We will leave aside this point for the time being, but see Elordieta (1997, 1999) for discussion and analysis.

between two adjacent words which are included in the same clitic group. He then reformulates (38) as follows (the subscript indicating 'clitic group'):

(41) W ($_c$ X w w Y) Z

The other type of liaison, the one determined by the structural relationships holding between two words, is an f-level rule, that is, it applies between two clitic groups contained in the same phrase:

(42) X ($_f$ Y c c) Z

As we can see, although Rotenberg showed the inadequacies of boundary theory as a theory of phrasal phonology, his model still has to recur to distinctions between nonlexical and lexical categories. The former are alleged to form closer domains with the following lexical elements (i.e., clitic groups), and the latter form domains with the following words based on syntactically defined relations of locality. This is the difference between (41) and (42). There is no explanation for this difference, however, and the nature of the high degree of cohesion between nonlexical and lexical categories is left as a stipulation. This is a recurrent problem in the literature of phrasal phonology, as we will see.

An important aspect worth mentioning from Rotenberg's (1978) view of phrasal phonology is that it served as a starting point for both the Direct Reference Theory and the Prosodic Hierarchy Theory. His formulations of the contexts of application of phonological rules included both reference to domains (i.e., c-level and f-level rules, or c-domains and f-domains), and structural relationships among the elements involved in the rules, such as c-command and edge of constituent. The notion of *domains* is the basis of the PHT, and relations of command and branchingness are central to the hypothesis of the DRT. In a way, then, Rotenberg must be seen as a common ancestor of the two contemporary approaches to phrasal phonology. What must remain clear is that in no case does Rotenberg's theory claim that syntactic and phonological constituencies are isomorphic. Neither does the most developed example of DRT, the model proposed by Kaisse (1985). We proceed to discuss it next.

2.2. Kaisse (1985)

The main idea in the DRT is that the domains of application of phonological processes of external sandhi are directly constrained by syntactic relations such as c-command and edge locations (cf. Lobeck and Kaisse 1984, as well as Manzini 1983 for an early proposal along these lines). It is argued that these relations define parameters whose settings characterize unmarked rules of external sandhi. There are two parameters, the c-command condition and the edge-condition:

(43) 1. The c-command condition: One of the words must c-command the other.
      2. The edge condition: The sandhi pair (i.e., the words participating in the phonological rule) must lie on the edge of the constituent that contains them.

The parameters may be set as follows:

(44) 1a. Word *a* must c-command word *b*.
      1b. Word *b* must c-command word *a*.

1c. Words *a* and *b* must c-command each other (government required).
1d. There is no c-command requirement.

2a. Words *a* and *b* must lie at the left edge of their containing constituent.
2b. Words *a* and *b* must lie at the right edge of their containing constituent.
2c. Words *a* and *b* must lie at both edges of their containing constituent (they must exhaust that constituent).
2d. There is no edge requirement.
2e. Words *a* and *b* must lie at one edge of their containing constituent.

The definition of c-command used is *domain c-command* (from Lobeck and Kaisse 1984: 171):
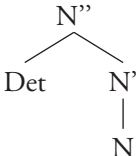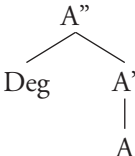
(45) Domain c-command: In the structure $[_{X_{max}} \ldots \alpha \ldots]$, X^{max} is defined as the domain of α. α c-commands everything in its domain. $\alpha = X^j$, $j \geq 0$

This definition of c-command is actually m-command, that is, *a* m-commands *b* if the first maximal projection dominating *a* also dominates *b*. To avoid any confusions, we will maintain the name *c-command*, keeping in mind that it stands for m-command.

An illustrative example is lenition in Gilyak. In this language, in a sequence of words *a b*, an obstruent in initial position of *b* is voiced if *a* ends in a nasal and spirantized if *a* ends in a vowel, but only if *b* c-commands *a*. Other phenomena analyzed by Kaisse include French liaison, tone sandhi in Ewe, Italian raddoppiamento sintattico, Mandarin tone sandhi and Kimattumbi vowel shortening, which cannot be reviewed here for reasons of space. The reader is referred to the original source. Let us illustrate Kaisse's (1985) theory with her analysis of French liaison. She shows that Rotenberg's (1978) statement on the syntactic conditions constraining liaison, summarized in (46), can be reinterpreted in terms of c-command relations as in (47):

(46) Liaison may apply between two words *a* and *b* if *b* ends the constituent that contains *a* (or if *a* is a nonlexical item).

(47) Liaison applies between two words *a* and *b* where *b* c-commands *a*.

Kaisse claims that an analysis in terms of c-command can obviate the stipulation that nonlexical items always trigger liaison, as well as any need to make a distinction between c-level and f-level liaison. Determiners, possessive pronouns, clitics, degree adverbs and prenominal adjectives are all c-commanded by the right-adjacent elements with which they make liaison, since the maximal projections containing the latter also contain the former. Kaisse is following earlier assumptions in generative syntax in which determiners and possessive pronouns were taken to be specifiers of the maximal projection headed by a noun, i.e., N", and degree modifiers were taken to be specifiers of A". (48a,b) illustrate the assumed structure for determiners (identical to the one assumed for possessive pronouns) and degree modifiers, respectively:

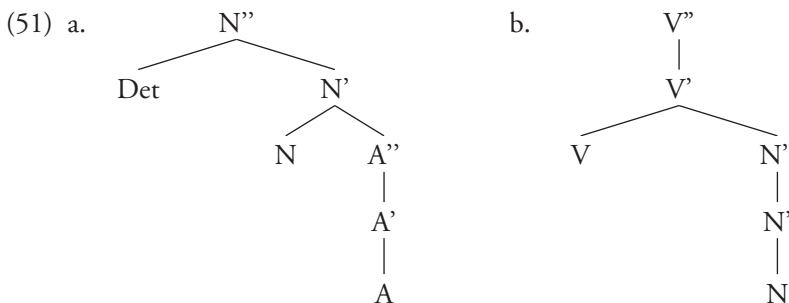(48) a.   N"   b.   A"
            ╱   ╲   ╱   ╲
        Det   N'   Deg   A'
                       │   │
                       N   A

As for prenominal adjectives, they are taken as leftward complements of nouns. Hence, in this case, nouns c-command adjectives as well:

(49)
```
              N''
            /     \
         Det       N'
                 /    \
               A''     N
```
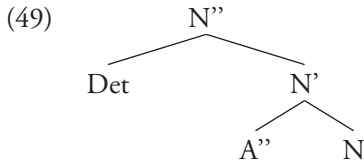
Clitics are assumed to be sisters of verbs, so the c-command relation between the verb and the clitic is straighforward. Note that Kaisse also eliminates all reference to edge conditions from the context of application of liaison she states in (47). This is because of examples like the following:

(50) a. *un endroit // obscur*
    a   place   obscure

    b. *J'en veux // un*
       I-of them want one

    c. *Il   cherchait // Albert*
      He was looking for Albert

In these examples, the words to the right of the slash are single-word complements of the words on the left of the slash, and thus end the constituent that contains the word on the left as well. However, no liaison is found between those words. Kaisse concludes that Rotenberg's analysis is incorrect, and that an analysis in terms of c-command does not have to face those problems. Word *b* in the examples in (50) is contained within a maximal projection, and therefore cannot c-command out of it. That is, word *b* does not c-command word *a*, and liaison is correctly predicted not to occur. (51a) represents the structure of (50a), and (51b) represents that of (50b,c):

(51) a.
```
            N''
          /     \
       Det       N'
               /    \
             N       A''
                     |
                     A'
                     |
                     A
```
b.
```
        V''
        |
        V'
      /    \
     V      N''
            |
            N'
            |
            N
```

Several problems may be noticed in this analysis. First, the liaison context formed by a determiner and a prenominal adjective entails difficulties for a c-command treatment. A prenominal adjective cannot c-command out of its maximal projection, A'', and thus it cannot c-command the determiner:

(52) a. *un_éminent avocat*
      an eminent lawyer

    b. *un_intelligent ami*
      an intelligent friend

c.

```
            N"
          /    \
        Det      N'
                  \
                   A"
                   |
                   A'
                   |
                   A
```
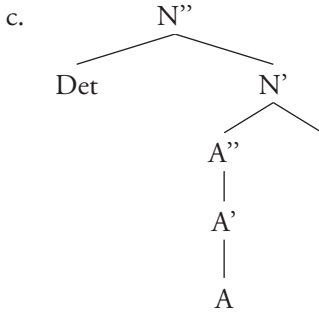
Kaisse notes this problem and suggests several solutions, none of which is satisfactory (cf. Kaisse 1985: 167, fn. 4). One possibility she suggests is that prenominal adjectives are nonphrasal, but this is purely stipulatory. Another alternative is to recur to the special status of nonlexical categories that Rotenberg referred to, namely that determiners and other nonlexical items cliticize to the following word; then this word would be able to c-command them:

(53)

```
                   N"
                   |
                   N'
                 /    \
               A"       N
               |
               A'
               |
               A
             /   \
           Det     A
```
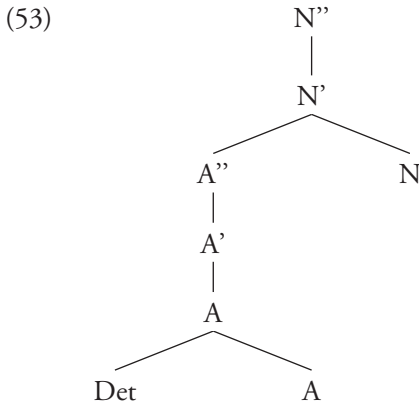
This alternative would imply going back to the distinction lexical/nonlexical that Kaisse herself wanted to avoid, so if valid it would seriously diminish the alleged force of her proposal, which is that the domains of application of rules of external sandhi are governed by structural relations of c-command among participants, without regard to syntactic class membership or category. A last suggestion of a solution to the problem is that the c-command condition could be weakened to allow liaison if *b* c-commands *a* or if *a* is nonlexical and c-commands *b*. This alternative would present the same problems as the previous one.

Another problem would be posed by liaison occurring between prepositions and what follows. Prepositions are not considered specifiers, but heads of their own maximal projections, i.e., prepositional phrases. If the following material is included in a different maximal projection, as complement of the preposition, these items cannot c-command out of this maximal projection, and thus cannot c-command the preposition. However, liaison is found between monosyllabic prepositions and whatever vowel-initial material follows:

(54) a. *dans_une salle   publique*   b. *chez_elle*
     in   a   room public   (at)home she
                                      'at her house'

c.

```
              P''
            /      \
          P          N''
                   /     \
                 Det       N'
                          /   \
                         N
```
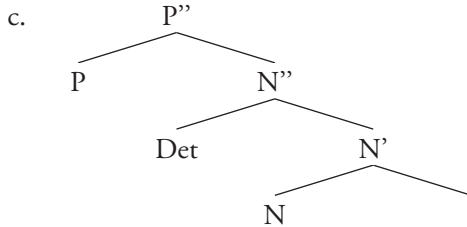
A more serious problem arises when we take into account current assumptions on syntactic structure. Functional categories are not considered to be specifiers of maximal projections headed by lexical categories. Rather, they are heads of their own maximal projections, taking maximal projections as complements. Thus, a determiner is not a specifier of a nominal phrase, but the head of the Determiner Phrase (cf. Abney 1987, Szabolcsi 1983, 1987), which selects a Noun Phrase as a complement; an auxiliary verb heads an Auxiliary Phrase, taking a Verb Phrase as a complement; a complementizer is the head of a CP (former S'), with Inflection Phrase (i.e., IP, the former S) as its complement; this IP is headed by Infl, and has a Verb Phrase as its complement (or maybe AuxP, when an auxiliary verb is present). Under these assumptions, Kaisse's analysis cannot account for the environments in which liaison applies, because the words following determiners and auxiliaries cannot c-command out of their maximal projections, that is, word *b* does not c-command word *a*, but liaison occurs. This is the same problem as the one posed by prepositional phrases discussed above:

(55) a.

```
          DP                       b.          AuxP
        /    \                               /      \
      D        NP                          Aux        VP
              /   \                                  /   \
             N                                      V
```
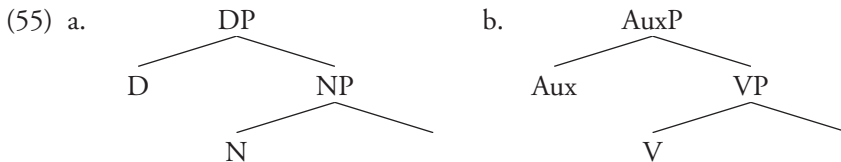
All these difficulties indicate that Kaisse's treatment of French liaison is less than successful, and that an alternative analysis has to be found. In section 7 we will present additional evidence from Basque and Irish which shows that the DRT as stated in terms of c-command cannot account in a straightforward way for the nature of phonological processes operating across words.

One last point should be mentioned. As shown, one should be careful and not think that the DRT advocates for an isomorphism between syntactic and phonological constituents, or that it allows phonological rules to access all sorts of syntactic information. The amount and type of information that the DRT allows phonological processes to access is limited, being constrained to the category-neutral, label-neutral, c-command relationships and edge conditions existing among syntactic terminal nodes, as determined by θ-theoretic hierarchical structure.

Since Kaisse's (1985) proposal, the truth is that not too many scholars adopted this view of the syntax-phonology interface. Odden (1987, 1990, 1996) is the clear-

est defender of the DRT and suggests adding reference to the syntactic notion of head as a relevant parameter for discriminating contexts of application of certain postlexical rules.

2.3. Rizzi and Savoia (1993)

Within the DRT approach, a more sophisticated model would be the one proposed by Rizzi and Savoia (1993) (henceforth, R&S) to account for u-propagation in southern Italian dialects. The phenomenon is triggered by the vowel /u/ ending a word, which spreads its feature [+back] to the first vowel in a following word, or causes the insertion of a /w/ onglide before it. For instance, in the Verbicaro dialect:[6]

(56) a. [u ˈmwɛːlə]   vs.   [ˈmɛːlə]
          'the honey'   'honey'

      b. [lu ˈfwattsə]   vs.   [I ˈfattsə]
          it   I-do   them I-do
          'I do it'   'I do them'

R&S observed that the phenomenon of u-propagation occurs in specific syntactic contexts, different in the eight dialects studied. According to the authors, contexts of application of phonological processes can be defined by making reference to five parameters of syntactic cohesion holding between the trigger and the target in a phonological process. The general syntactic relation between trigger and target is that the trigger X-governs the target, where X-government is a variable ranging over the following types of relations:[7]

(57) a. A and B govern each other.   c. A Agr(eement) governs B.
      b. A F(unctionally) governs B.   d. A governs B.

R&S define government in traditional terms (i.e., A governs B if the first maximal projection dominating A also dominates B). Then, A F-governs B if A is a functional category governing B, and A Agr-governs B if A and B stand in an agreement relationship and A governs B.

Let us consider one of the dialects illustrating the need for F-government in order to explain the facts. In the Stigliano dialect, u-propagation in nominal contexts only occurs between a determiner and a following adjective or noun (i.e., (58a-c) below), but not between a quantifier and a following adjective or noun (cf. (58d-e)), a prenominal adjective and a noun (cf. (58f)), or a noun and a following adjective (cf. (58g)):

(58) a. [lu ˈpweːðə]   b. [ˌn aːtu ˈkwɔːnə]   c. [nu bˈbwellə ˈfɪɟɟə]
          the foot   another dog   a   dear/nice boy/son

---

[6] R&S only provide phonetic transcriptions of the data, rather than orthographic transcriptions. We will follow their system, except for the trigger of the process, which we transcribe as [u], instead of surface [ə], for ease of identification of the trigger.

[7] An additional parameter is proposed that does not involve any kind of syntactic cohesion between trigger and target, namely that A and B are adjacent.

    d. [ccu g'grannə]   (*g'grwannə)
       more big
       ('bigger')

    e. ['ɔttu 'ka:nə]   (*g'gkwa:nə)
       eight dogs

    f. [nə b'brɔvu 'fiɟɟə]   (*'fwiɟə)
       a   good   boy/son

    g. [nə 'swɪccu 'ɣrannə]   (*'ɣrwannə)
       a   bucket big
       ('a big bucket')

In verbal contexts, u-propagation only occurs between a preverbal clitic and a following verb (59a). It does not apply between an auxiliary and a past participle (59b), between a modal or causative verb and an infinitive (59c,d), between a copula and a following adjective or noun (59e), between a verb and an object (59f), or between a verb and the first word in a small clause (59g):

(59) a. [lu 'fwatʃə]
       it   I-make
       'I make it'

    b. ['l addʒu maɲ'dʒa:tə]   (*mwaɲ'dʒa:tə)
       it I-have eaten
       'I have eaten it'

    c. [ɣwə'loimu maɲ'dʒa]   (*mwaɲ'dʒa)
       (we) want   eat
       'we want to eat'

    d. [fɔtʃ'eimu 'fa]   (*'fwa)
       (we)-make do

    e. [su   t'taβələ]   (*t'twaβələ)
       (they)-are tables

    f. [tə'neimu 'se:tə]   ('swe:tə)
       (we)-have thirst
       'we are thirsty'

    g. [fa'neilu 'nɪurə]   (*'nwɪurə)
       make-it black

Finally, u-propagation does not take place across a subject-predicate juncture:

(60) [lə ˌpətʃə'nwɪnnu 'caɲdʒə] (*'cwaɲdʒə)
     the child   is crying

R&S point out that a purely structural condition such as c-command or government is not sufficient to capture the correct environment of application of u-propagation. For instance, the structural relationship between a determiner and an adjec-

tive or noun does not seem to be different from the one holding between a pronominal adjective and a noun, but u-propagation occurs in the first case and not in the second. The structures assumed by R&S are the following:

(61)

	NP			NP
D	N'	D	N'	
lu	N	nə	A	N'
the		a		
	lwittə		bbrɔvu	fiɟɟə
	bed		good	boy/son
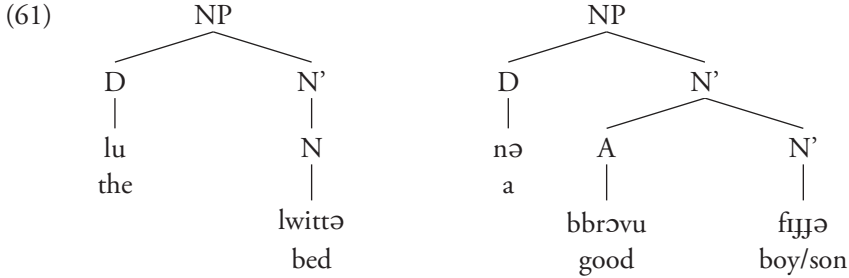
As R&S also argue, a puzzling asymmetry arises in verbal contexts, as u-propagation applies in the sequence clitic-verb (cf. (61a)), but it does not apply in the sequence causative verb-clitic:

(62) [faʧeimu   leilə]   (*lweilə)
      let-us-do   to-him-it
      'let us do it to him'
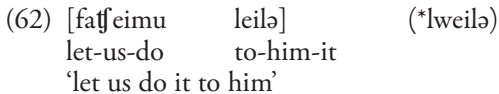
The sequence clitic-verb does not seem to be more connected in terms of c-command or government than the sequence causative verb-clitic. Indeed, orthography would seem to indicate otherwise, as the sequence verb-clitic is written as a single word. R&S provide the structures in (63) to illustrate their point. Although they do not actually state their syntactic assumptions, it seems apparent from the structures in (63) that they assume that a proclitic originates as a complement of V and adjoins to it, whereas in a construction involving a causative verb followed by an infinitive, the clitic is the subject of the clause with the infinitive:

(63)

	V			V
cl	V	V	cl	
lu	pəttənweokə	faʧeimu	leilə	
him	I-comb	let-us-do	to-him-it	
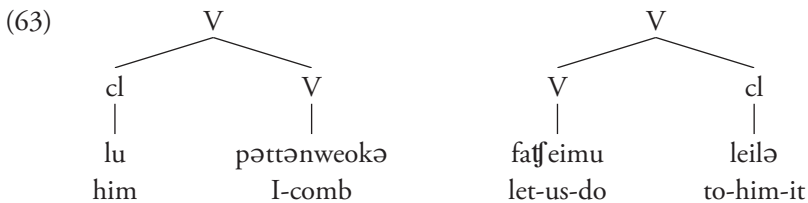
We have seen in (59c,d) that a modal or causative verb does not trigger u-propagation on a following infinitive. Interestingly, a causative verb with an enclitic does trigger /u/ propagation on a following infinitive, in imperative constructions (cf. (64)):

(64) ['fallu   'fɔ]
      make-him-it do
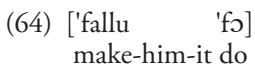
Structurally, the sequence formed by a causative verb and a following infinitive should be the same whether or not an enclitic is attached to the causative verb, but then the results cannot receive an account in terms of c-command or government. R&S argue that the difference lies in the fact that u-propagation only occurs if the

trigger is a functional category, and they add that trigger and target must govern each other. The first condition would account for the absence of u-propagation between an adjective and a noun or a noun and an adjective (cf. (58f,g)), between a verb (without an enclitic) and what follows (cf. (59c,d,f), or between a subject and a predicate (cf. (60)). The requirement for mutual government stems from the need to explain the absence of u-propagation between an auxiliary and a main verb or a copula and a following adjective or participle (cf. (59b,e). Also, R&S claim that mutual government holds between an enclitic of a causative verb and the following infinitive by assuming right-adjunction of the clitic to the causative verb and incorporation (i.e., right-adjunction) of the infinitive to the causative verb+clitic complex:

(65)

```
                              V
                    ┌─────────┴─────────┐
                    V                   V
              ┌─────┴─────┐             │
              V           cl         kwandaːnə
              │           │
              fa          lu
```
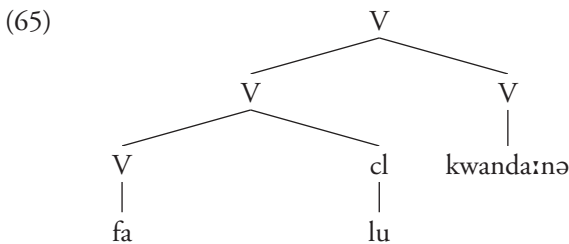
R&S also argue that mutual government helps explain the absence of u-propagation between an enclitic in a causative verb and a following infinitive (cf. (59g)) or between an enclitic in a perception verb and the first word in its small clause complement (cf. (66) below). In both cases, the potential target does not govern the enclitic, as shown in the structures in (67a,b), respectively:

(66) sən'deilu kan'danə   (*kwan'danə)
     hear-him sing

(67) a.

```
                    VP                          b.              VP
              ┌─────┴─────┐                            ┌────────┴────────┐
             'V           SC                           V                 S
          ┌───┴───┐    ┌───┴───┐                   ┌───┴───┐         ┌───┴───┐
          V       cl   NP      AP                  V       cl        NP      VP
          │       │            │                   │       │                 │
        fa'nei    lu           A                 san'dei   lu                V
                               │                                             │
                             'nɪurə                                       kan'danə
```
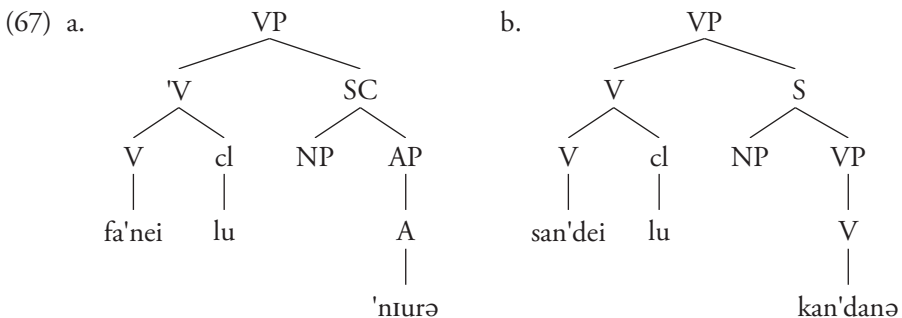
Thus, R&S analyze the environment where u-propagation occurs as one in which an element A (the trigger) F(unctionally) governs an element B (the target), and both A and B govern each other.

Certain issues arise with R&S' analysis which should be clarified. First of all, notice that for the proposed analysis to work, R&S have to assume a non-DP structure for nominal contexts (cf. (61)). Indeed, as R&S themselves discuss (R&S: 313, fn. 7), if the most widely assumed DP structure were considered, determiners and nouns would not be in a mutual government relationship, as nouns would be domi-

nated by NP. R&S would then need to assume that there is incorporation of the head noun (and the pronominal adjective) to DP, or that the determiner itself merges or cliticizes to the pronominal adjective or noun in PF. The former option would face the problem of having to posit left-adjunction of the adjective to the head noun, and then right-adjunction of the complex head adjective-noun to D.

As for the case of u-propagation between enclitics of causative verbs and following infinitives, the problem arises with the fact u-propagation occurs even when causative verbs excorporate, or at least move to a higher functional head. Mutual government between the enclitic and the following word is hard to defend there, as adverbs may be inserted between the two verbs. This is a problem that R&S acknowledge (cf. R&S: 313, fn. 7), and speculate with the hypothesis that mutual government may be calculated under reconstruction. This move is crucial, and it certainly deserves a detailed elaboration, stating clearly how this reconstruction is computed rather than leaving it as a sketchy mention in a footnote. The same problem arises when trying to account for the domain of application of u-propagation in Verbicaro, for which R&S argue that u-propagation occurs obligatorily between any functional head and another head that it governs (i.e., F-government) or between any two heads that mutually govern each other (cf. R&S: 292-295).

Finally, it is worth pointing out that there are certain assumptions that R&S make that are rather debatable, such as the claim that quantifiers and numerals are not functional categories, in order to explain why they do not pattern with determiners in allowing for u-propagation (cf. 58d,e). This assumption clashes with a substantial amount of syntactic literature that treats quantifiers and numerals as functional categories in the DP or NP projection (cf. Shlonsky 1991, Giusti 1991, Ritter 1991, Sigurðsson 1993, Matthewson 1998, 2001, Vangness 2001, Longobardi 2002, Artiagoitia 2002, Giannakidou 2004, Borer 2005, Etxeberria 2005, among others).

In sum, the model proposed by R&S constitutes a sophisticated and elaborate attempt to pin down the whole range of parameters of syntactic cohesion that may determine contexts of application of phonological phenomena applying across words. However, certain syntactic assumptions are not without problems, and perhaps further work would have avoided them. However, the distinction between functional and lexical categories that is advocated for in this proposal is an important one that is recurrent in other models of the syntax-phonology interface, as we will see below.

There are more recent developments of the syntax-phonology interface that argue for a direct influence of syntax on the creation of contexts of application of phonological processes, namely those of Seidl (2001), Dobashy (2003), Ishihara (2003, 2007), Kratzer and Selkirk (2007), and Pak (2007, 2008). However, since some of these proposals argue against the shortcomings of the other major competing alternative theory of the syntax-phonology interface, the Prosodic Hierarchy Theory, we will review this model first in the following section

3. The Prosodic Hierarchy Theory

The basic postulates of the Prosodic Hierarchy Theory (PHT) are explicitly stated in Selkirk (1978, 1980a,b), and Nespor and Vogel (1982, 1986). As we mentioned

earlier, the main claim of the Prosodic Hierarchy Theory (PHT) is that there exists a suprasegmental, hierarchically arranged organization of the utterance, called *prosodic structure.* This structure is composed of a finite set of universal prosodic constituents, which are the domains of application of phonological rules and phonetic processes. From the bottom up, these constituents are the syllable, the foot, the prosodic word, the clitic group, the phonological phrase, the intonational phrase, and the utterance.[8] These constituents are mapped from morphosyntactic structure by algorithms which make reference to non-phonological notions, that is, syntactic information, but prosodic structure and the constituents that compose it are not isomorphic with syntactic structure.

The motivation for the PHT comes mainly from the observation that many phonological processes seem to require access to very limited morphosyntactic information, and that syntactic constituents do not determine the domains for the application of phonological rules. Proponents of this theory claim that syntactic constituents do not determine the domains for the application of phonological rules in a direct way. Those processes that are directly sensitive to morphological structure, triggered by certain morphemes or certain morpheme combinations, are deemed as the object of Lexical Phonology (cf. Kiparsky 1982, 1985, Mohanan 1986). There are some rules that are sensitive to syntactic category information, referring to syntactic labeled bracketings, such as the two vowel deletion rules of Greek discussed in Kaisse (1977), which require that the words participating in those rules are contained in the same NP or VP. Another example would be the rule of Verb Final Vowel Deletion in Italian, which optionally deletes the final vowel of a word *a* when followed by another word *b* which is its complement, but only if word *a* is a verb (cf. van Hoorn 1983, Vogel, Drigo, Moser and Zannier 1983). For instance, according to Nespor and Vogel (1986: 32-33), in an example such as (68) the final vowel of the verb can be deleted, but not that of the noun:

(68) a. *So   che vuol(e)   notare.*   b. *Ho   le suole nuove.*   (*suol*)
　　　　 I-know that he-wants swim　　　　　　　　I-have the soles new
　　　　 'I know he wants to swim.'　　　　　　　　'I have new soles.'

These and similar examples, described in Kenstowicz and Kisseberth (1977) and Kaisse (1977), among others (see references therein), are considered to fall outside the scope of prosodic phonology and form a different subsystem of rules.[9] Hayes (1990) claims that these rules receive a better treatment if they are considered to apply in the lexicon, as precompiled phrasal rules, given their idiosyncratic domains of application (cf. the discussion of this theory in section 4).

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[8] Additional constituents have been proposed, such as the Focal Phrase, located between the Phonological Phrase and the Intonational Phrase (cf. Kanerva 1990), or the Small Word, which comprises part of a Word (cf. Rice 1993), but they have not received universal consideration.

[9] But see Meinschäfer (2004) for an alternative analysis of the facts in prosodic phonology terms, which does without specific reference to syntactic categories. Further research would be necessary to see whether closer inspection of similar facts reported in the literature could lead to the same outcome, but the issue is definitely worth investigating.

The PHT is not concerned with these rules or with those that require reference to morphological structure. Only phonological rules applying below and above the word level that are sensitive only to phonological or prosodic factors constitute the object of study of the PHT. Nespor and Vogel (1986) provide examples aimed to show that leaving aside the type of rules mentioned above, there are rules whose domains of application cannot be formulated in terms of morphosyntactic constituents. One of the examples is Penultimate Lengthening in Yidin. In this language, there is a phonological rule that lengthens the penultimate vowel of any nonderived word with an odd number of syllables. In derived words, whether or not the sequence *root + suffix* forms a domain of application of Penultimate Lengthening depends on the number of syllables contained in the suffix. If the suffix is monosyllabic, the penultimate syllable of the derived word is lengthened, provided the stem has an even number of syllables, that is, provided the derived word has an odd number of syllables. However, if the suffix is bisyllabic, Penultimate Lengthening applies to the stem, not to the derived word, irrespective of the number of syllables of the stem or of the derived word. Thus, compare (69a,b) with (69c):

(69) a. *galí:-na*   b. *ŋunaŋgara:-nda*   c. *madi:nda-ŋaliŋ*
         go-purp.   whale-dat.   walk up-pres.

Indeed, in derived words that contain the sequence *root + bisyllabic suffix + monosyllabic suffix*, the two suffixes behave like a nonderived word for purposes of penultimate lengthening, i.e., the rule applies to the sequence formed by the two suffixes:

(70) *gumari-daga-ŋu*   →   *gumá:ridagá:ŋu*
      red-inch.-past
      'to have become red'

Evidence from stress assignment also indicates that the two suffixes together behave as a separate phonological domain. Stress is assigned to alternating syllables in Yidin, and in (70) the third and fourth syllables are unstressed, which is a forbidden sequence in this language. This shows that the morphological word is not the domain of Penultimate Lengthening or Stress Assignment, and that phonological properties (i.e., number of syllables) determine the domain of application of these rules.

As far as syntax is concerned, Nespor and Vogel try to provide additional evidence against an approach that would posit syntactic constituents as domains of application of phonological rules. One of the problems that would arise for such an approach would be the existence of rules which are sensitive to the length of syntactic constituents. Under a strictly syntactic approach, this would be unexpected, because the number of words is irrelevant for the definition of syntactic constituents. A constituent composed of two words should have the same phonological behavior as a constituent of the same type composed of more than two words. However, this is not the case with certain rules. For instance, Nasal Assimilation in Spanish. In this language, nasals are homorganic to a following consonant both within a word and across words:

(71) a. ga[m]ba   'shrimp'   c. la[ŋ]gosta   'lobster'
        b. co[m] piedad   'with pity'   d. come[ŋ] carne   '(they) eat meat'

Nasal Assimilation does not apply between just any two words, however. Syntactic constituency does not determine the domain of application of the rule. Rather, it depends on the length of the syntactic constituent containing the word with the nasal and the one containing the following word. Thus, compare (72) and (73), examples in which the word containing the nasal ends a subject NP and the triggering word starts a VP:

(72) a. [_NP_ Mi faisá[ŋ]] [_VP_ corre siempre].   (< faisá[n])
          my pheasant   runs always

    b. [_NP_ *Ese tucá[m]* [[_VP_ *parece enfermo*].   (< tucá[n])
            that toucan   seems sick

(73) a. [_NP_ *El nuevo canario de mi amiga Carme[n]*] [_VP_ *canta sólo cuando está solo*].
                                  (?**Carmen[ŋ]*)
          the new canary of my friend Carmen   sings only when (it)is alone

    b. [_NP_ *Su nuevo sombrero con tres plumas de tucá[n]*] [_VP_ *cuesta sin duda*
                                  (?**tucá[ŋ]*)
         her new   hat   with three feathers of toucan   costs without
                                                              doubt

       más que el sombrero de su hermano].
       more than the hat   of her brother

Nespor and Vogel claim that the domain of application of this phonological process is the intonational phrase, a higher unit in the prosodic hierarchy which is composed of one or more phonological phrases, depending on their length and the rate of speech (cf. ch. 7 of Nespor and Vogel 1986 for detailed discussion).

Another problem for a syntactic analysis of phonological domains would be the fact that there are rules which may even apply across sentences, and there are no syntactic constituents that combine two sentences. One such rule is Flapping in American English:

(74) a. It's hot. Open the window   →   It's ho[ɾ]open the window
    b. Don't shout. It's rude.   →   Don't shou[ɾ]it's rude

The last problem presented by Nespor and Vogel for a direct-syntax approach is that empty categories do not have any effect on the application of phonological rules, and under a syntactic approach this is unexpected. Certain phenomena have been suggested in the literature to be sensitive to traces and empty categories intervening between two words, such as *to*-Contraction and Auxiliary Reduction in American English (cf. King 1970, Lakoff 1970, Zwicky 1970, Selkirk 1972, Kaisse 1983, among others) and Specifier Vowel Deletion in Italian (cf. Rizzi 1979, Vanelli 1979), but Nespor and Scorretti (1985) show that these processes are not affected by the presence of empty categories, and provide a non-syntactic analysis of these rules.

The prosodic theory thus envisioned forms a subsystem of the phonological component of the grammar and interacts with other subsystems such as autosegmental phonology, metrical theory, and lexical phonology. For instance, the most appropri-

ate analysis of harmony rules requires an interaction of autosegmental phonology, which accounts for the way in which the rules operate, and prosodic theory, which accounts for the domains in which the rules apply. Phenomena of relative prominence and rhythm require a treatment in terms of grids regarding the substance of the rules, and a treatment in terms of prosodic theory as far as their domains are concerned.

Two different approaches can be distinguished in the PHT: the Relation-Based Approach (RBA), developed mainly by Nespor and Vogel (1982, 1986) and Hayes (1989), and the End-Based Approach (EBA), proposed by Selkirk (1986) and Chen (1987). They differ in the kind and amount of syntactic information they require access to in the construction of sentence-level prosodic categories. The RBA makes reference to X-bar theoretic notions of phrase structure, such as head-complement, modifier-head, and specifier-head relations, as well as syntactic branching.[10] The EBA recurs only to the edges of syntactic heads or maximal projections, i.e., X^0 and X^{max}. We start presenting the main points of the RBA first, in section 3.1. We will concentrate on the issues that interest us in this dissertation, that is, the phonological relation between functional and lexical categories, and will point to the shortcomings of this model as an explanatory model of this interaction. The EBA will be discussed in section 3.2.

3.1. The Relation-Based Approach (RBA)

The principles that establish the geometry of the hierarchical structures of prosodic constituents according to the RBA are presented in (14) (from Nespor and Vogel 1986, henceforth N&V). The first two principles are subsumed under Selkirk's (1984) *Strict Layer Hypothesis.*

(75) *Principle 1.*
A given non-terminal unit of the prosodic hierarchy, X^p, is composed of one or more units of the immediately lower category, X^{p-1}.

Principle 2.
A unit of a given level of the hierarchy is exhaustively contained in the superordinate unit of which it is a part.

Principle 3.
The hierarchical structures of prosodic phonology are *n*-ary branching.

Principle 4.
The relative prominence relation defined for sister nodes is such that one node is assigned the value "strong" (*s*) and all the other nodes are assigned the value "weak" (*w*).

These four principles construct phonological representations of the form presented in (76):

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10 Chen (1990) suggests that in order for the Relation-Based approach to be complete and accurate, it would need to refer to the argument-adjunct distinction as well.

(76)

$$X^P$$
$$X^{P-1}_w \qquad X^{P-1}_s$$
$$X^{P-2}_w \quad X^{P-2}_w \quad X^{P-2}_w \qquad X^{P-2}_w \quad X^{P-2}_s$$
. . . . .
. . . . .
. . . . .
$$X^{P-j} \quad X^{P-j} \quad X^{P-j} \qquad X^{P-j} \quad X^{P-j}$$
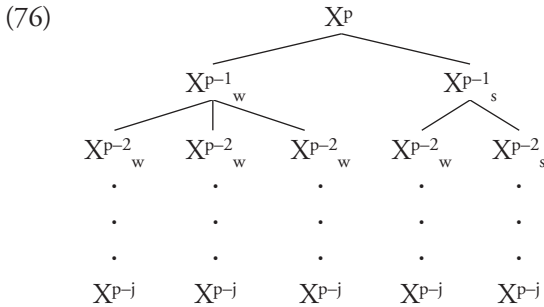
The structure in (77) would be a schematic prosodic tree. Notice that at each level there may be more than one constituent, symbolized by the parentheses (U = Utterance; IP = Intonational Phrase; PPh = Phonological Phrase; CG = Clitic Group; PWd = Prosodic Word; Ft = Foot; Syl = Syllable):[11]

(77)

$$U$$
$$IP \qquad (IP)$$
$$PPh \quad (PPh) \quad \ldots \qquad PPh \quad (PPh) \quad \ldots$$
$$CG \quad (CG) \quad \ldots \qquad CG \quad (CG) \quad \ldots$$
$$PWd \ (PWd) \quad \ldots \qquad PWd \ (PWd) \quad \ldots$$
$$Ft \quad (Ft) \quad \ldots \qquad Ft \quad (Ft) \quad \ldots$$
$$Syl \quad (Syl) \quad \ldots \qquad Syl \quad (Syl) \quad \ldots$$
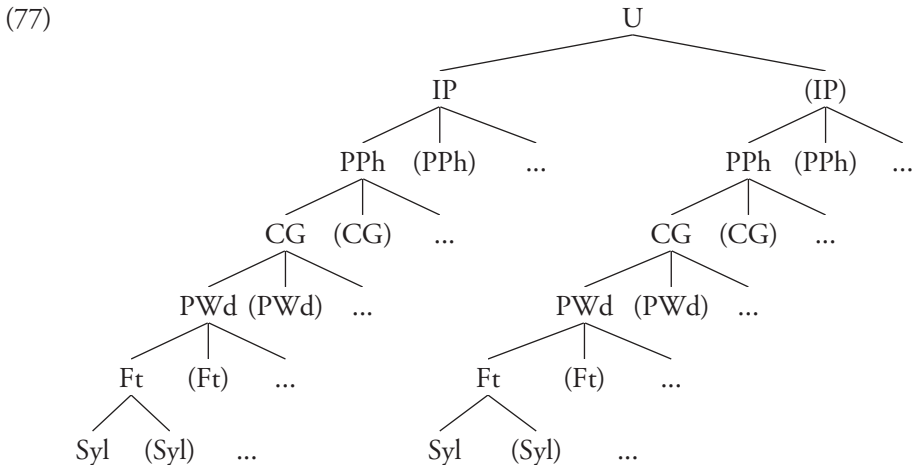
Notice that the principles stated in (75) reveal certain important differences between syntactic and prosodic structure. On the one hand, although prosodic structure has immediate constituent analysis like syntactic structure, one of the original tenets in Prosodic Phonology is that prosodic structure does not allow for recursion of categories, unlike syntactic structure. That is, whereas a syntactic constituent of a given type (say, an NP) can have as its immediate daughter a token of the same category (another NP), an intonational phrase cannot contain another intonational phrase, the same way a phonological phrase cannot contain another phonological phrase, or a prosodic word cannot contain another prosodic word, and so on.[12] Also,

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[11] We use the more standard notation for the Prosodic word, Clitic Group, the Phonological Phrase, and the Intonational Phrase, departing from N&V's notation (ω, C, Φ, I, etc.).

[12] Selkirk (1995) discusses evidence that prosodic structure can be recursive, and hence suggests considering recursivity as a violable condition or constraint, in the spirit of Optimality Theory. However, she still holds that Layeredness (the property that would prevent one constituent of type *n* dominating a constituent of type *n+1* or higher) is inviolable and hence universally highly ranked.

in syntax a category of type *n* can immediately dominate a category of type *n+1* or higher (e.g., an NP can select for a CP), whereas in prosodic structure this is illegitimate (i.e., a Prosodic Word cannot contain a Phonological Phrase). Finally, the possibility for *n*-ary branching in prosodic structure is not observed in syntactic structure, which obeys binarity strictly.

Selkirk (1980a) distinguishes three types of prosodic rules: domain span, domain juncture, and domain limit rules. That is, rules can be specified to apply within a domain of the prosodic hierarchy (e.g., within a prosodic word), between two elements that are located at the edges of their respective domains (e.g., between a word ending a phonological phrase and a word beginning another phonological phrase), or at the left or right edges of a domain. These three types of rule application can be characterized as follows, where A and B are segments, one of which may be null; X, Y, and Z are strings of segments, all of which may be null; and D_i and D_j stand for prosodic categories:

(78) a. Domain span:
$$A \rightarrow B \ / \ [...X\_\_\_Y...]_{Di}$$
　　b. Domain juncture:
　　　　i) $A \rightarrow B \ / \ [...X\_\_\_Y]_{Dj} \ [Z...]_{Dj} \ ...]_{Di}$
　　　　ii) $A \rightarrow B \ / \ [...X]_{Dj} \ [Y\_\_\_Z...]_{Dj} \ ...]_{Di}$
　　c. Domain limit:
　　　　i) $A \rightarrow B \ / \ [...X\_\_\_Y]_{Di}$
　　　　ii) $A \rightarrow B \ / \ [X\_\_\_Y...]_{Di}$

In this model of PHT, functional elements such as determiners, auxiliaries, possessive pronouns, or conjunctions are included in phonological words, clitic groups or phonological phrases with the heads with which they are associated phonologically. That is, these elements may be either independent phonological words, which combine with other words to form phonological phrases, they may be clitics which attach to phonological words to create clitic groups, or they may be affixes which combine with a stem to form a phonological word. This is the typology of phonological patterns of *function words.* For the sake of discussion, let us present the algorithms for the creation of phonological words, clitic groups and phonological phrases that N&V propose:

(79) *ω domain*　　　　(ω = phonological word)

　　A. The domain of *ω* is Q. (Q = terminal element of a syntactic tree)
　　　　or
　　B.　I. The domain of *ω* consists of
　　　　　　a. a stem;
　　　　　　b. any element identified by specific phonological and/or morphological criteria;
　　　　　　c. any element marked with the diacritic [+W].
　　　　II. Any unattached elements within Q form part of the adjacent *ω* closest to the stem; if no such *ω* exists, they form a *ω* on their own.

Phonological words may thus be equal to or smaller than the terminal element in a syntactic tree (i.e., Q), as expressed by A and B in (79), respectively. Possibility A

refers to phonological words which are composed of the stem and all affixes, or by the two members of a compound together (e.g., Greek, Latin; cf. N&V: 110-116, Nespor and Ralli 1996). Possibility BIa is exemplified by those cases in which each stem (plus affixes) counts as a phonological word, that is, with each member of a compound word forming its own phonological word (e.g., Sanskrit, Turkish, Italian; cf. N&V: 117-122, Nespor and Ralli 1996).[13] Both possibilities can coexist in the same language, although one option is always the least favored one (Nespor and Ralli 1996; Peperkamp 1997).

Part Ib of possibility B refers to the distinctions that some languages show between prefixes and suffixes in terms of phonological word formation. In Hungarian and Italian prefixes are specified to form independent phonological words, as opposed to suffixes, which combine with the stem to form one phonological word (cf. N&V: 122-134). Then, there are affixes which form phonological words on their own by virtue of satisfying minimal prosodic size requirements such as bisyllabicity (e.g. Yidin; cf. N&V: 134-136). Part Ic refers to affixes which are idiosyncratically specified to form independent words, as in Dutch (cf. N&V: 136-140), hence the diacritic [+W]. For more discussion on prosodic words, see Peperkamp (1997), Hall and Kleinhenz (1999) and Vigário (2003), among others.

Part II of possibility B responds to the necessity of obeying the Strict Layer Hypothesis, which says that every level of prosodic constituency must exhaustively parse the entire segmental string. That is, every segment must be part of a phonological word, a phonological phrase, an intonational phrase, and an utterance. By this condition, elements that do not qualify as stems, such as conjunctions, complementizers and clitics, also form a ω, either by attaching to a ω within Q or by themselves.

The clitic group is defined as in (80). This definition assumes that there are elements lexically specified as clitics, with the mark [+CL], following Klavans (1982). DCL and CL stand for directional and nondirectional clitics, respectively. DCLs are idiosyncratically specified for directionality of attachment, i.e., as proclitics or enclitics. CLs would be those that only require an adjacent host:[14]

(80) *C domain*
     The domain of *C* consists of a ω containing an independent (i.e. nonclitic) word plus any adjacent ωs containing
     a. a DCL, or
     b. a CL such that there is no possible host with which it shares more category memberships.

The existence of this constituent is proposed on the grounds of the observation that there are phonological rules that only apply to the sequence formed by a lexical

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[13] Reiss (2003) offers a reanalysis of vowel harmony in Hungarian that renders superfluous the need to assume that each member of a compound constitutes an independent prosodic word, as argued traditionally in the literature. It could be that other cases could be reanalyzed the same way.

[14] Incidentally, it must be pointed out that positing non-directional clitics contradicts Klavans's (1982) claim that all clitics are specified for direction of attachment.

word and the clitic that attaches to them (cf. Cohn 1989, Hayes 1989).[15] However, Inkelas (1990) argues that these rules can be reanalyzed as applying either in the phonological word or in the phonological phrase, and that no evidence has been provided yet of any language that crucially needs the phonological word, the clitic group, and the phonological phrase. She concludes then that the status of the clitic group as a prosodic constituent is questionable. The same position is adopted by Zec (1988, 1993), Selkirk (1995), and Booij (1996), among others. For additional discussion on clitics, see Van der Leeuw (1997), Gerlach and Grijzenhout (2001) and references therein.

The building algorithm for the phonological phrase is stated in (81) (taken from Bickmore 1990). Reference is made to the recursive and the non-recursive side of a head. The recursive side is the direction of branching (i.e., of complementation) in a language, and the non-recursive side is the opposite side, that is, the side where specifiers are located:

(81) *Phonological phrases* contain: a head X and all elements on the non-recursive side of the head which are still within X^{max}.

Parameters:
a. obligatory, optional, or prohibited inclusion of the first complement on the recursive side of X.
b. this complement may branch or not.

Most, if not all, proponents of this definition of phonological phrases assume the syntactic model of Chomsky (1981), in which functional categories are considered as specifiers or modifiers located on the non-recursive side of heads, that is, on the opposite side of the direction of branching of a language. Determiners, demonstratives and possessive pronouns are considered specifiers of noun phrases, auxiliaries are specifiers of verb phrases, degree adverbs are modifiers of adjectives, and so on. This is how functional categories which are not already included within a phonological word together with a stem, or in a clitic group together with another phonological word, end up contained in the same phonological phrase with the head they are associated with. This is illustrated by the rule of Raddoppiamento Sintattico in Italian, which is analyzed as applying across two words contained in a phonological phrase. By this rule, the initial consonant of a word is lengthened when preceded by a word ending in a stressed vowel. The consonant to be transformed into a geminate must be followed by a sonorant, especifically a vowel or other nonnasal sonorant. Examples of the contexts in which RS applies are marked with, and those in which it does not are marked with // (cf. (82) and (83), respectively):[16]

(82) a. *Avrá   _trovato il   pescecane.*
          (s)he-will-have found the shark
          '(S)he must have found the shark'

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[15] Bruce Hayes was the first one to propose the clitic group as a constituent in the prosodic hierarchy, in a 1984 paper, only later published in 1989.
[16] In examples (82)-(87) I maintain N&V's convention of indicating the relevant stressed syllables with acute accents, although in standard Italian orthography they should be written as grave accents.

    b. *La gabbia é _giá   _caduta.*
      the cage has already fallen
      'The cage has already fallen'

    c. *É appena passato co   tre _cani.*
      (s)he-has passed with three dogs
      '(S)he has just passed by with three dogs'

(83) a. *Devi   comprare delle mappe   di cittá // molto vecchie.*
      you-must buy   some maps of city   very   old
      'You must buy some very old city maps'

    b. *La gabbia era dipinta di giá // completamente.*
      the cage   was painted already completely
      'The cage was already completely painted'

    c. *L'entrata allo zoo costa di piú //per i turisti che per i locali.*
      the-entrance to-the zoo costs more   for the tourists than for the locals
      'The entrance to the zoo is more expensive for tourists than for locals'

The sentences in (82) and (83) are structured in phonological phrases as indicated in (84) and (85), respectively, following the phonological-phrase-formation algorithm expressed in (81) (where Φ = phonological phrase):

(84) a. $[\text{Avrá\_trovato}]_\Phi$ $[\text{il pescecane}]_\Phi$
    b. $[\text{La gabbia}]_\Phi$ $[\text{é\_giá\_caduta}]_\Phi$
    c. $[\text{É appena passato}]_\Phi$ $[\text{con tre\_cani}]_\Phi$

(85) a. $[\text{Devi comprare}]_\Phi$ $[\text{delle mappe}]_\Phi$ $[\text{di cittá}]_\Phi$ // $[\text{molto vecchie}]_\Phi$
    b. $[\text{La gabbia}]_\Phi$ $[\text{era dipinta}]_\Phi$ $[\text{di giá}]_\Phi$ // $[\text{completamente}]_\Phi$
    c. $[\text{L'entrata}]_\Phi$ $[\text{allo zoo}]_\Phi$ $[\text{costa di piú}]_\Phi$ // $[\text{per i turisti}]_\Phi$ $[\text{che per i locali}]_\Phi$

The first complement of a head on its recursive side may be optionally joined into the phonological phrase that contains the head if this complement is non-branching, that is, formed by only one phonological word (and provided the head is not focalized, cf. Frascarelli 2000). This is called "phonological phrase restructuring" by N&V (p. 173). Thus, the phrasing in (86) can be optionally rephrased as in (87).

(86) $(\text{Se prenderá})_\Phi$ $(\text{qualcosa})_\Phi$ $(\text{prenderà})_\Phi$ $(\text{tordi})_\Phi$
    if (s)he-catches something (s)he-will-catch thrushes
    'If (s)he catches something, (s)he will catch thrushes'.

(87) $(\text{Se prenderá\_qualcosa})_\Phi$ $(\text{prenderá\_tordi})_\Phi$

Quechua is a left recursive language, and the processes of Word Initial Voicing Assimilation and the Reduction Rule mentioned by Muysken (1977) are analyzed as applying within a phonological phrase. The first rule applies to auxiliaries, copulas and existential particles which occur to the right of a head (i.e., on the non-recursive side), if the last segment of the preceding word is voiced. The effects of this rule are exemplified in (88) and (89). In (88b), the initial voiceless consonant of the copula *ka* becomes voiced after the preceding word's final vowel. In (89), however, the initial consonant of a verb is not voiced after the verbal complement's word-final vowel.

N&V: 184 analyze the distinction as a difference in phonological phrasing: in (88), the copula and the preceding word are in the same phonological phrase, whereas in (89) the complement and the verb form separate phonological phrases:

(88) a. *[gana-k ka-rka-ni]*$_\Phi$ b. [Pedro-mi ga-ni]$_\Phi$
        earn   be-used.to-1sg.   Pedro   be-1sg.
        'I used to earn'   'I am Pedro'

(89)   *[papa-da]*$_\Phi$ *[kara-ni]*$_\Phi$ (*gara-ni)
        potatoes   serve
        'I serve potatoes'

More examples of processes analyzed as applying within phonological phrases using the RBA can be found in Cho (1990), Condoravdi (1990), Kidima (1990), McHugh (1990), Rice (1991), Hayes and Lahiri (1991), Zsiga (1992) and Frota (2000), among others. These authors explore the relevance of different aspects of syntactic structure in the definition of a phonological phrase, such as branchingness, the necessity of the head-complement relation, or the notion of lexical government. It should be borne in mind, however, that the new developments in syntactic theory since the second half of the 1980s assign maximal projections to functional categories, taking lexical categories or other functional projections as complements. Hence, the definition of phonological phrase in the RBA would need to be reformulated. Perhaps proponents of the RBA could define a phonological phrase as a constituent formed by a functional head and a lexical head it dominates, as well as any adjunct of the lexical head. However, the meaning or theoretical implication of such a mapping would remain obscure. Why would such a context form one phonological phrase? Why can functional categories not form independent phonological words or phonological phrases, while lexical heads can? As in R&S' approach, the relationship between functional and lexical categories is crucial in the RBA, but left unexplained. The same criticism holds of the other model of the PHT, which we will review in the next subsection.

The intonational phrase (*I*) and the utterance (*U*) are the higher levels in the prosodic hierarchy. The syntactic criteria defining these prosodic constituents are less well understood. Citing (N&V: 188), "The formulation of the basic *I* formation rule is based on the notions that the intonational phrase is the domain of an intonational contour and that the ends of intonational phrases coincide with the positions in which pauses may be introduced in a sentence.". There are certain types of constructions that form intonation domains on their own, usually phrased in independent intonational phrases, separated from the other material in an utterance by pauses, intonational boundaries, or final lengthening. These constructions include parenthetical expressions, nonrestrictive relative clauses, tag questions, vocatives, exclamative expressions, and certain left- and right-dislocated phrases. The English examples they cite are the following:

(90) a. Lions [as you know]$_I$ are dangerous
     b. My brother [who absolutely loves animals]$_I$ just bought himself an exotic tropical bird.
     c. That's Theodore's cat [isn't it?]$_I$
     d. [Clarence]$_I$ I'd like you to meet Mr. Smith.

  e. [Good heavens]$_I$ there's a bear in the back yard.
  f. They are so cute [those Australian koalas]$_I$.

According to N&V, these constructions share a common property, namely that they are in some sense structurally external to the root sentence they are associated with. The concept of root sentence is the only syntactic notion used to define intonational phrases. N&V propose the following rule of Intonational Phrase Formation:[17]

(91) *Intonational Phrase Formation*
  I. *I domain*
    An *I* domain may consist of
    a. all the Φs in a string that is not structurally attached to the sentence tree at the level of s-structure, or
    b. any remaining sequence of adjacent Φs in a root sentence.
  II. *I construction*
    Join into an *n*-ary branching *I* all Φs included in a string delimited by the definition of the domain of *I*.

*I*s may undergo processes of restructuring, like Φs. In the examples above from Italian we saw that a non-branching complement may restructure and form part of one Φ with the verb. In the case of *I*s, N&V point out that a sentence such as (92) can be uttered in one *I* (cf. (93a), or in smaller *I*s (93b,c):

(92) My friend's baby hamster always looks for food in the corners of its cage.

(93) a. $_I$[My friend's baby hamster always looks for food in the corners of its cage]
  b. $_I$[My friend's baby hamster] $_I$[always looks for food in the corners of its cage]
  c. $_I$[My friend's baby hamster] $_I$[always looks for food] $_I$[in the corners of its cage]

Chunking an utterance in short *I*s becomes more marked when the sentence is shorter. That is, a sentence such as (94) can be pronounced in one *I* (95a), but the divisions in *I*s in (95b,c) become more marked:

(94) The hamster eats seeds all day.

(95) a. $_I$[The hamster eats seeds all day]
  b. $_I$[The hamster] $_I$[eats seeds all day]
  c. $_I$[The hamster] $_I$[eats seeds] $_I$[all day]

However, length or syntactic branchingness is only one of the factors that can play a role in restructuring processes.[18] N&V also mention rate of speech, style and

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[17] As the reader may have noticed, N&V write the examples in (89) without commas, but orthographically the strings delimited by *I* boundaries are usually preceded and followed by commas. In fact, Potts (2005) and Selkirk (2005) suggest the term 'comma phrase' to refer to expressions such as parentheticals, nonrestrictive relative clauses, appositives, vocatives, question tags, and topicalized and dislocated phrases, that is, the type of expressions considered by N&V as *I*s. Prosodically, these expressions are cued by pauses of significant elongations (i.e., final lengthening) and final rising contours. Potts (2005) challenges the idea that these expressions are root sentences, and shows that they adjoin directly to the linguistic material upon which they are dependent for their interpretation (DPs or CPs).

[18] N&V seem to equate length with syntactic branchingness, as suggested by expressions such as "… a short (i.e. nonbranching) ϕ …" (cf. N&V: 193), but these are separate dimensions or parameters, as there may be long or short nonbranching and branching syntactic phrases. For a discussion of these

contrastive prominence (i.e., focus) as factors affecting the segmentation of the utterance in *I*s. Thus, the faster an utterance is pronounced, the fewer *I*s it will be divided into, and the more words and syllables an *I* will contain. Conversely, the slower an utterance is pronounced, the more *I*s it will be divided into, and the fewer words and syllables it will contain. As for style of speech, it is frequently observed that the more formal the style, the greater the likelihood for an utterance to be divided into shorter *I*s; and conversely, the more informal or colloquial the style, the greater the likelihood for an utterance to be divided into longer *I*s. Citing Bing (1979), N&V point out that assigning contrastive prominence to a linguistic expression that usually does not carry any level of prominence (such as pronouns) leads to the insertion of *I*-boundaries to the right of those elements.[19]

N&V (196-205) mention other factors constraining *I* restructuring, that is, the creation of shorter *I*s out of a longer *I*. They point out that restructuring is usually preferred at the right edge of an NP, and also at the left edge of an embedded CP ($\bar{S}$, in their notation), if doing so does not break an NP. Also, *I*-boundary insertion is disfavoured if it separates a verb from its argument. It should be noted, however, that these generalizations are based on intuitions. It would be pertinent to confirm the observations reported by N&V through experimental data.

There are segmental phonological rules that apply within *I*. In the Tuscan dialect of Italian there is a rule, known as Gorgia Toscana, that changes the voiceless stops /p, t, k/ into the corresponding fricatives [ɸ, ɵ, h] between two [-cons] segments within and across words. The target segment and the [-cons] segments must be in the same *I*. This process is illustrated in (96); the initial /k/ of *corre* undergoes the rule in (96a) (as indicated by the underlining symbol underneath), but not in (96b), a version of the same sentence pronounced with two *I*s (as indicated by the absence of the underlining symbol):

(96) a. *I*[*Il pericolosissimo   struzzo nigeriano corre più velocemente di quello siriano*]
          the dangerous-super. ostrich Nigerian runs more fast   than the Sirian
          'The extremely dangerous Nigerian ostrich runs faster than the Syrian one'

      b. *I*[Il pericolosissimo struzzo nigeriano] *I*[corre più velocemente di quello siriano]

N&V (211-213) argue that nasal assimilation in Spanish also applies within *I*. An underlying alveolar nasal /n/ assimilates in place of articulation to the following consonant within the same *I*. For instance, in the sentences in (97a,b), only the nasals followed by a consonant in the same *I* assimilate to that consonant. Those nasals that assimilate are underlined, and those that fail to assimilate are written without a symbol. Thus, the nasals in the first *I* in (97a) assimilate in place of articulation to the following /g/ and /b/, respectively, but the final nasal *of saben* in the second *I* does

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[19] Bing (1979) distinguishes between contrastive stress, which does not induce *I*-boundary insertion, and contrastive prominence, which does. N&V illustrate the notion of contrastive prominence with the example *I*[Paul called Paula] *I*[before *she*] *I*[called *him*], in comparison to *I*[Paul called Paula before Carla called Carl]. See Selkirk (2005) for a review of the discussion in the literature on this issue and an analysis.

not assimilate to the /p/ that starts the third *I*. In (97b), the nasals ending the first and second *I*s (i.e., the final nasals of *Carmen* and *canción*) do not assimilate to the following consonants starting a new *I*; the nasals in the second *I* do assimilate to the following consonants in the same word, i.e., in the same *I*:

(97) a. $_I$*[Un gran balcón]* $_I$*[como saben]* $_I$*[puede ofrecer mucho placer]*
       a big balcony as   they-know can offer much pleasure
      'A large balcony, as they know, can offer much pleasure'

    b. $_I$*[Carmen]* $_I$*[cántanos una nueva canción]* $_I$*[por favor]*
       Carmen sing-us a   new song   please
      'Carmen, sing us a new song, please'

The Utterance (*U*) is the highest constituent in the Prosodic Hierarchy. It is mostly isomorphic with the syntactic constituent that could be called a *sentence*, a CP (X^n, in N&V's terminology) dominating all other nodes in the syntactic structure. N&V (222) formulate this definition of *U*:

(98) *Phonological Utterance Formation*
      I. *U domain*
         The domain of *U* consists of all the *I*s corresponding to X^n in the syntactic tree.
      II. *U construction*
         Join into an n-ary branching *U* all *I*s included in a string delimited by the definition of the domain of *U*.

The processes of Flapping in American English and Linking or Intrusive 'r' in British English apply across words contained in all prosodic constituent types, even across words that are clearly contained in different *I*s. The examples in (99) illustrate Flapping (where the segment undergoing the rule is underlined) and those in (100) illustrate Linking-r ((99b) is a case with an orthographic 'r' which is not pronounced):

 (99) a. the whi<u>t</u>e owl   →   the whi[ɾ] owl
     b. My brother bough<u>t</u> a parrot last week.   →   bough[ɾ]
     c. Ichabo<u>d</u>, our pet crane, usually hides when guests come.   →   Ichabo[ɾ]

(100) a. some raw oysters   →   some raw[ɾ] oysters
     b. A rare type of grasshopper invaded our yard last year.   →   grasshoppe[ɾ]
     c. The giant panda, as you know, is an endangered species.   → panda[ɾ]

It is worth pointing out that *U*s may not be isomorphic with the syntactic constituent CP that may be considered a sentence. Flapping and Linking-r may apply between sentences (cf. N&V: 236-237):

(101) a. Have a seat. I'll be right back.   →   …sea[ɾ] I'll …
     b. Call Anna. It's late.   →   … Anna[ɾ] It's…

Certain restrictions seem to hold on sentence-crossing, however. N&V (237-244) cite pragmatic and phonological conditions: the two sentences must be uttered by the same speaker, the two sentences must be addressed to the same interlocutor(s), the two sentences must be relatively short, and there must not be a pause between

the two sentences. But again, as with the *I* level, this kind of observations and hypotheses remain to be tested experimentally.[20]

Apart from N&V, we refer the reader to Hayes (1989), Nespor (1990), Vogel and Kenesei (1990) and Frota (2000), among others, for discussion on Is and Us as levels of the Prosodic Hierarchy (see Kanerva 1990 for an intermediate constituent between the intonational phrase and the phonological phrase, the focus phrase).

Before turning to the other major approach within the PHT, the End-based Approach, it is worth bringing to discussion the proposal by Pak (2005) and Pak and Friesner (2006) to separate prosodic domains which are defined in terms of pure morphosyntactic information, such as prosodic words, clitic groups and phonological phrases, from prosodic domains whose creation does not depend only on morphosyntactic information but varies depending on factors such as branchingness/ length, style, tempo, or eurhythmy. Pak (2005) and Pak and Friesner (2006) argue that the first type of domains are created from syntactic structure at an earlier stage in the derivation from syntax to PF, and that the second type of domains are created at a later stage, when metrical information and notions such as register or style, length or weight of constituents and eurhythmy may influence prosodic domain formation. Pak (2005) and Pak and Friesner (2006) suggest that the rules applying in the latter type of domains have properties of rules applying in intonational phrases. They argue that this temporal and architectural distinction between domains of one type and another has its reflections in the fact that in some languages rules of one type have domains of application that cross domains of the other type. Pak (2005) and Pak and Friesner (2006) bring forth the cases of tone sandhi in Xiamen (Chen 1987), which applies in morphosyntactically-defined phonological phrases, namely between a verb and its complement. It may happen that the verb and its complement are pronounced in separate intonational phrases, but tone sandhi applies nonetheless. This is illustrated in (102), where the domain of tone sandhi is indicated by the symbol '#' and intonational phrase-boundaries are indicated by the symbol '%':
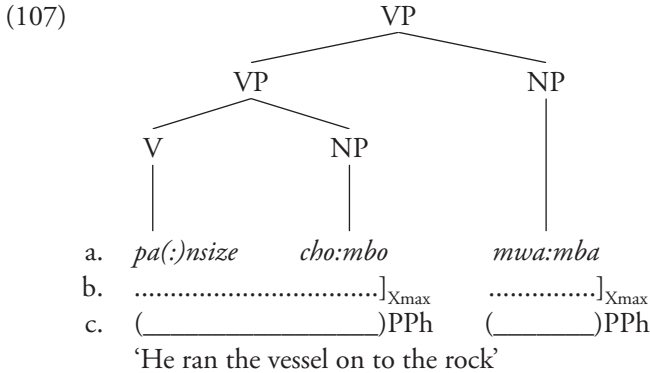
(102) *tian-po # tsing-bing yi si % So-lian # pai-lai # e tik-bu*
       telegram prove   he be USSR   send   *e* spy
       'The telegram proves that he is a spy sent by the USSR'

Pak and Friesner (2006) argue that French liaison is another case exemplifying the reality of domain-mismatches. Liaison may apply between two words in separate accent domains, as illustrated in (103). The final consonant of *faut* (in boldface) may undergo liaison, although the following vowel-initial word is in a separate accent domain, given the pause between the two words. In fact, the two words are in separate intonational phrases:
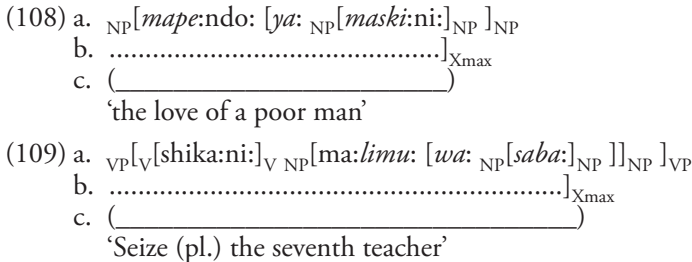
(103) *qu'il fau**t**   (pause) interdire*
       that one must   forbid
       Liaison: (…faut interdire)
       Accent: (…faut)(interdire)

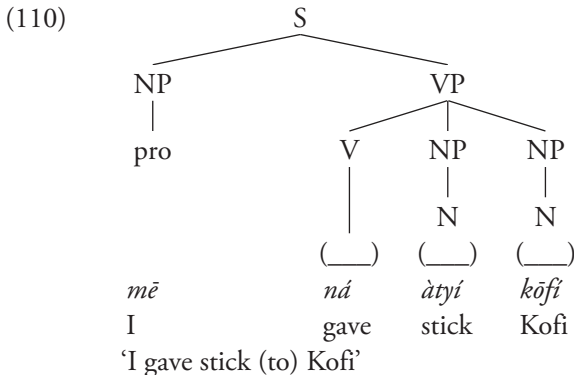[20] See Selkirk (2005) for further discussion on this topic.

The opposite situation is exemplified by (104), where *hivers* is in the same accentual domain with *autres*, but no liaison applies to the final consonant of *hivers*:

(104) hivers autres qu'en Afrique
       winters other than-in Africa
       Liaison: (hivers)(autres…)
       Accent: (hivers autres…)

3.2. The End-Based Approach (EBA)

As mentioned above, the proposal in this model of the PHT is that the relation between syntactic structure and prosodic structure above the foot and below the intonational phrase is defined in terms of the *ends* of syntactic constituents of designated types. The idea is that a derived phonological domain will comprise the string of the surface syntactic structure that is demarcated by the left or right ends of heads or maximal projections. This claim is a generalization of Chen's (1987) proposal for the domain of tone sandhi in Xiamen Chinese. For this author, the domain of tone sandhi is delimited by the right edges of X^{max}. The parameters for the mapping of syntactic structure onto prosodic structure are thus the following:

(105) *End parameter settings:*
       (i) a. $]_{Word}$ b. $_{Word}[$
       (ii) a. $]_{Xmax}$ b. $_{Xmax}[$

The string that falls between two left or right boundaries of the relevant constituent level forms one phonological domain. The string contained between two word boundaries is a phonological or prosodic word, and the string contained between two boundaries of maximal projections is a phonological phrase. Assuming a language with right edge settings for the word and X^{max} constituent levels, the following phonological domains would be obtained, where PWd stands for 'prosodic/phonological word', and PPh stands for 'phonological phrase' (from Selkirk 1986: 387):

(106) a.

Selkirk exemplifies the workings of this theory by analyzing the domains of application of stress assignment in Chi Mwi:ni, which is assigned at the phrasal level. Selkirk identifies the domain as the phonological phrase, delimited by X^{max} right edge boundaries:

(107)

```
                              VP
                    ┌─────────┴─────────┐
                   VP                    NP
              ┌─────┴─────┐               │
              V           NP              │
              │           │               │
  a.      pa(:)nsize    cho:mbo        mwa:mba
  b.      ..................]Xmax       .............]Xmax
  c.      (_____)PPh        (_____)PPh
```

'He ran the vessel on to the rock'

This shows that the verb and its complement form a domain, and that the adjunct NP forms a separate domain, set off from the first by the right-edge boundary of the complement NP. In noun and verb phrases, which are always right-branching, with the head on the left, the head is joined in a stress domain with what follows; see (108).

(108) a. $_{NP}$[*mape*:ndo: [*ya*: $_{NP}$[*maski*:ni:]$_{NP}$]$_{NP}$
      b.   ....]$_{Xmax}$
      c.   (_____)
      'the love of a poor man'

(109) a. $_{VP}$[$_V$[shika:ni:]$_V$ $_{NP}$[ma:*limu*: [*wa*: $_{NP}$[*saba*:]$_{NP}$]]$_{NP}$]$_{VP}$
      b.   ....]$_{Xmax}$
      c.   (_____)
      'Seize (pl.) the seventh teacher'

Ewe sets the X^{max} parameter in the opposite direction, $_{Xmax}$ [, defining the domains for tone sandhi (cf. Clements 1978). This is a rule which makes a mid tone extra high when it is located between two high tones all within the same derived domain:

(110)

```
                              S
                    ┌─────────┴─────────┐
                   NP                    VP
                    │            ┌───────┼───────┐
                   pro           V       NP      NP
                                 │       │       │
                                 │       N       N
                                 │       │       │
                                (___)   (___)   (___)
                                 mē      ná     àtyí    kōfí
                                 I      gave    stick   Kofi
```

'I gave stick (to) Kofi'

As for the RBA, an important aspect of the EBA is that function words' boundaries do not count for the mapping between syntactic and prosodic structure, and are included in larger prosodic domains, as stated in Selkirk's (1984) *Principle of the Categorial Invisibility of Function Words* (PCI). This principle is based on the observation that function words are not assigned the silent demibeat of syntactic timing that nonfunction words receive in the syntax-phonology mapping and are not assigned a third-level main word stress, as well as on the observation that function words are usually unstressed, and it is a crosslinguistically attested fact that they often cliticize to an adjacent word. This assumption is expressed in (106) above, where the function words ('fw') in the subject phrase do not project any right Word or X^{max} boundaries and are subsumed in the following domains. Indeed, Selkirk claims that the close phonological juncture of function words with an adjacent word is illustrated by the great likelihood that phonological rules of external sandhi operate between a function word and an adjacent word. However, this is just an observation of the facts and does not constitute an argument for the PCI.

Selkirk (1984) extends this assumption to pre-head modifiers and specifiers as well, in order to account for French liaison. Recall that the triggers of basic liaison (i.e., the unmarked contexts, in colloquial speech) are determiners, prepositions, possessive pronouns, prenominal adjectives, degree adverbs, auxiliary verbs and clitics:

(111) a. *très_ aimables_enfants*   c. *en_   ont_ avalé*
       very nice   children   it(cl.) have drunk
     b. *dans_un_énorme   wagon*
       in   an enormous train car

Selkirk suggests a new parameter defined by the notion 'head' and an end setting $]_{Xhead}$ to capture the domain of liaison, arguing that function words are not heads of maximal projections, simply because they do not project maximal projections. She claims also that specifier phrases do not project maximal projections, following Stowell (1981) and Emonds (1985). This is how she manages to include prenominal adjectives and degree adverbs in the same domain with the following head. For this author, auxiliaries and clitics are also specifiers of the verb, and thus no boundary is inserted at their right edge. A plausible alternative analysis in the same line, perhaps simpler in that it does not have to recur to a new parameter defined by the notion 'head', would be to assume that $]_{Xmax}$ is the relevant setting that defines the domain for liaison. This ensures that all function words are contained in the same domain with a lexical category that follows. A structure like (106) would illustrate this, so we will not exemplify this alternative any further. In any case, what should remain clear is the stipulatory flavor of this analysis. Why is it that function words have that property of not being able to project maximal projections, and not even count as words? The same goes for specifiers and modifiers.

The PCI has been assumed by all scholars working within the EBA. For instance, Chen (1987) analyzes tone sandhi in Xiamen Chinese as applying within phonological phrases, delimited by setting the $]_{Xmax}$ parameter. However, subject and object pronouns do not have phonological phrase boundaries on their right

edges, and they normally cliticize to the tone group on their right. Thus, contrast the examples in (112), which contain subject and object pronouns, with the example in (113), which contains a lexical NP subject and object (cliticization is indicated by the '=' sign):

(112) a. (*yi/lang = sia k'a kin*)$_\Phi$ b. (*ts'iah li/lang = lai*)$_\Phi$
            he/someone write more fast   invite you/someone come
            'He/someone writes faster'   'Invite you/someone to come'

(113) (*Ting sio-tsia*)$_\Phi$ (*p'eu*)$_\Phi$ (*sia-liao-loo*)$_\Phi$
            Ting miss   letter   write-asp.
            'Miss Ting has written the letter'

Other work on phonological phrase formation using the EBA includes Selkirk and Tateishi (1988) for Japanese, Selkirk and Shen (1990) for Chinese, and Kenstowicz and Sohn (1997) for Korean, among others. Most recently, Selkirk (1995, 2000) and Truckenbrodt (1995, 1999, 2002), among others, have modeled the EBA in terms of alignment constraints operating in Optimality Theory grammars, as we will see below.

Some authors explore the relevance of different aspects of syntactic structure in the definition of a phonological phrase, such as branchingness. In Kinyambo, for instance, high tone deletion occurs within phonological phrases delimited by the right edge of branching syntactic maximal projections (Bickmore 1990). Thus, observe the difference in phrasing between (114a) and (114b). In (114b) a phonological phrase boundary is inserted at the right edge of the branching indirect object, leaving the direct object on its own. If restructuring were at stake, the direct object would form part of the preceding phonological phrase.

(114) a. [*Nejákworech'* [*ábakoz'*]$_{NP}$ [*émbwa*]$_{NP}$]$_{VP}$
            (*Nejákworech' ábakoz' émbwa*)$_\Phi$
            he-will-show workers dog
            'He will show the dog to the workes'

      b. [*Nejákworech'* [*ómukama* [*w'ábakózi*]$_{PP}$]$_{NP}$ [*émbwa*]$_{NP}$]$_{VP}$
            (*Nejákworech' ómukama w'ábakózi*)$_\Phi$ (*émbwa*)$_\Phi$
            he-will-show chief   of workers dog
            'He will show the dog to the chief of the workers'

In the light of such evidence (see Bickmore 1990 for more details, as well as Cowper and Rice 1987 for a discussion of consonant mutation in Mende), these scholars suggest adding the parameter "(non)branchingness" to the list of parameters in (81). In a similar vein, although not within the EBA, Zec and Inkelas (1990) and Inkelas and Zec (1995) suggest an alternative approach in which phonological phrases are formed bottom up from syntactic sisters (head and complement), but syntactically nonbranching maximal projections do not constitute independent phonological phrases and are phrased with the adjacent head. The phonological evidence they present is not segmental in nature, but has to do with the distribution of the emphatic particle *fa* in Hausa or the second position clitics in Serbo-Croatian. They even argue that branchingness can have an effect in the opposite direction, from

prosody to syntax, in that certain syntactic operations such as topic construction in Serbo-Croatian or heavy NP shift in English have to be branching prosodically at some level. Thus, topics in Serbo-Croatian have to contain at least two phonological words, and the shifted constituents in English have to contain at least two phonological phrases. The problem with this proposal is that syntactic or prosodic branchingness does not seem to be a universally necessary constraint for all languages. It may apply with full force in Kinyambo, Mende, Hausa or Serbo-Croatian, but in Italian it does not seem to be an obligatory condition to fulfil, according to N&V. Also, it should not escape to our attention that allowing for prosody to influence syntax has important theoretical implications. In the theory of grammar assumed in the generative model, only a unidirectional relationship or mapping from the syntactic component to the phonological component (the level of Phonetic Form, which prosody forms part of) is claimed to exist. Thus, arguing for a bidirectional relationship between these two modules raises questions about the theoretical changes that such a move would involve: among others, whether the relationships are bidirectional or multidirectional (i.e., all components or levels are related to one another), or whether the traditional assumption that the construction of an utterance proceeds derivationally from one module to another (i.e., the inverted T- or Y-model) should be abandoned in favor of a parallel derivation between components, perhaps à-la Jackendoff (1997). Unfortunately, the authors do not discuss these issues and these questions remain unanswered.

Selkirk and Shen (1990) analyze the rules of Obligatory Tone Deletion, Left-to-Right Tone association, and Default Tone Insertion in Shanghai Chinese, and conclude that they apply within a phonological word, defined through the insertion of prosodic word boundaries to the left edge of a lexical word. Function words do not project boundaries, and hence form part of a phonological word together with the lexical word and function words to their left. (115) illustrates a minimal pair between a verb phrase with a pronominal object and one with a lexical object. Additional examples are provided in (116), with the labeled structures to the left of the arrow representing syntactic structure and the representations to the right of the arrow illustrating the division of the string in phonological words:

(115) a. (*taN 'noN leq*)
       hit   you has
       'has hit you'

     b. (*taN*) ('*mo leq*)
        hit   horse has
        'has hit the horse'

(116) a. [*'z* ['*laq* [*'zawNhe*]$_{NP}$]$_{PP}$]$_{VP}$ →   ('*z 'laq*) ('*zawNhe*)
       live in   Shanghai
       'live in Shanghai'

     b. [*taw* [*ziq pe 'zo*]$_{NP}$]$_{VP}$ →   (*taw ziq pe*) ('*zo*)
       pour indef. class tea
       'pour a cup of tea'

Observe the mismatch between syntactic and phonological constituency reflected in (116). The preposition in (116a) and the quantifier and classifier in (116b) form part of a PP and NP, respectively, but form prosodic words with the preceding verb. Hale and Selkirk (1987) claim that the PCI is responsible for

some of the syntax-phonology mismatches observed in different languages, such as these attested in Shanghai Chinese. That is, the invisibility of function words to the assignment of edge boundaries, or rather, their inability to project boundaries is what allows for these mismatches to occur. For a string word-function word-word there are four typological possibilities that can be realized, depending on the head directionality of languages. Given a syntactic parsing of the string such as the one in (117), head-initial languages would divide the string into prosodic words as in (118a) or (118b), depending on which setting for the edge parameter they select:

(117)
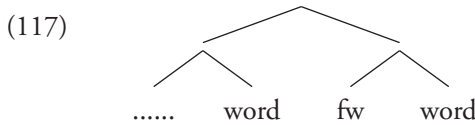
...... word fw word

(118) a. Parameter =]$_{Word}$ .... (word) (fw word) ......
     (e.g., English, French, Shona)

    b. Parameter = $_{Word}$[...... (word fw) (word) .....
     (e.g., Kwakwala, Kukuya, Shanghai Chinese)

Head-final languages, on the other hand, would parse the string in the opposite fashion, as shown in (119), and the only observed output in phonological wording is the one in (120a):[21]

(119)
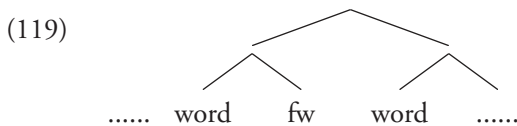
...... word fw word ......

(120) a. Parameter = $_{Word}$[...... (word fw) (word) .....
     (e.g., Japanese, Shanghai Chinese)

    b. Parameter =]$_{Word}$ ...... (word) (fw word) .....
     No examples found.

The conspicuous absence of examples of possibility (120b) deserves a comment. Hale and Selkirk attribute it to the alleged tendency of function words to be attracted to a preceding stress. But this is a stipulation, and empirically wrong: as shown in (118a), in head-initial languages function words most naturally form prosodic words with following words, although stress precedes those function words (i.e., the default assumption is that the lexical words preceding the function words bear stress). This pattern covers the overwhelming majority of cases. Only a few cases of function words grouping with the preceding word are attested in head-initial languages; to the three languages in (118b) we could perhaps add Dschang-

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[21] Actually, the reader should be warned that there is an error in Hale and Selkirk's article, on page 177. The syntactic structure that appears there for head-final languages is similar to the one posited for head-initial languages, i.e., (117). Reading the text discussing the two structures the reader notices that the structure the authors had in mind was the one we present in (119).

Bamileke (cf. Hyman 1985) and Yagua (cf. Payne and Payne 1989, Everett 1989). This is surprising under Hale and Selkirk's assumptions on the inherent attraction to the preceding stress that function words display. In the majority of cases, then, it seems that a function word tends to associate phonologically with a word with which it is syntactically more closely related. This observation, although extremely interesting, needs to be clearly stated as well as explained, and unfortunately the EBA (similar to the RBA and R&S's proposal) does not attempt an explanation. Evidence is presented in section 7 showing that the syntactic relationship holding between a functional and a lexical category acts as a constraining force in the syntax-phonology interface, and an alternative view is presented that is based precisely on the nature of the morphosyntactic relationships between functional and lexical heads.

It is not easy to show the superiority of the EBA over the RBA or vice versa, as most phenomena could receive an analysis under both approaches. Only Bickmore (1990) and Cho (1990) attempt a comparison of both models, and reach opposite conclusions. Also, Chen (1987, 1990) suggests the possibility that phonological domains in one language may be constructed following the EBA but that certain relation-based considerations may also play a role. For Xiamen tone sandhi, he claims that adjuncts do not project phonological phrase boundaries, but as Truckenbrodt (1999) points out, it could be that such adjuncts do not project onto phrases and hence no boundaries are inserted at their edges.

3.2.1. The EBA in Optimality Theory

The EBA saw new developments with the advent of Optimality Theory. In Selkirk (1995, 2000), Truckenbrodt (1995, 1999, 2002), Sandalo and Truckenbrodt (2002) and Prieto (2006), among others, the syntax-phonology mapping is conceived as the result of having candidate prosodic phrasings of the input syntactic structure of a sentence evaluated by a ranked set of violable constraints. The empirical evidence comes from languages such as English, Italian, Bengali, Brazilian Portuguese, Tohono O'odham, Kimatuumbi, Chicheŵa or Chi Mwi:ni.

As illustrative examples of this approach, let us summarize Truckenbrodt's (1995, 1999) analyses of vowel shortening in Kimatuumbi and Chi Mwi:ni and vowel lengthening in Chicheŵa (three Bantu languages). In Kimatuumbi and Chi Mwi:ni shortening applies in words that are not XP-final. Thus, in the examples from Kimatuumbi in (121a) the long vowel of *mpúunga* 'rice' is shortened because it is not final in the NP, whereas the long vowel in *baándu* 'people' is not shortened because it is final in its NP. In (121b), the long vowel in *mpúunga* is not shortened because it is final in its NP (the lack of shortening in *waabói* 'has rotted' is due to the same circumstance). In (121c) shortening does not apply to the direct object *kikóloombe* 'shell' or to the indirect object *Mambóondo* 'Mamboondo' because they end their NPs:

(121) a. $[_N[mpúunga]$ *wá* $[baándu]_{NP}]_{NP}$ → *mpunga wá baándu*
         rice   of   people
         'people's rice'.

b. [*mpuungá*]$_{NP}$ [*waabói*]$_{VP}$ → *mpuungá waabói*
  rice   has-rotted
  'The rice has rotted'.

c. [*naampéi* [*kikóloombe*]$_{NP}$ *Mambóondo*]$_{NP}$]$_{VP}$ → *naampéi kikóloombe*
                                                                    Mambóondo

  I-him-gave shell Mambóondo
  'I gave Mamboondo the shell'.

In the Chi Mwi:ni example in (122) the same condition for shortening applies. Only the vowel in *panziize* 'he ran' can shorten, as it is not final in its XP, i.e., the VP. The other two words are final in their NPs, and thus the long vowels they contain cannot be shortened.

(122) [*panziize* [*choombo*]$_{NP}$ [*mwaamba*]$_{NP}$]$_{VP}$ → *panzize choombo mwaamba*
      he-ran   vessel   rock
      'he ran the vessel onto the rock'

Based on a previous analysis of the facts couched in the EBA by Cowper and Rice (1987), as an alternative to a DRT analysis provided by Odden (1987), Truckenbrodt (1995, 1999) claims that in Kimatuumbi and Chi Mwi:ni long vowels shorten except in the prosodic word immediately preceding the right edge of a phonological phrase. Phonological phrase boundaries are determined by the constraint ALIGN-XP,R ((ALIGN (XP, R; Φ, R)), which demands that the right edge of a lexical maximal projection be aligned with the right edge of a phonological phrase. This explains why an indirect object and a direct object are separated in different domains for vowel shortening: a phonological phrase boundary is inserted at the right edge of the indirect object NP.

In Chicheŵa, on the other hand, penultimate vowels in a word lengthen if the word is final in its XP:

(123) a. [*mleêⁿdo*]$_{NP}$ (cf.   [*mleⁿdó uuyu*]$_{NP}$)
          'visitor'   'this visitor'

b. [*kagaálu*]$_{NP}$ [*kanáafa*]$_{VP}$
  (small) dog died
  'The (small) dog died'

Thus, it seems as if phonological phrases in these three Bantu languages are constructed the same way, by the force of a highly ranked ALIGN-XP,R. However, in Chicheŵa no lengthening occurs on the indirect object NP *mwaná* 'child' in (124a) or on the direct object *nyuᵐbá* 'house' in (124b), although it applies on the words *ⁿjíîⁿga* 'bicycle' and *mwáála* 'rock', which end their phrases.

(124) a. [*tinapátsá* [*mwaná*]$_{NP}$ [*ⁿjíîⁿga*]$_{NP}$]$_{VP}$
          we-gave   child   bicycle
          'We gave the child a bicycle'.

b. [*amaményá* [*nyuᵐbá*]$_{NP}$ [*dí mwáála*]$_{NP}$]$_{VP}$
  he-hit   house   with rock
  'He hit the house with a rock'.

Truckenbrodt (1995, 1999) analyzes the asymmetry between Kimatuumbi-Chi Mwi:ni and Chicheŵa as the effect of two other constraints, Wrap-XP and Nonrec. Wrap-XP demands that each XP is contained in the same phonological phrase, i.e., without having the words in the XP in separate phonological phrases. This constraint is compatible with Align-XP,R in cases in which a bigger or more inclusive XP_1 containing two or more XPs projecting right edges of phonological phrases is still wrapped together in one phonological phrase. This would be the case of a VP wrapped as a phonological phrase but containing two objects whose right edges are aligned with the right edge of phonological phrases as well. Banning or allowing such recursive phonological phrases is the role of Nonrec. In Kimatuumbi such recursive structures are allowed, thus respecting Align-XP,R and Wrap-XP but violating Nonrec. In Chicheŵa, however, an XP must be wrapped in a phonological phrase without having inner phonological phrases. That is, a VP forms a single phonological phrase, respecting Wrap-XP and Nonrec but violating Align-XP,R. The relative ranking of these constraints for Kimatuumbi and Chicheŵa, then, is as in (125):[22]

(125) a. Kimatuumbi: Align-XP,R , Wrap-XP >> Nonrec
      b. Chicheŵa: Wrap-XP, Nonrec >> Align-XP,R

However, example (123b) needs some clarification, as the subject and the verb are in separate phrases: why isn't the IP or CP containing the subject and the verb wrapped? Truckenbrodt (1995, 1999) explains these cases by assuming Selkirk's PCI (i.e., that functional projections are invisible to prosodic boundary insertion) and that IP or CP do not need to be wrapped together. Thus, Align-XP,R applies without obstacles.[23]

Narrow focus, however, plays a role in Chicheŵa, as a constituent bearing narrow focus is phrased separately. Thus, if the verb in (126a) were focalized, penultimate lengthening would apply to it, and if the first object in (126b) were focalized its penultimate vowel would be lengthened as well:

(126) a. [*tinapáatsá* [*mwaná*]$_{NP}$ [*^{n}jí^{n}ga*]$_{NP}$]$_{VP}$
         we-gave   child   bicycle
         'We *gave* the child a bicycle'.

      b. [*amaményá* [*nyuú^{m}bá*]$_{NP}$ [*dí mwáála*]$_{NP}$]$_{VP}$
         he-hit   house   with rock
         'He hit the *house* with a rock'.

Truckenbrodt (1995, 1999) attributes these facts to the effect of a constraint Align-Foc (Align (Foc,R; Φ,R)), which demands that each focused constituent is right-aligned with a phonological phrase boundary, and it has to be ranked above Wrap-XP in order to enforce violations of this constraint.

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[22] For Chi Mwi:ni, Seidl (2001) shows that an OT analysis along the lines of Truckenbrodt's would have to posit a higher ranking of align-xp, r and nonrec over wrap-xp.

[23] Truckenbrodt (1995, 1999) uses the same argument to account for the presence of a left edge prosodic boundary on VP when preceded by a subject in Kimatuumbi and hence the presence of phrasal high tone insertion at the right edge of the subject.

Finally, another positive aspect of this kind of OT analysis is that it allows a rean-alysis of Hale and Selkirk's (1987) account of Tohono O'odham eliminating lexical government from the parameters of the syntax-phonology interface. In this language, there are phonological phrase boundaries at the right edge of subjects in Spec,IP and VP-adjoined objects but not at the right edge of VP-internal objects or subjects. Hale and Selkirk (1987) argued that this asymmetry could be explained under the assumption that in Tohono O'odham lexically governed maximal projections do not project right edge phonological phrase boundaries. Truckenbrodt (1995, 1999) shows that such a parameter is not needed. Having WRAP-XP and NONREC ranked above ALIGN-XP,R accounts for the absence of breaks in the VP.

The survey of OT analyses of the syntax-prosody interface can be closed by men-tioning that in addition to constraints such as ALIGN and WRAP that make reference to syntactic information, other purely prosodic constraints imposing conditions on size and balancing of phonological phrases have been invoked in the literature. For instance, UNIFORMITY (phonological phrases must be of equal length, i.e., contain-ing the same number of prosodic words; cf. Ghini 1993, Sandalo and Tuckenbrodt 2002, Prieto 2005, 2006), SYMMETRY (a string is divided into phonological phrases displaying a symmetrical distribution of length, i.e., $(ww)_\Phi \ (w)_\Phi \ (ww)_\Phi$ is better than $(w)_\Phi \ (ww)_\Phi \ (ww)_\Phi$); cf. Ghini 1993), INCREASING UNITS (phonological phrases on the recursive side are heavier, i.e., contain more prosodic words, than those in the nonrecursive side; cf. Ghini 1993), BINARY-MAP (a major phrase/phonological phrase must contain minimally and/or maximally two minor phrases, i.e., prosodic words; cf. Selkirk 2000, Prieto 2005, 2006), or MAXIMUM-MAP (a major phrase/ phonological phrase must not contain more than a language-specific maximum number of syllables or of levels of prosodic branchingness; cf. Elordieta, Frota and Vigário 2005).

As mentioned at the beginning of this section, proponents of the PHT claim that all postlexical or phrasal phonological rules can be handled by the theory, in the sense that all the domains of application of such rules are prosodic in nature, not syntactic. However, there is a residue of phonological rules that seem to resist an analysis in terms of prosodic domains, such as the vowel deletion rules of Greek and verb final vowel deletion in Italian mentioned at the beginning of this section. Hayes (1990) considers such rules outside the scope of the PHT, assigning them a lexical character. We review Hayes's proposal in the following section.

4. Precompiled Phrasal Phonology

The main idea in Hayes's (1990) Precompilation Theory is that all rules applying across words whose structural description refers to syntactic labels and categories do not belong in the postlexical component but in the lexical component, and should be considered as rules of phrasal allomorphy. The lexicon is viewed as including a set of phrasal allomorphs for every word, generated by lexical phonological rules. Each of these allomorphs is marked to surface in certain syntactic contexts, encoded by means of phonological instantiation frames. Hayes illustrates this proposal through the rule of Hausa final vowel shortening, a process where final long vowels of verbs appear as short when the verb precedes a full NP direct object:

(127) a. *ná: kámà:*   c. *ná: kámà*   *kí:fí:*
       I   have-caught   I   have-caught fish
       'I have caught (it)'   'I have caught a fish'

      b. *ná: kámà:*   *ší*   d. *ná: ká:mà:*   *wà Mú:sá: kí:fí:*
       I   have-caught it   I   have-caught prt. Musa   fish
       'I have caught it'   'I have caught Musa a fish'

Only in (127c) does the final long vowel of the verb *ká:mà:* appear as short, that is, when followed by a full NP direct object. In all other contexts, the vowel appears as long. This distribution would be captured by assuming that the two allomorphs of the verb *ká:mà:* are *ká:mà:* and *ká:mà*, and that the rule of vowel shortening refers to this phonological instantiation frame, generating the allomorph with the short vowel. The longer form is inserted elsewhere. The vowel shortening rule would be formalized as in (128):

(128) V: $\rightarrow$ V / [... ____]$_{[Frame\ 1]}$
       Frame 1:   / [$_{VP}$ ____ NP ...], NP non-pronominal

Other cases that Precompilation Theory can deal with are the *a/an* alternation of the indefinite determiner in English, as it affects just this particular syntactic category, or the alternation that the Spanish feminine definite determiner shows between *el* and *la* (i.e., *el* before nouns whose initial vowel is stressed, and *la* elsewhere).

Precompilation Theory is suitable as a model of phrasal allomorphy, for phonological processes that are sensitive to syntactic or morphological category information, rather than category-blind processes such as those that the theories reviewed so far occupy themselves with. However, Hayes makes a strong claim, which is that all phrasal rules can be accounted for by the Prosodic Hierachy Theory (PHT), and those which are directly sensitive to syntactic information and cannot be handled by the PHT are precompiled rules. Obviously, both of these claims would be rejected by proponents of the DRT. After Kaisse (1985) there were almost no further developments of the DRT for several years that could rebate Hayes's claim. In sections 6 and 7 I will review Seidl's (2001) Minimal Indirect Reference Theory and the proponents of the phase-based phrasal phonology (Dobashy 2003, Ishihara 2003, 2007, Kratzer and Selkirk 2007, Pak 2007, 2008, among the most noteworthy proposals).

In the next two sections I present data that pose a challenge to the proposals for phonological domain formation that have been surveyed so far, which thus suggests that the nature of the syntax-phonology interface is more complex than hitherto assumed.

5. Feature-checking relationships and phonological domains (Elordieta 1997, 1999)

5.1. Distribution

Elordieta (1997, 1999) presents a process of Vowel Assimilation (VA henceforth) in Lekeitio Basque (LB henceforth), by which a syllable-initial vowel assimilates in all its features to an immediately preceding syllable-final vowel. This process is optional and it applies in colloquial speech. In nominal contexts, it only applies be-

tween the final vowel of a noun or adjective and the initial vowel of a following inflectional head (a determiner or case marker) attached as a suffix. It does not apply across members of compounds, or between a noun and an adjective. This is illustrated in (129), where for each of the underlying forms in the lefthand column two alternative outputs can be obtained. The form on the left represents the surface representation without vowel assimilation having applied, and the righthand column contains the surface representation with the application of vowel assimilation. The stem-final vowels in the output forms are always high, due to the application of a process of Vowel Raising (VR henceforth), which raises a stem-final nonhigh vowel when immediately followed by a vowel-initial suffix (a, e > i; o > u). Syllable boundaries are indicated by dots:[24],[25]

(129) a. */orma-a/*   *or.mi.a   or.mi.i*
           wall-det.sg.
           'the wall'

       b. */baso-ak/*   *ba.sú.ak   ba.sú.uk*
           forest-det.pl.
           'the forests'

       c. */seme-a-ri/*   *se.mi.a.ri   se.mi.i.ri*
           on-det.sg.-dat.
           'to the son'

       d. */ume-en/*   *u.mí.en   u.mí.in*
           child-gen.pl.
           'of the children'

       e. */ortu-eta-tik/*   *or.tu.e.tá.tik   or.tu.utá.tik*
           garden-det.pl.-abl.
           'from the gardens'

       f. */polísi gaixto-ak-kin/*   *polísi gaix.tu.á.kin   polísi gaix.tu.ú.kin*
           policeman bad-det.pl.-soc.
           'with bad policemen'

Derivational morphemes are consonant-initial in LB, so it is not possible to test the behaviour of derivational morphemes with respect to VA. VA may also apply in underived domains, i.e., roots, although the application of the rule seems to be lexically determined (cf. *bi.ar, bi.ir* 'to need', *si.es.ta, si.is.ta* 'nap', but *si.ar, *si.ir* 'through', *bi.á.je, *bi.í.je* 'trip').

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[24] Nominal inflection in Basque is morphologically attached to the last word of the last constituent of the Noun Phrase, not to every constituent contained in it. Thus, when a noun is followed by an adjective, the determiner and case markers or postpositions will be added to the adjective, the noun remaining in its bare uninflected form. There is a distinction in the plural determiner between locative and non-locative cases: *-a* is the singular determiner, *-ak* is the plural determiner, and *-eta* is the plural determiner for locative cases.

[25] Acute marks indicate that the syllable on top of which they are positioned is stressed. See Hualde, Elordieta and Elordieta (1994), Hualde (1999) for more information on how accent is assigned in LB.

The rule of VA does not apply between two members of a compound or across words. See (130) and (131), respectively:

(130) a. /*buru-andi*/   *buruándi*   **buruúndi*
           head-big
           'big-headed'

       b. /*soro-antz*/   *soroántza*   **soroóntza*
           mad-look
           'mad look, aspect'

(131) a. *seru asula*   *seru asula*   **seru usula*
           sky blue
           'blue sky'

       b. *etxe andidxa*   *etxe andidxa*   **etxe endidxa*
           house big
           'big house'

In verbal contexts, VA applies between the final vowel of a verb and the following initial vowel of an inflected auxiliary. The lexical verb is inflected for aspect, and inflected auxiliaries are formed by the amalgamation of agreement markers and tense and mood morphemes with the roots of auxiliary verbs. Most forms in the verbal paradigm of LB present an initial consonant, but past tense verbal forms with a third person ergative marker begin with the vowel /e/ (glossed in the examples as a non-present morpheme, *non-pres*). In this context no rising of the final vowel of the lexical verb occurs, as VR is restricted to morphological concatenation, i.e., nominal inflection. As the examples in (132) show, inflected auxiliaries form a separate word from the participial verb:

(132) a. /*dxo e-ba-n*/   *dxo eban*   *dxo oban*
           hit 3erg.--pres.-rt. -past
           '(s)he hit him/her/it'

       b. /*galdu e-ba-s-an*/   *galdu ebasan*   *galdu ubasan*
           lose 3erg.--pres.-rt-3abs.pl.-past
           '(s)he lost them'

       c. /*ikasi e-b-e-n*/   *ikasi ében*   *ikasi íben*
           learn 3erg.--pres.-rt.-erg.pl.-past
           'they learnt it'

       d. /*atrapa e-b-e-s-en*/   *atrapa ebésen* *atrapa abésen*
           catch 3erg.--pres.-rt-erg.pl.-3abs.pl.-past
           'they caught them'

VA does not apply, however, between a lexical verb and a causative verb, *eraiñ,* which in linear sequence appears between the lexical verb and the inflected auxiliary:

(133) *altza eraiñ dotzat*   **altza araiñ*
       rise make
       'I have made him/her stand up'

There are two modal particles which constitute independent syntactic heads and that may intervene between the lexical verb and the inflected auxiliary. Their basic semantic function is to express epistemic attitudes of the speaker concerning the existence or non-existence of the state of affairs identified by other elements in the sentence. The modal particle *ete* appears in interrogative and exclamative sentences, and conveys a meaning of wondering, uncertainty, doubt, suspicion, on the part of the speaker about the event expressed in the sentence, and *ei* indicates that what is being expressed in the sentence has been reported by other people and that the speaker cannot fully assure the veracity of the event denoted by the proposition. I call the particles *ete* and *ei* 'dubitative' and 'evidential', respectively. No VA occurs between a lexical verb and these particles:

(134) a. *etorri ete   díras?*   **etorrí ite díras?*
         come dub. aux
         'I wonder whether they have come'

     b. *atrapa ei   dósu*   **atrapa ai dósu*
         catch evid. aux
         'It is reported/it is said that you have caught it'

In adverbial nonfinite clauses, the verb appears followed by a subordinating conjunction. No VA applies between these elements either:

(135) a. *ekarri árren*   **ekarri írren*
         bring despite

     b. *konpondu esik*   **konpondu usik*
         fix   unless

     c. *amaitxu árte*   **amaitxu úrte*
         finish   until

VA does not occur across any other two words, such as an object and a verb, a subject and a verb, or two objects:

(136) a. *arraña erosi dau*   **arraña arosi dau*
         fish   buy aux
         '(s)he has bought fish'

     b. *laguna etorri da*   **laguna atorri da*
         friend come aux
         'the friend has come'

     c. *amumári   erregalúa ein dotzagu*   **amumári irregalúa ein dotzagu*
         grandmother-dat. present-abs. make aux
         'We have made (i.e., bought and given) a present for grandmother'

An important distributional generalization arises, then: VA only applies between lexical heads and following elements realizing inflectional features, such as determiners and inflected auxiliaries. The syntactic and prosodic nature of the elements that can and cannot be subject to the process unveils serious problems for the different theories of phrasal and prosodic phonology in order to account for phenomena of this type.

5.2. Challenges for theories of phrasal and prosodic phonology

The rule of VA presents a problem for its classification as a lexical or postlexical rule, following the assumptions of classical lexical phonology. VA cannot be a lexical rule, since it applies across words (i.e., between a verb and its inflection), it may apply in nonderived environments, and is an optional rule depending on register and speech rate. However, VA is not a postlexical rule in the classical sense, applying across-the-board, as its context of application is syntactically constrained. Moreover, in the case of nominal roots it may have lexical exceptions, a property recognized for lexical rules.

Now I will discuss the challenges that VA presents for the different theories of phrasal phonology reviewed so far, starting with the DRT, which argues that c-command relationships and edge locations can define contexts of application of phonological rules. The syntactic structure of the Basque sentence is still a matter of debate, as syntacticians do not agree on whether Basque is a right- or left-headed language or on the nature of head movement. On the one hand, some generative grammarians have been assuming head-final structures for this language, following descriptive observations that heads follow their complements across all or almost all categories (cf. Ortiz de Urbina 1989, 1994, 1995; Laka 1990; Albizu 1991, 1992; Artiagoitia 1992; Arregi 2003, 2004). On the other hand, some researchers have posited a left-headed structure (Ormazabal, Uriagereka and Uribe-Etxebarria 1994; G. Elordieta 1997; Haddican 2004). And still others have assumed a bidirectional structure, right-headed for lexical projections and left-headed for functional projections (A. Elordieta 2001). However, in all the proposals the c-command relationship between a lexical verb and a modal particle or causative verb in affirmative clauses is the same as the c-command relationship between a lexical verb and an inflected auxiliary. In some proposals head-to-head incorporation is assumed from the verb to a modal and then to the auxiliary, both in right- and left-headed structures (Ortiz de Urbina 1989, 1994, 1995; Albizu 1991; G. Elordieta 1997; A. Elordieta 2001), creating a complex head. The structures that result after participial verb movement to the inflected auxiliary (abbreviated as T), a modal particle and a causative are schematized in (137). Intermediate heads and projections such as v, Aspect and Auxiliary are omitted for reasons of simplification, and Agreement is subsumed under T:

(137)
             T   Mod V_{caus}

         V   T   V   Mod   V V_{caus}
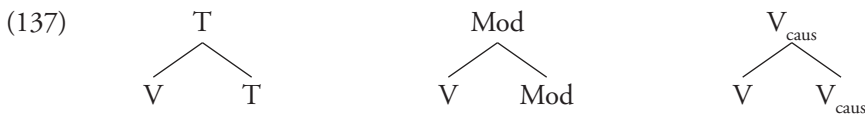
In other proposals all heads stay in situ and thus a modal particle c-commands a lexical verb the same way an inflected auxiliary c-commands the verb in the absence of a modal (Laka 1990; Artiagoitia 1992; Arregi 2003, 2004).[26] The structures in (138) represent right-headed structures assumed by these researchers:

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[26] Artiagoitia (1992) assumes a left-headed IP, which merges at PF to the right of the lexical verb. Arregi (2003, 2004) also assumes merging between V and T at the level of Morphosyntactic stutucture. Finally, Haddican (2004) defends a left-headed structure and argues that the modal particle and the auxiliary stay in situ and they are both c-commanded by the lexical verb, which rises (together with VP) to a higher projection, Polarity Phrase.

(138) a.
```
                T'
            ╱        ╲
          VP          T
          │
          V
```
b.
```
                T'
            ╱        ╲
         ModP         T
        ╱    ╲
       VP     Mod
       │
       V
```
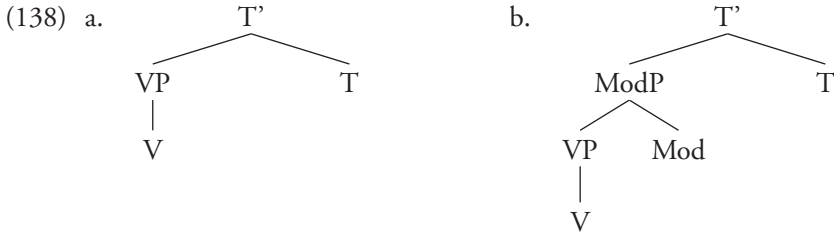
For the cases of a subordinating conjunction taking a non-finite clause as a com-
plement (cf. (135)) the same left- or right-headed possibilities as the ones just men-
tioned could be considered.

For the Determiner Phrase, similar scenarios arise. If a right-headed structure is
assumed, the NP selected by D may either stay in situ or rise to Spec,DP. In both
cases, the determiner cliticizes or merges with its NP complement at PF, or more
correctly, with the right edge of the NP. This explains the fact that the determiner is
always attached to the rightmost word in an NP (i.e., as a phrasal clitic, cf. Elordieta
1997).

(139) a.
```
              DP
          ╱        ╲
        Spec        D'
                 ╱      ╲
               NP        D
              △         │
          gixon argal   -a
```
b.
```
                DP
            ╱        ╲
          Spec        D'
          △        ╱     ╲
      gixon argal$_i$   NP     D
                      │      │
                     t$_i$    -a
```
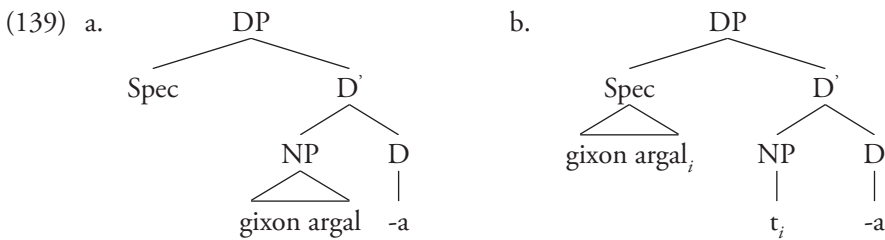
If a left-headed structure is assumed, the NP complement has to rise to Spec,DP
in order to account for the surface order NP-D. In this case the same process of clit-
icization would apply.

(140)
```
                    DP
              ╱            ╲
           Spec             D'
           △            ╱      ╲
      gixon argal$_i$    D        NP
                       │        │
                       -a       t$_i$
```
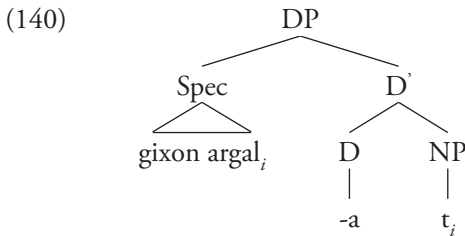
With these structures in mind, it seems evident that a DRT analysis of the do-
mains of application of VA in terms of c-command relationships and/or branching
configurations will not work, because regardless of the head parameter chosen, the c-
command relationships and branching configurations holding between the particip-
ial verb and an inflected auxiliary, a modal particle or a causative verb are identical,
i.e., no distinctions can be drawn. The question could be whether c-command is a
necessary although not a sufficient condition, but it is clear in any case that other
syntactic parameters must be invoked in order to come up with the correct explana-
tion.

The same problem arises for Rizzi and Savoia's (1993) model, as of the five parameters of syntactic government they posit, none of them corresponds to the relationships between the heads between which VA applies. Thus, whether the head adjunction or the in-situ analysis is considered, the government relationships are the same in all cases between the different heads. Since both an inflected auxiliary and a modal particle or a complementizer are functional heads, F-government does not seem to be a solution, and neither does Agr-government in the sense of Rizzi and Savoia, as this relationship only holds between expressions displaying morphosyntactic agreement in gender and/or number, i.e., in nominal contexts.

On the other hand, prosodic considerations do not help discriminate the contexts of application of VA. It cannot be argued that the domain of application of VA is a phonological word, that is, a phonological string that contains one primary stress and is separated from other strings that contain their own primary stress. This is because the lexical verb and the inflected auxiliary may each bear independent stress, and still VA applies. In the following examples, we mark main word stress with an acute accent mark:

(141) a. *ekarrí ebésen edarídxak*   →   *ekarrí ibésen edarídxak*
           bring aux   drinks
           'They brought the drinks'

       b. *saldú ebésen etxíak*   →   *saldú ubésen etxíak*
           sell   aux   houses
           'The houses they sold'

Clitic groups have also been usually classified as prosodic units that contain only one syllable with main stress, and thus the domain of application of VA cannot be the clitic group either. The phonological phrase would be too inclusive a domain, because it would incorrectly predict VA across the two members of a compound, even though in compounds there is only one syllable with word stress. According to the RBA, lexical words are always contained in different phonological phrases, unless they are modifiers (i.e., adjuncts) or specifiers of another lexical head, or unless the parameters allowing the inclusion of the first complement of a lexical head are selected (cf. the phonological phrase building algorithm presented in (81), section 3.1). If the assumption in which a lexical verb incorporates onto a causative verb, modal particle or inflected auxiliary is considered, it is clear that it is not possible to refer to recursive and nonrecursive sides, or relational notions such as modifiers, specifiers or adjuncts, because none of these relations can apply to distinguish or separate the heads in the resulting structures. And if the proposals with no incorporation are adopted (cf. (138)) the result is the same, as the elements involved are all independent heads, and none of them is a specifier or adjunct.

The EBA would face the same problems. The domains determined by making reference to left- or right-edges of XPs would not separate the members of a compound noun, across which VA does not apply. And there would be no way to distinguish the domain formed by a lexical verb and an inflected auxiliary from the one formed by a lexical verb and a modal particle. There would be no XP boundaries if head incorporation is assumed, and if no incorporation is assumed a bracket would

be inserted to the left or to the right of a VP in all cases. Recurring to boundaries of lexical X⁰s would not work, either. Positing left edge boundaries of lexical heads would fail to explain the absence of VA between a participial verb and a modal particle, a subordinating conjunction or a postposition, since the latter are not lexical categories and thus cannot be assigned a bracket on their left edge. The EBA is based on the Principle of Categorial Invisibility of Function Words proposed by Selkirk (1984). However, the problem of VA in Lekeitio Basque shows that not all function words behave similarly from a prosodic point of view, even when the syntactic configuration in which they appear is the same. Thus, we have to conclude that VA demonstrates that the distinctions between lexical and nonlexical categories might be richer than hitherto assumed.

The last resort for proponents of the PHT could be the theory of Precompiled Phrasal Phonology, under the hope that the syntactic sensitivity displayed by VA could be dealt with in this theory. A precompilation analysis of VA would force us to posit five allomorphs for vowel-initial auxiliary verbs or for the third person ergative marker *e-*. There would be the basic allomorph with the underlying initial /e/ and allomorphs with initial /a/, /i/, /o/ and /u/. Likewise, for each determiner we would need three allomorphs: one with the underlying initial vowel (i.e., /a/ for the nonlocative singular and plural determiners, /e/ for genitive markers and locative plural determiners) and two more with the high vowels /i/ and /u/, to be inserted after the last word in an NP ending in [i] or [u] (after Vowel Raising). The problem with this analysis is that the theory of Precompiled Phrasal Phonology is best suited to account for phenomena which affect and are triggered by specific syntactic categories or morphemes. VA, however, is not a process of this kind. It has a limited distribution, but it is not a rule that affects only a specific morpheme or syntactic category. Saying that the rule applies to determiners and auxiliaries preceded by nouns/adjectives and verbs only describes the problem, failing to capture the generalization that only the categories realizing inflectional features are capable of undergoing the process. This is a syntactic regularity, not an arbitrary fact.

From this discussion it is clear then that the domain of application of VA resists an analysis in the different theories of phrasal phonology proposed in the literature, and that another type of phonological constituent must be sought for that corresponds to the domain of occurrence of VA in Lekeitio Basque.

5.3. Morphosyntactic Feature Chains and Phonological Domains

In the face of such a challenge, Elordieta (1997, 1999) develops an analysis based on the distributional generalization that VA always applies between a lexical head (noun, adjective or verb) and a following inflectional element (determiner/case marker and inflected auxiliary). Elordieta argues that this relationship between lexical and inflectional heads is a reflex of the syntactic relationships of feature checking among heads as assumed in the minimalist approach to syntax, at least in the version of minimalism that was around at the time, i.e., Chomsky (1995). One of the basic tenets in this theory is that formal features have to be checked in the syntactic derivation by other formal features so as to be properly licensed. If features are not checked, the derivation is canceled. For example, the nominative case feature in the subject is

properly licensed if it is checked by the nominative case assigning feature of T, and the accusative case feature in the object is checked by the head v. In both instances, feature checking is carried out in a Spec-head relationship, by raising the subject and object NPs to Spec of TP and Spec of vP, respectively.[27] If the features do not match, the derivation is canceled. Another relationship is the one holding between the heads T and v. In Chomsky (1995), T has V- or v-features that attract the raising of V (in v). In turn, the verb has Tense features that need to be checked with those of T.[28] Another relationship of this kind is the one established between a Determiner (D) and the head of its NP complement (i.e., N). As argued by Longobardi (1994), the fact that the head N rises overtly to D in many languages constitutes evidence for this relationship; the head D attracts the categorial feature [N] to check the [±R] (referential) feature of D. Other authors have argued more recently that the overt realization of agreement or concord in phi-features between a determiner, a noun and an adjective in a DP in some languages means that an operation that checks or values phi-features takes place among these heads (cf. Pesetsky and Torrego 2001).

The heads D and T are precisely those that participate in VA with nominal expressions and verbs, respectively. Elordieta (1997) (cf. also Elordieta 1999) points out that this parallelism is not coincidental; D and T are the inflectional heads that enter in checking relationships with N and V and participate in VA processes with them. Elordieta argues that this link between a close degree of morphosyntactic cohesion as defined in feature checking terms and a close degree of phonological cohesion is part of Universal Grammar, and some languages may instantiate these domains in the phonological component. The main claim is that the relationships of feature checking established among features in syntactic heads are primitive relationships of *feature chains*, following ideas of Zubizarreta and Vergnaud (1997). That is, the heads containing those features involved in feature checking relationships would constitute the feature chains {C, T}, {T, v}, {T, D}, {v, D} and {D, N}.[29] The feature chain {C, T} is observable in the rising of inflectional heads in T to C in questions or focus constructions. The chain {T, v} is established by the relationship between the

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[27] Recent developments of the minimalist theory posterior to Elordieta (1997) have abandoned the idea that T or v possess Case features, and that only DPs have uninterpretable Case features (in D or N) that need to be valued and deleted in Spec,TP and Spec,vP (cf. Chomsky 2001a, b). For Pesetsky and Torrego (2001, 2004), nominative Case is an uninterpretable T feature on D which must be valued by T itself. What matters for the purposes of the discussion is that feature checking/valuation relationships between DPs (or D/N) and T and v are still assumed.

[28] The argument in Chomsky (1995) that the head Tense has a V-feature would have to be revised if Chomsky's (2000) suggestion that categorial features may not exist is correct, following ideas that categorial information arises configurationally, based on the syntactic context in which bare roots are inserted (cf. Marantz 1997 and others). Other authors, however, still defend the existence of categorial features and their participation in operations of feature checking or feature valuation, i.e., the operation Agree (cf. Matushansky 2005, 2006, Rezac 2004, Jouitteau 2005). Irrespective of how this debate is settled, it seems clear that the existence of a syntactic relationship between the features in the heads T and v/V is still commonly assumed. For instance, Pesetsky and Torrego (2004) argue that the relationship between the head Tense and the head v (and V) consists on the presence of an interpretable unvalued T-feature in Tense, which needs to be valued by the uninterpretable valued T-feature in V (which rises to v).

[29] Elordieta (1997) also includes the chain {P, D}, to refer to the relationship between an adposition and a determiner. P assigns Case to the DP complement, and hence an uninterpretable Case feature in D would need to be checked by P.

heads T and *v*/V as discussed above. The chain {T, D} stands for the relationship between T and a subject DP, such as checking of Nominative Case or of the phi-features of the Subject DP, which would be in D and in T. The chain {*v*, D} is determined by the relationship between *v* and the head D of the object DP, as in the assignment of Accusative case or the cheking of phi-features of the object. And the chain {D, N} stands for the relationship between the determiner and the noun in a DP (checking of features of referentiality or specificity, or checking of phi-features).

Zubizarreta and Vergnaud (1997) claim that these pairs are primitive entities of grammar, as they express the objectively inescapable fact that in grammar there are formal features contained in heads that are related to formal features on another head. Although this relationship is expressed in minimalist terms as movement operations of feature checking, Zubizarreta and Vergnaud argue that it is not the operation of feature checking itself that expresses a primitive relation in grammar, but the chains themselves. In Zubizarreta and Vergnaud's theory, these chains are independent of phrase structure, although coexistent with it. They are present throughout the syntactic derivation, up to the moment it is sent to the PF and LF interface levels.

The sets of formal features of these pairs of heads are in a strictly local configuration, by forming a complex X^0 or by being in a Spec-head or head-complement configuration. These three possibilities are schematically represented below by the heads X and Y in (142a-c), respectively:[30]

(142) a.   X   b.   ZP   c.   XP

            Y   X   XP   Y'   X   YP

                                              X   Y   Y   ZP
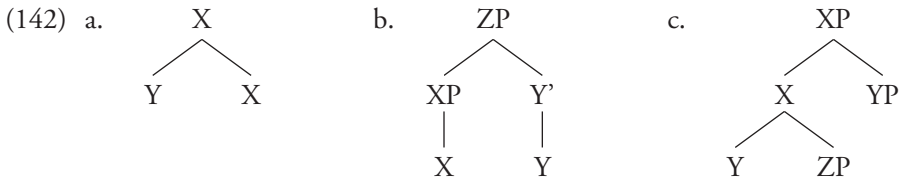
These chains are objects at LF and PF, where they must receive an interpretation. Turning our attention to PF, the relevant interface level for our purposes, the idea in the framework of Zubizarreta and Vergnaud is that the chains presented above are primitive entities of grammar, and that they are units for morphosyntactic mapping. The main idea defended by Elordieta (1997, 1999) is that the cohesion of feature chains is represented or made visible in other components of grammar, namely that this syntactic cohesion is reflected in the components of grammar where heads and their features are spelled out. The morphemes realizing the heads in feature chains form phonological constituents, and as such, certain phonological processes may be specified to apply in them. In Elordieta (1997, 1999) it was proposed that these phonological constituents could not be identical to phonological or prosodic words, as a lexical verb and an inflected auxiliary may each bear their own stress (cf. (132c,d, 141)). Hence, it was suggested that feature chains were not directly mapped to phonological structure but to an intermediate structure, the level of Morphological Structure (MS), argued for in the theory of Distributed Morphology. From MS, fea-

---

[30] Chomsky (2000) holds the view that head movement operations occur in PF, after the syntactic derivation has been spelled out. However, Matushansky (2005, 2006) offers convincing arguments that show that head movement is syntactic in nature.

ture chains would be mapped into the phonological component proper as constituents or domains where phonological processes may apply. This is how PF inherits domains which do not look prosodic. That is, in addition to domains formed at PF by prosodic properties of morphemes, PF also contains constituents which are mapped from this intermediate component between syntax and PF. The claim is that feature chains are realized or represented at the level of MS as morphosyntactic units, which we call MS-words, if the heads are spelled out linearly adjacent. The conditions on MS-word formation are stated in (143).

(143)   *Conditions on MS-word formation*
         Two overtly realized heads will form an MS-word if:
         a. the heads form a morphosyntactic feature chain, and
         b. the heads are spelled out linearly adjacent, either as a result of incorporation (cf. 142a), or by being spelled out in linearly adjacent heads (i.e., in a spec-head or in a head-complement configuration, cf. (142b,c).

Another argument for positing MS as a level where constituents formed by morphosyntactic feature checking operations are represented is the fact that at this level there are morphological operations holding between X^0s (merger, fusion, fission, cf. Marantz 1988, Bonet 1991, Halle and Marantz 1992, 1994, Noyer 1992, inter alia), which may affect the morphological output of the syntactic string.

A similar idea is expressed more recently in Epstein and Seely (2002). After questioning the theoretical validity of the proposal that phases are the syntactic domains that are spelled-out to PF, these authors argue that each and every syntactic object resulting from an operation of feature valuation (or feature checking, in Chomsky's 1995 and Elordieta's 1997, 1999 terms) is mapped or spelled-out to the interface levels PF and LF. That is, the syntactic object formed by two heads whose features enter in a feature valuation operation are mapped to the interface levels. Thus, the heads forming the feature chains in Elordieta's proposal would be cyclically or iteratively spelled out as syntactic objects (MS-words) to PF, where they would then constitute a phonological domain.

The following schematic derivations for the chains {T, v} and {D, N} illustrate this idea. In the syntactic component two steps are reflected, one in which the feature chain is represented as an input in the syntactic structure, and one in which the linear order between heads is realized, before the syntactic derivation is spelled out to MS and PF. In Basque, the lexical verb occurs to the left of the inflected auxiliary, and the noun appears to the left of the determiner. The possible syntactic configurations that give rise to these relative orders were discussed above. In all of them the locality conditions between heads are met. For the sequence v/V-T, there is either incorporation of V to v to T, as in (137), or a head-complement relation between T and v, as in (138). For the sequence N-D, either a head-complement configuration can be postulated, as in (139a), or a spec-head configuration, as in (139b), (140).[31]

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[31] Elordieta does not assign labels to the constituents at PF whose sources are MS-words, in part because of lack of proper terminology. They could be called PF-words, but this term should not be confused with the notion of phonological words, used in the Prosodic Phonology literature as a synonym of prosodic word.

(144)   *Syntax*   {T, *v*}
                                                  ↓
                                               {*v*/V T}
        Spell-Out

                                          ↙

        MS   [V T] _{MS-word}
                                ↓
        PF   [V T]

(145)   *Syntax*   {D, N}
                                                  ↓
                                               {N D}
        Spell-Out

                                          ↙

        MS   [N D] _{MS-word}
                                ↓
        PF   [N D]
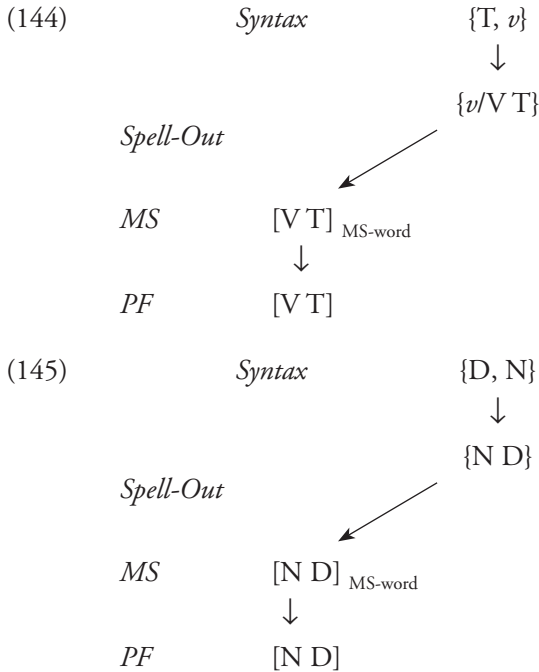
The proposal in Elordieta (1997, 1999) is that these MS-words are interpreted in the phonological component (PF) as phonological constituents or domains, where certain phonological processes may be specified to apply. As shown by the fact that verbs and inflected auxiliaries in Basque may have independent primary stresses, the domains corresponding to MS-words need not coincide with prosodic domains, such as the prosodic word, the clitic group or the phonological phrase. In fact, the case of Basque shows the coexistence of two types of domains: on the one hand, the verb and the auxiliary form one MS-word and hence one phonological domain for certain rule applications such as VA, and on the other hand they form two prosodic words. The domain of application of VA in Lekeitio Basque would then be the phonological constituents formed by the MS-words [V T] and [N D].

With this analysis, the fact that VA does not occur between two lexical categories can be explained. There is no feature chain involving two lexical categories, and thus two adjacent lexical heads are not mapped as one MS-word, but as separate ones. Hence, they do not fall in the same constituent that is visible at PF. On the other hand, the relationship between a participial verb and a causative verb, a subordinating conjunction or a modal particle is not a feature chain relationship; the verb does not check tense features or any other feature in the modal particle or the causative verb. These heads do not possess features that the verb also possesses and has to check. Thus, the heads realizing those syntactic nodes are not mapped as part of the same MS-word and hence cannot form a domain where VA is specified to apply. The same analysis would apply to compounds. Interestingly, the case of compounds is the opposite of the one involving a verb and an inflected auxiliary: compounds only display one word accent but they are not a domain for VA, whereas a verb and its in-

flection may have one accent each and together they form a domain for VA. In particular, from the data presented, we have to conclude that there exist other sources for phonological constituency apart from prosodic properties.

It should be pointed out that the details of the feature relationships between heads advocated in Elordieta's (1997, 1999) proposal would have to be revised and updated in accordance with developments in the minimalist framework. For instance, the operations of feature checking and the operation Attract-F(eature) that Elordieta assumes (following Chomsky 1995) would have to be interpreted in terms of the operations of feature valuation and Agree: unvalued features in probes seek goals with valued features that can assign or share their value with them. But the spirit of the relationship between features in heads is still the same. The pairs of heads (more accurately, the pairs of features in those heads) involved in feature valuation remain identical (cf. footnotes 28 and 29).

Elordieta (1997, 1999) presents other phenomena that pose challenges for the PHT but can receive an account in his alternative model: ATR harmony in Ìgbo, French liaison and Irish initial consonant mutation. For reasons of limit of space, we cannot review these data here and thus the reader is referred to the original source. One important thing to bear in mind is that not all languages are expected to reflect the mapping from feature chains to phonological domains empirically. Not all languages need to have processes that apply in such domains, the same way that not all languages have phonological processes applying in prosodic domains. It is a mapping that is encoded in Universal Grammar, but in order for it to have any observable effects the phonological process that selects the phonological constituent so formed has to exist in the first place. Not all languages are rich in phonological processes applying between morphemes or words. Related to this point would the question of whether the inventory of feature chains can be effectively delimited to a finite taxonomy, after a closer look at the different phonological processes of this type (i.e., it might be the case that not all feature checking relationships are visible at PF, as Gillian Ramchand points out to me). This is an empirical issue that awaits further study.

The advantages of Elordieta's (1997, 1999) proposal would be threefold. First, it offers a principled explanation for the *Principle of the Categorial Invisibility of Function Words* (PCI), that is, for the stipulation that functional categories are included in the same prosodic constituent with lexical categories. Second, it provides a way of understanding the descriptive observations that Hale and Selkirk (1987) unveil (cf. (118b) and (120b) above), namely the absence of cases in head-final languages in which a functional category forms a prosodic constituent with the adjacent lexical head it is not associated syntactically with (i.e., the word to its right), and the very few instances among head-initial languages in which a functional category forms a prosodic constituent with the adjacent lexical head it is not lexically associated with (i.e., the word to its left). Third, the theory just described recurs to a notion that already exists independently in the grammar, such as feature checking relationships. DRT models based on c-command and F- or Agr-government relationships also present the advantage of resorting to structural notions that are present in the syntactic derivation already, but the model in Elordieta (1997, 1999) refines these ideas in a more restrictive system.

6. Minimal Indirect Reference (MIR)

As pointed out in section 2.2, after Kaisse's (1985) proposal of the DRT there have been very few attempts at continuing with this approach to the syntax-phonology interface, and the PHT has been dominant in the field, especially the EBA. However, Seidl's (2001) Minimal Indirect Reference model (MIR) criticizes the assumptions of the PHT that there is a prosodic hierarchy independent of syntax and defends a more syntactic account for determining phonological domains. Seidl argues that there are two parses or levels of representation of postsyntactic structure: the first morphosyntactic parse, which she calls Morphosyntactic Representation or M_0, mapped from syntactic structure, and a further parse which she calls the Prosodic Representation or P_0, mapped from M_0 by the Phonological Domain Generator. Then, Seidl argues that there are rules that are specified in the grammar to operate at either of these two levels. Rules applying at the Morphosyntactic Representation or M_0 are called M-rules, and Seidl claims that they apply on edges of phases (Chomsky 2001a), that is, at the edges of propositional units such as a verb phrase (vP) or a full proposition (CP). On the other hand, rules operating at the later level of the Prosodic Representation or P_0 are called P-rules and can only make reference to theta-domains, or domains where theta-roles are assigned, namely VP, vP and NP. Seidl calls M-rules and P-rules early and late rules, respectively. The architecture of the Minimal Indirect Reference (MIR) model that she proposes is the following:

(146) Output of Morphosyntax (M_0) $\Leftarrow$ Early Rules

             $\downarrow$ $\Leftarrow$ Phonological Domain Generator

       Prosodic Representation (P_0) $\Leftarrow$ Late Rules

             $\downarrow$

       Surface Phonological Representation
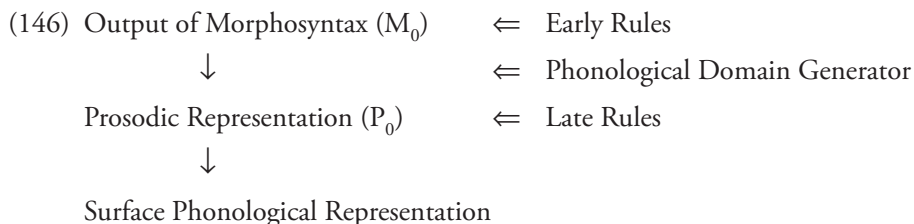
Seidl calls the theory she advocates Minimal Indirect Reference, because although P-rules operate on a level of representation that is not purely syntactic in nature, M-rules operate directly on syntactic information. It is worth pointing out in this regard that there are questions that arise about the exact nature of the levels of Morphosyntactic Representation (M_0) and Prosodic Representation (P_0). It is not clear whether M_0 is a level of syntax or of the phonological component. On the one hand, Seidl claims that her theory is a theory of postsyntactic grammar, and hence both M_0 and P_0 should be levels of representation created after the derivation is sent to the phonological component or PF. However, in some other instances Seidl claims that M-rules apply to a level of syntax, or that they apply directly on the syntactic representation. Perhaps M_0 is a level of PF immediately after Spell-Out that still preserves all syntactic information, a level such as Morphological Structure proposed in the theory of Distributed Morphology (cf. Halle and Marantz 1993, 1994, and the literature thereafter), which Seidl adopts. In fact, she refers to the P-parse or Prosodic Representation (P_0) as a "post-Morphological Merger structure", citing Marantz (1988) and following work (see pages 20 and 32

in her book). Although the level of Prosodic Representation is vaguely left at that, Seidl makes it clear that the domains on which rules operate at this level are prosodic domains, although different from those in the prosodic hierarchy of Prosodic Phonology, reviewed in section 3. These prosodic domains are theta-domains, or to express it in better terms, prosodic domains that are derived or mapped onto P_0 from theta-domains of M_0. However, this implies in turn that M_0 is a level of representation that preserves almost all syntactic information and is hence almost indistinguishable from a syntactic level. Unfortunately, the exact nature of this level is not explicitly stated.[32]

Seidl's main criticism against the PHT is that the PHT is too restrictive, in that it assumes that the phonological domains are of only one kind, derived from an algorithm that creates prosodic domains from syntactic structure. She claims that the existence of domain clustering violations and domain paradoxes (or layeredness violations) poses serious problems for the PHT, and that these phenomena are assumed naturally under MIR, once the dichotomy between M-rules and P-rules is recognized. Domain clustering violations arise in cases in which it seems that there are not enough levels in the Prosodic Hierarchy to cover the domains in which prosodic rules apply, and domain paradoxes or layeredness violations arise when the domains for two rules may be of equal size, smaller or bigger than each other.

Mende is an example of domain clustering violation. A first rule of tone sandhi changes a high (H) tone to a low (L) tone when it is preceded by another H tone within the same phonological domain. Thus, in (147) the H tone of *fáji* changes to a L tone as it is preceded by a H tone in the preceding word:

(147) nyɛ́ fájì wɛ́-ìtà   →   nyɛ́ vàjì wɛ́-ìtà
      six fish buckets
      'six fish buckets'

A second rule of consonant mutation lenites the initial consonant of a word in certain domains. In the following examples, /k/ and /ng/ change into /g/ and /w/:

(148) a. ngǐ kànáá   →   ngǐ gànáá
         his case
         'his case'

      b. bí ngúlɛ́í   →   bí wùlɛ́í
         your oil
         'your oil'

---

[32] This point leads to the issue of the mapping from syntax to phonology, that is, what syntactic information exactly is mapped onto the phonological component or PF. According to the theory of Distributed Morphology, syntactic structure is mapped onto the level of Morphological Structure and is visible there (syntactic labels included), in order for morphological processes such as merger, fission, fusion, impoverishment and vocabulary insertion to work. Also, some recent influential proposals argue that word order is computed at PF with algorithms that compute syntactic structure, more concretely c-command relationships (cf. Kayne's 1994 Linear Correspondence Axiom and Nunes' 2004 Chain Reduction, for instance).

Tone sandhi domains and consonant mutation domains are non-isomorphic. Thus, in (149a) below the subject forms one domain for mutation separate from the object and the verb, but for tone sandhi each word forms its own domain. In (149b) the possessor and the noun form one domain for mutation but separate domains for tone sandhi. The domains for these two rules are indicated in parentheses in the glosses:[33]

(149) a. *ì*   *nyá pókɔ́lέ   lɔ́*   → *ì nyá wókɔ́lέ lɔ́*
           (subj-pst) (me imitated certain) *mutation domain*
           (subj-pst) (me) (imitated certain) *tone sandhi domain*
           'he imitated me.'

       b. *nyá ndóli*   → *nyá wóli*
           (my ear)   *mutation domain*
           (my)(ear)   *tone sandhi domain*
           'my ear'

The domains for consonant mutation are of equal size or larger than the domains for tone sandhi. But the problem for the PHT is that the domains of these rules do not seem to correspond to prosodic domains in the PHT. Since tone sandhi operates across words, the domain must be bigger than a prosodic word. If it is a phonological phrase, then consonant mutation should apply in the next higher category, an intonational phrase, but clearly the domain for tone sandhi is not the intonational phrase: no prosodic cues associated to intonational phrases (boundary tones, final lengthening, pauses, pitch reset) delimit the boundaries between the subject and the verb in (149a) or the possessor and the noun in (149b). Recursive phonological phrases as in Truckenbrodt (1995, 1999) would not be an alternative, either (cf. (150)), as the two rules are of a different nature and they would be applying in the same domain, and it would be difficult to formalize the specific levels of recursive phrasing each rule applies in. For instance, in (149a) the object pronoun *nyá* is contained in the same phonological phrase together with the verb for consonant mutation, but it constitutes a separate domain from the verb for tone sandhi. We would have to assume that tone sandhi operates on the lower or most embedded level of phrasing, whereas consonant mutation applies to the second level of recursive phrasing. This is an awkward solution that Seidl rejects.

(150) *ì*   *nyá   pókɔ́lέ   lɔ́*   → *ì nyá wókɔ́lέ   lɔ́*
       $((\text{subj-pst})_\Phi ((\text{me})_\Phi (\text{imitated certain})_\Phi)_\Phi)_\Phi$
       'he imitated me'

Seidl (2001) suggests a different solution: that tone sandhi and consonant mutation operate at different levels of representation. Tone sandhi applies first, in the syntactic domain of a phase. The syntactic structure Seidl assumes for Mende is the following:

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[33] In (148b), however, the possessor forms one domain for tone sandhi with the noun. Seidl argues that the difference between (148b) and (149b) is due to the alienable-inalienable distinction between nouns.

(151)
```
                    MoodP
             ┌────────┴────────┐
            DP               Mood'
            │          ┌───────┴───────┐
          Subj_i     Mood            AspectP
                      │          ┌──────┴──────┐
                     Mood       DP          Aspect'
                                │       ┌──────┴──────┐
                               Obj_j  Aspect          vP
                                       │         ┌─────┴─────┐
                                  Verb_k+Aspect  DP          VP
                                                 │      ┌─────┴─────┐
                                                t_i    DP           V
                                                       │            │
                                                      t_j          t_k
```
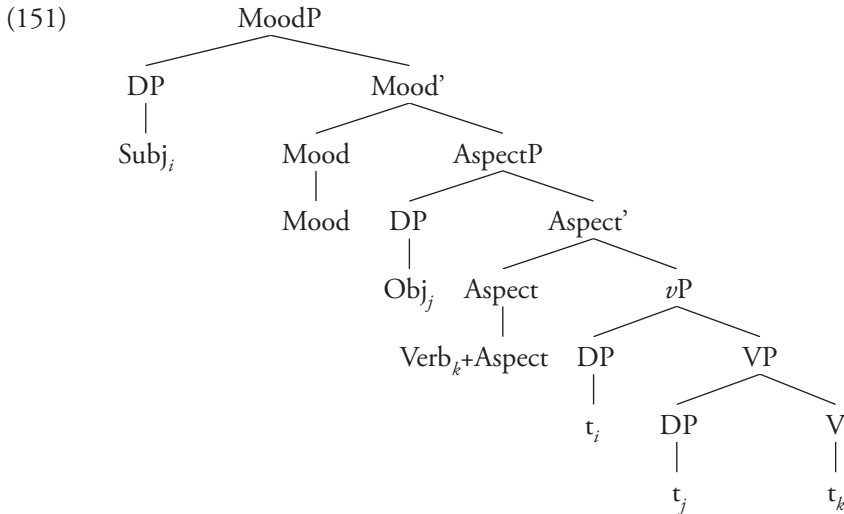
Although Seidl focuses more on consonant mutation and is not very explicit about the phase analysis for tone sandhi, we must conclude from the syntactic structure in (151) that the subject, the object and the verb are not in a phase (vP), and hence they are in separate domains for the application of M-rules, which operate on phases. In order to account for mutation domains, Seidl suggests an analysis in which mutation is caused by a case marker on the initial consonant of a following word in the same maximal projection. She argues that these case markers are non-segmental and are associated to the possessor in (148) and (149b) or the object pronoun in (149a), and posits the existence of a rebracketing process of the case marker or clitic with a following word (with the head noun in (148) and (149b) and with the verb in (149a)). This rebracketing takes place at Morphological Structure, the level of representation proposed by the theory of Distributed Morphology, which Seidl assumes. That is, the rebracketing takes place after all syntactic operations have taken place. The following scheme is slightly adapted from Seidl (2001: 28):

(152) $[(\ldots X^0 + case)_{w\ w}(X^0\ldots)]_{YP}$ → $[(\ldots X^0)_{w\ w}(case + X^0\ldots)]_{YP}$

Interestingly, consonant mutation has lexical exceptions, whereas tone sandhi does not. Seidl attributes this intriguing difference to the different nature of the rules. Mutation applies after rebracketing, i.e., after Morphological Structure, whereas tone sandhi applies at an earlier level, in syntax, before rebracketing and similar Morphological Structure processes take place. What she means is that consonant mutation applies at the P-parse, in the phonological component after Morphological Structure, where according to the theory of Distributed Morphology Vocabulary Insertion and all morphophonological operations take place, and hence the phonological processes operating at this level may be sensitive to lexical idiosyncrasies. On the other hand, tone sandhi is an M-rule, applying at a purely syntactic or morphosyntactic representation, at what Seidl calls the M-parse, and hence is not subject to lexical idiosyncrasies.

In Luganda and Yoruba there are violations of the principle of layeredness, that is, there are overlapping domains for different rules. In Luganda the domain for high tone plateauing (HP) can be identical, smaller or larger than the domain for Vowel Shortening (VS) (Seidl 2001: 46-51). Along the lines of her proposal for Mende, Seidl argues that HP is an M-rule applying in the *v*P phase, and VS is a P-rule applying at a later stage, after morphological rebracketing of enclitics with the verb. The difference in levels of application is associated to the fact that VS is sensitive to speech rate, as the rebracketing applies only in fast speech.

In Yoruba, a tonal OCP rule changing a H tone to mid when preceded by another H tone operates between a verb and an object enclitic but not between a verb and a nominal or verbal stem. On the other hand, regressive ATR harmony applies between a subject proclitic and a verb but not between a verb and an enclitic (Seidl 2001: 51-54). Thus, both rules apply in the clitic group or the prosodic word but have overlapping domains. This situation is represented in (153), where curly brackets indicate ATR harmony domains and round brackets indicate tonal OCP domains:

(153) a.   {ó (kó}   wá)   →   ọ́ kọ́ wa
           he taught us

      b.   {ó (lé}   wá)   →   ó lé wa
           he chased us

Seidl's solution for this paradox is that the tone rule is an M-rule applying in the *v*P phase (affecting the verb and its object), and ATR harmony is a P-rule applying between a clitic and a host on a post-merger structure which places together a subject proclitic and the verb.

Seidl also criticizes the PHT for its inability to predict the correct domains of application of certain rules. For instance, Seidl shows that Truckenbrodt's (1995, 1999) analysis for Kimatuumbi Vowel Shortening (VS) sketched above runs into problems once a detailed syntactic analysis of this language is considered. Recall that Truckenbrodt accounts for the domain of application of VS by having the constraints ALIGN-XP,R and WRAP-XP ranked high, so that a right edge boundary is inserted between an indirect object and a direct object, for instance, with a recursive phonological phrase boundary wrapping the VP (cf. (154)). The relative ranking of ALIGN-XP,R and WRAP-XP higher than NONREC produces the following schematic phrasing for a sentence such as (121c), repeated as (155) below, with a verb followed by an indirect object and a direct object:[34]

(154) ((V NP)$_\Phi$ NP)$_\Phi$

(155) [*naampéi*   [*kikóloombe*]$_{NP}$ *Mambóondo*]$_{NP}$]$_{VP}$ →   *naampéi kikóloombe*
                                                                           Mambóondo

      I-him-gave shell   Mambóondo
      'I gave Mamboondo the shell'.

This analysis faces a problem, however. Seidl claims that previous work on Bantu syntax shows that the verb moves out of VP and rises to TP, and that the indirect ob-

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34 The absence of a left boundary on the second NP is due to the low ranking of ALIGN-XP,L.

ject is base-generated in a functional projection (Applicative Phrase). The following structure is claimed by Seidl for these types of sentences:

(156)

$$
\begin{array}{c}
\text{TP} \\
\diagup \quad \diagdown \\
\textit{pro}_i\text{-}V_j \qquad \textit{v}\text{P} \\
\diagup \quad \diagdown \\
\text{t}_j \qquad \text{AplP} \\
\diagup \quad \diagdown \\
\text{NP} \qquad \text{VP} \\
| \qquad \diagup \quad \diagdown \\
\text{IO} \quad \text{t}_j \qquad \text{NP} \\
| \\
\text{DO}
\end{array}
$$
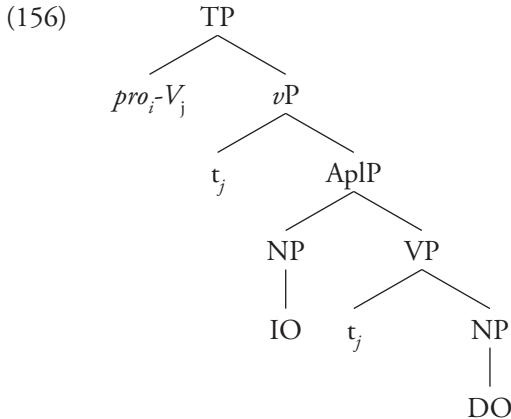
The maximal projection containing the verb and its objects is TP, but TP is a functional projection, and Truckenbrodt assumes that functional projections do not need to be wrapped. The only lexical maximal projections are the indirect object NP and the VP. Thus, the resulting phrasing would be V (IO)$_\Phi$ (DO)$_\Phi$ (hence (V)$_\Phi$ (IO)$_\Phi$ (DO)$_\Phi$), an incorrect output for any Bantu language.

Seidl proposes a solution not only for Kimatuumbi, but for the two parametric types of phrasing observed in Bantu languages in double complement constructions, (V NP NP) or (V NP) (NP).[35] These two patterns correlate with different syntactic properties: in almost all languages displaying the (V NP NP) pattern (which Seidl calls symmetric languages) the arguments and the verb move out of their base-generated positions to specifiers of functional projections, whereas in almost all languages displaying the (V NP) (NP) pattern (called asymmetrical languages) the DO stays in its VP-internal position. Seidl then proposes that theta-domains are phonological domains in Bantu, or more concretely, that at the P-parse phonological domain boundaries are projected to the left or right edges of theta-domains. But Seidl makes the claim that in order for theta-domains to project boundaries the constituent theta-marked by the head of that theta-domain must stay in situ. The head itself may move out, as the verb does in asymmetrical Bantu languages, but the theta-marked constituent must stay in situ. In symmetrical languages no argument stays in its theta-domain, where it receives a theta-role, and thus no phonological boundary is projected in the maximal projection it surfaces in. The resulting phrasing is hence (V NP NP), with left and right boundaries due to default insertion of boundaries at the beginning and end of sentences. In asymmetrical languages, on the other hand, the DO stays in its theta-domain (the VP), and a phonological phrase boundary is projected on the left edge of VP, deriving the (V NP) (NP) pattern.

Finally, Seidl also offers an explanation for the few symmetric and asymmetric languages that differ from the most common phrasing pattern in their groups. For

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[35] Φ-symbols are eliminated since Seidl argues against the PHT.

instance, the (V NP) (NP) phrasing of a symmetric language like Chaga is explained by the covert movement of the DO, i.e., after the syntactic derivation is sent to PF, and the (V NP NP) phrasing of an asymmetric language like Chicheŵa is explained by the parametric choice in this language for inserting right edge brackets at the right edge of theta-projections, i.e., VP.

Overall, Seidl's (2001) MIR theory provides an interesting alternative to the PHT, at least to the empirical shortcomings of this theory. Seidl's proposal also rebates Hayes's (1990) claim that all rules applying across words whose structural description refers to syntactic labels and categories do not belong in the postlexical component but in the lexical component, and should be considered as rules of phrasal allomorphy. On the one hand, Seidl argues that the domains of application of postsyntactic phonological rules are not defined by the PHT, and on the other hand, her theory also contains rules which apply on a level which maintains almost all syntactic information, the Morphosyntactic Representation. Her M-rules, applying at M_0, are not precompiled rules in Hayes's sense.

Apart from my previous point that perhaps more clarity in the definition of M_0 would have been desirable, I could also mention a concern that I have about the fact that MIR deals with domains which always include more than one lexical word (phases and theta-domains) but not smaller domains around a lexical word, with adjacent function words. Her theory would gain much more importance if its scope were widened to deal with that level of syntactic structure, where so many phonological processes occur. Also, Seidl's conclusion that prosodic constituency above the word does not exist at all seems too strong, as her model does not offer an alternative for deriving the highest prosodic domains such as the intonational phrase or the utterance, which surpass theta-domains or phases. Finally, it is worth pointing out that Seidl's MIR would not be able to provide an account of the domains of application of VA in LB, since this model is suited to capturing phenomena that hold in phases or theta-domains, which are larger than the ones in which VA applies.

7. Theories of phonological phrasing based on phases and Multiple Spell-Out

Assuming the minimalist theory of grammar, Dobashy (2003) and Ishihara (2003) defend an innovative proposal, which is that phonological phrases are mapped from syntactic phases (vP and CP) by Multiple Spell-Out. That is, as soon as a syntactic phase is completed by the syntactic operations responsible for creating syntactic structure, a cycle is created and Spell-Out proceeds (cf. Uriagereka 1999; Chomsky 2000, 2001a, b, among others, for arguments in favor of Multiple Spell-Out). In the minimalist framework, the syntactic constituents that are spelled-out are the sisters of the heads of so-called "strong phases" vP and CP. The sisters of v and C are VP and IP, respectively. Dobashy (2003) claims that Spell-Out linearizes these constituents, that is, it assigns a certain word order within them on the basis of asymmetric c-command relationships, as in Kayne (1994): word a precedes word b if word a asymmetrically c-commands word b. Then, Dobashy argues that these constituents (VP and IP, sisters of vP and CP, respectively) are also mapped as phonological phrases in PF, without the need for reference to edges or to maximal projections,

as in the Prosodic Hierarchy Theory.[36] In a schematic sentence such as (157), first the sister of v is mapped, and then the sister of C. This would leave the phonological phrases (or *p-phrases*, in Dobashy's terminology) in (158):

(157) $[_{CP}$ C $[_{IP}$ Subj Infl $[_{vP}$ XP v $[_{VP}$ V Obj]]]]

(158) a. Spell-Out sister of v: $_{\Phi}$(V Obj)
       b. Spell-Out sister of C: $_{\Phi}$(Subj Infl XP v)

However, Dobashy points out that a problem arises when trying to linearize the two constituents. Linearization works on asymmetric c-command relationships, but the first constituent (V Obj) is not available to future operations of linearization after it is spelled out in a previous cycle, and thus the constituent (Subj Infl XP v) cannot be linearized with anything. In order to solve this problem, Dobashy assumes that the first element in a constituent that is linearized is not mapped as part of the p-phrase and is left for future Spell-Out operations that linearize strings. Thus, from (157), V would not be mapped as part of the p-phrase that contains the object, so that it can be computed in the linearization process that produces the linear order between the sister of C and the string that has been spelled out earlier, i.e., the sister of v. Considering (157) again, the operations of linearization and mapping to phonological constituency would work as follows (for details on linearization, see chapter 1 of Dobashy 1993):

(159) a. Spell-Out sister of v:
           — Linear order: V « Obj
           — Mapping to Φ: Obj
           — In Φ: (Obj)$_{\Phi}$

       b. Spell-Out sister of C:
           — Linearization of c-command domain of v: v « V
           — Linearization of c-command domain of Infl: Infl « XP « v
           — Linearization of the rest: Subj « Infl
           — Linear order: Subj « Infl « XP « v « V
           — Mapping to Φ: Infl « XP « v « V
           — In Φ: (Infl « XP « v « V)$_{\Phi}$ (Obj)$_{\Phi}$

       c. Spell-Out Root:
           — Linearization of c-command domain of C: C « Subj
           — Mapping to Φ: Subj
           — In Φ: (Subj)$_{\Phi}$ (Infl « XP « v « V)$_{\Phi}$ (Obj)$_{\Phi}$

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[36] It should be added that Dobashy follows Chomsky (2001b) in assuming that DP is also a phase. Due to space limitations we will not consider examples involving DPs here, but the reader is referred to chapter 3 in Dobashy (2003). On the other hand, it should be pointed out that Ishihara (2003) differs from Dobashy in proposing that it is the phase itself that is spelled out, rather than the sister of the head of a phase. However, in this section we will review only Dobashy's model, due to space limitations and to the fact that Ishihara's work is focused exclusively on phrasing of wh-questions in Japanese, not on more general data bearing on the issue that concerns the present article, that is, how phonological domains are determined by syntactic structure.

As a result, from the syntactic structure in (157), the following p-structure is created (Dobashy assumes that C is mapped together with the subject in one p-phrase):

(160) (C Subj)$_\Phi$ (Infl XP v V)$_\Phi$ (Obj)$_\Phi$

As Dobashy points out, this is the prediction for phonological phrasing that the Relation-Based Approach to prosodic theory makes, from a sentence consisting of a subject, a verb and an object.

Of course, (S)$_\Phi$ (V)$_\Phi$ (O)$_\Phi$ is not the only phrasing pattern in an SVO language. These are other choices mentioned by Dobashy (2003: 38):

(161) Italian: (S)$_\Phi$ (V)$_\Phi$ (O)$_\Phi$ or (S)$_\Phi$ (VO)$_\Phi$ if O is non-branching.
          Kimatuumbi: (S)$_\Phi$ (VO)$_\Phi$
          Kinyambo: (S) (V O)$_\Phi$ or (S V O)$_\Phi$ if S is non-branching.

The option that some languages may display for incorporating a syntactically non-branching object into the phonological phrase containing the verb, in a process known as restructuring, is included in the parameters for phonological phrasing in the Relation-Based Approach (cf. (81)). Dobashy also assumes the process of restructuring, but parameterizes it as restructuring to the left (the case of the object in Italian) or to the right (the case of the subject in Kinyambo). As for the phrasing (S)$_\Phi$ (VO)$_\Phi$, Dobashy claims that it is due to the raising of the verb to Infl in Bantu languages and to the raising of the object NP to Spec of vP.

Thus, something commendable about a theory of syntax-phonology mapping based on Multiple Spell-Out is that it can derive phonological phrasing based on syntactic constituents that exist independently as part of general grammar, that is, as the material that is sent by Spell-Out to the phonological component (sisters of the head of a phase). Dobashy claims that the advantage of this theory is that there is no need to make reference to notions such as maximal projections or recursive and non-recursive sides, as stated in (81), section 3.

Kahnemuyipour (2004), Ishihara (2007), Kratzer and Selkirk (2007), and Pak (2007) continue the line of Dobashy (2003) and Ishihara (2003), and make proposals based on the direct relationship between syntactic phases and phonological domains. Adapting a previous proposal by Kahnemuyipour (2004), Kratzer and Selkirk (2007) claim that in broad focus utterances, phrasal stress is assigned to the highest phrase within a spellout domain, that is, a phase (vP and CP). This guarantees that in the sequence verb-object or object-verb (depending on whether a language is head-initial or head-final), it is always the object that gets phrasal stress, and similarly for the sequences verb-prepositional phrase or prepositional phrase-verb. In German, when a VP contains an object and a PP, it is always the object that gets phrasal stress. Kratzer and Selkirk (2007) explain this fact assuming a syntactic configuration in which the object is located higher than the PP. Phrasal stress on a subject is accounted for by analyzing the subject as the highest phrase within the spellout domain which TP constitutes as the sister of C, the head of the CP phase. Subjects do not get phrasal stress independently of the predicate if they do not rise outside VP. That is, if they stay inside VP, as in the case of some unaccusative subjects, they get phrasal stress as the highest phrases within VP (i.e., like objects). Kratzer and Selkirk (2007) make the more general claim that the highest phrase within the spellout domain is spelled out as a prosodic major phrase:

(162)   *The Highest Phrase Condition on prosodic spellout*
        The highest phrase within the spellout domain of a phase corresponds to a prosodic major phrase in phonological representation.

Ishihara (2007) proposes a simpler theory of the syntax-phonology mapping, namely that Spell-Out domains (VP and TP, as sisters/complements of heads of *v*P and CP phases) constitute Major Phrases. Kratzer and Selkirk (2007) argue that this version of the mapping between spellout domains and Major Phrases cannot account for the absence of phrasal stress on constituents within a VP that are not the highest phrase within it, that is, the verb and PP complements within VP.

Finally, Pak (2007) follows a similar path in proposing an analysis of phrasal tone domains in San Mateo Huave. In this language, preverbal subjects and time/place adverbs form their own tone domains, while postverbal subjects and adverbs phrase together with the verb. Pak (2007) accounts for this asymmetry between preverbal and postverbal positions following the Multiple Spell-Out view, in that sisters/complements of heads of phases are spelled out, and that these spellout domains are mapped onto PF as phonological domains. Pak assumes that CP and *v*P are the syntactic phases, and that everything inside those phases except the heads (C and *v*) and the material in the edge (i.e., specifiers and adjuncts) is spelled out. The heads and specifiers/adjuncts are spelled out in a separate cycle. Then, Pak proposes that tones are assigned to the linearized output of each phase. She claims that preverbal subjects and time/place adverbs in in SVO sentences in Huave occupy a topic position in Spec,CP and that postverbal subjects in VOS sentences are in a lower position, in Spec,*v*P or Spec,TP. Thus, preverbal subjects are in the highest spellout domain, separate from the spellout domain formed by the sister/complement of C, i.e., TP. This means that the verb and what follows is thus in a separate domain from the subject. On the other hand, postverbal subjects are not in Spec,CP but in a lower position (Spec,*v*P or Spec,TP).[37]

Proponents of the PHT (Nespor and Vogel 1986, most notably) provided arguments against the DRT, and the later defendants of a more prominent role of syntactic relationships (such as Elordieta 1997, 1999 or Seidl 2001) offered arguments that showed that the PHT was unable to account for certain phenomena. However, the

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[37] Pak (2007) does not offer a detailed syntactic analysis of the position that the verb and the object occupy, but in order for her analysis to go through, the verb, the object and the subject must be in the same spellout domain. If it is true that the postverbal subject is in Spec,*v*P or Spec,TP and is hence outside the spellout domain of the *v*P phase, the only possible spellout domain containing the verb, the object and the subject is the one of the CP phase, formed by the sister of C, arguably TP. But the possible position of the verb and the object raise problems for this analysis. In order for the verb to be in the same spellout domain, it cannot be in C, as it would be in a separate domain. But which head would the verb be in? T, perhaps? Then the object must be in Spec,*v*P, which leaves it in the same spellout domain with the verb. The question then is where the subject is. It cannot be in Spec,VP, because this would leave the subject in a separate spellout domain. Perhaps the solution would be to assume double specifiers or adjunctions to *v*P of some sort. Pak (2007) does not address this issue, but it certainly deserves a closer look, so that her analysis becomes solid and convincing. At the time this article is going to press, I have had notice of Pak's recently finished PhD dissertation at the University of Pennsylvania (2008), where this author fleshes out a more developed theory, but unfortunately there is no time to refer to it in the discussion in this section.

scholars claiming that prosodic constituency at the phrasal level is created in terms of spellout domains of phases have not yet presented detailed and concrete comparisons with previous approaches, to show the superiority of their theory. An argument that seems clear is that it is highly economical in terms of linguistic computation to take advantage of an already available mapping operation from the syntactic component to PF (Multiple or Cyclic Spell-Out) that sends syntactic domains to PF. The simplest theory of the syntax-phonology interface would be to assume that those domains are interpreted as phonological (prosodic) domains. But detailed discussions and empirical comparisons with other approaches are still missing. It is to be expected that in the near future there will be published monographic work that will make such a contribution.

A comparison with other proposals arguing for a more direct relationship between syntax and phonology than hitherto assumed in the PHT (such as Elordieta's 1997, 1999 feature-checking or feature-validation approach or Seidl's MIR) is also lacking. Here, I will simply suggest an idea that comes to mind, namely that these proposals could be integrated as part of the same theory of the syntax-phonology interface, Elordieta's proposal being a model of the "lower" part (p-words) and the phase-based theory being a model of the higher constituents (p-phrases). A more detailed comparison or discussion of this interesting possibility would take more space than the one available in this already lengthy article, so I leave it for further research.

8. Concluding remarks

In this article I have offered an overview of the most relevant theoretical models of the interface between syntax and phonology. Two classical lines of thought can be distinguished: on the one hand, the Direct Reference Theory advocates for a direct reading of phonological relationships between words from their syntactic configurations. Parametric structural relationships of c-command or m-command determine phonological relationships. To Kaisse's (1985) original model, Rizzi and Savoia (1993) added parameters like Agr-government and F-government. On the other hand, the Prosodic Hierarchy Theory (PHT) or Prosodic Phonology defends an indirect relationship between syntax and phonology. Phonological processes are specified to apply in prosodic constituents, which may not be isomorphic with syntactic constituents, although they may be derived from morphosyntactic structure. Two approaches can be distinguished within Prosodic Phonology: the Relation-Based Approach (RBA), originally developed by Nespor and Vogel (1986), and the End-Based Approach (EBA), proposed by Selkirk (1986). From the mid 90s, several scholars have couched the basic algorithms of the EBA in Optimality Theory. Although Prosodic Phonology and the PHT have been the dominant view of the syntax-phonology interface for the past two decades, in recent years there have been several proposals arguing that the sources of phonological constituency are not the ones proposed by Prosodic Phonology, or at least that there may be other sources of phonological constituency apart from the ones assumed in classical Prosodic Phonology. All these proposals defend a direct mapping from syntax to PF, claiming that the sequences formed by syntactic expressions that are contained in specific syntactic domains

(theta-domains, as in Seidl's Minimal Indirect Reference Theory, or spellout domains of phases, as in Dobashy 2003, Ishihara 2003, 2007, Kratzer and Selkirk 2007, Pak 2007, among others) or that participate in specific syntactic relationships (such as feature-checking or feature-validation, as in Elordieta 1997, 1999) are mapped in PF as phonological constituents. Of these, Elordieta (1997, 1999) and Seidl (2001) raise strong objections to Prosodic Phonology, given its inability to capture the domains of application of certain phenomena.

If we accept Elordieta's and Seidl's criticisms, three possibilities are to be considered regarding the PHT or Prosodic Phonology. One possibility would be that the prosodic structure building algorithms proposed by the PHT (described in section 3) could be revised to accommodate the data and problems raised in the above mentioned work, rendering the need for these alternative theories vacuous. A second possibility would be to adopt the opposite position, that the PHT should be abandoned. The third possibility would be that two types of phonological constituency coexist, one of them as envisioned by the PHT and another one as devised by the proponents of a more "syntactic" type of constituency.

The evidence in Elordieta's work and Seidl's objections to the PHT indicate that the first possibility is not a very likely scenario. As for the second possibility, it might be too soon to adopt it. Alternative theories such as Seidl's MIR or the phase-based model do not say anything about the word level or the different possibilities arising between a word and an adjacent functional category, or higher domains such as the intonational phrase or the utterance. As for Elordieta's (1997, 1999) feature chain mapping proposal, ideally it would have to be assumed that such a mapping is encoded in Universal Grammar and is not language-dependent, but it is important to raise a cautionary note: not all languages should be expected to reflect the mapping between MS-words and PF domains overtly, or to be more exact, the feature chain proposal should not be taken to mean that prosodic constituency as derived by the RBA or the EBA of the PHT is proven not to exist. On the one hand, the feature chain mapping proposal does not extend to higher prosodic domains such as the intonational phrase or the utterance, and on the other hand, further work is needed in order to see whether all the phenomena accounted for by the PHT can be successfully reinterpreted in the feature chain-based model. Indeed, Elordieta (1997, 1999) suggests that although French liaison could be treated more satisfactorily through the feature chain alternative, certain residual data can be explained by making reference to clitichood. Also, the fact that the lexical verb and the inflected auxiliary in Basque may bear independent word prominence suggests that they are independent prosodic words (i.e., that they have boundaries that are visible for prosodic interpretation), although they constitute one single domain for the application of VA and function like the domain formed by a noun or adjective and a suffixed determiner. Thus, it might be that the third possible scenario is real, that is, that there are two possible ways of deriving phonological constituency, one as devised in Elordieta's model (or in the phase-based models) and one as devised in the PHT.

If the existence of the PHT were proven to be true, one interpretation of the availability of two strategies for mapping phonological constituents from syntactic structure could be that the creation of phonological constituency in PHT terms is a development that simplifies the creation of phonological constituency. In the feature

chain mapping, some functional categories form phonological domains with the lexical heads they are syntactically related to and others do not. Whether they form one unit depends on whether they are related in a feature chain. Some languages may have chosen to simplify the mapping from syntax to phonology, so that all functional categories form phonological domains with the lexical heads they select. Intuitively, it seems as if the mapping were simpler. Additional research is necessary in order to elucidate the role that each theory plays in each language, so that a fuller understanding of the mapping between syntax, morphology and phonology is obtained. Hopefully, the discussion in this chapter has demonstrated the need for such work and has pointed to the directions or avenues to be taken.

References

Abney, S., 1987, *The English noun phrase in its sentential aspect*, PhD thesis, MIT.

Albizu, P., 1991, «Sobre la existencia del movimiento largo de núcleos en euskera», ms, Instituto Universitario Ortega y Gasset.

—, 1992, «Where is COMP in Basque?», ms, University of Southern California.

Arregi, K., 2003, *Focus on Basque movements*, PhD thesis, MIT.

—, 2004, «Basque is right-headed», ms., University of Illinois at Urbana-Champaign.

Artiagoitia, X., 1992, *Verbal projections in Basque and minimal structure*, PhD thesis, University of Washington (= Supplements of *ASJU,* Donostia).

—, 2002, «The functional structure of Basque Noun Phrases», in X. Artiagoitia, J. Lakarra and P. Goenaga (eds.), *Erramu Boneta: Festschrift for Rudolf P. G. de Rijk*, Supplements of the *International Journal of Basque Linguistics and Philology*, Bilbao, Universidad del País Vasco and Diputación Foral de Gipuzkoa, 73-90.

Bickmore, L., 1990, «Branching nodes and prosodic categories», in Inkelas and Zec (eds.), 1-17.

Bing, J., 1979, *Aspects of English prosody*, PhD thesis, MIT.

Booij, G., 1996, «Cliticization as prosodic integration: The case of Dutch», *The Linguistic Review* 13, 219-242.

Bonet, E., 1991, *Morphology after syntax: Pronominal clitics in Romance languages*, PhD thesis, MIT.

Borer, H., 2005, *Structuring sense*, Oxford U.P., Oxford.

Chen, M., 1987, «The syntax of Xiamen tone sandhi», *Phonology Yearbook* 4, 109-149.

—, 1990, «What must Phonology Know about Syntax?», in Inkelas and Zec (eds.), 19-46.

Cho, Y-M. Y., 1990, «Syntax and phrasing in Korean», in Inkelas and Zec (eds.), 47-62.

Chomsky, N., 1981, *Lectures on Government and Binding*, Foris, Dordrecht.

—, 1995, *The Minimalist Program*, Cambridge, Mass, MIT Press.

—, 2000, «Minimalist Inquiries», in R. Martin, D. Michales and J. Uriagereka (eds.), *Step by Step: Essays on Minimalist Syntax in Honor of Howard Lasnik*, 89-156, MIT Press, Cambridge, Mass.

—, 2001a, «Derivation by Phase», in M. Kenstowicz (ed.), *Ken Hale: A Life in Language*, 1-52, MIT Press, Cambridge, Mass.

—, 2001b, «Beyond Explanatory Adequacy», in *MIT Ocasional Papers in Linguistics* 20, MIT, Cambridge, Mass, 1-28.

— and M. Halle, 1968, *The sound pattern of English,* Harper and Row, New York.

Clements, G. N., 1978, «Tone and syntax in Ewe», in D. J. Napoli (ed.), *Elements of tone, stress, and intonation*, Georgetown U.P., Washington, D.C., 21-99.

Cohn, A., 1989, «Stress in Indonesian and bracketing paradoxes», *NLLT* 7, 167-216.

Condoravdi, C., 1990, «Sandhi rules of Greek and Prosodic Theory», in Inkelas and Zec (eds.), 63-84.

Cowper, E. and K. Rice, 1987, «Are phonosyntactic rules necessary?», *Phonology Yearbook* 4, 185-194.

Dell, F., 1970, *Les règles phonologiques tardives et la morphologie dérivationnelle du français*, PhD thesis, Massachusetts Institute of Technology.

D'Imperio, G. Elordieta, S. Frota, P. Prieto, and M. Vigário, 2005, «Intonational phrasing in Romance: The role of syntactic and prosodic structure», in S. Frota, M. Vigário and M. J. Freitas (eds.), *Prosodies: With special reference to Iberian languages*, Mouton de Gruyter, Berlin, 59-97.

Dobashy, Y., 2003, *Phonological phrasing and syntactic derivation*, PhD thesis, Cornell University.

Elordieta, A., 2001, *Verb movement and constituent permutation in Basque*, PhD thesis, Leiden University, published by LOT.

Elordieta, G., 1997, *Morphosyntactic feature chains and phonological domains*, PhD thesis, University of Southern California.

—, 1999, «Phonological cohesion as a reflex of morphosyntactic feature chains», *Proceedings of the Seventeenth West Coast Conference on Formal Linguistics*, CSLI Publications, Stanford, 175-189.

—, 2007, «Segmental phonology and syntactic structure», in G. Ramchand and C. Reiss (eds.), *The Oxford handbook of linguistic interfaces*, Oxford U.P., Oxford, 125-178.

—, S. Frota, P. Prieto and M. Vigário, 2003, «Effects of constituent weight and syntactic branching on intonational phrasing in Ibero-Romance», in M.-J. Solé, D. Recasens and J. Romero (eds.), *Proceedings of the 15th International Congress of Phonetic Sciences*, Causal Productions Pty Ltd, Barcelona, 487-490.

—, S. Frota and M. Vigário, 2005, «Subjects, Objects and Intonational Phrasing in Spanish and Portuguese», *Studia Linguistica* 59, 110-143.

Emonds, J., 1985, *A unified theory of syntactic categories*, Foris, Dordrecht.

Epstein, S. D. and Seely, T. D., 2002, «Rule applications as cycles in a level-free syntax», in S. D. Epstein and T. D. Seely (eds.), *Derivation and explanation in the Minimalist Program*, Cambridge, Blackwell, 65-89.

Etxeberria, U., 2005, *Quantification in Basque*, PhD thesis, University of the Basque Country.

Everett, D., 1989, «Clitic doubling, reflexives, and word Order alternations in Yagua», *Lg* 65, 339-372.

Frascarelli, M., 2000, *The syntax-phonology interface in focus and topic constructions in Italian*, Kluwer Academic Publishers, Dordrecht.

Frota, S., 2000, *Prosody and focus in European Portuguese*, Garland, London.

Gerlach, B. and Grijzenhout, J., 2001, *Clitics in phonology, morphology and syntax*, John Benjamins, Amsterdam.

Ghini, M., 1993, *Phonological phrase formation in Italian*, MA thesis, University of Toronto.

Giannakidou, A., 2004, «Domain restriction and the argument of quantificational determiners», *Semantics and Linguistic Theory* 14, 110-128, Cornell Linguistics Club, Cornell.

Giusti, G., 1991, «The categorical status of quantified nominals», *Linguistische Berichte* 136, 438-454.

Haddican, B., 2004, «Basque Functional Heads», *The Linguistic Review* 21, 87-124.

Hale, K. and E. Selkirk, 1987, «Government and tonal phrasing in Papago», *Phonology Yearbook* 4, 151-183.

Hall, T. A. and U. Kleinhenz, 1999, *Studies on the phonological word*, John Benjamins, Amsterdam.

Halle, M. and A. Marantz, 1993, «Distributed Morphology and the pieces of inflection», in K. Hale and S. J. Keyser (eds.), *The view from Building 20: Essays in linguistics in honor of Sylvain Bromberger*, MIT Press, Cambridge, Mass, 111-176.

—, 1994, «Some key features of Distributed Morphology», paper presented at the Symposium on Distributed Morphology, LSA Annual Meeting, Boston.

Hayes, B., 1989, «The Prosodic Hierarchy in meter», in P. Kiparsky and G. Youmans (eds.), *Rhythm and Meter,* Academic Press, San Diego, 201-260.

—, 1990, «Precompiled Phrasal Phonology», in Inkelas and Zec (eds.), 85-108.

— and A. Lahiri, 1991, «Bengali intonational phonology», *NLLT* 9, 47-96.

Hualde, J. I., 1999, «Basque accentuation», in H. van der Hulst (ed.), *Word prosodic systems in the languages of Europe*, Mouton de Gruyter, Berlin, 947–993.

—, G. Elordieta and A. Elordieta, 1994, *The Basque dialect of Lekeitio,* Supplements of *ASJU,* Bilbao and San Sebastián.

Hyman, L., 1985, «Word domains and downstep in Bamileke-Dschang», *Phonology Yearbook* 2, 47-83.

Inkelas, S., 1990, *Prosodic constituency in the lexicon*, Garland Publishing, New York.

— and D. Zec (eds.), 1990, *The phonology-syntax connection*, University of Chicago Press, Chicago.

—, 1995, «Syntax-phonology interface», in J. Goldsmith (ed.), *The Handbook of Phonological Theory*, Blackwell, Cambridge, 535-549.

Ishihara, S., 2003, *Intonation and Interface Conditions*, PhD thesis, MIT.

—, 2007, «Major Phrase, Focus Intonation, Multiple Spell-Out (MaP, FI, MSO)», *The Linguistic Review* 24, 137-167.

Jackendoff, R., 1997, *The architecture of the language faculty*, MIT Press, Cambridge.

Jouitteau, M., 2005, *La syntaxe comparée du breton*, PhD thesis, Université de Nantes.

Kahnemuyipour, A., 2004, *Syntactic categories and Persian stress*, PhD thesis, University of Toronto.

Kaisse, E., 1977, *Hiatus in modern Greek*, PhD thesis, Harvard University.

—, 1983, «The syntax of auxiliary reduction in English», *Lg* 59, 93-122.

—, 1985, *Connected speech: The interaction of syntax and phonology*, Academic Press, Orlando.

Kanerva, J., 1990, «Focusing on phonological phrases in Chicheŵa», in Inkelas and Zec (eds.), 145-161.

Kayne, R., 1994, *The antisymmetry of syntax*, MIT Press, Cambridge.

Kenstowicz, M. and Kisseberth, Ch., 1977, *Topics in Phonological Theory*, Academic Press, New York.

— and Sohn, H.-S., 1997, «Phrasing and focus in Northern Kyungsang Korean», in P. M. Bertinetto *et al.* (eds.), *Certamen Phonologicum III*, 137-149.

Kidima, L., 1990, «Tone and syntax in Kiyaka», in Inkelas and Zec (eds.), 195-216.

King, H., 1970, «On blocking the rules for contraction in English», *LI* 1, 134-136.

Kiparsky, P., 1982, «Lexical Morphology and Phonology», in I.-S. Yang (ed.), *Linguistics in the morning calm*, Hanshin Publishing Co., Seoul, 3-91.

—, 1985, «Some consequences of the theory of Lexical Phonology», *Phonology Yearbook* 2, 85-138.

Klavans, J., 1982, *Some problems in a theory of clitics*, Indiana University Linguistics Club.

Kratzer, A. and E. Selkirk, 2007, «Phase theory and prosodic spellout: The case of verbs», *The Linguistic Review* 24, 93-135.

Laka, I., 1990, *Negation in syntax: On the nature of functional categories and projections*, PhD thesis, MIT.

Lakoff, G., 1970, «Global rules», *Lg* 46, 627-639.

Lobeck, A. and E. Kaisse, 1984, «On the domain of locality conditions», in *Proceedings of the Third West Coast Conference on Formal Linguistics,* Stanford Linguistics Association, Stanford, Calif., 170-178,

Longobardi, G., 1994, «Reference and proper names: A theory of N-movement in syntax and Logical Form», *LI* 25, 609-665.

—, 2001, «The structure of DPs: Some principles, parameters, and problems», in C. Collins and M. Baltin (eds.), *The Handbook of contemporary syntactic theory*, Blackwell Publishers, London, 562-601.

Manzini, R., 1983, «Syntactic conditions on phonological rules», in *MIT Working Papers in Linguistics 5,* MIWPL, Cambridge, Mass, 1-9.

Marantz, A., 1988, «Clitics, morphological merger, and the mapping to Phonological Structure», in M. Hammond and M. Noonan (eds.), *Theoretical morphology*, Academic Press, San Diego, 253-270.

—, 1997, «No escape from syntax», *UPenn Working Papers in Linguistics* 4.2, 201-225.

Matthewson, L., 1998, *Determiner systems and quantificational strategies: Evidence from Salish*, Holland Academic Graphics, The Hague.

—, 2001, «Quantification and the nature of crosslinguistic variation», *Natural Language Semantics* 9, 145-179.

Matushansky, O., 2005, «Moving a-head», in K. Hiraiwa and J. Sabbagh (eds.), *Minimalist approaches to clause structure*, MIT Working papers in Linguistics 50, Cambridge, Mass.

—, 2006, «Head-movement in linguistic yheory», *LI* 37, 69-109.

McHugh, B., 1990, «The phrasal cycle in Kivunjo Chaga tonology», in Inkelas and Zec (eds.), 217-242.

Meinschäfer, J., 2004, «Final vowel deletion in Italian and the notion of optional rule application», presented at the workshop *Variation and change in phonology and phonetics*, University of Potsdam, October 7-10.

Milner, J.-C., 1967, «French truncation rule», *Quarterly Progress Report* 86, 273-283. Research Laboratory of Electronics, MIT, Cambridge, Mass.

Mohanan, K. P., 1986, *The theory of Lexical Phonology*, Reidel, Dordrecht.

Morin, Y.-C. and J. Kaye., 1982, «The syntactic bases for French liaison», *JL* 18, 291-330.

Muysken, P., 1977, *Syntactic developments in the verb phrase of Ecuadorian Quechua,* Foris, Dordrecht.

Napoli, D. J. and M. Nespor, 1979, «The syntax of word-initial consonant gemination in Italian», *Lg* 55, 812-841.

Nespor, M., 1990, «On the separation of prosodic and rhythmic phonology», in Inkelas and Zec (eds.), 243-258.

— and A. Ralli, 1996, «Morphology-phonology interface: Phonological domains in Greek compounds», *The Linguistic Review* 13, 357-382.

— and M. Scorretti, 1985, «Empty elements and phonological form», in J. Guéron, H.-G. Obenauer and J.-Y. Pollock (eds.), *Grammatical representation*, Foris, Dordrecht, 203-235.

— and I. Vogel, 1982, «Prosodic domains of external sandhi rules», in H. van der Hulst and N. Smith (eds.), *The structure of phonological representations (Part I),* Foris, Dordrecht, 225-255.

—, 1986, *Prosodic Phonology*, Foris, Dordrecht.

Noyer, R., 1992, *Features, positions, and affixes in Autonomous Morphological Structure*, PhD thesis, MIT.

Nunes, J., 2004, *Linearization of chains and sideward movement*, MIT Press, Cambridge, Mass.

Odden, D., 1987, «Kimatuumbi phrasal phonology», *Phonology Yearbook* 4, 13-26.

—, 1990, «Syntax, lexical rules and postlexical rules in Kimatuumbi», in Inkelas and Zec (eds.), 259-277.

—, 1996, *Kimatuumbi phonology and morphology*, Oxford U.P., London.

Ormazabal, J., J. Uriagereka and M. Uribe-Etxebarria, 1994, «Word order and wh-movement: Towards a parametric account», paper presented at GLOW 17, University of Vienna.

Ortiz de Urbina, J., 1989, *Some parameters in the grammar of Basque*, Foris, Dordrecht.

—, 1994, «Verb-initial patterns in Basque and Breton», *Lingua* 94, 125-153.

—, 1995, «Residual verb-second and verb-first in Basque», in K. E. Kiss (ed.), *Discourse configurational languages,* Oxford U.P., New York, 99-121.

Pak, M., 2005, «Explaining branchingness effects in phrasal phonology», *Proceedings of the West Coast Conference in Formal Linguistics 24*, 308-316.

—, 2007, «Phrasal tone domains in San Mateo Huave», *Proceedings of the 33rd Annual Meeting of the Berkeley Linguistics Society.*

—, 2008, *The postsyntactic derivation and its phonological reflexes*, PhD thesis, University of Pennsylvania.

— and M. Friesner, 2006, «French phrasal phonology in a derivational model of PF», *Proceedings of NELS 36*, 480-491.

Payne, D. and T. Payne, 1989, «Yagua», in D. Derbyshire and G. Pullum (eds.), *Handbook of Amazonian languages,* vol. 2, Mouton de Gruyter, Berlin, 249-474.

Peperkamp, S., 1997, *Prosodic words*, PhD thesis, University of Amsterdam, published by LOT.

Pesetsky, D. and E. Torrego, 2001, «T-to-C movement: Causes and consequences», in M. Kenstowicz (ed.), *Ken Hale: A life in language*, MIT Press, Cambridge, Mass, 355-426.

—, 2004, «The syntax of valuation and the interpretability of features», in *Clever and right: A festschrift for Joe Emonds.*

Potts, C., 2005, *The logic of conventional implicatures*, Oxford U.P., Oxford.

Prieto, P., 2005, «Syntactic and eurhythmic constraints on phrasing decisions in Catalan», *Studia Linguistica* 59, 194-222.

—, 2006, «Phonological phrasing in Spanish», in S. Colina and F. Martínez-Gil (eds.), *Optimality-theoretic advances in Spanish phonology*, John Benjamins, Amsterdam/Philadelphia, 39-60.

Reiss, C., 2003, «Deriving the feature-filling/feature-changing contrast: An application to Hungarian vowel harmony», *LI* 34, 199-224.

Rezac, M., 2004, «The EPP in Breton: An unvalued categorial feature», in A. Breitbarth and H. van Riemsdijk (eds.), *Triggers*, Mouton de Gruyter, Berlin and New York, 451-492.

Rice, K., 1991, «Prosodic constituency in Hare (Athapaskan): Evidence for the foot», *Lingua* 82, 201-245.

—, 1993, «The structure of the Slave (Northern Athabaskan) verb», in S. Hargus and E. Kaisse (eds.), *Phonetics and Phonology* 4. *Studies in lexical phonology,* San Diego, Calif: Academic Press, 145-171.

Ritter, E., 1991, «Two functional categories in Noun Phrase: Evidence from Hebrew», in S. Rothstein (ed.), *Syntax and Semantics* 26, 37-62, Academic Press, San Diego.

Rizzi, L., 1979, «La teoria della traccia e processi fonosintattici», *Rivista di Grammatica Generativa* 4, 165-181.

— and L. Savoia, 1993, «Conditions on /u/ propagation in Southern Italian dialects: a locality parameter for phonosyntactic processes», in A. Belletti (ed.), *Syntactic theory and the dialects of Italy*, Rosenberg and Sellier, Torino, 252-318.

Rotenberg, J., 1978, *The syntax of phonology*, PhD thesis, MIT.

Sandalo, F. and H. Tuckenbrodt, 2002, «Some notes on phonological phrasing in Brazilian Portuguese», *MITWPL* 42, 285-310.

Schane, S., 1968, *French phonology and morphology*, MIT Press, Cambridge, Mass.

Seidl, A., 2001, *Minimal Indirect Reference: A theory of the syntax-phonology interface*, Routledge, London.

Selkirk, E., 1972, *The phrasal phonology of English and French*, PhD thesis, MIT.

—, 1974, «French liaison and the X notation», *LI* 5, 573-590.

—, 1980a, «On prosodic structure and its relation to syntactic structure», in T. Fretheim (ed.), *Nordic Prosody II,* Tapir, Trondheim, 111-140.

—, 1980b, «Prosodic domains in phonology: Sanskrit revisited», in M. Aronoff and R. T. Oehrle (eds.), *Language sound structure*, MIT Press, Cambridge, Mass, 107-136.

—, 1984, *Phonology and syntax: The relation between sound and structure*, MIT Press, Cambridge, Mass.

—, 1986, «On derived domains in sentence phonology», *Phonology Yearbook* 3, 371-405.

—, 1995, «The prosodic structure of function words», in *University of Massachusetts Occasional Papers 18: Papers in Optimality Theory,* GLSA, University of Massachusetts, Amherst.

—, 2000, «The interaction of constraints on prosodic phrasing», in M. Horne (ed.), *Prosody: Theory and experiment*, Kluwer, Dordrecht, 231-261.

—, 2005, «Comments on intonational phrasing», in S. Frota, M. Vigário and M. J. Freitas (eds.), *Prosodies: With special reference to Iberian languages*, Mouton de Gruyter, Berlin, 11-58.

— and T. Shen, 1990, «Prosodic domains in Shanghai Chinese», in Inkelas and Zec (eds.), 313-337.

— and K. Tateishi, 1988, «Syntax and downstep in Japanese», in C. Georgopoulos and R. Ishihara (eds.), *Essays in honour of S.-Y. Kuroda*, Kluwer, Dordrecht, 519-543.

Shlonsky, U., 1991, «Quantifiers as functional heads: A study of quantifier float in He-
    brew», *Lingua* 84, 159-180.

Sigurðsson, H. A., 1993, «The structure of Icelandic NP», *Studia Linguistica* 47, 177-197.

Stowell, T., 1981, *Origins of phrase structure*, PhD thesis, MIT.

Szabolcsi, A., 1983, «The possessor that ran way from home», *The Linguistic Review* 3, 89-
    102.

—, 1987, «Functional categories in the Noun Phrase», in I. Kenesei (ed.), *Approaches to
    Hungarian,* vol. 2, University of Budapest.

Truckenbrodt, H., 1995, *Phonological phrases: Their relation to syntax, focus, and promi-
    nence*, PhD thesis, MIT.

—, 1999, «On the relation between syntactic phrases and phonological phrases», *LI* 30,
    219-256.

—, 2002, «Variation in p-phrasing in Bengali», in P. Pica and J. Rooryck (eds.), *Linguistic
    Variation Yearbook*, vol. 2, John Benjamins, Amsterdam, 259–303.

Uriagereka, J., 1999, «Multiple Spell Out», in S. D. Epstein and N. Hornstein (eds.),
    Working minimalism, MIT Press, Cambridge, 251-282.

van der Leeuw, F., 1997, *Clitics: Prosodic studies*, PhD thesis, University of Amsterdam,
    published by LOT.

van Hoorn, H., 1983, «Cancellazione della vocale finale prima di consonante», ms., Uni-
    versity of Amsterdam.

Vanelli, L., 1979, «Una forma supplettiva dell'articolo e la sua fonosintassi», *Rivista de
    Grammatica Generativa* 4, 183-206.

Vangness, Ø. A., 2001, «On Noun Phrase architecture, referentiality, and article system»,
    Studia Linguistica 55, 249-299.

Vigário, M., 2003, *The Prosodic Word in European Portuguese*, Mouton de Gruyter, Berlin
    and New York.

Vogel, I., M. Drigo, A. Moser and I. Zannier, 1983, «La Cancellazione di vocale in ita-
    liano», *Studi di Grammatica Italiana,* 191-230.

— and Kenesei, I., 1990, «Syntax and semantics in phonology», in Inkelas and Zec (eds.),
    339-363.

Zec, D., 1988, *Sonority constraints on prosodic structure*, PhD thesis, Stanford University.

—, 1993, «Rule domains and phonological change», in S. Hargus and E. Kaisse (eds.),
    Studies in Lexical Phonology, Academic Press, San Diego, 365-405.

— and S. Inkelas, 1990, «Prosodically-constrained syntax», in Inkelas and Zec (eds.), 365-
    378.

Zsiga, E., 1992, «A mismatch between morphological and prosodic domains: Evidence
    from two Igbo rules», *Phonology* 9, 101-135.

Zubizarreta, M.L. and J.-R. Vergnaud, 1997, «Feature chains», ms., University of Southern
    California.

Zwicky, A., 1970, «Auxiliary reduction in English», *LI* 1, 323-336.