The Interface Between Phonology and the Other Components
of the Grammar in a Dialect of Basque

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1. Introduction[1]

The purpose of this paper is to investigate the interface between phonology and the other components of the grammar in the Gipuzkera dialect of Basque from Beterri (henceforth GBB).

Nespor and Vogel among others have noted that "a totally autonomous phonological component is implausible " (Nespor and Vogel 1986). In traditional generative phonology, for instance, the application of rules frequently depends on some criteria other than the purely phonological. That information is often incorporated in the rules themselves through the various types of boundaries.

The aim of this paper is to determine the kinds of information other than the purely phonological, that are relevant for the application of two phrasal phonological rules in GBB: vowel degemination and nasal assimilation. The paper is organized in four sections: Section 2 contains a brief phonological description of my informant's dialect, a definition of the two phonological rules I will be dealing with and a sample of the kind of data that needs to be accounted for. In section 3 I consider two theories - an End Based theory and a Relational Based theory - which have been posited to deal with this type of phenomenon and I show that they are unable to account for the GBB data. In section 4, I propose an analysis based on a Phrasal Formation rule which successfully accounts for all the data. Finally in section 5, I analyze the effects that a phonological process, stress, has on the applicability of vowel degemination and nasal assimilation.

2. The Data

2.1. Phonetic inventory of GBB

The following chart (the symbols used are those of the International Phonetic Association) represents the phonemes which occur in my informant's dialect:[2]

	bil	inter	dental	dorso-alveo	apico-alveo	palat	velar	uv
stop	p d		t d				k g	
nasal	m				n		ŋ	
fricat		f		s	ś		ʃ	
affric				ts	tś	tʃ		
lateral					l	λ		
vibrant								R

That /ts/, /tś/, and /tʃ/ are true affricates and not consonant clusters can be inferred from the lack of true consonant clusters in Basque.[3]

2.2. Phonological Rules

Vowels and alveolar nasals may undergo vowel degemination (henceforth VD) and nasal assimilation (NA) respectively. These two rules are defined as follows:

Vowel degemination: A vowel deletes whenever it is preceded by the same vowel, both within the word (1a) and across word boundaries (1b):[4]

(1) (a) [saaR-a] 'old' → [saRa] after VD
     (b) [bere etʃe-a] 'his house' → [beretʃea] after VD

At this point of the discussion, it may seem arbitrary to favour the deletion of the second vowel over the first as the rule formulation entails. However, evidence supporting this claim will be provided in section four.

Nasal assimilation: /n/ assimilates to the place of articulation of the following consonant. The following examples show that NA functions both as an internal sandhi rule (2a,d,f,h,j) and as an external sandhi rule (2b,c,e,g,i,k).

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[3] All the data in this paper appear in their corresponding phonetic form. However, whenever reference to the orthographic form of a segment is needed, the segment will be printed in *italics*. Below is a list with the graphemic symbols corresponding to the above given phonemes:

/l/ *l*; /λ/ *l*;
/p/ *p*; /t/ *t*; /k/ *k*;
/b/ *b*; /d/ *d*; /g/ *g*;
/m/ *m*; /n/ *n*; /ŋ/ *n*;
/ſ/ *r*; /R/ *rr*; /j/ *j*;
/s/ *z*; /ś/ *s*; /ʃ/ *x*;
/ts/ *tz*; /tś/ *ts*; /tʃ/ *tx*.
h has no phonetic realization.

[4] Evidence for the existence of two [a]s underlyingly in (1a) is provided by the verbal form [saartu] 'to grow old' where both [a]s are always preserved. This particular case of VD appears to be morphologically conditioned. More research should be done on this kind of process, but since this process is beyond the scope of this paper I will not be dealing with it here.

/n/ → [m] / ___   [b]
                  [p]

(2) (a) [on] →   [ombera]
          'good'   'easy going'
     (b) [etʃean] →   [et eam bildu ginen]
          'at home'   'we gathered at home'
     (c) [eun] →   [eum pago]
          'one hundred'   'one hundred beech-trees'

/n/ → [ɲ] / ___   [g]
                  [k]

(2) (d) [an] →   [aɲgo]
          'there'   'from there'
     (e) [amaren] →   [amareɲ gona]
          'mother's'   'mother's skirt'
     (f) [anka]
          'leg'
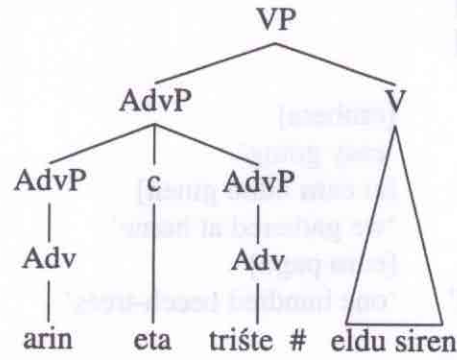   (g) [eun] →   [euɲ kutʃa]
          'one hundred'   'one hundred boxes'

/n/ → [n̪] / ___   [t]
                   [d]

(2) (h) [an̪ton]
          'Anton'(proper name)
     (i) [eun] →   [eun̪ tonelada]
          'one hundred'   'one hundred tons'
     (j) [an̪dereno]
          'miss'
     (k) [esan] →   [esan̪ dut]
          'to say'   'I have said'

2.3. The Data

I will confine my investigation to the study of the behavior of these two rules, VD and NA, as *external sandhi rules* or *phrasal phonological rules (PPRs)*, and specifically, to the determination of the conditions under which PPRs apply and when they are blocked. Below is a sample of the kind of data that need to be accounted for. The symbol # means that the phonological rule, whose structural description is met, does not apply; = that it applies; parenthesis around a vowel indicate that that vowel is deleted.
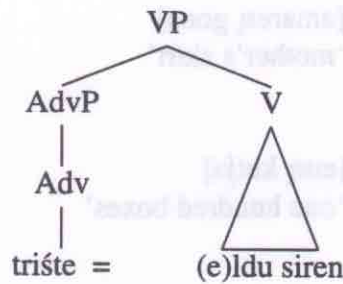
(3a)   arin eta triśte # eldu siren
       fast and sad come aux.
       'they came in a hurry and sad'

(3.a')

VP

AdvP   V

AdvP   c   AdvP

Adv   Adv

arin   eta   triśte # eldu siren

(3b)   triśte = (e)ldu siren
       sad   come aux.
       'they came sad'

(3b')

VP

AdvP   V

Adv

triśte =   (e)ldu siren

(3c)   aita-ren # bisitsa ośo-a
       father of   life   whole ART
       'father's whole life'

(3c')

NP

NP   N'

N   N   AdjP

         Adj

aita-ren # bisitsa   ośo-a

(3d)   aita-rem = bisitsa
       father of   life
       'father's life'

(3.d')

$$
\begin{array}{c}
\text{NP} \\
\diagup \quad \diagdown \\
\text{NP} \qquad \text{N} \\
| \\
\text{N} \\
| \\
\text{aita-rem =} \qquad \text{bisitsa}
\end{array}
$$

(3a) through (3d) reveal that VD and NA do not apply systematically because even though the phonological environments of (3a) and (3b) and (3c) and (3d) respectively are identical, rule application is limited to (3b) and (3d). The conclusion to be reached from these examples is that the applicability of PPRs depends on some criteria other than the merely phonological ones, and it is the purpose of this paper to account for this type of data.

3. Inadequacy of an End-Based Theory and a Relation-Based Theory

In the last part of section 2, I showed that Phrasal Phonological rules cannot be accounted for in phonological terms alone. Theories on phrasal phonology are concerned with the determination of the types of information which are relevant for the application of PPRs. In this section, I will present an analysis of the GBB data provided by two theories of this kind, an End-based theory and a Relation-based theory, and I will show that they are unable to account for the entire corpus of data.

3.1. End-based theory

The end-based theory claims that the "syntax phonology mapping can be defined simply by reference to the ends of the syntactic constituents" (Selkirk,1986:38a). Thus, a phrasal phonological rule will apply *within* "the stretch of the syntactic structure that is demarcated by the right or left ends of the selected constituents.[5]

$[_\alpha$ ....., where .... contains no $[_\alpha$

.......$]_\alpha$, where .... contains no $]_\alpha$.

α can be realized as a X or Xmax, where X stands for any lexical category, i.e. N,V,P and,

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[5] Unlike Selkirk, Nespor and Vogel(1986) claim that the choice of the left end, [, or the right end,], is not arbitrary. According to them, the choice of [or] is dependent on the side of the head which a language takes as the non-recursive or recursive side, where non recursive stands for the side of the head in which the occurrences of complements are highly limited and, the recursive side stands for the side of the head where complements occur freely. That is, they argue that VO languages, like English, where the recursive side goes to the right of the head (Direct objects occur to the right of V, the head of VP), the right end of the head should be marked. On the other side, in OV languages, like Basque, where the recursive side is to the left of the head, the left end of the head should be marked. In other words:

non recursive H] recursive (English)
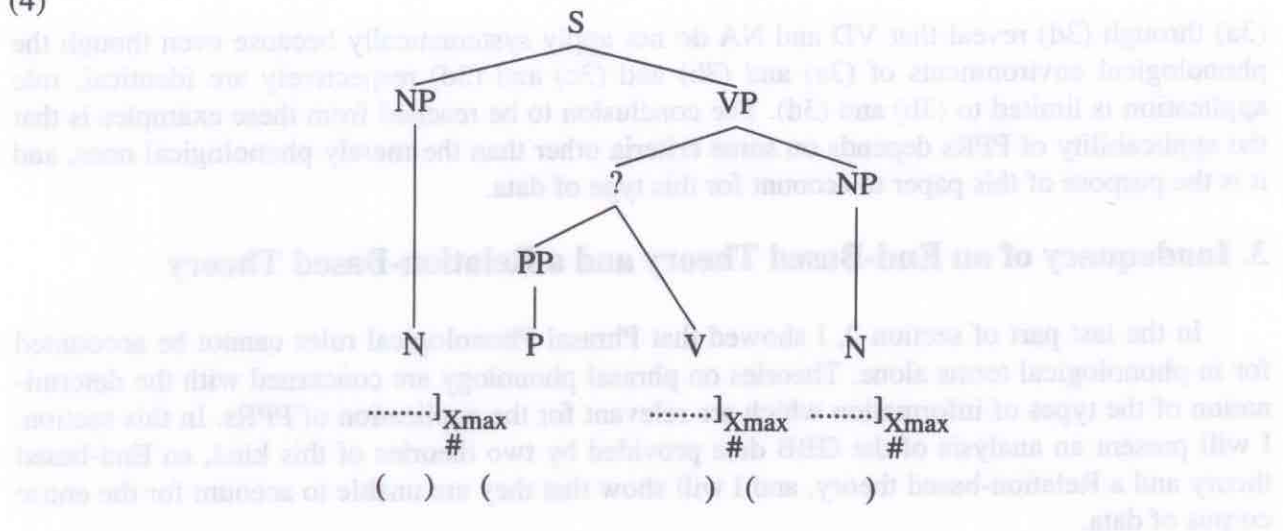recursive [H non recursive (Basque)

Xmax stands for any phrase, for instance NP,VP,PP.[6]

The combination of these two parameters, right or left end and categorial rank (X or Xmax), gives rise to four possibilities, i.e $[_X$ $,[_{Xmax}$ $,]_X$ $,]_{Xmax}$. PPRs will apply within the domains that are demarcated by them.

The tree structure in (4) (Selkirk 1986:384) illustrates Selkirk's analysis for the formulation of domains within which PPRs, in particular, tone sandhi, apply. She takes an example from Xiamen, provided by Chen (1985):
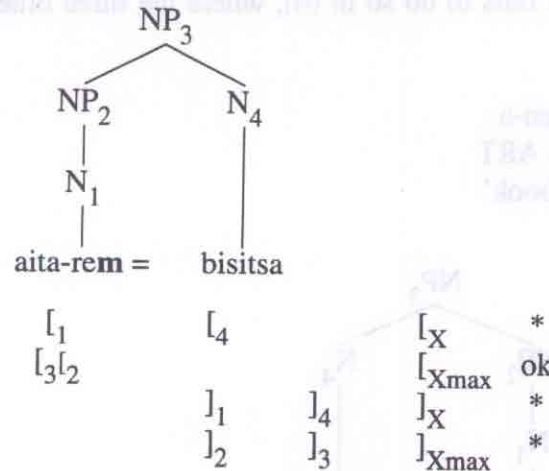
(4)

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                    S
              /           \
            NP             VP
           / \            /   \
          ?                    NP
         / \                  /  \
        PP               ....]Xmax
        / \              #
       N   P    V    N
    ...]Xmax  ...]Xmax  ...]Xmax
       #       #        #
      ( )     ( )      ( )
```

Selkirk argues that in Xiamen, the EBT, more specifically the consideration of $]_{Xmax}$, adequately predicts where tone sandhi applies or is blocked. In (4), tone sandhi is blocked at the right ends of Xmax (b), and it is applied within the stretch of the syntactic structure demarcated by two $]_{Xmax}$ (c).

The EBT would make the following predictions for the GBB data:

(5a)   aita-rem = bisitsa
        father of   life
        'father's life'

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[6] X and Xmax are terms used by the X-convention. The head of any phrase is termed X and the phrasal category containing it is referred to as Xmax (maximal projection) (Henk van Riemsdijk and Edwin Williams 1986:41). Hence, NP,PP,VP,Adj P are phrasal categories or Xmax, all of which contain a head or lexical category, N,P,V,Adj respectively which give the name to the phrasal category they occur in.
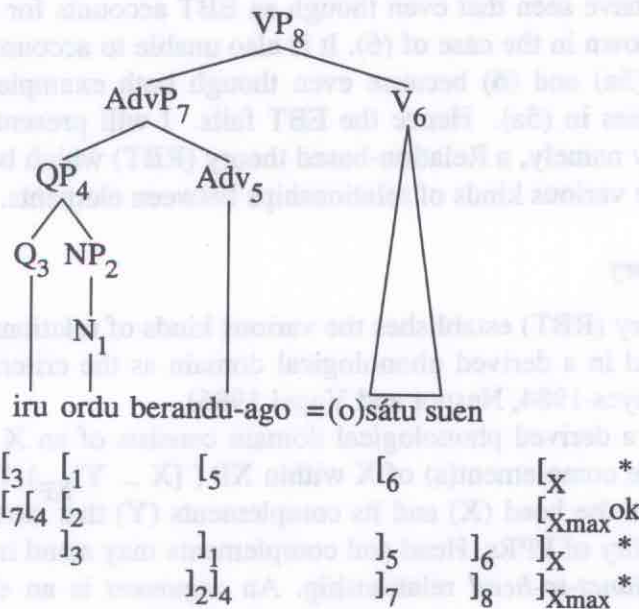
(5a')

NP$_3$

NP$_2$ N$_4$

N$_1$

aita-re**m** =   bisitsa

[$_1$ [$_4$ [$_X$ *
[$_3$[$_2$ [$_{Xmax}$ ok
          ]$_1$]$_4$]$_X$ *
          ]$_2$]$_3$]$_{Xmax}$ *

The consideration of [$_X$,]$_X$ and]$_{Xmax}$ divides the NP into two domains, *aitaren* and *bizitza* and thus, they predict, contrary to our data, that NA is blocked between the two domains. The application of [$_{Xmax}$ on the other side, considers *aitaren bizitza* as one single domain, hence, accounting for the application of NA within it. Out of the four possibilities, [$_{Xmax}$ is the only one that makes the right predictions.

(5b)   iru ordu berandu-ago = (o)śatu suen

        three hours later comp. complete aux.

        'he/she completed it three hours later'

(5b')

VP$_8$

AdvP$_7$ V$_6$

QP$_4$ Adv$_5$

Q$_3$ NP$_2$

N$_1$

iru ordu berandu-ago =(o)śatu suen

[$_3$ [$_1$ [$_5$ [$_6$ [$_X$ *
[$_8$[$_7$[$_4$ [$_2$ [$_{Xmax}$ok
              ]$_1$]$_5$]$_6$]$_X$ *
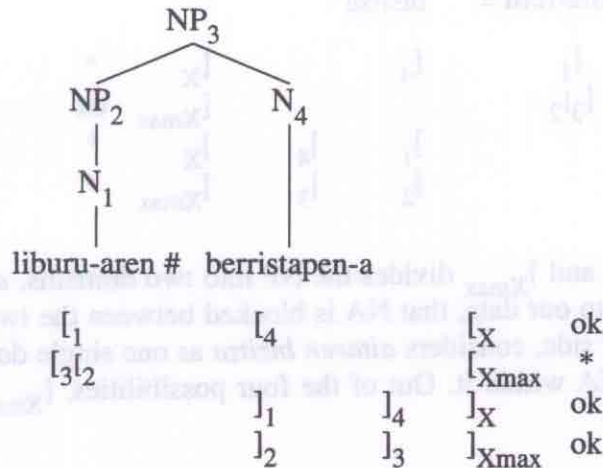   ]$_2$]$_4$]$_7$]$_8$]$_{Xmax}$ *

In the same way as with (5a), in (5b), [$_{Xmax}$ makes the right prediction by considering the whole VP as a single domain within which VD applies.[7] However, while so far [$_{Xmax}$ is able to

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[7] Following Txillardegi (1987), I have assumed that auxiliaries cliticize to the main verb.

make the right predictions, it fails to do so in (6), where the three other possibilities predict the right output:

(6)   liburu-aren # berristapen-a
        book   of   renovation ART
        'the renovation of the book'

(6')

$$NP_3$$

$$NP_2 \qquad N_4$$

$$N_1$$

liburu-aren # berristapen-a

$[_1$	$[_4$	$[_X$	ok
$[_3[_2$		$[_{Xmax}$	*
$]_1$	$]_4$	$]_X$	ok
$]_2$	$]_3$	$]_{Xmax}$	ok

Contrary to the data, $[_{Xmax}$ takes the NP as a domain within which NA is predicted to apply. $[_X$, $]_X$, $]_{Xmax}$, on the other hand, divide NP_3 into two domains, (*liburuaren*) and (*berriztapena*), thus accounting for the non application of NA.

To summarize, we have seen that even though an EBT accounts for some data, it does not account for all of it as shown in the case of (6). It is also unable to account for the differences in the behavior of NA in (5a) and (6) because even though both examples have identical tree-structures, NA only applies in (5a). Hence the EBT fails. I will present an alternative theory within Phrasal Phonology namely, a Relation-based theory (RBT) which bases the determination of PPR application on the various kinds of relationships between elements.

3.2. Relation-based theory

Relation-based theory (RBT) establishes the various kinds of relationships holding between the constituents contained in a derived phonological domain as the criteria for determining the applicability of PPRs (Hayes 1984, Nespor and Vogel 1986).

According to RBT, a derived phonological domain consists of an X (the head of a constituent) and Y, which is the complement(s) of X within XP ($[X ... Y]_{XP}$). For RBT, it is the relationships holding between the head (X) and its complements (Y) that are relevant for the determination of the applicability of PPRs. Head and complements may stand in an *argument-to-head* relationship or in an *adjunct-to-head* relationship. An *argument* is an element which is subcategorized for by its head, i.e. in 'he gave John the book', the NPs that follow the verb are its arguments; in 'he put the book on the table' the NP and PP are arguments of "put". *Adjuncts* or *modifiers* in Jackendoff's terms (1977), "contribute to the main assertion of the head", and are not subcategorized for by the head, i.e. in 'pretty girl' the adj P is an adjunct of "girl"; in 'he ran clumsily' the adv P is an adjunct of "run".[8] In GBB, when head and complement stand in an
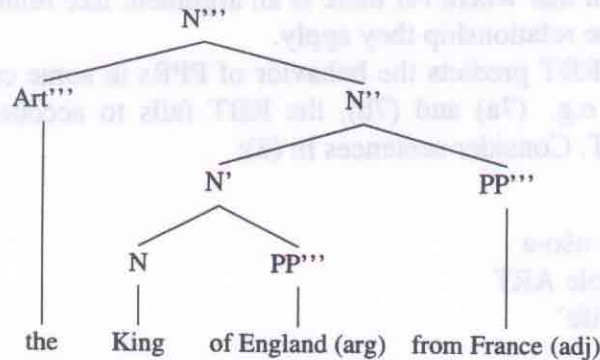
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[8] According to Jackendoff, not only do arguments and adjuncts play different semantic roles, but they also have different tree representations. While arguments are attached to the node X' and are close to their heads, adjuncts are
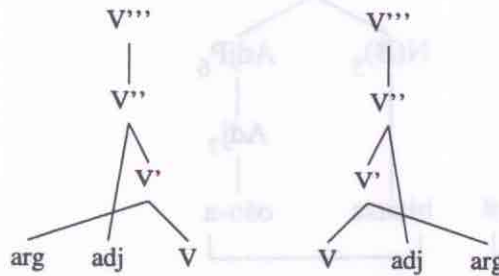
argument-to-head position, PPRs are blocked; when they are in an adjunct-to-head position they apply.[9] By means of the functional distinction of argument and adjunct, the RBT is able to account for the difference in the behavior of PPRs in (5a) and (6), repeated here as (7a) and (7b) and which the EBT could not account for:

(7a) aitarem bisitsa   (7b) liburuaren beRistapen-a
      father of life   book of renovation ART
      'father's life'   'the renovation of the book'

attached to the X'' node: (Jackendoff:1977:59)

I believe the syntactic property which differentiates arguments from adjuncts in the tree structure to be untenable, at least for Basque. If we accepted the syntactic property of arguments and adjuncts as represented in the above given tree, we would obtain the following ill formed tree structures in Basque:

Hence, I restrict the notions of argument and adjunct to *exclusively semantic roles*.

[9] The behavior of PPRs based on the relationship between two constituents is language specific. In GBB, arguments block the application of PPRs while adjuncts do not. In Korean, the reverse situation holds. In the latter, obstruent fortition (indicated by an apostrophe) applies if the two elements in question stand in an argument to head relationship (1). If they stand in an adjunct to head relationship then obstruent fortition blocks (2) (Yoon,1988).

1) k'os kati →   .. k'ati
   flower like
   'like a flower'
2) toy-tolok sokhi → ...*s'ok..
   if possible quickly
   'as quickly as possible'
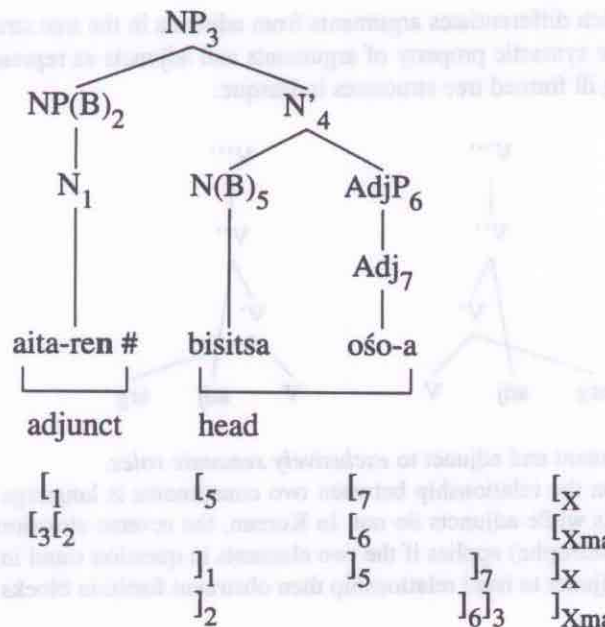
(7a')   aita-re**m** =   bisitsa   (7b')   liburu-aren#   beRistapen-a
        ⌊_____⌋   ⌊_____⌋   ⌊_____⌋   ⌊_____⌋
         adjunct   head   argument   head

The relationship between *aitaren* and *bizitza* is different from the one between *liburuaren* and *berriztapena*. The latter case can be thought of as an abbreviation of a whole sentence, "the book renovates something", where "book" is an agent and is therefore responsible for the renovation or revision of, let's say, a theory. In this case there is an argument like relationship between the complement *liburuaren* and its head *berriztapena*. In this case, NA is blocked in (7b). In (7a), similar paraphrases cannot be given because *aitaren* plays a different role within the NP than *liburuaren*. *Aitaren* is a modifier, an adjunct of *bizitza* and thus, NA applies. Consequently we conclude from these data that whenever there is an argument like relationship PPRs are blocked; if there is an adjunct type relationship they apply.

However, while a RBT predicts the behavior of PPRs in some cases where an EBT makes the wrong predictions, e.g. (7a) and (7b), the RBT fails to account for some data which is accounted for by an EBT. Consider sentences in (8):

(8a)   aita-ren # bisitsa ośo-a
        father of life whole ART
        'father's whole life'

(8a')

$$NP_3$$

NP(B)$_2$ ————— N'$_4$

N$_1$ N(B)$_5$ AdjP$_6$

                    Adj$_7$

aita-ren #   bisitsa   ośo-a
⌊_____⌋   ⌊_____⌋
 adjunct   head

[$_1$	[$_5$	[$_7$	[$_X$	ok
[$_3$[$_2$		[$_6$	[$_{Xmax}$	*
]$_1$	]$_5$	]$_7$	]$_X$	ok
]$_2$		]$_6$]$_3$	]$_{Xmax}$	ok

(8b)   berandu eta triste # eltsen badira.
        late   and sad   arrive if aux.
        'if they come late and sad'

(8b')


```
                          VP₈
                ┌──────────┴──────────┐
             AdvP₇                  V(B)₆
        ┌─────┼─────┐                 ╱╲
     AdvP₄   c₂  AdvP(A)₅            ╱  ╲
       │           │
     Adv₁        Adv₃
       │           │
   berandu  eta  triśte  # eltsen badira
   └──────────┬──────────┘  └─────┬─────┘
           adjunct              head

     [₁      [₂      [₃          [₆        [X      ok
   [₈[₇[₄            [₅                    [Xmax    *
             ]₁      ]₂          ]₃   ]₆   ]X      ok
             ]₄            ]₅]₇   ]₈        ]Xmax   ok
```

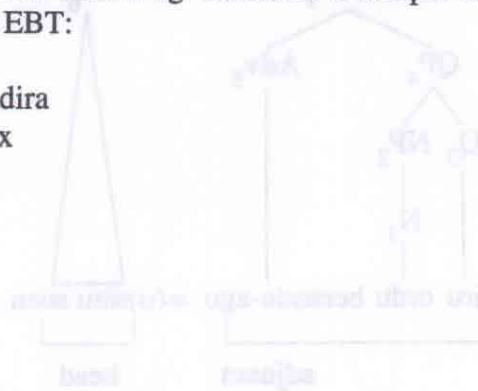According to a RBT, NA and VD should apply in (8a) and (8b) respectively because complements and heads stand in an adjunct-to-head relationship. However, as the data show, both rules are blocked and consequently the RBT fails to account for sentences like the above. An EBT, on the other hand, perfectly accounts for the behavior of PPRs in (8a) and (8b) by means of $[_X$, $]_X$ or $]_{Xmax}$ which divide the NP and the VP into two different domains respectively, *aitaren* and *bizitza osoa*; and *berandu eta triste* and *heltzen badira* between which, PPRs are blocked.

So far I have provided data which one of the two theories accounts for and which the other cannot account for, and viceversa. The following constitute a sample of data which cannot be accounted for by either a RBT or an EBT:
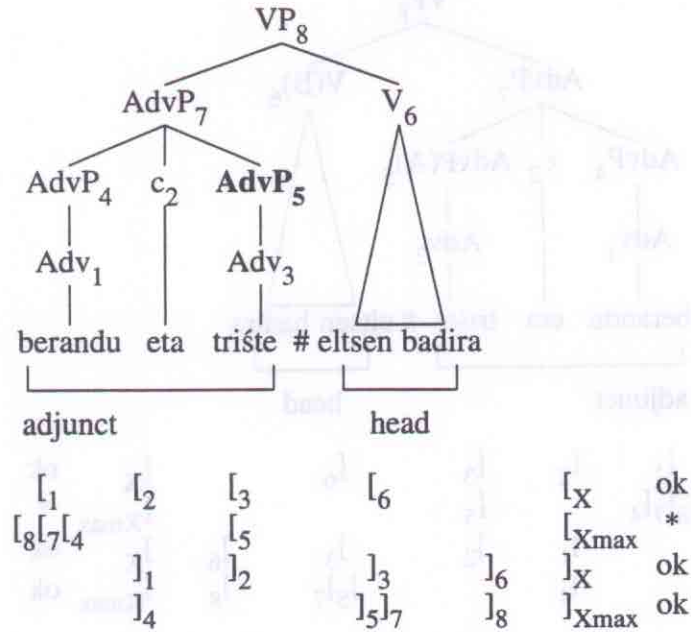
(9a)   berandu eta triśte # eltsen badira
        late   and sad   arrive if aux
        'if they arrive late and sad'

(9a')


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            VP_8
          /      \
      AdvP_7      V_6
      /  |  \      /\
  AdvP_4 c_2 AdvP_5  / \
    |         |     /   \
  Adv_1     Adv_3  /     \
    |         |   /_____\
 berandu  eta triśte # eltsen badira
 |_____|      |_____|
      adjunct                head
```

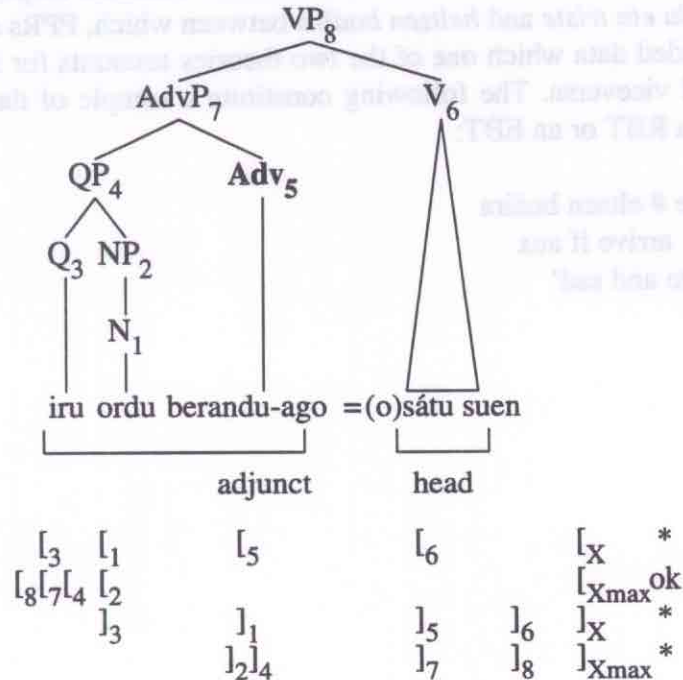|					
$[_1$	$[_2$	$[_3$		$[_6$	$[_X$ ok
$[_8[_7[_4$		$[_5$			$[_{Xmax}$ *
	$]_1$	$]_2$	$]_3$	$]_6$	$]_X$ ok
	$]_4$		$]_5]_7$	$]_8$	$]_{Xmax}$ ok

(9b)   iru ordu berandu-ago = (o)śatu suen
        three hours late   comp.   complete aux.
        'he/she completed it three hours later'

(9b')


```
              VP_8
            /      \
        AdvP_7      V_6
        /    \       /\
     QP_4    Adv_5  / \
     /  \      |   /   \
   Q_3  NP_2   |  /     \
         |     | /       \
        N_1    |/_____\
  iru ordu berandu-ago  =(o)śatu suen
  |_____|  |_____|
        adjunct            head
```

$[_3$	$[_1$	$[_5$		$[_6$	$[_X$ *
$[_8[_7[_4$	$[_2$				$[_{Xmax}$ ok
	$]_3$	$]_1$	$]_5$	$]_6$	$]_X$ *
		$]_2]_4$	$]_7$	$]_8$	$]_{Xmax}$ *

In (9a) and (9b), both Adv P_7 are modifiers or adjuncts of their respective heads, thus, a RBT contrafactually predicts that VD applies in both examples. An EBT selects $[_X$, $]_X$ or $]_{Xmax}$ as the criteria which make the right predictions in (9a), but in (9b), the three of them fail to make the right predictions. Therefore, neither theory accounts for the data. Both theories should be

abandoned in favor of a more satisfactory analysis.

4. A New Proposal: a Phrasal Formation Rule

In section 3 it was shown that neither an EBT nor a RBT can account for the whole set of data. In this section, it will be shown that their failure should not lead to their total rejection as valid frameworks since the success of the analysis to be presented here, partially resides on the claims made by both theories. I posit a Phrasal Unit Formation Rule (PUFR) which encompasses (i) syntactic notions such as c-command, categorial rank and reference to the ends of the constituents -the latter two were considered by the EBT; and, (ii) functional notions like argument and adjunct -borrowed from the RBT. The PUFR is presented below:

Phrasal Unit Formation Rule (PUFR): PPRs are blocked at the right end of Xmax in the domain of application:

$$[..(Z)..Xmax \#...(Z)..]_{YP}$$

(i) if Xmax is not in mutual c-commanding relationship with Y or if
(ii) Xmax is an argument of Y (the head of YP), where Y can precede Xmax as in [$Y..Xmax]_{YP}$ or follow it as in [$Xmax...Y]_{YP}$.[10]

Hence, given either conditions in PUFR, PPRs are blocked at the right end of Xmax regardless of where the head Y is or whether there is another element, i.e. Z, between Y and the Xmax considered.
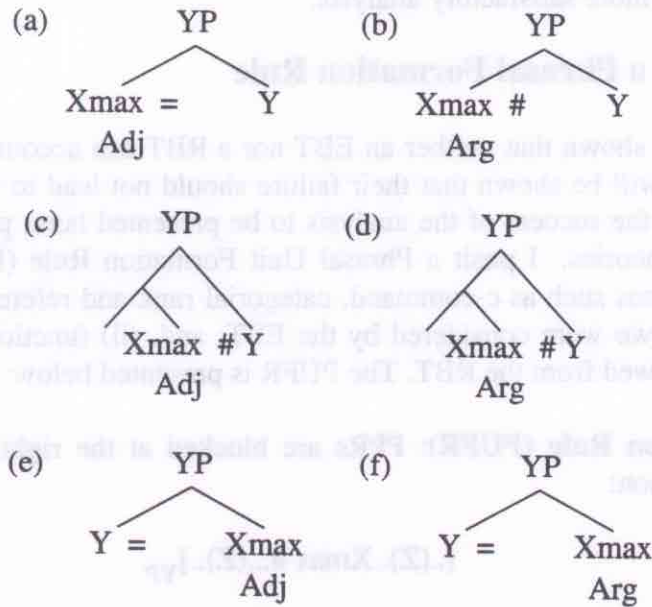
The PUFR would make the following predictions in trees (a-f):

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[10] An alternative analysis to the one given would explicitly account for the cases where PPRs *apply* instead of where they are blocked. If a PUFR were to be formulated in this way, it would take the following form:

"PPR applies within the domains given below:
a) [.... Xmax = Z Y]$_{YP}$ where Z is anything, including zero
   [.....Y Xmax = Z]$_{YP}$
   if Xmax is an adjunct in a mutually c-commading relationship with Y.

b) [....Y = Xmax Z]$_{YP}$
   if Xmax is a complement in a mutually c-commanding relationship with Y."

The rule as it stands presents several drawbacks: firstly, not only does it have to refer to the domain of rule application three times, but it also has to specify the internal composition of the domain in each of the cases; secondly, it does not capture the generalization whereby an Xmax must always be in mutual c-commanding relationship with Y; thirdly, it is far too complicated. As a result of the above, the formulation presented in the text is more appropriate than the one presented here.

```
(a)        YP              (b)          YP
          /  \                         /  \
    Xmax =    Y               Xmax #    Y
    Adj                       Arg

(c)        YP              (d)          YP
          /  \                         /  \
   Xmax # Y                    Xmax # Y
   Adj                         Arg

(e)        YP              (f)          YP
          /  \                         /  \
    Y =    Xmax               Y =     Xmax
           Adj                        Arg
```

In (a) and (b), condition (i) is not met, Xmax and Y are in a mutually c-commanding relation-ship, however, since Xmax and Y stand in an argument-to-head relationship in (b), PPR is blocked in (b) but not in (a) as predicted by PUFR. In (c) and (d), condition (i) is met therefore, regardless of whether complement and head stand in an argument-to-head or adjunct-to-head relationship, PPRs are blocked in both cases. Finally in (e) and (f), PPRs are applied after Y because they are only blocked at the right end of Xmax and Y is a lexical category and not an Xmax. In short, given the assumption that Xmax (specified here as argument or adjunct) and head (Y) are in a mutually c-commanding relationship, the PUFR makes the following predic-tions:

(a) (Y) = (Z) arg   ] # (Z) (Y)
(b) (Y) = (Z) adj   ] = (Z) (Y)

where PPRs are blocked at the right ends of an Xmax when it is an argument (a), but not when it is an adjunct (b). Furthermore, if the head is at the left of the Xmax, with or without an interven-ing element (Z), the PUFR predicts by default that PPRs will apply after Y.

The types of information encoded in condition (i) and condition (ii) in the PUFR will be dealt with separately in the remainder of this section.

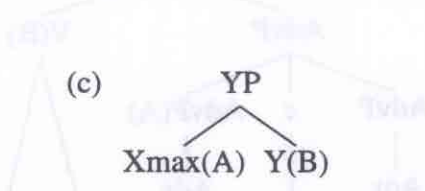## 4.1. Information on syntactic notions: c-command and rank distinction

Condition (i) of PUFR, "PPRs are blocked at the right end of Xmax in the domain of appli-cation, if Xmax is a complement not in mutual c-commanding relationship with Y", makes cru-cial use of the notions of *c-command* and of *rank distinction* (Xmax as opposed to X).

By c-command I mean:

"Node A c(constituent)-commands node B iff the first branching node immediately dom-inating A also dominates B" (Reinhart:1981).
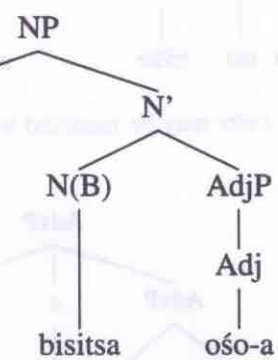
```
              Xmax
             /    \
            A      B
```

The constituents considered by the PUFR, namely Xmax and Y (the head of YP) can be in three different types of relationships in terms of c-command:

(a)
```
            YP
           /  \
     Xmax(A)  Y(B)
```

(b)
```
            YP
           /  \
        X(A)  Y(B)
```

(c)
```
            YP
           /  \
      Xmax(A) Y(B)
```

In (a), Xmax (A) c-commands Y(B), but Y does not c-command Xmax. In (b), the reverse is given, namely, Y, the head of YP c-commands A but A does not c-command B. Finally in (c), Xmax and Y mutually c-command. The following GBB data instantiate the three different types of relationships I have referred to above and which condition (i) of PUFR makes predictions for:[11]

(1) A c-commands B, but B does not c-command A. Hence, A # B

(10)   aita-ren   # bisitsa ośo-a
        father of life whole ART
        'father's whole life'

(10')

```
                        NP
                       /  \
                  NP(A)    N'
                    |     /  \
                    N   N(B)  AdjP
                    |    |     |
                    |    |    Adj
                    |    |     |
             aita-ren # bisitsa ośo-a
```

_____

[11] In the following examples, the Xmaxs and heads of the constituents that contain them both are all in an adjunct to head relationship so that the blockage of PPRs cannot be attributed to functional notions or condition (ii) in PUFR.

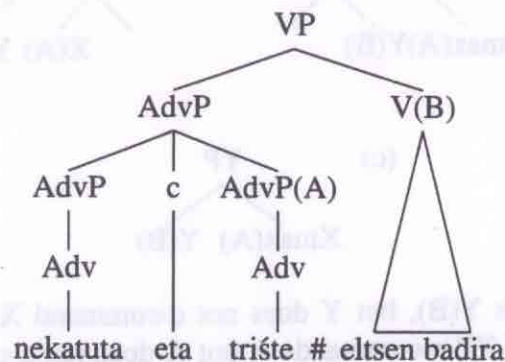Node A (an Xmax) c-commands node B (the head of the NP that contains them both) because the branching node immediately dominating A also dominates B. However, B does not c-command A because the first branching node dominating B dominates Adj P but not node A. Therefore, as predicted by the PUFR, the sandhi rule is blocked.

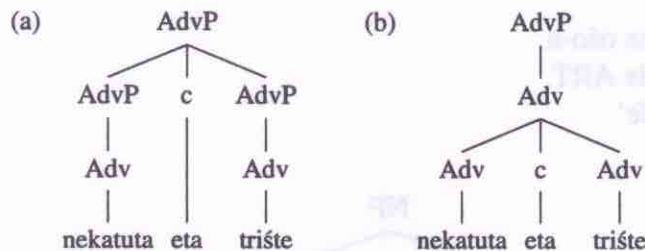(2) B c-commands A, but A does not c-command B. Hence, A # B

(11)   nekatuta eta triśte # eltsen badira
        tired   and sad   come if aux.
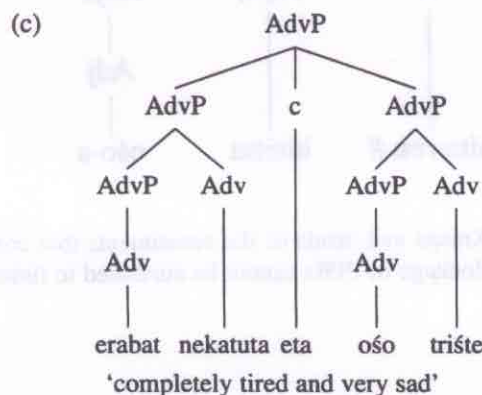   'if they come tired and sad'

(11')

The first branching node dominating B dominates A, but the reverse, is not true, i.e. the first branching node dominating A does not dominate B, hence the sandhi rule is again blocked.[12]

---

[12] A priori, the coordinate structure *nekatuta eta triste* may have two possible representations:
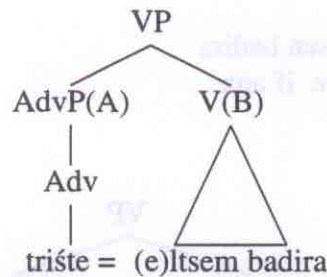

However, the fact that both *nekatuta* and *triśte* may be modified within the coordinate structure indicates that tree structure (3) is the most appropriate one:

'completely tired and very sad'

(3) A c-commands B and B c-commands A. Hence A = B

(12a)   triśte =   (e)ltsem badira
          sad   come if aux
          'if they come sad'

(12a')

VP
├── AdvP(A)
│   └── Adv
│   └── triśte
└── V(B)
    └── = (e)ltsem badira

(12b)   aita-re**m** =   bisitsa
          father of   life
          'father's life'

(12b')

NP
├── NP(A)
│   └── N
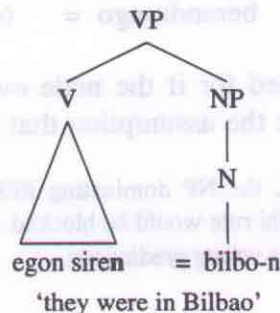│   └── aita-re**m** =
└── N(B)
    └── bisitsa

In both examples, node A and B mutually c-command each other and PPRs apply.

The relevance of c-command as encoded in PUFR has been shown in examples (10) through (12).[13] In the remainder of this subsection I will present some data which illustrate *rank*

---

[13] I am aware of the existence of other interpretations of the c-command relation. For instance, there is Kaisse's notion of the c-command relation: domain c-command. However such a notion is inappropriate for the GBB data as it will be shown below. Kaisse claims that a PPR applies between two words if they are in a c-commanding relationship - that is, in a domain c-commanding relationship. Domain c-command is defined as follows:

"In the structure [..... α ......], Xmax is defined as the domain of α . Then α c-commands any β in its domain."(Kaisse: 1985). Given the following tree structure:

VP
├── V
│   └── egon siren
└── NP
    └── N
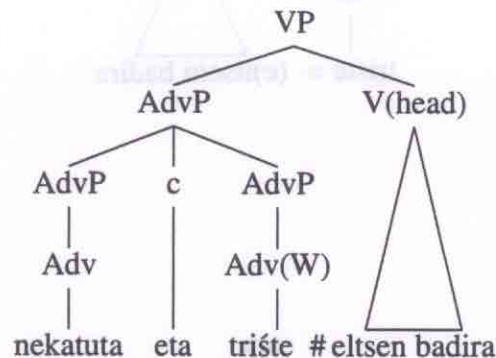   └── = bilbo-n

'they were in Bilbao'

distinction as a crucial element of PUFR.

The node over which conditions (i) and (ii) of PUFR are defined is an Xmax. If such an element were an X (a lexical category) - i.e. W - instead of a maximal projection, PUFR would not be able to account for the following data because, elements **W** and **V** (head) would not be in a mutually c-commanding relationship, and hence, PUFR would predict the non application of VD in (13a) and (13b):
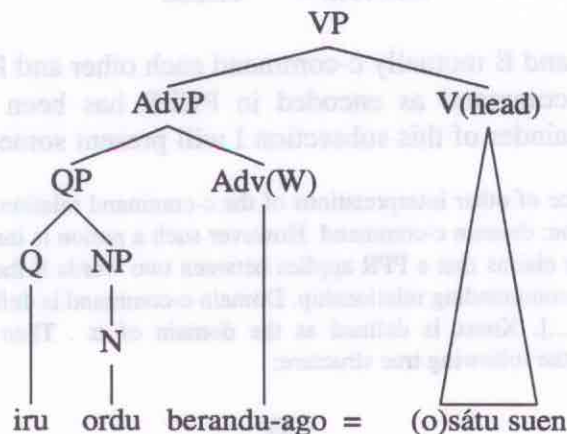
(13a)   nekatuta eta triśte   # eltsen badira
        tired   and sad   arrive if aux.
        'if they come tired and sad'

(13a')

VP
├── AdvP
│   ├── AdvP
│   │   └── Adv
│   │   └── nekatuta
│   ├── c
│   │   └── eta
│   └── AdvP
│   └── Adv(W)
│   └── triśte
└── V(head)
    └── # eltsen badira

(13b)   iru ordu berandu-ago = (o)śatu suen
        three hours later comparative complete aux.
        'he completed it three hours later'

(13b')

VP
├── AdvP
│   ├── QP
│   │   ├── Q
│   │   │   └── iru
│   │   └── NP
│   │   └── N
│   │   └── ordu
│   └── Adv(W)
│   └── berandu-ago =
└── V(head)
    └── (o)śatu suen

These two examples are accounted for if the node over which conditions (i) and (ii) are defined is a *maximal projection*, given the assumption that whenever there are two Xmaxs, the

---

According to Kaisse's notion of c-command, the NP dominating *Bilbon* would prevent the N from domain c-commanding the V and consequently, the sandhi rule would be blocked. However, that is not the case since the NA actually applies. Domain c-command makes the wrong predictions.

lowest is taken as the reference point. That is, in (13a), the lowest Adv P, *triste*, and the head of the VP do not mutually c-command each other, so PUFR correctly predicts that VD is blocked. In (13b), on the other hand, the lowest Xmax within the VP is the Adv P *hiru ordu beranduago*. Since the Adv P and its head are in a mutually c-commanding relationship, VD applies as predicted by the PUFR. Hence, the specification in PUFR of the categorial rank of the elements which are likely to undergo the application of PPRs is crucial.

4.2. Information on functional relations: adjunct vs argument

A RBT bases its predictions on the types of functional relationships holding between *complements*[14] (Xmax) and their *heads* (Y). The PUFR also considers functional relations as one of the determining factors for the prediction of the behavior of NA and VD as stated by condition (ii): "PPRs are blocked at the right end of Xmax in the domain of application if Xmax is an argument."[15] The rule as it stands accounts for the following set of data which exhaustively considers all the logical possibilities as far as the position of the head (head initial, medial, final) and number of complements (one or two) is concerned. The whole set of data to be considered here can be schematicized as follows: (H stands for the head Y, and C for the complement Xmax)

1 complement: C H (Xmax Y)
                   H C (Y Xmax)

2 complements: C C H (Xmax Xmax Y)
                    C H C (Xmax Y Xmax)
                    H C C (Xmax Xmax Y)

I will first consider the behavior of PPRs in head-final and head-initial one complement-constituents and how the PUFR accounts for it.[16]

1 Complement

a) Head final:

(14a)   arg # H: ume-a # agurtu suen
                          child ART   greet aux.
                          'he/she greeted the child'
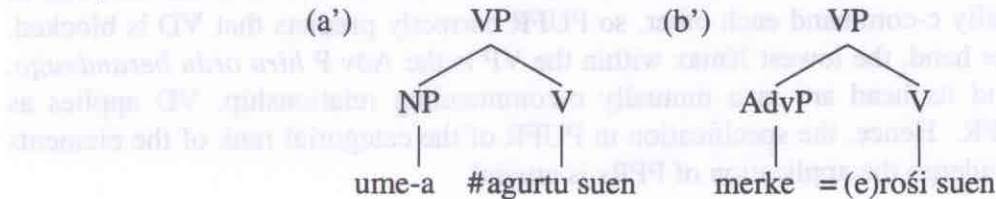
(14b)   adj = H: merke = (e)rośi suen
                          cheap buy aux.
                          'he/she bought it cheap'

---

[14] Complement is the neutral term for argument and adjunct.

[15] It also incorporates the notion of categorial rank, but it has already been dealt with.

[16] In these examples complements and head are in a mutually c-commanding relationship.

(14a'-b')

(a')	VP	(b')	VP

(a')
VP
NP   V
ume-a   #agurtu suen

(b')
VP
AdvP   V
merke = (e)roŝi suen

b) Head initial:

H = arg:(15)   (a)   ipini = (i)nguruan
                       put around
                       'put it around'

H = adj: (b)   aurkitu zenue**m** = bilbo-n?
                       find aux. Bilbao in
                       'did you find it/him/her in Bilbao?'

According to PUFR, PPRs are blocked at the right end of Xmax if Xmax is an argument (14a), but it applies if it is an adjunct (14b). Since heads (H) are not maximal categories both VD and NA apply in (15a) and (15b) respectively.

So far, the pattern that arises is asymmetric: adjunct and argument are differentiated in head-final constituents, but not in head-initial constituents:

arg #   H   adj =   H
   H =   arg   H   = adj

Asymmetries of this type can also be found in other languages. Hung (1987), for instance, reports the case of Fuzhou which also has an asymmetric pattern. However, while in GBB the distinction of argument and adjunct is lost in head-initial constituents, such a distinction is maintained in the whole paradigm in Fuzhou;

arg #   H   adj =   H
   H =   arg   H   # adj

The asymmetric pattern which arises in the behavior of PPRs in head-final constituents and in head-initial constituents in GBB directly results from the PUFR, which, as it has previously been said, affects the right end of Xmaxs only, ensuring the application of VD and NA between head and the complement that immediately follows it.

I will now consider the behavior of PPRs in constituents with two complements and the predictions provided by PUFR.

2 Complements

a) Head final (C C H):[17]

---

[17] It may not be clear why I have considered the indirect object *anaiari* an argument (16a). A morphological

arg # arg # H:(16)   (a)   ipuin-a # anai-ari   # irakur iesaiokesu
                             tale ART brother to read aux.
                             'you may read the tale to brother'

adj = adj = H: (b)   mendi-am = bespera-m =   bildu-ko gara
                             mountain in previous day in gather fut aux.
                             'we shall gather in the mountain the day before'

arg # adj = H: (c)   ume-a # aitsulo-am = bilatu suen
                             child Art cave in find aux.
                             'he/she found the child in a cave'

adj = arg # H: (d)   mendi-am = bisikleta # aurkitu suen
                             mountain in bicycle find aux.
                             'he/she found the bicycle in the mountain'

As far as C C H constituents are concerned, Phrasal Phonological rules parallel the behavior of PPRs found in head-final constituents with one complement. In other words, in C C H constituents, the functional notions of argument and adjunct determine the behavior of PPRs.

It is interesting to note that, in order for the semantic function between a complement and its head to occur, complement and head *need not be syntactically adjacent,*[18] as the schematic account of the above given examples shows:

C_1 C_2 H

arg # C_2 H (16a,c)

adj = C_2 H (16b,d)

The complement immediately preceding the head (C_2) does not prevent the first complement (C_1) from taking its functional role with respect to the head as the behavior of PPRs show: in (16a) and (16c) PPRs are blocked because C is an argument and in (16b) and (16d) where it is an adjunct, they apply.

b) Head medial:

arg # H = arg:(17)   (a)   ipuin-a # asaldu siom = botikari-ari?
                             tale ART explain aux. pharmacist to
                             'did he/she explain the tale to the pharmacist?

---

analysis of the auxiliary, starting from the right, -su: 2nd per.sing.subject; -ke: potential; -o: 3rd per.sing.I.O; -i: 3rd per.sing.DO; shows that information on the indirect object is marked in it. However, this does not entail that information on nominals is always marked in the auxiliaries - locatives, for instance, are not marked. It seems that in Basque, indirect objects behave more like direct objects than like other nominals. Hence, it can be said that in Basque, indirect objects are arguments of the verb.

[18] This corresponds with the content of footnote 8, where I argued against the syntactic characterization that Jackendoff attributes to arguments and adjuncts.

adj = H = adj: (b)   bilbom = bildu sirem = bespera-n
                         Bilbao in gather aux the previous day on
                         'they gathered in Bilbao the day before'

arg # H = adj: (c)   ume-a # aurkitu sutem = bide-an?
                         child ART find aux way in
                         'did they find the child in the way?'

adj = H = arg: (d)   aitsulo-am = bilatu sutem = bikote-a
                         cave in find aux. couple ART
                         'they found the couple in the cave'

Condition (ii) of PUFR accounts for the above given examples. C H C constituents encompass the patterns pertaining to C H constituents, where phrasal phonological rules behave differently depending on whether the complement is an argument or an adjunct, and also, the ones pertaining to H C where phrasal phonological rules always apply regardless of whether the complement is an argument or an adjunct. Finally, I will consider head-initial constituents:

c) Head initial:

H = arg # arg:(18)   (a)   erosi siom = botila # anaia-ri?
                             buy aux. bottle brother to
                             'did he/she buy the bottle for brother?'

H = adj = adj: (b)   bildu sirem = biaramuneam = Bilbo-n?
                         gather aux. the next day on Bilbao in
                         'did they gather on the next day in Bilbao?'

H = arg # adj: (c)   ekaRi suem = papera # astelenea-n?
                         bring aux. paper Monday in
                         'did he/she bring the paper on Monday?'

H = adj = arg: (d)   ikusi sutem = bilbom = bikote-a?
                         see aux.   Bilbao in couple ART
                         'did they see the couple in Bilbao?'

As stated, PUFR only affects Xmaxs. Since H is at the left of an Xmax, PPRs apply between H (a lexical category or X) and the Xmax that comes after it as (18a) and (18b) show. It should be noted that the relationship between H and C_1 is reflected on the behavior of PPRs occurring between C_1 and C_2 as the following schema of sentences (18a) through (18d) show:

H C_1 # C_2 (18a) and (18c)
    argument

$$H \qquad C_1 = C_2 \text{ (18b) and (18d)}$$
$$\text{adjunct}$$

Moreover, if there were another complement next to C_2 within the same domain of application, the relationship between H and C_2 would be reflected on the behavior of PPRs between C_2 and C_3. Therefore, the PUFR would make the following predictions:

$$H = \text{arg} \# \text{arg} \# C_3$$

$$H = \text{adj} = \text{adj} = C_3$$

$$H = \text{arg} \# \text{adj} = C_3$$

$$H = \text{adj} = \text{arg} \# C_3$$

The following chart gives an schematic account of all the logical possibilities considered here and which are accounted for by condition (ii) of PUFR.

1 complement

a) C H
    arg # H
    adj = H

b) H C
    H = arg
    H = adj

2 complements

a) C C H
    arg # arg # H
    adj = adj = H
    arg # adj = H
    adj = arg # H

b) C H C
    arg # H = arg
    adj = H = adj
    arg # H = adj
    adj = H = arg

c) H C C
    H = arg # arg
    H = adj = adj
    H = arg # adj
    H = adj = arg

To summarize, in this section I have proposed an analysis which accounts for the GBB data. This analysis is an enriched version of an EBT and a RBT because not only does it make reference to the ends of the constituents, rank distinction and functional relations but also it considers the notion of c-command.

5. Stress and PPRs

So far we have seen that semantic and syntactic notions influence the behavior of PPRs. In this section, I will show the effects that a phonological process, stress, has on the applicability of PPRs.

In connected speech the stress pattern is somewhat flexible provided that *there are not two adjacent stressed syllables.*

Thus for example, in isolation [ór] 'there' and [dáuka] 'has' are stressed. However, since in connected speech the sequence of these two words would create an impermissible stress sequence - *[ór dáuka] 'he/she has it there', Basque speakers take one of the two following solutions:

(a)   One of the words, in this case *hor* [or], loses its own stress and cliticizes to the next word: [ordáuka].[19]

(b)   The stress of the second word shifts to the end of the word: [ór dauká].[20]

The constraint on the stress pattern in connected speech has a direct bearing on the applicability of PPRs. That is, whenever the application of VD results in an impermissible stress sequence or whenever the distance between two adjacent stressed syllables is reduced by virtue of NA application, VD and NA do not apply.

a) Vowel degemination:

cv$cv́   v$cv́$cv → * cv$cv́$cv́$cv   then

cv$cv́ # vcv́$cv

b) Nasal assimilation:

*cv$cv́n bv́(c) → * cv$cv́m$ bv́(c) then

cv$cv́n //# bv́(c)[21]

The application of VD between two words creates the unacceptable sequence. In the case of NA, it already existed prior to the application of NA. Since the non application of NA is not sufficient to prevent the occurrence of the two adjacent syllables a *pause* is inserted. The data below show the behavior of PPRs in relation to the stress pattern constraint. In the same way as in section 3, I will consider one complement constituents and then two complement constituents.

1 Complement:

a) C H

arg # H: PPRs always block in this position.

adj ? H:(19)   (a)   #:   eún litró # odól
                               hundred litre blood
                               'one hundred litres of blood

---

[19] Txillardegi (1987) gives this manifestation.

[20] My informant, Joseba Gabilondo, preferred solution (b) to solution (a).

[21] Not only does the rule block but also a pause is inserted.

(b)   =:   merké = (e)rosí suen

                  cheap buy aux.

                  'he bought it cheap'

If VD applied as predicted by the PUFR in (19a), its outcome would result in two adjacent stressed syllables, namely, *[eún litródól], and therefore, VD does not apply as reflected in our judgments.

    In section 2 I claimed that the second vowel, rather than the first, gets deleted by VD. (19b) seems to provide evidence supporting such a claim. In (19b), after the application of VD, [érosí] is stressed on [e] and [i]. Since [e] was not stressed prior to the application of VD it seems reasonable to believe that VD affects the second vowel instead of the first one. In any case, it is not crucial for the PUFR whether it is the first or the second vowel that gets deleted by VD.

b) H C

H ? arg: (20)   (a)   #:   (su) sará # amá

                                  (you) are mother

                                  you are the mother'

                (b)   =:   (su) sará = (a)dministratsáileá

                                  (you) are administrator

                                  'you are the administrator'

H ? adj: (c)   #:   begí # isúgaRi-ak

                                  eye marvelous ART

                                  'the marvelous eyes'

                (d)   =:   egón-gela = (a)undí bat daukágu

                                  be room ART big one have we

                                  'we have a big sitting room'

    It should be noticed that according to the analysis proposed in section 4, neither the syntactic nor the semantic criteria prevented PPRs from applying between H and its immediate complement (H = C). However, the phonological information on stress affects rule application between the head and its following complement, preventing PPR from applying in (20a) and (20c).

2 Complements

a) H C C[22]

H ? arg # adj:(21)   (a)   #:   ba # áldakí # irákurtsen # adj?

                                      know   read

                                    'does he/she know how to read?'

---

[22] In order to see if our hypothesis regarding the stress pattern works between the word *irakurtzen* and a following adjunct (21a), the adjunct should stressed and its first consonant should be a bilabial. I have not been able to find a word with these characteristics and which would be suitable for this context.

	(b)	=:	badáki = (i)rákurtsen # adj.
			know read
			'he/she knows how to read'

H ? adj ?adj:

	(c)	#:	ekáRi-ko dusú # udáskene-an ? adj
			bring fut. aux. fall in
			'will you (sing) bring it in the fall?'

	(d)	=:	ekáRi-ko dusúe = (e)dalóntsi-an ? adj
			bring fut aux glass in
			'will you (pl.) bring it in the glass?'

H ? arg # arg (it is the same as (21a) and (21b))

H ? adj ? arg: (it is the same as (21c) and (21d))

Once again these examples illustrate that the generalization H = C does not hold whenever the stress pattern is violated.

b) C H C

arg # H ? arg: (22)

	(a)	#:	anaia-k ba áldakí # irákurtsen?
			brother know read
			'does brother know how to read?'

	(b)	=:	anaia-k badáki = (i)rákurtsen
			brother knows read
			'brother knows how to read'

arg # H ? adj:

	(c)	#:	ardo-a ekáRi-ko dusú # udáskene-an
			wine bring fut. aux. fall in
			'will you (sing) bring the wine in fall?'

Due to the restrictions on the data available, I have not provided examples of adj H adj and adj H arg. However, the given examples clearly show that whenever the application of PPRs creates a sequence which violates the stress pattern, PPRs are blocked.

c) C C H

arg # arg # H (PPRS are always blocked)

adj ? adj ? H: (23)

	(a)	#:	bilbón # bárt ikusi zuen
			bilbao in yesterday night see aux.
			'he saw him/her yesterday night'

In the above given examples, I have shown that restrictions on the stress pattern condition the applicability of PPRs. It follows that phonological information on the stress pattern needs to be encoded into our PUFR. There are two possible ways in which this information can be included in our general rule:

(a)   The phonological information on stress is incorporated in the PUFR:

Vowel degemination: "a vowel is deleted whenever it is preceded by the same vowel both within a word and across word boundaries, provided that the application of VD does not create a sequence of two stressed vowels".

Nasal assimilation: "n assimilates to the place of articulation of the next consonant iff the nasal occurs in an unstressed syllable".

(b)   The information is added to the general conditions in the PUFR:

"PPRs are blocked at the end right end of Xmax in the domain of application

$$[..(Z)...Xmax ..(Z)..]_{YP} \quad \text{if Xmax}$$

a) is not in mutual c-commanding relationship with Y, or if

b) Xmax is an argument of Y or,

c) whenever the last syllable of Xmax is stressed and the first or the second syllable is stressed too.

The latter way of handling the restriction on the stress pattern is clearly the most appropriate one because (i) this analysis is applicable to other PPRs without having to specify the conditions on stress in each of the rules;[23] ii) it captures the general idea of the existence of an overruling stress pattern in the language which the former rule formulation does not capture.

Conclusion

The failure of the phonological component to determine the behavior of PPRs led to the positing of an analysis which includes other types of information, namely, syntactic and semantic. The proposed analysis is a combination of an enriched EBT and RBT, neither of which incorporates c-command. More specifically, the analysis (a) refers to the ends of maximal projections, (b) makes use of the semantic notions of argument and adjunct and, of the syntactic notion of c-command, and finally, (c) it is subject to the stress pattern.

An analysis of this kind shows that phonology is not autonomous from syntax or semantics; it reveals the interface between phonology and the other components of the grammar.

REFERENCES

Chen, M 'What Must Phonology Know About Syntax?', in *The Phonology-Syntax Connection*, ed. by Sharon Inkelas and Draga Zec. The University of Chicago Press, 19-46

Chen, M. (1987a) 'The Syntax of Xiamen Tone Sandhi', *Phonology Yearbook 4*, 109-149

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[23] Another PPR which I have not considered here is consonant devoicing, as for example in [ez dut] 'I have not' which is pronounced [estut] as a result of consonant devoicing.

Clements. (1978) 'Tone and Syntax in Ewe' *Elements of Tone, Stress, and Intonation*, ed. D.J Napoli, 21-99, Georgetown University Press, Washington, D.C

Hung, T. (1987) *Syntactic and Semantic Aspects of Chinese Tone Sandhi*, Ph.D dissertation, UCSD

Jackendoff, R. (1977) *X Syntax: a Study of Phrase Structure*, Cambridge, Mass.: MIT Press

Kaisse, E. (1985) *Connected Speech: the Interaction of Syntax and Phonology*, New York: Academic Press

Nespor, M and I. Vogel. (1986) *Prosodic Phonology*. Foris

Selkirk, E. (1986) 'On Derived Domain in Sentence Phonology', *Phonology Yearbook 3*, 71-405

Reinhart, T. (1981) 'Definite NP Anaphora and C-Command Domains', *Linguistic Inquiry 12* 605-635

Riemsdijk and Edwin Williams. (1986) *Introduction to the Theory of Grammar*, MIT Press

Txillardegi. (1980) *Euskal Fonologia*. Ediciones Vascas

Txillardegi. (1984) *Euskal Azentuaz*, Elkar

Yoon, T. (1988) 'Syntactic Conditioning of Fortition in Korean' unpublished manuscript, UCSD