NUCLEAR PHENOMENA IN

BRAZILIAN PORTUGUESE

by

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ABSTRACT

NUCLEAR PHENOMENA IN BRAZILIAN PORTUGUESE

In this thesis we will analyse phonological phenomena which involve nuclear positions in Brazilian Portuguese. The theory of Charm and Government is the framework on which our analysis is based.

We will discuss the distribution of Brazilian Portuguese vowels with respect to the primary stressed position which, we propose, is subject to charm constraints imposed on nuclear segments.

Emphasis is placed on analysing vowel coalescence in Brazilian Portuguese. Specifically, we will consider phonological processes which involve vowel-glide alternations. We will argue that whether a high vowel alternates or fails to alternate with its corresponding glide depends on the governing relations that adjacent nuclear positions contract with each other.

Our analysis aims not only to provide a general account for the occurrence of high vowels and glides, but also to determine how glides are phonologically interpreted in Brazilian Portuguese.

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O resto é mar...

(TOM JOBIN)

To Johnzinho

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PREFACE

In this thesis we will analyse phonological phenomena which involve nuclear positions in Brazilian Portuguese. Specifically, we will consider vowel coalescence with emphasis on the process of vowel-glide alternations.

The data we present comes from the Brazilian Portuguese dialect spoken in Belo Horizonte, in the state of Minas Gerais. We will refer to this dialect as BP. References to other dialects are made whenever they are useful for supporting an argument or when they throw some light on the discussion of a given issue.[1]

The analysis we provide is based on nouns and adjectives, whose morphological structure consists of a noun stem, which may optionally be followed by a derivative suffix, in turn followed by the morpheme of

[1] The translation into English of the data originally collected in Portuguese was based on the examples provided by "Novo Dicionário Barsa das Línguas Inglesa e Portuguesa", HOUAISS, A. & AVERY, C.B (ed.). APPLETON-CENTURY-CROFTS, New York, Division of Meredith Publishing Company, 1964.

gender.[2]

The framework we have adopted is the theory of Charm and Government which has been developed by KAYE, LOWENSTAMM and VERGNAUD (1985, 1990).

In Chapter 1 we present the basic assumptions of the theory of Charm and Government, providing the tools necessary for the analysis we propose later.

In Chapter 2 we provide a general account of how word stress is assigned in BP. We will argue that primary stress is lexically determined. We will also consider how secondary stress and word level stress are assigned and we will state some constraints which are imposed on posttonic constituents in BP.

In Chapter 3 we discuss the distribution of BP vowels with respect to the primary stressed position. We will see that some vowels may only occur in posttonic position, whereas others may occur either

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[2] The processes we consider in this thesis also apply to verbal forms. However, considering that the presentation of data from verbs would necessarily lead us to the discussion of verbal morphology - which is more complex than the morphological structure of nouns and adjectives - we restricted our data to nouns and adjectives.

pretonically or in primary stressed position. We will propose that the distribution of vowels in BP with respect to the primary stressed position is accounted for by charm constraints imposed on nuclear segments.

In Chapter 4 we present a review of the literature on high vowels and glides in BP. We will see that there is controversy as to whether high vowels and glides are both underlying segments or whether the latter are derived. We will consider both views in different frameworks showing that further research is still needed to account for the distribution of high vowels and glides and the phonological representation of glides in BP.

In Chapter 5 we consider governing relations involving a sequence of strictly adjacent nuclear positions. The proposal presented in this Chapter will be applied to our analysis of vowel-glide alternations in BP which is presented in the remaining Chapters of this thesis.

In Chapter 6 we investigate forms in which prevocalic high vowels, i.e. [iV,uV], and prevocalic glides, i.e. [jV,wV], occur. We aim to define the conditions under which a high vowel alternates or fails to alternate with its corresponding glide. We will also determine how prevocalic palatal glides are syllabified in BP. We will see that unlike prevocalic palatal glides, forms which present prevocalic back glides, e.g. [wa], may differ with respect to their syllabification.

In Chapter 7 we consider forms which present postvocalic high vowels, i.e. [Vi,Vu], and forms which present postvocalic glides, i.e [Vj,Vw]. We will determine the phonological representation of postvocalic glides in BP and also when a postvocalic high vowel or a postvocalic glide is phonetically manifested in BP.

Finally, in Chapter 8 we analyse forms presenting intervocalic palatal glides and forms presenting sequences of high vowels. We will determine how intervocalic glides are phonologically interpreted in BP and which of the high vowels in a sequence of high vowels may be phonetically manifested as a glide.

CHAPTER 1

THE THEORY OF CHARM AND GOVERNMENT

1.0. Introduction

In this Chapter we will present the theory of Charm and Government with the aim of providing the tools necessary for the analysis we propose later. We will first discuss how the theory addresses the organization of phonological strings. Then we will consider the internal representation of nuclear segments in Brazilian Portuguese. We will also address the governing properties of nuclear segments, defining the potential governors and the potential governees.

1.1. A Theory of Phonological Strings

1.1.0. Introduction

One of the tasks of Government Phonology (henceforth GP) is to explain how phonological strings are organized.[1] More precisely GP aims to explain how segments and skeletal positions are associated to phonological constituents. The theory proposes that skeletal positions along with their segments are associated to constituents in terms of the relations (called governing relations) they contract with each other. The establishment and manifestation of governing relations are derived from principles of Universal Grammar which, along with parameters, define phonological systems. In the following section we will present the GP proposal concerning the organization of phonological strings.

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[1] For other lines of research in GP and a full presentation of the theory as well as theoretical evidence for its basic assumptions see KAYE, J, LOWENSTAMM, J. & J.-R. VERGNAUD (henceforth KLV) (1985, 1990), CHARETTE (1988, 1991) and KAYE, J. (ed.) (1990b).

1.1.1. On the Notion of Phonological Government

Government is defined as a binary, asymmetric relationship between adjacent skeletal positions. The establishment of a governing relation between adjacent positions defines a governing domain where one of the positions is the head - or the governor - and the other position is the complement - or the governee. For a governing relation to be established two conditions must be satisfied: formal and substantive. The formal conditions are stated in (1).

(1) **Formal Conditions**
a. Strict Locality
b. Strict Directionality

The strict locality condition requires the governor to be adjacent to the governee at the zero level of projection. That is, the level of projection at which all positions are present. The strict directionality condition defines the nature of headship within a governing domain.[2]

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[2] Directionality of government in phonological constituents differs from syntactic ones in the sense that in the latter directionality is subject to parametric variation whereas in the former it is universally defined. That is why directionality of government in phonological constituents is called "strict". This issue will be addressed in detail in the following pages.

The substantive condition defines the governing properties of segments, i.e. whether a given segment is a governor or a governee. The theory assumes that all phonological segments are formed by a set of primitive, autonomous, independently pronounceable units which are called elements. These elements may occupy a skeletal position alone or they may combine, forming a compound segment. The combinatorial possibilities of elements are defined in terms of a property called charm.[3] Besides defining the combinatorial possibilities of elements, charm characterizes the cardinal nature of segments. Very roughly speaking, charm characterizes a segment either as a vowel or as a consonant.

Segments are either charmed or charmless. Charmed segments are either positively or negatively charmed. Positively charmed segments have the property of "voweliness" and they occur in nuclear head positions. Negatively charmed segments have the property of "consonantiness" and they occur in non-nuclear head positions, i.e. onsets. Charmless segments do not have either the property of "voweliness" or "consonantiness". A neutrally charmed or charmless

[3] Later in this Chapter we will discuss the theory of Charm when we present the internal representation of BP vowels.

segment may occur either in a nuclear position or in a non-nuclear position.

The property necessary for a skeletal position to govern or to be governed by an adjacent skeletal position is given by the charm value of the segments which are linked to the skeletal positions. Charmed segments are governors and charmless segments are governees.[4]

According to the theory, phonological or lexical representations are organized as follows: at the segmental level there is a linear sequence of segments; at the skeletal level there is a linear sequence of skeletal positions which are associated to segments; at the constituent level there are onset-rime sequences where the rimes are the immediate projection of nuclear heads. The onset-rime sequence represents what is called the syllable.[5]

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[4] Later research has shown that the governing property of a segment involves not only its charm value but also its complexity (cf. KLV (1990)). The notion of complexity and its role in the governing properties of segments is discussed in section 1.3.

[5] In GP the nucleus, onset and rime are the only constituents present in phonological representations. Evidence for denying the so-called Coda constituent is given in KAYE (1989c). As for the arguments on denying the syllable as a phonological constituent see KAYE (1989e) and KLV (1990).

Nuclear positions and their segments are lexically associated to nuclear constituents.[6] As for the non-nuclear positions, they are phonologically interpreted according to the governing relations they contract with each other. There are two types of governing relations: constituent and interconstituent. Let us first consider constituent government.

[6] This property follows from the "Licensing Principle" which establishes that all positions in a domain must be licensed, except the head of this domain (cf Kaye (1989e)). Nuclear positions are the head of the onset-nucleus sequence so that they are themselves licensed.

1.1.2. Constituent Government

Consider the phonological or lexical representation of [vídrû] 'glass' illustrated below.[7]

$$
\begin{array}{cccccc}
(2) & \mathrm{O} & \mathrm{R} & \mathrm{O} & & \mathrm{R} \\
 & & | & & & | \\
 & & \mathrm{N} & & & \mathrm{N} \\
 & & | & & & | \\
 & \mathrm{x} & \mathrm{x} & \mathrm{x} & \mathrm{x} & \mathrm{x} \\
 & | & | & | & | & | \\
 & \mathrm{v}^{-} & \mathrm{i}^{+} & \mathrm{d}^{-} & \mathrm{r}^{\circ} & \hat{\mathrm{u}}^{\circ}
\end{array}
$$

(2) illustrates a sequence of skeletal positions which are associated to segments. Recall that nuclear positions and their segments are lexically associated to nuclear constituents. Let us then consider how the non-nuclear positions are syllabified.

Let us first consider the syllabification of the initial non-nuclear position in (2) - which is filled with the segment v^{-}. The only available constituent to which it may be associated is the initial onset. Thus, there is no ambiguity regarding its syllabification,

[7] The symbols û and î correspond to lax high vowels and their counterparts i and u correspond to tense high vowels. The superscripts on the segments illustrated in (2) correspond to the charm value of those segments. The role of charm in phonological representations is addressed in the following pages.

i.e. it must be attached to the initial onset.[8]

Let us now consider the phonological interpretation of the remaining two non-nuclear positions in (2). In the sequence of non-nuclear positions illustrated in (2) the far left position is filled with a charmed segment, i.e. the negatively charmed segment d^-. The non-nuclear position which immediately follows d^- is filled with a charmless segment, i.e. the neutrally charmed segment r°. We have seen that charmed segments are governors and charmless segments are governees. Therefore, the negatively charmed segment d^- must govern the charmless segment r°. Given that the non-nuclear position filled with d^- has to govern the non-nuclear position filled with r°, it must be associated to a constituent head. This is because only a head position may govern a complement.

In order for the skeletal position filled with d^- to be associated to a constituent head it is projected over the onset constituent. Given that d^- is associated

[8] In the cases where a sequence of non-nuclear positions occurs, syllabification may be apparently ambiguous. This is because in a sequence of non-nuclear positions both positions may be associated to the same constituent, i.e. a branching onset, or to different constituents, i.e. a rimal position and the following onset. As we will see shortly, in GP there is no ambiguity regarding the syllabification of a sequence of non-nuclear positions.

to a constituent head, it can govern the following non-nuclear position which is filled with r°. We derive a structure where two positions interacting in a governing relation are associated to the same constituent.

```
(3)   O   R   O       R
      |   |   |\      |
      |   N   | \     N
      |   |   |  \    |
      x   x   x   x   x
      |   |   |   |   |
      v-  i+  d-  r°  û°
              |   ↑
              -----
```

A governing relation involving two adjacent positions which are associated to the same constituent is defined as:

(4) <u>Constituent Government</u>
a. Strictly local
b. Strictly directional - head initial

The strict locality condition requires the governor to be adjacent to the governee at the zero level of projection. The strict directionality condition requires the head to be initial in all phonological systems. Constituent government operates from left-to-right. It follows from the conditions in (4) that constituents are maximally binary, i.e. branching constituents are at most associated to two skeletal positions.[9] In (5) we illustrate the branching constituents (the head is underlined).

```
(5)  a. O            b.    N            c.    R
        |\                 | \                |  \
        | \                |  \               |   \
        |  \               |   \              N    \
        x   x              x    x             |     \
        |   |              |    |             x      x
        α⁻  β°             α⁺/°  β°           |      |
                                              α⁺/°    β°
```

(5a) represents a branching onset governing domain where the head presents a negatively charmed segment and the complement must present a neutrally charmed segment. Branching onsets present a stop or non-sibilant fricative in the head position and a liquid in the complement position. BP is a language which presents branching onsets, eg. [klárû] 'clear' or [lívrû] 'book'.[10]

(5b) illustrates a branching nucleus governing domain. It represents the structure of both long vowels and heavy diphthongs.[11] Long vowels represent the case in which the same segmental material occupies both the governing and the governed positions. Heavy

---

[9] This claims follows from the "Binary Theorem" which is demonstrated in KLV (1990).

[10] A phonological process involving branching onsets in BP is discussed in Chapter 6.

[11] Heavy-diphthongs represent what has been referred to in the literature as falling diphthongs.

diphthongs represent the case where the governing position is filled with either a positively charmed segment or with a complex charmless segment and the governed position is filled with a simplex charmless segment.[12]

(5c) represents a branching rime governing domain where the nuclear head governs its following rimal complement. The theory proposes that nuclear head positions have the property of governing non-nuclear positions regardless of their charm value (cf. KAYE (1989e)). Therefore, nuclear heads always govern rimal complements. The segment occurring as the nuclear head may be either positively charmed or charmless and the segment occurring in the rimal complement will be neutrally charmed. Branching rimes occur in BP in forms like [pástũ] 'field' and [póhtũ] 'harbour'.

The representations in (5) illustrate governing domains in which two skeletal positions are associated to the same constituent. In the following section we will consider governing domains involving skeletal positions which are associated to different constituents.

[12] The internal representation of nuclear segments in BP is defined later in this Chapter.

1.1.3. Interconstituent Government

Consider the lexical representation of [pástû] 'field' illustrated below:

(6)

$$\begin{array}{ccccc}
\mathrm{O} & \mathrm{R} & & \mathrm{O} & \mathrm{R} \\
 & | & & & | \\
 & \mathrm{N} & & & \mathrm{N} \\
 & | & & & | \\
\mathrm{x} & \mathrm{x} & \mathrm{x} & \mathrm{x} & \mathrm{x} \\
| & | & | & | & | \\
\mathrm{p}^{-} & \mathrm{a}^{+} & \mathrm{s}^{\circ} & \mathrm{t}^{-} & \hat{\mathrm{u}}^{\circ}
\end{array}$$

From the lexical representation in (6) we must show to which constituents the non-nuclear positions are associated. The far left non-nuclear position filled with the segment p^- is associated to the initial available onset. As for the two other non-nuclear positions filled with s° and t^-, we again must show to which constituents they are associated. Non-nuclear skeletal positions along with their segments are associated to constituents according to the governing relations they contract with each other. Therefore, the non-nuclear positions in (6) will be associated to constituents according to the governing relations established between them.

In the preceding section we considered the form [vídrû] 'glass' showing that its sequence of adjacent non-nuclear positions - filled with the segments d^- and

r° - are associated to the same constituent (cf. (3)). In this case the first non-nuclear position in the sequence is filled with a negatively charmed segment, i.e. d^{-}, being followed by a non-nuclear position filled with a neutrally charmed segment, i.e. r°.

In (6) we also have a sequence of non-nuclear positions. However, unlike the case of [vídrũ] - where the sequence of non-nuclear positions presents a negatively charmed segment followed by a neutrally charmed segment - the representation in (6) presents a sequence of non-nuclear positions where a neutrally charmed segment, i.e. s°, is followed by a negatively charmed segment, i.e. t^{-}.

We have seen that charmed segments are governors and charmless segments are governees. Therefore, the non-nuclear position filled with t^{-} in (6) will govern the position filled with s°. In order for the non-nuclear position filled with t^{-} to govern the non-nuclear position filled with s° it must be associated to a constituent head. This is because only a head position may govern a complement. The non-nuclear position filled with t^{-} is then projected over the onset constituent - which is a non-nuclear head. Given that t^{-} is associated to a constituent head, it can govern the preceding position filled with s° which is then associated to the rimal complement (which is a non-head position). We derive a structure where two positions interacting in a governing relation are associated to different constituents.

```
(7)  O    R       O    R
     |    |\      |    |
     |    N \     |    N
     |    |  \    |    |
     x    x   x   x    x
     |    |   |   |    |
     p^-  a^+ s°  t^-  û°
              ↑   |
              -----
```

A governing relation involving two adjacent positions which are associated to different constituents is defined as:

(8) <u>Interconstituent Government</u>
a. Strictly local
b. Strictly directional - head final

The strict locality condition requires the governor to be adjacent to the governee at the zero level of projection. The strict directionality condition requires the head to be final in all phonological systems. Interconstituent government operates from right-to-left. In (9) we illustrate an interconstituent governing domain (the head is underlined).

(9)
```
O  R       O
   |\      |
   N \     |
   |  \    |
   x   x   x
       |   |
       β°  α-
       ↑   |
       -----
```

(9) illustrates a non-nuclear interconstituent governing domain. According to the theory, a governing relation is always present between an onset and the preceding rimal complement (cf. KAYE (1989c)). The onset position usually presents a negatively charmed segment and the rimal complement presents a charmless segment.[13] BP is a language which presents branching rimes, e.g. [pástû] 'field' and [táhdî] 'afternoon'.[14]

---

[13] A governing relation between an onset and a rimal complement still holds when both positions are filled with neutrally charmed segments. In this case the neutrally charmed segment occurring in the onset position must have a complexity greater than the neutrally charmed segment occurring in the rimal complement. For details on the charm value and complexity of segments occurring in non-nuclear head positions see HARRIS (1990).

[14] In some dialects of BP, including the Belo Horizonte one, there is a phonological process according to which an alveolar stop is phonetically manifested as an alveo-palatal affricate when it is followed by a front high vowel, i.e. /tîα/ --> [číα] 'aunt' and /dîα/ --> [dǯíα] 'day'. For typing purposes forms presenting alveolar stops followed by a high vowel will be phonetically transcribed with an alveolar stop rather than with an alveo-palatal affricate, i.e. [táhdî] rather than [táhdǯî].

In this section we considered interconstituent governing domains, i.e. governing domains in which the adjacent positions are associated to different constituents. In this thesis we will be investigating governing relations which involve sequences of strictly adjacent nuclear positions. The following section is devoted to the investigation of representations presenting such sequences.

1.1.4. Sequences of Adjacent Nuclear Positions

In this section we investigate governing relations involving strictly adjacent nuclear positions. Consider the representation in (10).

(10)
$$\begin{array}{cccc} O & R & O & R \\ & | & & | \\ & N & & N \\ & | & & | \\ & x & & x \\ & | & & | \\ & \alpha & & \beta \end{array}$$

In order to consider the representation illustrated in (10) - which involves a sequence of adjacent nuclear positions - let us examine the phonological representations of nuclear and non-nuclear positions.

Nuclear heads are associated to skeletal positions at the level of lexical representation (cf. 1.1.1). A nucleus although it always dominates a skeletal position may or may not have segmental content. That is, a nuclear skeletal point may be linked to a segment (cf. (11a)) or it may have no segmental content, i.e. it may be "empty" (cf. (11b)).[15]

---

[15] The theory claims that "empty" positions are filled with an element which presents special properties. This element is called the cold element -

```
(11) a. O   R          b. O   R
        |   |             |   |
        |   N             |   N
        |   |             |   |
        x   x             x   x
        |   |             |   |
        β   α             β   Ø
```

Onsets on the other hand can either be associated to a skeletal position filled with segmental material (cf. (12a)), or they can be associated to a skeletal position which dominates no segmental material (cf. (12b)), or they can dominate no skeletal position (cf. (12c)).[16]

```
(12) a. O   R          b. O   R          c. O   R
        |   |             |   |                 |
        |   N             |   N                 N
        |   |             |   |                 |
        x   x             x   x                 x
        |   |             |   |                 |
        β   α             Ø   α                 α
```

Let us now examine the governing relations which involve a sequence of adjacent nuclear positions - as illustrated in (10). Notice that the onset which

---

which is represented by v°. The properties of the cold element are addressed later in this Chapter when we present the internal representation of nuclear segments. Empty positions are subject to a special type of government called Proper Government. For the discussion of Proper Government see KAYE (1990a), CHARETTE (1988, 1991).

[16] We refer the reader to CHARETTE (1988) for the discussion on the different behaviour of onsets which dominate no segmental material (cf. (12b)) and onsets which dominate no skeletal position (cf. (12c)).

intervenes between the adjacent nuclear positions in (10) dominates no skeletal position, so that the two nuclear positions are adjacent and therefore subject to government. Remember that for a governing relation to hold between two adjacent positions one of the positions must be filled with a segment which has the property necessary for governing the segment occurring in the other position. The property of a skeletal position to govern or to be governed is given by the charm value of the segments which are linked to the skeletal positions. The charm value of a segment is given by its internal representation. The internal representation of a segment consists of the elements of which it is formed.

In this thesis we will be concerned with governing relations which may hold in representations such as the one illustrated in (10), i.e. sequences of adjacent nuclear positions.[17] In order to consider governing relations involving adjacent nuclear positions we have to determine the governing properties of nuclear segments. That is, we have to define which nuclear segments are potential governors and which ones are potential governees. In the

[17] In Chapter 5 we provide a theoretical discussion on governing relations between adjacent nuclear positions.

following sections we will discuss the internal representation of nuclear segments defining the class of governors and the class of governees.

1.2. The Internal Representation of Nuclear Segments

In this section we will present the theory of phonological representation of vowels as proposed in KLV (1985) and KAYE (1989e).[18] According to the theory, any segment consists either of one element or a combination of elements. Elements are understood as autonomous, independent pronounceable units. It is assumed that any vowel system is derived from the set of elements given in (13).

(13) A^{+} I° U° $Ɨ^{+}$ N^{+} v°

The superscripts assigned to the elements in (13) represent their charm value. Charm is a property which, among other things, expresses the combinatorial possibilities of elements.[19]

Elements occurring in nuclear positions are either positively or neutrally charmed. Positive charm represents the property of "voweliness". Since what characterizes a vowel is resonance, an element which

[18] For the internal representation of consonants cf. KLV (1990), YOSHIDA (1991), HARRIS (1990).

[19] Charm also determines cardinal properties of segments. Positively charmed segments are associated to nuclear head positions. Negatively charmed segments are associated to non-nuclear head positions, i.e. onsets. Neutrally charmed or charmless segments are associated either to nuclear or non-nuclear positions.

enhances a particular resonating cavity is positively charmed. In (14) we illustrate the positively charmed elements from (13) and the respective resonating cavity they enhance.

(14) A^{+} Oral cavity
Ɨ^{+} Pharyngeal cavity
N^{+} Nasal cavity

The remaining elements in (13), i.e. I°, U° and v°, are neutrally charmed, i.e. charmless. A neutrally charmed element has neither the property of "voweliness" nor "consonantiness". That is, a charmless segment can be assigned either to a nuclear position or to a non-nuclear position, i.e. an onset or a rime.[20]

The theory claims that any vowel system is derived from the set of elements given in (13). Those elements may occur either alone or in combination. In order to combine elements the "Charm Principle" must be satisfied.

(15) <u>Charm Principle</u>
Elements with like charm cannot combine.

[20] In Chapter 6 we will address in detail the representations in which the charmless elements I° and U° occupy a nuclear position or a non-nuclear position.

According to the Charm Principle, the positively charmed elements - A^+, $\mathbf{I}^+$, N^+ - cannot combine with each other since they have like charm. Notice that neutrally charmed elements - I°, U°, v° - may combine with each other. This is because the charm property of a neutrally charmed element is the absence of charm so that the charm principle is not violated. The combination of elements is given by a phonological expression which reflects a fusion process. In (16) we illustrate a combination of two elements.

(16) $\left(\underset{\text{operator}}{A^+} \;.\; \underset{\text{head}}{\underline{I}^\circ} \right)$

A phonological expression always involves a binary operation. The full stop in (16) separates the two terms of the phonological expression. The term on the left is called the operator and the term on the right is called the head.[21]

Each element has a number of phonetic properties one of which is marked. The marked phonetic property of an element is called its salient property.[22] In (17) we illustrate the elements presented in (13) and

---

[21] Henceforth, in any phonological expression we will underline the element which is the head.

[22] In KLV (1985) the salient property of an element is referred to as its "hot feature".

their respective salient properties.

(17)	A^{+}	openness (non-high)
	I°	frontness (non-back)
	U°	roundness
	I^{+}	ATR-ness
	N^{+}	nasality
	v°	none

In a phonological expression the element which is the operator is not fully expressed; only its salient property is. In a fusion process the element which is the operator transmits its salient property to the element which is the head. The segment which results from a fusion process has all the properties of its head except for the salient property of its operator. Consider the phonological expressions in (18).

(18) a. $(A^{+} . \underline{I}^{\circ})^{\circ}$ = [ɛ]

b. $(I^{\circ} . \underline{A}^{+})^{+}$ = [æ]

Let us first consider (18a). The operator in (18a) is the element A^{+} whose salient property is openness. Given that in a fusion operation the operator transmits its salient property to the head, the property of openness is transmitted to the element I° which is the head of the phonological expression in (18a). The result of the fusion process illustrated in (18a) is an I° which has the property of openness, i.e. [ɛ].

In (18b) the operator is the element I° whose salient property is frontness. The property of frontness from the operator is transmitted to the head of the phonological expression in (18b), i.e. A^{+}. The result of the phonological expression in (18b) is an A^{+} which has the property of frontness, i.e. [æ].

Notice that outside the parentheses which enclose the phonological expressions in (18) there is a superscript. This superscript corresponds to the charm value of the phonological expression, i.e. the charm value of a segment. The charm value of a segment is given by the charm value of its head.[23] In (18a) the head is the element I° which is neutrally charmed so that the charm value of the segment resulting from the phonological expression in (18a), i.e. [ϵ], is neutrally charmed. In like manner the segment which results from the phonological expression in (18b), i.e. [æ], is positively charmed since the head of the phonological expression in (18b) is the element A^{+} which is positively charmed.

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[23] The positively charmed element I^{+} and N^{+} have the property of transmitting their charm value when they occur as operators in a phonological expression. We will address this issue shortly.

Let us now consider phonological expressions which involve more than two elements. Consider (19).

(19) $(\mathbf{\underline{I}}^{+} \,.\, (A^{+}.\underline{I}^{\circ})^{\circ})^{+} \quad = \quad$ [e]

(19) illustrates a phonological expression whose head is another phonological expression.[24] The result of the phonological expression which is the head in (19) is the segment [ɛ] - whose charm value is neutral (cf. (18a)). The operator of the full expression in (19) is the ATR element which gives its salient property, i.e. ATR-ness, to the head. The resultant segment from the phonological expression in (19) is a tense mid vowel, i.e. [e].

It is important to mention that the ATR element plays a special role with respect to charm. It functions as if its salient property, i.e. ATR-ness, gives positive charm value to a phonological expression (cf. KLV (1985:312)). Therefore, any phonological expression presenting the ATR element is positively charmed. Notice that the segment resulting from the phonological expression in (19), i.e. [e], is positively charmed.

[24] The theory claims that the head of a phonological expression can be another phonological expression - as illustrated in (19) - but the operator must be an element. It follows that a phonological expression such as $*((A^{+}.I^{\circ}).\mathbf{\underline{I}}^{+})$ is not possible.

In (17) we have illustrated the salient property of the elements from which vowel systems are derived. Notice that there is an element, i.e. v°, which does not present any salient property. This element is called the "cold element" or the "cold vowel". Given that the cold element does not have any salient property, it cannot be open - which is the salient property of A^{+}; it cannot be front - which is the salient property of I°; it cannot be round - which is the salient property of U°; it cannot be ATR, which is the salient property of I^{+}; and it cannot be nasal - which is the salient property of N^{+}. Therefore the cold element must be a high, back, unrounded, lax and non-nasal vowel, i.e. [ɨ].

Recall that in a phonological expression the resulting segment receives all the properties of its head except for the salient property of the operator. If the cold element occurs as the operator in a phonological expression it has no role to play since the cold element does not have any salient property to transmit in a fusion operation. For example, the phonological expression $(v^{\circ}.\underline{A}^{+})^{+}$ is interpreted as the same as the single element A^{+}, i.e. both expressions correspond to the segment [a]. This is because in a phonological expression such as $(v^{\circ}.\underline{A}^{+})^{+}$ the operator, i.e. the cold element, has no salient property to transmit to the head, i.e. A^+. Therefore $(v^\circ.\underline{A}^+)^+$ is interpreted as [a].

On the other hand, if the cold element is the head of a phonological expression, e.g. $(A^+.\underline{v}^\circ)^\circ$, it has a role to play. That is, in a phonological expression such as $(A^+.\underline{v}^\circ)^\circ$ the salient property of openness from the operator, i.e. A^+, is transmitted to the head, i.e. the cold element. The segment which results from $(A^+.\underline{v}^\circ)^\circ$ is an open [ɨ] which corresponds to a schwa, i.e. [α]. Notice that the segment [α] is neutrally charmed since its head, i.e. $\underline{v}^\circ$, is a neutrally charmed element.

As we have seen, the cold element only plays a role in a phonological expression when it occurs as the head. If the cold element occurs as the operator, it has no effect over the phonological expression. The cold element may be understood as the number zero in the representation of numbers in the decimal numerical system. Notice that "three" can be represented either as 3 or as 03. This is because the number zero has no effect over the representation of decimal numbers when it occurs to the left of a given number. In like manner the cold element may be understood as being present as the operator in a phonological expression. That is, a phonological expression such as $(v^{\circ}.\underline{A}^{+})^{+}$ is identical to A^{+} given that the cold element has no effect over the phonological expression when it occurs as the operator.

Consider the phonological expressions in (20) which represent the BP oral vowels:

(20)	a.	A^{+} or $(v^{\circ}.\underline{A}^{+})^{+}$	=	[a]
	b.	I° or $(v^{\circ}.\underline{I}^{\circ})^{\circ}$	=	[î]
	c.	U° or $(v^{\circ}.\underline{U}^{\circ})^{\circ}$	=	[û]
	d.	$(A^{+}.\underline{I}^{\circ})^{\circ}$	=	[ɛ]
	e.	$(A^{+}.\underline{U}^{\circ})^{\circ}$	=	[ɔ]
	f.	$(A^{+}.\underline{v}^{\circ})^{\circ}$	=	[ɑ]
	g.	$(\text{Ɨ}^{+}.\underline{I}^{\circ})^{+}$	=	[i]
	h.	$(\text{Ɨ}^{+}.\underline{U}^{\circ})^{+}$	=	[u]
	i.	$(\text{Ɨ}^{+}.(A^{+}.\underline{I}^{\circ})^{\circ})^{+}$	=	[e]
	j.	$(\text{Ɨ}^{+}.(A^{+}.\underline{U}^{\circ})^{\circ})^{+}$	=	[o]

The segments [a,î,û], correspond to the elements A^{+}, I°, U°, pronounced in isolation or with the cold element as the operator. The segments [ɛ,ɔ,ɑ,i,u] result from a phonological expression involving a simplex head and an operator. The segments [e,o] result from a phonological expression involving a complex head and the ATR element as the operator. In (20) we presented the internal representation of BP oral vowels. Nasal vowels also occur in BP as illustrated in the forms below.

(21) a. [lɑ̃́] 'wool'
b. [kuẽ́trû] 'coriander'
c. [koĩ́brɑ] 'Coimbra'
d. [neṍ] 'neon'
e. [piṹ] 'black fly'

f. [piɑ̃́nû] 'piano'
g. [viẽ́nɑ] 'Vienna'
h. [haĩ́ñɑ] 'queen'
i. [miṍmɑ] 'myoma'
j. [siṹmî] 'jealousy'

Nasal vowels in BP are derived from vowel-nasal consonant sequences where the nasal consonant may or may not surface. (21a-e) illustrate cases where the nasal consonant does not surface, e.g. /lanØ/ --> [lɑ̃] and /kuɛntrû/ --> [kuẽtrû]. (21f-j) illustrate the cases the nasal consonant surfaces, e.g. /pianû/ --> [piɑ̃nû] 'piano'.[25]

According to the theory, the nasal element N^{+} can only combine with neutrally charmed segments. This constraint follows from the Charm Principle which establishes that elements with like charm cannot combine (cf. (15)). Given that the nasal element is positively charmed it cannot combine with positively charmed elements. Considering the set of BP oral vowels illustrated in (20) one expects only the neutrally charmed segments, i.e. [î,û,ɑ,ɛ,ɔ], to co-

[25] For descriptions and analysis of nasal vowels in BP see CAMARA (1970), ALMEIDA (1976), CAGLIARI (1977,1982), SHAW (1986) AND SILVA (1989a).

occur with the nasal element N^{+}. This is exactly the case. In (22) we illustrate the internal representation of nasal vowels in BP.[26]

(22) a. $(N^{+}.(A^{+}.\underline{v}^{\circ})^{\circ})^{+}$ = [ɑ̃]
b. $(N^{+}.(A^{+}.\underline{I}^{\circ})^{\circ})^{+}$ = [ẽ]
c. $(N^{+}.(v^{\circ}.\underline{I}^{\circ})^{\circ})^{+}$ = [ĩ]
d. $(N^{+}.(A^{+}.\underline{U}^{\circ})^{\circ})^{+}$ = [õ]
e. $(N^{+}.(v^{\circ}.\underline{U}^{\circ})^{\circ})^{+}$ = [ũ]

Notice that when the low vowel [a] is nasalized, e.g. /kamɑ/ --> [kɑ̃mɑ] 'bed', it is phonetically manifested as a nasal schwa, i.e. [ɑ̃], rather than as a nasal open vowel, i.e. *[ã]. The fact that the vowel [a] is phonetically manifested as a schwa when it is nasalized follows from the theory of Charm. As we have seen [a] is a positively charmed segment whose internal representation is $(v^{\circ}.\underline{A}^{+})^{+}$. Given that the segment [a] is positively charmed it cannot combine with the nasal element which is also positively charmed. This is because, according to the Charm Principle, elements with like charm cannot combine. Therefore, a phonological expression such as $*(N^{+}.(v^{\circ}.\underline{A}^{+})^{+})^{+}$ cannot be phonologically interpreted given that the head and the operator are both positively charmed. However, if the head and the operator of the phonological expression $(v^{\circ}.\underline{A}^{+})^{+}$ -

[26] For typing purposes the lax vowels [ɪ,ʊ,ɛ,ɔ] are transcribed as [ĩ,ũ,ẽ,õ] when they are nasalized.

which corresponds to the segment [a] - are flipped around we have a neutrally charmed segment, i.e. $(A^{+}.\underline{v}^{\circ})^{\circ}$, which corresponds to a schwa. Given that the schwa is a neutrally charmed segment it may combine with the positively charmed nasal element. That is, we have a phonological expression such as $(N^{+}.(A^{+}.\underline{v}^{\circ})^{\circ})^{+}$ which corresponds to a nasal schwa, i.e. [ɑ̃]. In (22) we illustrated the internal representation of BP nasal vowels. In Chapter 3 we will consider some phonological phenomena involving the nasalization of vowels followed by a nasal consonant which surfaces, e.g. /kamɑ/ --> [kɑ̃mɑ] 'bed'.

In this thesis we will be concerned with phonological processes involving governing relations between adjacent nuclear positions. In order to consider governing relations involving adjacent nuclear positions we have to determine the governing properties of nuclear segments. That is, we have to define which nuclear segments are potential governors and which ones are potential governees. In the following section we will define the class of the governors and the class of governees.

1.3. Governing Properties of Nuclear Segments

In this section we will discuss governing properties of nuclear segments in order to define which of these segments are potential governors and which ones are potential governees.[27]

According to the theory, the necessary property for a skeletal position to govern or to be governed by an adjacent skeletal position is given by the charm value and the complexity nature of the segments which are linked to the skeletal positions.[28] Consider (23).

(23) a. Charmed segments may govern; charmless segments may be governed.

b. Charmed segments may not be governed.

c. Charmless segments may govern if they have a complexity greater than their governee.

(23) illustrates the principles which define governing properties of segments (cf. KLV (1990)). According to these principles we are able to define

[27] We will restrict the discussion of governing properties of nuclear segments to the BP nuclear segments whose internal representations were given in the preceding section.

[28] The complexity of a segment concerns the number of elements of which it is made (cf. section 1.2.1). The role of complexity with respect to governing properties of segments will be discussed shortly.

which BP nuclear segments are potential governors and which ones are potential governees. In (24) we illustrate the BP oral vowels and their respective charm value and complexity nature.

(24) Positively Charmed Segments

a.	[a]	A^{+}
b.	[e]	$(\text{Ɨ}^{+}.(A^{+}.\underline{I}^{\circ})^{\circ})^{+}$
c.	[i]	$(\text{Ɨ}^{+}.\underline{I}^{\circ})^{+}$
d.	[o]	$(\text{Ɨ}^{+}.(A^{+}.\underline{U}^{\circ})^{\circ})^{+}$
e.	[u]	$(\text{Ɨ}^{+}.\underline{U}^{\circ})^{+}$

Complex Neutrally Charmed Segments

f.	[ɛ]	$(A^{+}.\underline{I}^{\circ})^{\circ}$
g.	[ɔ]	$(A^{+}.\underline{U}^{\circ})^{\circ}$
h.	[ɑ]	$(A^{+}.\underline{v}^{\circ})^{\circ}$

Simplex Neutrally Charmed Segments

i.	[ĩ]	I°
j.	[ũ]	U°

(24a-e) illustrate positively charmed segments and (24f-j) illustrate charmless segments. The charmless segments illustrated in (24f-j) may be either complex (cf. (24f-h)), i.e. they result from a combination of elements in a fusion process; or they may be simplex (cf. (24i-j)), i.e. they are formed by a single element. According to the theory, charmed segments may govern and charmless segments may be governed (cf. (23a)). Therefore, the positively charmed segments illustrated in (24a-e) are potential governors[29] and the charmless segments illustrated in

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[29] Recall that nasal vowels are positively charmed segments (cf. (22)) so that they are also potential governors.

(24f-j) are potential governees.

Recall that charmed segments may not be governed (cf. (23b)). Therefore, the positively charmed segments given in (24a-e) cannot be governed. Charmless segments on the other hand may either be governed (by a charmed segment) or they may govern another charmless segment. The possibility of a charmless segment governing another charmless segment depends on its complexity. The complexity of a segment concerns the number of elements which are present in its internal representation. That is, the greater the number of elements in the internal representation of a segment, the more complex it is. Therefore, a charmless segment governs another charmless segment if it has a complexity greater than its governee (cf. (23c)). It follows from this that the complex charmless segments illustrated in (24f-h), i.e. [є,ɔ,ɑ], have the property of governing the simplex charmless segments illustrated in (24i-j), i.e. [î,û]. This is because complex charmless segments - whose internal representations present two elements - have a complexity greater than simplex charmless segments - whose internal representations consist of a single element.

It follows from this that neither of the simplex charmless segments [î] and [û] - which have the same degree of complexity - should govern the other. Nevertheless, this is not the case. Indeed a simplex charmless segment may govern another simplex charmless segment. Governing relations involving the simplex charmless segments [î] and [û] are discussed in detail in Chapter 8. In (25) we illustrate the governors and the governees of nuclear segments in BP.

(25) a. <u>Positively Charmed Governors</u>: [a,e,i,o,u]
<u>Charmless governees</u>: [ɛ,ɔ,ɑ,î,û]

b. <u>Complex Charmless Governors</u>: [ɛ,ɔ,ɑ]
<u>Simplex Charmless Governees</u>: [î,û]

(25a) shows that positively charmed segments may govern either complex or simplex charmless segments. (25b) shows that complex charmless segments may govern simplex charmless segments. In this section we have defined the governors and the governees of BP nuclear segments so that we are able to consider the governing relations involving a sequence of adjacent nuclear positions.

1.4. Conclusion

In this Chapter we have presented the theory of Charm and Government. We have defined how phonological government operates and we have shown how skeletal positions are syllabified. We have also defined the internal representation of BP nuclear segments and we have determined the class of governors and the class of governees.

Throughout this thesis we will be investigating phonological phenomena in BP which involve nuclear head positions. Nuclear heads are potentially subject to bear stress. In BP phonology the role of word stress is accorded a particularly significant place. Therefore, in the following Chapter we will discuss how word stress is assigned in BP.

CHAPTER 2

WORD STRESS IN BP

2.0. Introduction

The role of word stress in BP phonology is very important since various processes are sensitive to stress placement. Therefore, in order to consider the processes we will address later in this thesis, we have to show how stress is assigned.

In this Chapter we aim to provide a general account of how word stress is assigned in BP.[1] We will argue that primary stress is lexically determined. We will also consider how secondary stress and word level stress are assigned. Finally, we will state some constraints imposed on posttonic constituents in BP.

[1] There are few works on BP which deal explicitly with stress assignment. Among these are: MAJOR (1981, 1985) and SEGUNDO (1990, in preparation). In this Chapter we refrain from discussing previous analyses of stress assignment since we aim to provide a general account of stress placement rather than to provide a detailed theoretical discussion on the topic. Nevertheless, we will assume some of SEGUNDO's (in preparation) proposals throughout this thesis.

2.1. Primary Stress Assignment

In this section we will determine how primary stress is assigned in BP. Primary stress may be either final, penultimate or antepenultimate. In (1) we illustrate these patterns. The acute accent marks the primary stressed vowel.[2]

(1) i. Final Stress

a.	[sabiá]	'Sabiá (bird)'
b.	[oboɛ́]	'oboe'
c.	[dosié]	'dossier'
d.	[ikaraí]	'Icaraí (beach)'
e.	[faraɔ́]	'pharaoh'
f.	[kraó]	'Kraô (tribe)'
g.	[baú]	'trunk'

ii. Penultimate stress

a.	[piádɑ]	'joke'
b.	[duɛ́lû]	'duel'
c.	[kuéʎû]	'rabbit (masc)'
d.	[saídɑ]	'exit'
e.	[viɔ́lɑ]	'viola'
f.	[diógû]	'Diogo'
g.	[saúdî]	'health'

iii. Antepenultimate stress

a.	[mákînɑ]	'machine'
b.	[ɛ́lîsî]	'helix'
c.	[ézîtû]	'success'
d.	[sílɑbɑ]	'syllable'
e.	[kaɔ́tîkû]	'chaotic'
f.	[krónîkû]	'chronic'
g.	[úvûlɑ]	'uvula'

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[2] There are few forms where primary stress may fall on the fourth-to-last nuclear position, e.g. [hítîmîkɑ] 'rhythmic'. We will consider these forms later in this Chapter.

Forms in (1) show that final, penultimate and antepenultimate stressed nuclear positions may be filled with any nuclear segment from the set: [a,e,ɛ, i,o,ɔ,u].[3] In order to address how primary stress is assigned in BP we have to consider the morphological structure of nouns. This is because nuclear positions which are likely to bear primary stress must belong to a noun stem or to a suffix other than the suffix for gender. Every noun in BP consists of a stem, which may optionally be followed by one or more derivative suffixes, which must be followed by the gender suffix.[4] In (2) we illustrate an underived and a derived noun together with their respective morphological structures.

(2) a. [kázɑ] 'house'

kaz	+	ɑ
STEM		GENDER SUFFIX

b. [kazérʊ̂] 'housekeeper'

kaz	+	er	+	ʊ̂
STEM		SUFFIX		GENDER SUFFIX

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[3] In Chapter 3 we will see that the occurrence of certain vowels in BP depends on their position with respect to primary stress placement.

[4] The proposal of assuming an obligatory morpheme for gender in BP was first presented in CAMARA (1970). Other analysis which developed such a proposal are discussed in LOPEZ (1979) and SEGUNDO (in preparation).

(2a) illustrates the morphological structure of the noun [kázα] 'house', where the noun stem kaz is followed by the gender suffix α. (2b) shows that the morphological structure of the noun [kazérû] 'housekeeper' consists of the noun stem kaz followed by the derivative suffix er which is followed by the gender suffix û.[5]

We assume that the gender suffix corresponds to a nuclear position which may either be empty, i.e. Ø, or it may be filled with any of the nuclear segments [î,û,α]. The spelling out of the gender suffix, i.e. either as Ø or as [î,û,α], is lexically determined. This is because the same noun stem may have the gender suffix nuclear position either empty or filled with any of the segments [î,û,α], as illustrated in (3).[6]

[5] The derived form illustrated in (2b) represents an instance of non-analytic morphology, i.e. the sequence of morphemes is phonologically interpreted as a single morphological domain. Morphemes may also be grouped into analytic domains, i.e. where morphemes are phonologically interpreted within distinct morphological domains. In Chapter 3 we will address the interface between phonology and morphology where we discuss analytic and non-analytic morphological domains in BP.

[6] Evidence for the proposal that the gender suffix corresponds to a nuclear position is given in SEGUNDO (in preparation). She proposes that empty gender suffix nuclear positions and gender suffix nuclear positions which are spelled out by [î] are both lexically empty. Whether a gender suffix nuclear position remains empty (cf. (3a)) or whether it is spelled out by [î] (cf. (3b)) follows from the

(3)	a.	(pas + Ø)	[pás]	'peace'
	b.	(pas + ĩ)	[pásĩ]	'pass'
	c.	(pas + ũ)	[pásũ]	'step'
	d.	(pas + ɑ)	[pásɑ]	'raisin

Nouns may be either feminine or masculine. We assume that the information concerning the gender of a noun, i.e. whether it is feminine or masculine, is determined in the lexicon. This is because no principle rules the information for gender. That is, it is idiosyncratically defined.

In sum, we assume that the lexicon provides information concerning the gender of a noun as well as how the gender suffix nuclear position will be spelled out. In (4) we illustrate feminine and masculine forms where the gender suffix nuclear position is either empty or spelled out by [ĩ,ũ,ɑ].[7] The parentheses enclose the morphological structure of the nouns and the forms inside the square brackets correspond to their respective phonetic realizations. Below each form we provide the lexical information on gender and how the gender suffix nuclear position is spelled out.

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information provided in the lexicon.

[7] In (4) we illustrate only final and penultimate stressed forms. Antepenultimate stressed forms will be considered shortly.

(4)	a.	(kaki + Ø)	[kakí]	'persimmon'
		GENDER: Masculine GENDER SUFFIX: Ø		
		(pas + Ø)	[pás]	'peace'
		GENDER: Feminine GENDER SUFFIX: Ø		
	b.	(kak + ĩ)	[kákĩ]	'khaki'
		GENDER: Masculine GENDER SUFFIX: ĩ		
		(gaz + ĩ)	[gázĩ]	'gauze'
		GENDER: Feminine GENDER SUFFIX: ĩ		
	c.	(pat + ũ)	[pátũ]	'duck'
		GENDER: Masculine GENDER SUFFIX: ũ		
		(trib + ũ)	[tríbũ]	'tribe'
		GENDER: Feminine GENDER SUFFIX: ũ		
	d.	(kar + ɑ)	[kárɑ]	'bloke'
		GENDER: Masculine GENDER SUFFIX: ɑ		
		(fak + ɑ)	[fákɑ]	'knife'
		GENDER: Feminine GENDER SUFFIX: ɑ		

(4a-d) illustrate a masculine and a feminine noun respectively. In (4a) the gender suffix nuclear position is empty. In (4b-d) the gender suffix nuclear positions are spelled out by [î,û,ɑ] respectively.[8]

Let us consider how final and penultimate stress patterns are assigned.[9] If we consider the final stressed form (kaki + Ø) [kakí] 'persimmon' and the penultimate stressed form (kak + î) [kákî] 'khaki' we observe that in both forms primary stress falls on the final nuclear position of the noun stem. If we take derived forms into consideration, for example (fak + er + û) [fakérû] 'cutlery set', we observe that primary stress falls on the final nuclear position of the derivative suffix. We may thus generalize that primary stress falls on the final nuclear position of the noun stem or derivative suffix.[10] Consider (5).

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[8] Usually feminine nouns do not have the gender suffix spelled out as [û]. Except for the example given in (4c), i.e. (trib + û) [tríbû] 'tribe', we only find shortened forms of some feminine nouns where the gender suffix is realized as [û]. For example: [mɔ́tû] from [motosiklɛ́tɑ] 'motorcycle' or [fɔ́tû] from [fotografíɑ] 'photography'. Notice that in the shortened forms the gender suffix occurs as [û], whereas in their unshortened counterparts it occurs as [ɑ].

[9] The analysis of final and penultimate stress assignment we present in the following pages is proposed in SEGUNDO (in preparation). Antepenultimate stress assignment is addressed later in this section.

[10] The proposal that in final and penultimate forms primary stress falls onto the final nuclear position of the noun stem or derivative suffix was first presented in LOPEZ (1979). SEGUNDO (in preparation) develops such a proposal. Secondary stress assignment and word level stress are addressed in the following section.

```
(5)              / \                          /     \
                 s   w                        s       w
      O  R  O  R O R                    O  R  O  R
      |  |  |  |   |                    |  |  |  |
      |  N  |  N   N                    |  N  |  N
      |  |  |  |   |                    |  |  |  |
      x  x  x  x   x                    x  x  x  x
      |  |  |  |   |                    |  |  |  |
      k  a  k  i   Ø                    k  a  k  î

      [kakí] 'persimmon'                [kákî] 'khaki'
```

(5) shows that final and penultimate stressed forms present a binary foot where the strong node is assigned to the final nuclear position of the noun stem and the weak node is assigned to the gender suffix nuclear position.[11] We thus conclude that in final and penultimate stressed forms primary stress is assigned in like manner, i.e. the strong node is assigned to the final nuclear position of the noun stem or derivative suffix.

We have seen in (1) that primary stress may be final, penultimate or antepenultimate. The proposal that primary stress falls on the final nuclear position of the noun stem or derivative suffix allows

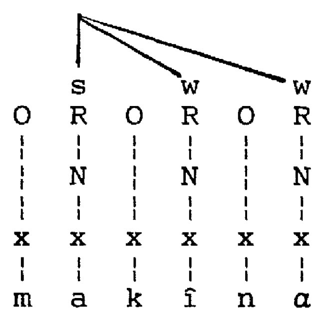
[11] In derived forms the strong node is assigned to the final nuclear position of the derivative suffix and the weak node is assigned to the gender suffix nuclear position. The stress pattern for the derived form (fak + er + û) [fakérû] 'cutlery set' is given below:

```
              / \
             s   w
   f  a  k  e  r  û
```

us to group final and penultimate stressed forms into a single binary foot pattern as illustrated in (5).

We now have to account for how antepenultimate stress is assigned. Recall that nouns in BP consist of a stem optionally followed by a derivative suffix which is followed by the gender suffix. Therefore, in an antepenultimate stressed form such as (makîn + α) [mákînα] 'machine' primary stress falls on the second-to-last nuclear position of the noun stem. In this case we have a ternary foot as illustrated in (6).

(6)



(makîn + α) [mákînα] 'machine'

(6) shows that the strong node is assigned to the second-to-last nuclear position of the noun stem. The weak node which immediately follows the primary stressed nucleus is assigned to the final nuclear position of the noun stem. The final weak node is assigned to the gender suffix nuclear position. We now have to determine whether when primary stress falls on the second-to-last nuclear position of a noun stem it

is ruled by some principle or whether it is idiosyncratically determined.

If primary stress is idiosyncratically assigned then we can expect to find noun stems with identical segmental sequences where primary stress will either fall on the final nuclear position of the noun stem, i.e. (CVCV̆C + V), or primary stress will fall on the second-to-last nuclear position of the noun stem, i.e. (CV̆CVC + V). This is because primary stress may fall either on the final or on the second-to-last nuclear position of a noun stem or derivative suffix (cf. (5,6)). Thus, if we find noun stems with identical segmental sequences which differ only with respect to primary stress assignment we conclude that primary stress is idiosyncratically determined. On the other hand, if primary stress is ruled by principles and parameters we expect that these principles and parameters will define primary stress placement.

In BP we do find pairs of forms whose noun stems present the same segmental sequence where in one case primary stress falls on the final nuclear position of the noun stem and in another case primary stress falls on the second-to-last nuclear position of the noun stem. These forms are illustrated in (7).

(7) a. (tonîk + û)
[toníkû] 'Tonico'
[tónîkû] 'tonic'

b. (azî + ɑ)
[azíɑ] 'heartburn'
[ázjɑ] 'Asia'

c. (parîs + Ø)
[parís] 'Paris'
[párîs] 'pairs'

The examples in (7) illustrate the morphological structure of nouns with their phonetic realizations shown below it. Note that both the final and the second-to-last nuclear position of a noun stem may bear primary stress.

Forms in (7) lead us to assume that whether primary stress falls on the final nuclear position of a noun stem (corresponding to the penultimate stress pattern) or on the second-to-last nuclear position of a noun stem (corresponding to the antepenultimate stress pattern) is idiosyncratically determined. This is because the noun stems illustrated in (7) present the same segmental sequence differing only with respect to primary stress placement.

However, one could question whether there is any particular difference in the phonological representation of forms in (7). It has been noticed in the metrical literature that in some languages primary stress is attracted to a rime which branches. That is, rimes which present either branching nuclei or branching rimes. These languages are assumed to be quantity sensitive. In (8) we illustrate the representation of a long vowel, a heavy diphthong and a branching rime.

```
(8)  a.   R            b.   R            c.   R
          |                 |                 |\
          N                 N                 N \
          | \               | \               |  \
          x  x              x  x              x   x
           \/               |  |              |   |
           a                a  j              a   s
```

Long vowels and heavy diphthongs present a structure where two nuclear positions are associated to a single nuclear constituent. In (8a) we illustrate the representation of a long vowel, i.e. [a:], and in (8b) we illustrate the representation of a heavy diphthong, i.e. [aj]. In (8c) we illustrate the representation of a branching rime.

One could suggest that BP is quantity sensitive. Thus, the primary stressed rime would either present a branching nucleus, i.e. it would be filled with a heavy diphthong or a long vowel (cf. (8a,b)), or the primary stressed rime would be branching (cf. (8c)).

The proposal that primary stress in BP is sensitive to branching rimes cannot be sustained. The first argument for denying that primary stress in BP is sensitive to branching rimes follows from the fact that we find penultimate stressed vowels preceded by a branching rime, e.g. (ahtîg + û) [ahtígû] 'article'. If primary stress were sensitive to branching rimes we would expect the branching rime to be primarily stressed, i.e. [áhtîgû], what is not the case.[12]

However, one could claim that in a form such as [ahtígû] 'article' primary stress falls on the second-to-last nuclear position because the primary stressed vowel corresponds to the representation of a long vowel - which is a branching structure (cf. (8a)). According to this proposal, the form [ahtígû] 'article' would have the following representation:

```
(9)  O  R      O  R      O  R
        |\     |  |      |  |
        N \    |  N      |  N
        |  \   |  |\     |  |
        x  x   x  x  x   x  x
        |  |   |   \/    |  |
        a  h   t    i    g  u
```

There are two arguments against the proposal that BP has long vowels. The first one concerns the lack of

[12] Notice that antepenultimate stressed branching rimes may occur in BP, e.g. [áhtîkû] 'arctic'.

experimental evidence for assuming that primary stressed vowels in BP are long. The second argument against the proposal that BP has long vowels concerns the phonological behaviour of languages which have long vowels and heavy diphthongs. In such languages there is usually phonological contrast between long and short vowels as well as segmental restrictions concerning the vowels in the vowel-glide sequences which correspond to heavy diphthongs. More specifically, a reduced set from the overall set of vowels in the language may fill the vowel position in the vowel-glide sequences which correspond to heavy diphthongs.

BP does not display the typical behaviour of languages which have long vowels and heavy diphthongs. That is, there is no contrast between short and long vowels neither are there segmental restrictions imposed on vowel-glide sequences in BP.[13] Since there is neither phonetic nor phonological evidence for assuming that BP has long vowels and heavy diphthongs we have to exclude the proposal that primary stressed vowels in BP present the structure of a branching nucleus (cf. (9)).

[13] A complete description and analysis of vowel-glide sequences in BP is provided in Chapter 7.

The facts we have discussed above lead us to assume that primary stress in BP is idiosyncratically assigned. Whether primary stress falls on the final nuclear position of a noun stem, i.e. (kakî + Ø) [kakí] 'persimmon' and (kak + î) [kákî] 'khaki', or whether it falls on the second-to-last nuclear position of a noun stem, i.e. (makîn + ɑ) [mákînɑ] 'machine', is determined in the lexicon. We then conclude that primary stress in BP is lexically determined where feet may be either binary or ternary. In (10) we present final, penultimate and antepenultimate stressed forms, their corresponding morphological structure, and their respective stress pattern.

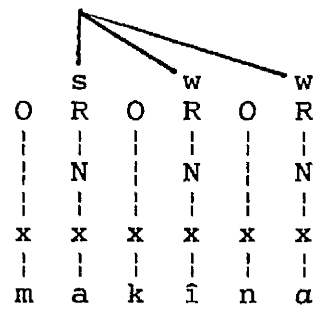
(10) a. (kakî + Ø) [kakí] 'persimmon'

```
                 / \
                s   w
    O   R   O   R O R
    |   |   |   |   |
    |   N   |   N   N
    |   |   |   |   |
    x   x   x   x   x
    |   |   |   |   |
    k   a   k   i   Ø
```

b. (kak + î) [kákî] 'khaki'

```
          /   \
         s     w
     O   R   O R
     |   |   | |
     |   N   | N
     |   |   | |
     x   x   x x
     |   |   | |
     k   a   k î
```

c. (makîn + α) [mákînα] 'machine'



In this section we have considered how primary stress is assigned. We showed that primary stress is lexically determined where feet may be either binary or ternary. In the following section we will consider how secondary stress and word level stress are assigned.

2.2. Secondary Stress and Word Level Stress

In this section we will be concerned with the parameters involved in the construction of metrical trees. More specifically, we will consider the analysis proposed by SEGUNDO (in preparation) which defines the parameters involved in secondary stress assignment and word level stress.

Our proposal differs from SEGUNDO's in two major aspects. First, we assume that primary stress assignment is lexically defined, whereas she claims that primary stress is parametrically determined. Whereas her proposal for stress assignment of final and penultimate stressed forms provides a generalization regarding primary stress assignment (cf. section 2.1.) she does not account for stress assignment of antepenultimate stressed forms.

The second difference from SEGUNDOS's proposal concerns secondary stress assignment and the construction of word level trees. Whereas she claims that metrical structure is built onto lexical representations we argue that metrical trees are built onto the projection of nuclear heads after phonological processes apply. We assume that only the nuclear heads which are not governed are projected to the level of nuclear projection, which we will represent as $\bar{R}$. The metrical structure, i.e. secondary stress and word trees, is thus built onto the level of nuclear projection. Evidence for our proposal concerning the construction of the metrical structure, i.e. that only those nuclear heads which are not governed are projected to the level of nuclear projection where metrical structure is built, is given in Chapter 5 where we address governing relations between adjacent nuclear positions. Metrical trees are built as follows:

(11)
a.Primary stress is assigned at the level of lexical representation where feet may be either binary or ternary.

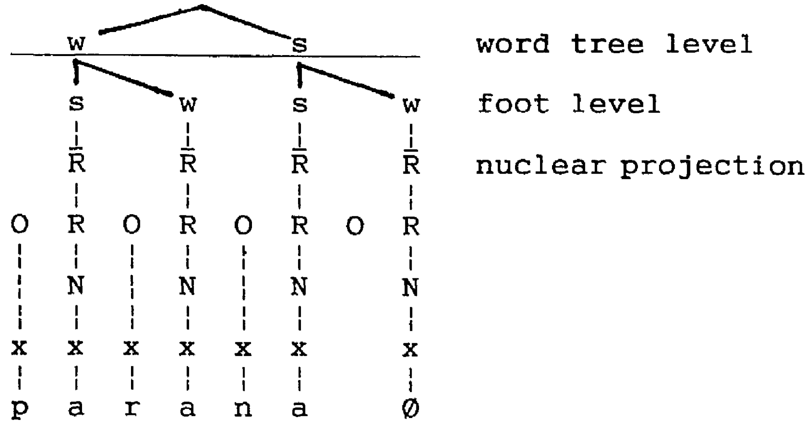
b.Phonological processes apply and those nuclear heads which are not governed are projected to the level of nuclear projection.

c.Secondary stress is assigned onto the level of nuclear projection according to the following parameters:
- feet are binary and left-headed.
- foot construction begins from the right edge.

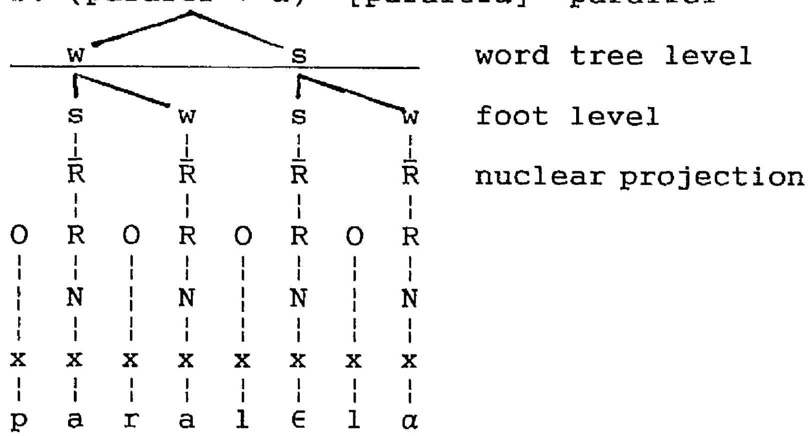
d.Right-headed word trees are built onto the projection of metrical heads.

According to the parameters defined in (11) forms such as (parana + ∅) [paraná] 'Paraná'; (paralɛl + α) [paralɛ́lα] 'parallel'; (satɛlît + î) [satɛ́lîtî] 'satellite'; have the following metrical trees:

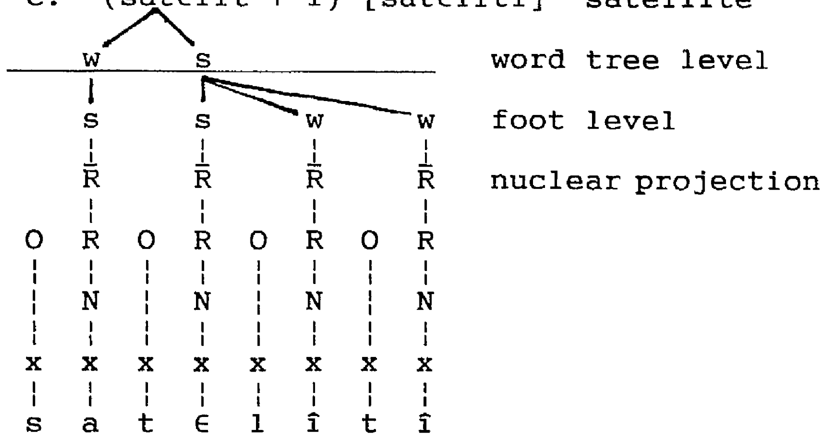
(12) a. (parana + Ø) [paraná] 'Paraná'



b. (paralɛl + ɑ) [paralɛ́lɑ] 'parallel'



c. (satɛlît + î) [satɛ́lîtî] 'satellite'



(12a-c) illustrate the metrical trees of final, penultimate and antepenultimate stressed forms respectively. The phonological representation of forms in (12) presents onset-rime sequences where both constituents are associated to a single skeletal position which is filled with segmental material. That is, neither branching constituents nor constituents whose skeletal positions are empty or constituents which are not associated to a skeletal position occurs. Nevertheless, the phonological representation of constituents plays a role with respect to stress assignment. More specifically, there are metrical constraints imposed on posttonic constituents. Such constraints will be stated in the following section.

2.3. Metrical Constraints Imposed on Constituents

In this section we will present the inventory of BP phonological constituents and we will state the metrical constraints imposed on posttonic constituents. Consider (13).

```
(13) a.  O     b.  O     c.  O          d. O
         |         |         |\
         |         |         | \
         x         x         x  x
         |        / \        |  |
         α       α   β       α  β

     e.  R     f.  R     g.  R       O
         |         |         |\      |
         N         N         N \     |
         |         |         |  \    |
         x         x         x   x   x
         |         |         |   |   |
         α         Ø         α   β   γ
```

(13a-d) illustrate the inventory of BP onsets and (13e-g) illustrate the inventory of BP rimes. Let us consider each representation in (13) in more detail.

(13a) illustrates an onset position which is associated to a single segment. An onset position which is associated to a single segment in BP may be filled with any of the following segments: [p,t,k,b, d,g,m,n,ñ,l,λ,f,v,s,z,š,ž,r,h].[14]

---

[14] For the internal representation of segments which may occupy an onset position see KLV (1990), HARRIS (1990) and YOSHIDA (1991).

(13b) illustrates an onset position filled with a complex consonant. In the representation of a complex consonant we have two segments associated to a single onset position. The complex consonants [kw, gw] may be associated to an onset position in BP.[15]

(13c) illustrates the representation of a branching onset. It represents a constituent governing domain where the far left position is the head and the far right position is the complement. Branching onsets present a stop or a non-sibilant fricative in the head position and a liquid in the complement position. The following branching onsets occur in BP: [pr,tr,kr,br,dr,gr,vr,fr,pl,tl,kl,bl,gl,fl].[16]

(13d) illustrates an onset constituent which is not associated to a skeletal position. In Chapter 5 we will consider the role of onsets which dominate no skeletal position in BP.[17]

---

[15] In Chapter 6 we will consider in detail the role of complex consonants in BP. See also SILVA (1992).

[16] [vl] occurs only in few loan words, e.g. [vladimih] 'Vladimir'. *[dl] does not occur.

[17] For the role of onsets which dominate no skeletal position see also CHARETTE (1988, 1991).

(13e) illustrates a nuclear position which is associated to a single segment.[18] A nuclear position which is associated to a single segment in BP may be filled with any of the following segments: [a,e,ɛ,i,o,ɔ,u,ĩ,ũ,ɑ].[19]

(13f) illustrates an empty nuclear position. Empty nuclear positions are subject to a special type of government called proper government. For details on proper government see KAYE (1990a) and CHARETTE (1988, 1991). Preliminary analyses of empty nuclear positions in BP are presented in SEGUNDO (1989) and SILVA (1989c). CAVACO (in preparation) analyses empty nuclear positions in European Portuguese.

(13g) illustrates the representation of a branching rime. Rimal positions are governed by the

---

[18] A single nuclear position may also have two segments associated to it. In this case we have the representation of a light diphthong, i.e.

```
  R
  |
  N
  |
  x
 / \
α   β
```

Light diphthongs will be discussed in Chapter 5 where we address governing relations between adjacent nuclear positions.

[19] See Chapter 1 for the internal representation of nuclear segments in BP. In Chapter 3 we will consider the distribution of BP nuclear segments in relation to the primary stressed position.

following onset position (cf. KAYE (1989c)). Rimal positions in BP may be filled with the following segments: [s,h,l,n].[20]

Given the inventory of BP phonological constituents in (13) let us consider the metrical constraints imposed on posttonic constituents. Consider (14).

(14) The posttonic rime in antepenultimate stressed forms may not be branching, i.e.
*[hékûhsû] but [hekúhsû] 'recourse'
*[pétîskû] but [petískû] 'snack'

(14) determines that whenever the final rime of a noun stem is branching, e.g. (hekuhs + û), primary stress will fall on the nuclear position of the branching rime, i.e. [hekúhsû] 'recourse'.[21]

[20] When the segment <u>n</u> occurs in a rimal position it triggers the nasalization of the vowel in the preceding nuclear position, e.g. (sant + û) [sãtû] 'saint'. In the cases the segment <u>l</u> occupies a rimal position it is vocalized, e.g. (alt + û) [áwtû] 'high'. The segment <u>h</u> may also be manifested as a velar fricative, i.e. [X], or as a trill, i.e. [ř], or as a retroflex, i.e. [τ], when it occurs in a rimal position, depending on a variety of sociolinguistic factors (cf. OLIVEIRA (1983)).

[21] This constraint was first observed by HARRIS (1983) on his analysis of Spanish.

(15) The second posttonic onset in antepenultimate stressed forms may neither be filled with the complex consonants [kw, gw], nor with the BP palatal consonants, i.e. [ñ,ʎ,š,ž], or with the segment [h].

*[ínîkwɑ]	but	[iníkwɑ]	'iniquitous'
*[gálîñɑ]	but	[galíñɑ]	'hen'
*[mánîʎɑ]	but	[maníʎɑ]	'shackle'
*[bólîšî]	but	[bolíšî]	'bowling'
*[kúrûžɑ]	but	[kurúžɑ]	'owl'
*[sígɑhû]	but	[sigáhû]	'cigarette'

(15) determines that whenever the final onset of a noun stem is filled with any of the segments [kw,gw,ñ,ʎ,š,ž,h] primary stress will fall on the final nuclear position of the noun stem, e.g. (bolîš + î) [bolíšî] 'bowling' but *[bólîšî].[22]

In (14-15) we have stated metrical constraints imposed on posttonic constituents. Some other metrical constraints are imposed on forms which present prevocalic and postvocalic glides, i.e. [jV,wV] and [Vj,Vw]. For example, in forms presenting posttonic prevocalic glides primary stress must fall on the nuclear position preceding the glide-vowel sequence, i.e. [famílјɑ] 'family' but *[fámîljɑ]. Also vowel-glide sequences are not allowed to occur in posttonic position, i.e. *[pátew], *[pátewtɑ] or *[pátɑtew]. In Chapters 6 to 8 we discuss the relationship between

[22] HARRIS (1983) observed that palatal consonants cannot occupy the final onset position in antepenultimate stressed forms in Spanish.

the metrical structure and forms which present glide-vowel sequences and vowel-glide sequences in BP. We will claim that glides in BP are derived from a nuclear position filled with a high vowel. Evidence for our claim is supported by the behaviour of the metrical structure in forms which present prevocalic and postvocalic glides.

We have seen that primary stress in BP may be either final, penultimate or antepenultimate (cf. (1)). That is, primary stress may fall at most on the third-to-last nuclear position of a noun. There are however some exceptional forms where primary stress may fall on the fourth-to-last nuclear position, e.g. [tɛ́kĩnĩkɑ] 'technic' and [hítĩmĩkɑ] 'rhythmic'. For reasons which are not yet clear these forms present the suffix -ik.

In this section we presented the inventory of BP phonological constituents and we have stated metrical constraints imposed on posttonic constituents.

2.4. Conclusion

In this Chapter we have considered how word stress is assigned in BP. We showed that primary stress is lexically determined where feet may be either binary or ternary. We have also addressed the construction of metrical trees. We argued that metrical trees are built onto the level of nuclear projection. Finally, we have stated some metrical constraints imposed on posttonic constituents. In the following Chapter we will discuss the distribution of BP vowels in relation to the primary stressed position.

CHAPTER 3

THE VOWEL SYSTEM OF BRAZILIAN PORTUGUESE

3.0. Introduction

In this Chapter we will see that the occurrence of certain vowels in BP depends on their position with respect to the primary stressed vowel. That is, some vowels only occur in posttonic position, others only in primary stressed position whereas others may occur either pretonically or in primary stressed position. We propose that the distribution of BP oral vowels with respect to the primary stressed position is accounted for by charm constraints imposed on nuclear segments.

In this thesis we are concerned with phonological processes involving sequences of adjacent oral vowels. Once the distribution of vowels is defined with respect to the primary stressed position we will be able to establish which sequences of vowels are found in BP. Thus, we can analyse phonological processes involving sequences of adjacent oral vowels.

3.1. Primary Stressed Vowels

We have seen in the previous Chapter that primary stress in BP may be either final, penultimate or antepenultimate. In (1) we reproduce forms from Chapter 2 which illustrate these three patterns.

(1) i. Final stress

a.	[sabiá]	'Sabiá (bird)'
b.	[obɔ́ɛ́]	'oboe'
c.	[dosié]	'dossier'
d.	[ikaraí]	'Icaraí (beach)'
e.	[faraɔ́]	'pharaoh'
f.	[kraó]	'Kraô (tribe)'
g.	[baú]	'trunk'

ii. Penultimate stress

a.	[piádɑ]	'joke'
b.	[duɛ́lû]	'duel'
c.	[kuéʎû]	'rabbit (masc)'
d.	[saídɑ]	'exit'
e.	[viɔ́lɑ]	'viola'
f.	[diógû]	'Diogo'
g.	[saúdî]	'health'

iii. Antepenultimate stress

a.	[mákînɑ]	'machine'
b.	[ɛ́lîsî]	'helix'
c.	[ézîtû]	'success'
d.	[sílɑbɑ]	'syllable'
e.	[kaɔ́tîkû]	'chaotic'
f.	[krónîkû]	'chronic'
g.	[úvûlɑ]	'uvula'

Forms in (1) show that in primary stressed position the following oral vowels occur: [a,e,ϵ,i,o,ɔ,u]. The internal representation of these vowels is given in (2).

$$
\begin{array}{lll}
\text{(2)} \quad (v^{\circ}.\underline{A}^{+})^{+} \text{ or } A^{+} & = & [\text{a}] \\
(\text{Ɨ}^{+}.(A^{+}.\underline{I}^{\circ})^{\circ})^{+} & = & [\text{e}] \\
(A^{+}.\underline{I}^{\circ})^{\circ} & = & [\epsilon] \\
(\text{Ɨ}^{+}.\underline{I}^{\circ})^{+} & = & [\text{i}] \\
(\text{Ɨ}^{+}.(A^{+}.\underline{U}^{\circ})^{\circ})^{+} & = & [\text{o}] \\
(A^{+}.\underline{U}^{\circ})^{\circ} & = & [\text{ɔ}] \\
(\text{Ɨ}^{+}.\underline{U}^{\circ})^{+} & = & [\text{u}]
\end{array}
$$

Notice that all the segments in (2) present at least one positively charmed element in their internal representation. Indeed this fact reflects a requirement imposed on the phonological system of BP, according to which a segment occurring in primary stressed position must have at least one positively charmed element in its internal representation.

Accordingly, we do not find the lax high vowels [î] and [û] - whose internal representations are $(v^{\circ}.\underline{I}^{\circ})^{\circ}$ and $(v^{\circ}.\underline{U}^{\circ})^{\circ}$ respectively - in primary stressed position since these segments do not present any positively charmed element in their internal representation.

With respect to the schwa - which contains the positively charmed element A^{+} in its internal representation, i.e. $(A^{+}.\underline{v}^{\circ})^{\circ}$ - it is never found in primary stressed position. Given that the segment [ɑ] has the positively charmed element A^{+} in its internal representation we have to explain why it does not occur in primary stressed position. According to our proposal, a segment which presents at least one positively charmed element in its internal representation should be able to occur in primary stressed position.

The fact that a schwa is never primary stressed follows from "la contrainte de Kryocéphalie" proposed in LOWENSTAMM (1986) which aims to account for the fact that a schwa is never long, i.e. *[ɑ:].[1] According to this constraint, a segment which has the cold element as its head cannot be the head of a branching nucleus, i.e. *N .

```
*N
 |\
 x x
  \/
   ɑ
```

Let us extend LOWENSTAMM's proposal as follows: a segment which has the cold element as its head cannot be the head of a domain. Such a proposal

[1] "La contrainte de kryocéphalie" states that a cold-headed segment, such as a schwa, cannot be the head of a branching nucleus. It has been proposed to account for stress phenomena in Arabic. More specifically, it accounts for the fact that a schwa is never stressed in Arabic. For a detailed discussion on this issue see LOWENSTAMM (1986).

accounts for the fact that a nuclear position filled with the segment [ɑ] cannot bear primary stress. This is because a nuclear position which bears primary stress is the head of the metrical domain. Thus it cannot be filled with a segment such as [ɑ] which has the cold element as its head. In the following section we consider the distribution of posttonic vowels.

3.2. Posttonic Vowels

In this section we consider the vowels which occur following primary stress. Considering the penultimate and antepenultimate stressed nouns in (1) one observes that the vowels occurring after the primary stressed position can be: [û,î,α]. In (3) we illustrate the internal representation of these vowels.

(3)	$(v^{\circ}.\underline{U}^{\circ})^{\circ}$	or	U°	=	[û]
	$(v^{\circ}.\underline{I}^{\circ})^{\circ}$	or	I°	=	[î]
	$(A^{+}.\underline{v}^{\circ})^{\circ}$			=	[α]

The occurrence of [û,î,α] following the primary stressed vowel in BP reflects a requirement imposed on the BP phonological system, according to which posttonic vowels must be formed by a single element and the resulting segment must be neutrally charmed. The single elements A^{+}, U° and I° are selected. The elements I° and U° correspond to the neutrally charmed lax vowels [î] and [û] respectively. However, the element A^{+} corresponds to the vowel [a] which is a positively charmed segment. We have seen in Chapter 1 that the internal representation of a segment such as [a] can be either A^{+} or $(v^{\circ}.\underline{A}^{+})^{+}$. We assume that in order to satisfy the requirement that a neutral segment must occur after primary stress, the elements which form the segment [a], i.e. $(v^{\circ}.\underline{A}^{+})^{\circ}$, are flipped around, yielding $(A^{+}.\underline{v}^{\circ})^{\circ}$. The phonetic manifestation of $(A^{+}.\underline{v}^{\circ})^{\circ}$ is a schwa, i.e. [ɑ], which is a neutrally charmed segment.

We have seen that posttonic vowels must be neutrally charmed segments. It follows from this constraint that nasal vowels should not occur in posttonic position. This is because nasal vowels are positively charmed segments. Indeed this is the case. It is important to mention that the constraint which prevents nasal vowels from occurring posttonically (because posttonic nuclear segments must be charmless) operates in colloquial speech. However, in careful speech, posttonic nasal vowels may occur. For example, forms like [viážẽj] 'trip', [ímɑ̃] 'magnet' and [fɔ́rũ] 'forum' which present posttonic nasal vowels in careful speech are pronounced as [viážî], [ímɑ] and [fɔ́rû] in colloquial speech.[2] That is, posttonic nasal vowels do not occur, as predicted by charm theory.

In like manner, positively charmed oral vowels, i.e. [a,e,i,o,u], occur in posttonic position in

[2] The phonological representation of these forms are respectively: /vîažɛnØ/, /îmanØ/ and /fɔrûnØ/. They represent cases of vowel-nasal consonant sequences where the nasal consonant does not surface (cf. Chapter 1).

careful speech, e.g. [sílaba] 'syllable'; [nádegas] 'buttocks'; [ábitu] 'habit'; [átomu] 'atom'. However, in colloquial speech posttonic lax oral vowels are realized instead, i.e. [sílɑbɑ]; [nádîgɑs]; [ábîtû]; [átûmû].

In this section we have discussed the distribution of posttonic vowels. In the following section we consider the distribution of pretonic vowels.

3.3. Pretonic Vowels

Let us now consider the vowels occurring in pretonic position. Consider the forms in (4).

(4)	a.	[orístɑ]	'hourly worker'
	b.	[duelístɑ]	'duellist'
	c.	[ɔríñɑ]	'hour (diminutive)'
	d.	[duɛlísîmû]	'the best duel'

(4) shows that in pretonic position either tense or lax mid vowels occur. Nevertheless, forms in (4) are instances of derived nouns. (4a) and (4c) are derived from the noun stem ɔr- 'hour' and (4b) and (4d) are derived from the noun stem duɛl- 'duel'. Evidence that the noun stem vowel of derived forms in (4) presents a lax mid vowel comes from the underived forms of these nouns when the noun stem vowel occurs in primary stressed position, i.e. [ɔ́rɑ] 'hour' and [duɛ́lû] 'duel'.

What is interesting about the forms in (4) is that in the derived forms in (4a-b) the noun stem vowel is phonetically manifested as a tense mid vowel, i.e. [e] and [o], whereas in the derived forms in (4c-d) the noun stem vowel is phonetically manifested as a lax mid vowel, i.e. [ɛ] and [ɔ]. Considering forms like (4), we have to explain why noun stems presenting an underlying lax mid vowel require some of their derived forms to present a tense mid vowel in pretonic position (cf. (4a-b)) whereas in other derived forms a pretonic lax mid vowel occurs (cf. (4c-d)).

One way of accounting for the alternations between tense and lax vowels in derived forms such as in (4) is to assume that the occurrence of pretonic tense and lax mid vowels is unpredictable. That is, speakers have to learn which derived forms present a pretonic lax mid vowel and which ones present a pretonic tense mid vowel. If the occurrence of pretonic lax and tense mid vowels is unpredictable, we should find tense and lax pretonic mid vowels not only in derived nouns - as illustrated in (4) - but also in underived ones. If pretonic tense and lax mid vowels occur at random, nothing should prevent underived nouns from presenting both tense and lax pretonic mid vowels. Consider forms in (5) which are instances of underived nouns.

(5)	a.	[venezuɛ́lɑ]	'Venezuela'
	b.	[pareó]	'Pareô'
	c.	[teoríɑ]	'theory'
	d.	[poɛ́tɑ]	'poet'
	e.	[proézɑ]	'prowess'
	f.	[marionɛ́tʃĩ]	'puppet'

(5) shows that in underived nouns only tense mid vowels occur in pretonic position. It is important to

say that there is no phonological contrast between tense and lax mid vowels in pretonic position, whereas the contrast between tense and lax mid vowels is observed in primary stressed position as illustrated in (6).[3]

(6)	a.	[sédî]	'thirst'
	b.	[sɛ́dî]	'headquarters'
	c.	[fóhmɑ]	'baking pan'
	d.	[fɔ́hmɑ]	'form'

We have seen that in underived nouns pretonic mid vowels must be tense (cf. (5)). On the other hand, in derived nouns either tense or lax pretonic mid vowels occur (cf. (4)). The fact that pretonic lax mid vowels only occur in derived forms (cf. (4c-d)) - but never in underived ones (cf. (5)) - leads us to posit that the morphological structure should be relevant in accounting for forms which present pretonic lax mid vowels. We will propose that derived forms which present pretonic lax mid vowels, e.g. [ɔríñɑ] and [duɛlísîmû] (cf. (4c-d)), present a different morphological structure from derived forms in which a tense mid vowel occurs pretonically, e.g. [orístɑ] and

[3] In some northern dialects of BP, e.g. Recife (in the state of Pernambuco), pretonic nuclear positions may present lax mid vowels, e.g. [pɔɛ́tɑ] 'poet' and [parɛó] 'Pareô'. However, no phonological contrast between pretonic tense and lax mid vowels is observed in any dialect of BP.

[duelístα] (cf. (4a-b)).

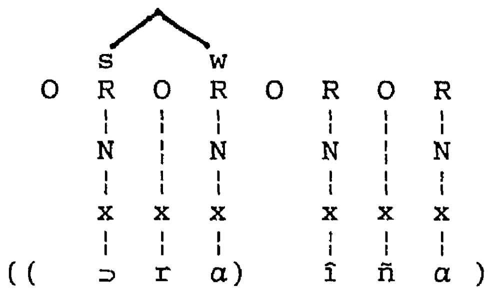
Let us assume that lax mid vowels only occur in primary stressed position in BP (where indeed phonological contrast is observed (cf. (6)). If our hypothesis is correct, we have to assume that in derived forms such as [ɔríñα] and [duɛlísĩmũ] (cf. (4c-d)) there must have been a point within the derivational history of these forms where the lax mid vowels occurred in primary stressed position. For reasons which we will consider shortly, throughout the derivational process it happened that the lax mid vowels surfaced in a position which is no longer primary stressed. We propose that the morphological structure of forms in (4c-d) is.

(7) a. ((ɔr+α) íñ + α) [ɔríñα]
b. ((duɛl+ũ) ísĩm + ũ) [duɛlísĩmũ]

We propose that the parentheses in (7) enclose independent morphological domains, i.e. a morphological domain which corresponds to what is called a word. Forms in (7) present two sets of parentheses. The innermost parenthesis enclose an underived noun, i.e. a noun stem followed by the gender suffix, and the outermost parenthesis enclose the innermost parenthesis and a derivational suffix followed by the gender suffix. The morphological categories enclosed in each set of parenthesis in (7) represent a morphological domain which corresponds to a cycle. The phonological interpretation of forms like (7) follows from the innermost cycle to the outermost one. We will consider next the derivation of [ɔríñα] (cf. (7a)) assuming that any form presenting a pretonic lax mid vowel is derived in like manner.

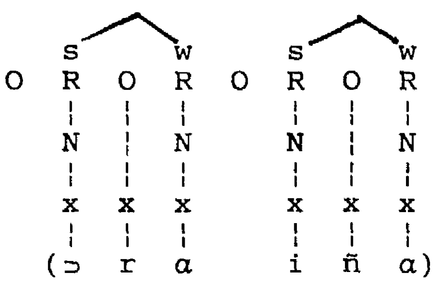
The innermost cycle - which corresponds to the underived noun [ɔrα] - is phonologically interpreted when the lax mid vowel occurs in stressed position.

(8)



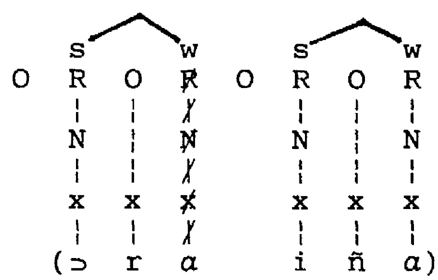
The innermost cycle is then accessible to the outermost cycle.

(9)



Notice that in (9) there are two strictly adjacent nuclear positions. That is, the initial nuclear position of the suffix is strictly adjacent to the final nuclear position of the noun. We claim that a sequence of strictly adjacent nuclei is the adequate environment for vowel deletion to take place. More specifically, we propose that a nuclear point is deleted when it is followed by a strictly adjacent nucleus.[4] It follows from our proposal that the final nuclear position of the noun in (9) is deleted since it is followed by a strictly adjacent nucleus. This process is illustrated in (10).

(10)

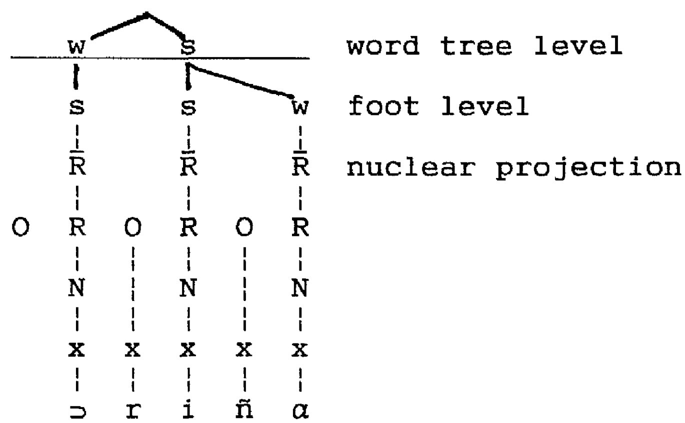


The deletion of the nuclear position in (10) yields a structure which presents a sequence of onsets. According to the theory every onset must be followed by a nucleus (cf. Chapter 1). Therefore, a structure presenting two consecutive onsets is ill-

[4] We assume that vowel deletion - or more precisely the loss of a nuclear position - takes place as the consequence of the establishment of right-headed internuclear governing relations which are considered in details in Chapter 5.

formed since one of the onsets is not preceded by a nucleus. We propose that the pointless onset in (10) is deleted in order to allow an onset-nucleus sequence to occur. Thus, the final onset from the noun is followed by the initial nucleus from the suffix. Nuclear heads are projected and the metrical structure is constructed. The final derivation of the form [ɔríñα] is illustrated in (11).

(11)



Notice that in the innermost cycle of the process of deriving [ɔríñα] (cf (8a)) the noun stem vowel was phonologically interpreted in primary stressed position where lax mid vowels may occur (cf. (6)). We assume the Principle of Strict Cyclicity (cf. KEAN (1974:179)) which establishes that all phonological processes triggered in an innermost cycle remain throughout the derivational process. Therefore, since the lax mid vowel in a form like [ɔríñα] was phonologically interpreted in the innermost cycle (where it occurred in primary stressed position (cf. (8a)) it remains as a lax mid vowel throughout the derivational process.

The noun stem vowel - which bore primary stress in the innermost cycle (cf. (8a)) - happens to be in pretonic position in the final derivation (cf. (11)). Notice that this outcome - a vowel which bears primary stress in the innermost cycle occurs in pretonic position in the final derivational process - follows from the parameters involved in the construction of metrical constituents in BP. Feet are built on the projection of nuclear heads. Word-trees are built on the projection of the metrical heads. Given that word trees are right-headed, the noun stem vowel in (11) must be assigned a weak node at the word tree level. Therefore, the noun stem vowel surfaces in pretonic position.

The analysis we have just presented accounts for forms in which lax mid vowels occur pretonically. Let us now consider derived forms in which a pretonic tense mid vowel occurs. Let us assume that the derived forms [orístɑ] and [duelístɑ] (cf. (4a-b)) present the morphological structures illustrated in (12).

(12) a. (or + ist + ɑ) [orístɑ]
b. (duel + ist + ɑ) [duelístɑ]

The parentheses in (12) enclose a single morphological domain which is phonologically interpreted as a word. That is, phonological processes take place as they would in any other single morphological domain.

We have seen that before primary stress only tense mid vowels occur in underived nouns in BP (cf. (6)). If forms like (12) are analysed as a single morphological domain, i.e. a word, they will not present lax mid vowels in pretonic position (since any single domain in BP does not allow lax mid vowels to occur pretonically). Given that forms in (12) must present tense mid vowels, we have evidence that (12) contains a single domain. The forms [orístɑ] and [duelístɑ] are obtained.

According to the analysis we have proposed in the preceding pages we should find mainly two ways of grouping morphemes in BP. In one case morphemes would be grouped as ((x)y), i.e. where more than one morphological domain is involved. In the other case the morphemes are grouped as (xy) when they are analysed as a single morphological domain.[5]

The proposal to analyse morphological domains as above is presented in KAYE (1989d). According to KAYE an instance in which morphological categories are grouped as ((x)y) or ((x)(y)) is called 'analytic' morphology and an instance in which morphological categories are grouped as (xy) is called 'non-analytic' morphology. In (13) we illustrate the forms which involve analytic and non-analytic morphology that we have considered in the preceding pages.

(13)
a. ((ɔr+ɑ) iñ + ɑ) [ɔríñɑ] 'hour (dim)'
b. ((duɛl+û) ísîm + û) [duɛlísîmû] 'duel (sup)'

c. (or + ist + ɑ) [orístɑ] 'hourly worker'
d. (duel + ist + ɑ) [duelístɑ] 'duellist'

(13a-b) illustrate instances of analytic morphology which involve internal domains. (13c-d) illustrate instances of non-analytic morphology which involve single domains. We agree with HALLE (1986:6) who claims that whether or not an affix is cyclic, or analytic in our terms, is an idiosyncratic and

[5] In the previous pages we considered cases in which more than one morphological domain is analysed as ((x)y). Morphological domains may also be grouped as ((x)(y)). Such cases are discussed in KAYE (1989d).

variable property of it.[6] It follows from this that the suffixes -íñ (cf. (13a)) and -ísîm (cf. (13b)) require analytic morphology whereas the suffix -ist (cf. (13c-d)) requires non-analytic morphology. Most of the suffixes in BP require non-analytic morphology. That is, suffixes are added directly to noun stems and they are phonologically interpreted as a single morphological domain. In (14) we illustrate some suffixes from BP which require analytic morphology.[7]

(14)	a. -iñ	'diminutive'
	b. -isîm	'superlative'
	c. -mẽt	'adverb'

Evidence that the suffixes illustrated above require analytic morphology comes from other

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[6] "I shall assume that whether or not an affix is cyclic is not a property of the morphological rule by which it is assigned, but is rather an idiosyncratic and variable property of the affix." HALLE (1986:6).

[7] Indeed we propose that the phonological representation of the suffixes -iñ and -isîm is:

```
O  N  O  N          O  N  O  N  O  N
   |  |  |             |  |  |  |  |
   x  x  x             x  x  x  x  x
   |  |                |  |  |  |
z  î  ñ             z  î  s  î  m
```

Notice that in the representations above the suffixes are preceded by the segment z. We assume that z is a floating consonant which does or does not attach the initial onset position of the suffix according to government constraints. Assuming the representations above we account for variable forms presenting diminutive and superlative suffixes, i.e. [ɔríña] ~ [ɔrazíña] 'hour (dim)' and [mɔlísîmû] ~ [mɔlizísîmû] 'softest'. For details on the analysis of these forms see SILVA (1989a).

phonological processes which, like the alternations between lax and tense vowels we have described before, take place when a vowel is primary stressed, or more precisely is within the dominant foot of a domain. We will discuss next the process of vowel nasalization in BP.[8]

It has been observed that a primary stressed vowel in BP must be nasalized when it is followed by a nasal consonant (cf. PONTES (1972), VANDRESSEN (1975), SHAW (1986)). On the other hand, a pretonic vowel which is followed by a nasal consonant can be either nasal or oral. These facts are illustrated in (15).

(15)	a.	[oseãnû]		*[oseánû]	'ocean'
	b.	[pẽna]		*[pénɑ]	'pity'
	c.	[fĩnɑ]		*[fínɑ]	'thin'
	d.	[žu̯anétî]	~	[žuãnétî]	'bunion'
	e.	[điamãtî]	~	[điãmãtî]	'điamond'
	f.	[dionízjû]	~	[diõnízjû]	'Dionísio'

Forms in (15a-c) show that a primary stressed vowel followed by a nasal consonant must be nasalized. Forms (15d-f) show that a pretonic vowel followed by a nasal consonant might or might not be nasalized. The

[8] Further evidence that the suffixes illustrated in (14) require analytic morphology comes from the process involving breaking up of branching onsets which is considered in Chapter 6. We refer the reader to SILVA (1989b) for details on this issue.

alternation between oral and nasal vowels in pretonic position (cf. (15d-f)) leads us to expect any pretonic vowel followed by a nasal consonant to be either nasal or oral. Nevertheless, some forms require a pretonic vowel followed by a nasal consonant to be nasalized. Consider forms in (16).

(16) a.	[oseα̃níñû]	*[oseaníñû]	'ocean (dim)'
b.	[pẽnísîmα]	*[penísîmα]	'most pitiful'
c.	[fĩnamẽtî]	*[finamẽtî]	'thinly'

Forms in (16) present suffixes which, according to our analysis, require analytic morphology (cf. (14)). Given that the suffixes in (16) require analytic morphology these forms will present the following morphological structure.

(17) a.	((osɛan+û) iñ + û)	[oseα̃níñû]
b.	((pɛn+α) ísîm + α)	[pẽnísîmα]
c.	((fîn+α) mẽt + î)	[fĩnamẽtî]

Let us consider the derivation of [pẽnísîmα] (cf. (17b)). We assume that any form which requires a pretonic vowel followed by a nasal consonant to be nasalized is derived in like manner. Consider (18).

(18)

s w

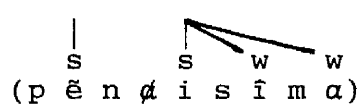
((p ẽ n α) î s î m α)

The innermost cycle is phonologically interpreted in (18) when the noun [pẽnα] 'pity' is derived. The noun stem vowel must be nasalized since it occurs in primary stressed position followed by a nasal consonant within the domain. We then proceed to the outermost cycle as illustrated in (19).

(19)

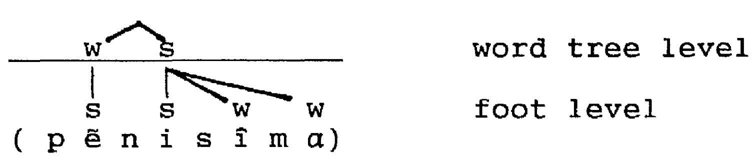
In (19) there is a sequence of adjacent vowels which corresponds to a sequence of strictly adjacent nuclear positions. That is, the initial nuclear position of the suffix is strictly adjacent to the final nuclear position of the noun stem. We have already proposed that in a sequence of adjacent nuclear positions the far left position is deleted (cf. (10)). It follows from our proposal that the final vowel of the noun in (19) is deleted. This process is illustrated in (20).

(20)



The final derivation of the form [pẽnísĩmɑ] is illustrated in (21).

(21)



In a form like [pẽnísîmɑ] a pretonic vowel followed by a nasal consonant must be nasalized, i.e. *[pɛnísîmɑ] (cf. (16b)). Vowel nasalization is obligatory in this case because the noun stem vowel is nasalized in the innermost cycle. Vowel nasalization must occur when a primary stressed vowel is followed by a nasal consonant (cf. (18)). Consider the derived forms in (22).

(22)

a. [oseanɔ́grɑfû]	~	[oseɑ̃nɔ́grɑfû]	'oceanographer'
b. [penózû]	~	[pẽnózû]	'distressing'
c. [finézɑ]	~	[fĩnézɑ]	'soft manner'

Forms in (22) show that in derived forms a pretonic vowel followed by a nasal consonant can be either oral or nasal. The alternation between oral and nasal vowels in forms in (22) is accounted for by the non-analytic nature of the derivative suffixes. The morphological structures of forms in (22) are illustrated in (23).

(23) a. (osɛan + ɔgrɑf + û)
b. (pɛn + oz + û)
c. (fîn + ez + ɑ)

Forms in (23) are phonologically interpreted as a single morphological domain. Therefore, as in underived nouns (cf. (15d-f)) a pretonic vowel followed by a nasal consonant in (23) can be either oral or nasal.

In the preceding pages we have considered phonological processes which involve analytic and non-analytic morphological domains.[9] We have shown that pretonic lax mid vowels, e.g. [ɔríña] and [duɛlísîmû], and pretonic nasal vowels, e.g. [oseãníñû] and [pẽnísîmɑ], must occur when the analytic suffixes -iñ-, -isîm- and -mẽt- are involved in derivational processes. Throughout this thesis - unless otherwise stated - derived forms that we will consider involve non-analytic morphology, i.e. they are phonologically interpreted as single morphological domains.

Let us now return to the discussion of constraints imposed on pretonic vowels in BP.

[9] The proposal to analyse morphological domains we have discussed in the preceding pages is presented in details in KAYE (1989d) and KAYE & VERGNAUD (1990). It is important to say that within this view a given suffix may require analytic morphology in one dialect and non-analytic morphology in another dialect. It is also possible that a suffix which generally requires analytic morphology may require non-analytic morphology when it occurs with a restricted set of noun stems. Both of these possibilities are attested in BP. That is, suffixes which require analytic morphology in the Belo Horizonte dialect (cf. (14)) require non-analytic morphology in the Natal dialect (cf. SEGUNDO (in preparation)). It also happens that the analytic suffixes presented in (14) occur in a non-analytic manner with a restricted set of noun stems. For a fuller description on analytic and non-analytic morphological domains in BP see SILVA (1989a).

Underived forms and forms involving non-analytic morphology must present pretonic positively charmed oral vowels, i.e. [a,e,i,o,u]. In (24) we illustrate the internal representation of BP positively charmed oral vowels.[10]

(24)

$$(v^{\circ}.\ \underline{A}^{+})^{+} \text{ or } A^{+} = [\mathrm{a}]$$
$$(\text{Ɨ}^{+}.(A^{+}.\underline{I}^{\circ})^{\circ})^{+} = [\mathrm{e}]$$
$$(\text{Ɨ}^{+}.\underline{I}^{\circ})^{+} = [\mathrm{i}]$$
$$(\text{Ɨ}^{+}.(A^{+}.\underline{U}^{\circ})^{\circ})^{+} = [\mathrm{o}]$$
$$(\text{Ɨ}^{+}.\underline{U}^{\circ})^{+} = [\mathrm{u}]$$

In this section we have discussed the distribution of pretonic vowels in BP. In the following section we summarize the discussion of the BP oral vowel system we presented in the preceding pages and we define which sequences of adjacent oral vowels we find in BP.

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[10] Nasal vowels - which are also positively charmed segments - may occur in pretonic position of underived forms and forms involving non-analytic morphology. Forms involving analytic morphology may present complex charmless segments in pretonic position, e.g. [ɔríñɑ] 'hour (diminutive)' and [duɛlísîmû] 'the best duel'.

3.4. Summary of the BP Vowel System

In (25) we present the distribution of BP oral vowels together with the charm requirements which must be satisfied with respect to the primary stressed position.

(25)

a. Primary stressed position: The segments must have at least one positively charmed element in their internal representation. [a,e,ɛ,i,o,ɔ,u]

b. Following primary stress: The segments must be formed by a single element and the resulting segment must be neutrally charmed. [û,î,ɑ]

c. Preceding primary stress: The segments must be positively charmed. [a,e,i,o,u]

At this point we are able to define which sequences of adjacent oral vowels we shall find in BP. Any primary stressed vowel, i.e. [a,ɛ,e,i,o,ɔ,u], can potentially be followed by [û,î,ɑ], and any primary stressed vowel can potentially be preceded by [a,e,i,o,u]. We also expect to find pretonic sequences of vowels presenting members of the set [a,e,i,o,u] and sequences of posttonic vowels presenting members of the set [û,î,ɑ].

Throughout this thesis we will be dealing with phonological processes which involve sequences of adjacent nuclear positions. More specifically, we will be investigating sequences of adjacent nuclear positions where one of the nuclear positions is filled with a high vowel and the other nuclear position is filled with some other vowel. In order to analyse such processes we have to define the underlying representation of high vowels in BP. This is the topic of the following section.

3.5. The Underlying Representation of High Vowels

In this section we will argue that the underlying representation of high vowels in BP corresponds to the lax high vowels [î] and [û] - whose internal representations are $\underline{I}^{\circ}$ and $\underline{U}^{\circ}$ respectively. Whether a tense or a lax high vowel is phonetically manifested depends on charm constraints imposed on nuclear segments.

Evidence for such a proposal - of assuming that the underlying representation of high vowels in BP corresponds to lax high vowels - comes from nasal vowels. We have seen that nasal vowels are derived from a fusion operation in which the positively charmed nasal element N^{+} combines with a charmless segment (cf. Chapter 1). The fact that the nasal element only combines with charmless segments follows from the Charm Principle which establishes that expressions with like charm cannot combine. Given that the nasal element is positively charmed it cannot combine with positively charmed elements. If high vowels in BP corresponded to the tense vowels /i/ and /u/ - which represent positively charmed segments, i.e. $(\text{Ɨ}^{+}.\underline{I}^{\circ})^{+}$ and $(\text{Ɨ}^{+}.\underline{U}^{\circ})^{+}$ - we would not expect high vowels to be nasalized. This is because the positively charmed segments /i/ and /u/ cannot combine with the positively charmed nasal element N⁺. Indeed, high vowels may be nasalized in BP, e.g. [sĩ] 'yes' and [ũ] 'one'. The fact that high vowels may be nasalized in BP, provides us with evidence that the underlying representation of high vowels in BP corresponds to the lax high vowels /î/ and /û/.[11]

According to our proposal, the underlying representation of high vowels in BP corresponds to lax high vowels. We have seen that both tense and lax high vowels occur in BP, e.g. [piádα] 'joke' and [έlîsî] 'helix' (cf. (1)). Thus, we have to explain the conditions under which a tense or a lax high vowel is phonetically manifested. We propose that whether a tense or a lax high vowel is realized depends on charm constraints imposed on nuclear segments, according to their position in relation to the primary stressed position.

Let us first consider primary stressed vowels. Recall that a nuclear position which bears primary

[11] KAYE's (1989e) discussion of the distribution of nasal vowels in French observes that high vowels cannot be nasalized, i.e. *[ĩ], *[ũ] and *[ỹ]. Interestingly, his analysis shows that the underlying representation of high vowels in French corresponds to tense high vowels.

stress must be filled with a segment which presents at least one positively charmed element in its internal representation (cf. (25a)). The lax high vowels [ɪ̂] and [û] - whose internal representations consist of the charmless elements I° and U° - do not present any positively charmed element in their internal representations. Then, their occurrence in primary stressed position violates charm constraints. We propose that in order to satisfy charm requirements the lax high vowels [ɪ̂] and [û] receive either the ATR element $\underline{I}^{+}$ or the nasal element N^{+} to their internal representations. The positively charmed segments [i,ĩ,u,ũ], which present a positively charmed element in their internal representations, are realized. Thus, charm requirements imposed on primary stressed nuclear heads are satisfied.

Let us now consider pretonic high vowels. We have seen that pretonic nuclear positions must be filled with a positively charmed segment (cf. (25c)). We assume that in order to satisfy charm requirements imposed on pretonic nuclear heads either the ATR element or the nasal element - which transmits positive charm to a phonological expression - is added to the internal representation of the lax high vowels /ɪ̂/ and /û/. Tense high vowels, i.e. [i,u], or nasal high vowels, i.e. [ĩ,ũ] - which are positively charmed segments - will occur in pretonic position. Thus, charm requirements imposed on pretonic nuclear heads are satisfied.[12]

Regarding posttonic nuclear positions we have seen that they must be filled with a neutrally charmed segment (cf. (25b)). Thus, the lax high vowels [ɪ] and [ʊ] - which are neutrally charmed segments - satisfy charm requirements imposed on posttonic nuclear positions.

[12] Throughout this thesis we will be discussing phonological phenomena which involve BP oral vowels. Thus, we will restrict our analysis of charm requirements to cases in which the ATR element is added to the internal representation of a high vowel so that a tense oral high vowel, i.e. [i,u], is realized. Cases in which the nasal element is added to the internal representation of a segment in order to satisfy charm requirements are not analysed in this thesis because they would require a detailed discussion of processes involving vowel nasalization in BP which would lead us beyond the scope of our research.

3.6. Conclusion

In this Chapter we have seen that the occurrence of certain vowels in BP is dependent on charm constraints imposed on nuclear heads. Such constraints define which sequences of adjacent vowels we shall find in BP (cf. (25)).

Throughout this thesis we will be investigating forms which present sequences of adjacent nuclear positions. Our analysis aims to account for the processes of vowel coalescence in BP with emphasis on the process of vowel-glide alternations.

In the following Chapter we present a review of the literature concerning high vowels and glides in BP. We will see that further research is still needed on this topic. Then, in the remaining Chapters of this thesis, we will present our analysis to account for the processes of vowel-glide alternations in BP.

CHAPTER 4

REVIEW OF THE LITERATURE

4.0. Introduction

A perusal of the phonological literature on BP shows that there has been controversy as to whether high vowels and glides are both underlying segments or if the latter are derived from the former. In this Chapter we will consider both views in different frameworks. First we consider CAMARA's (1953,1970) phonemic analysis. Later we consider works which are based on the linear generative framework. Finally, we discuss BISOL's (1989) analysis which aims to define the syllabic structure of diphthongs in BP within a non-linear framework.

4.1. A Phonemic View

4.1.1. Glides as Underlying Segments

The first Brazilian linguist - CAMARA - proposed in 1953 that glides should be analysed as independent phonemes in BP.[1] Such a proposal was based on the interpretation of glides as consonantal segments within the syllabic system of BP. Analysing glides as consonantal segments allows one to fit them into the closed syllable pattern CVC. This type of syllable would occur in forms such as [més] 'month' and [pástɑ] 'suitcase' as well as in forms like [páw] 'wood' and [gájtɑ] 'tin fife'. The basic argument for assuming this proposal is that it provides a simpler phonotatic system. This is because, if glides were analysed as vowels, a syllable of the type CVV would have to be assumed. This type of syllable would occur only in forms presenting vowel-glide sequences, e.g. [páw] 'wood' and [gájtɑ] 'tin fife'. In order to provide a simpler syllabic system - which excludes CVV syllables - glides were then analysed as consonantal segments.

[1] As we will see shortly, this proposal was later rejected by CAMARA (1970).

Although the proposal of analysing glides as consonants provides a simpler syllabic system - which excludes CVV syllables - it implies a more complex phonemic inventory - which includes glides. On the other hand, if glides are analysed as vowels, a simpler phonemic inventory - which excludes glides - is provided, and a more complex syllabic system - which includes CVV syllables - must be assumed. At this stage it appeared that the interpretation of glides as either vowels or consonants depended on simplifying either the syllabic system or the phonemic inventory of BP. Evidence about either assumption was lacking.

In 1970 CAMARA rejected his initial proposal that glides behave as consonants fitting into the closed syllable pattern CVC. He claimed then that glides have to be analysed as vowels - fitting into a CVV syllable type. CAMARA's argument for assuming that glides must be interpreted as vowels concerns the distribution of "R" sounds in Portuguese.

Two types of "R" are assumed in Portuguese. The so-called bland R - which is phonetically manifested as a tap - and the so-called strong R - whose phonetic manifestation varies considerably from dialect to dialect.[2] Contrast between bland and strong Rs is found only in intervocalic position, e.g. [kárû] 'dear' and [káhû] 'car'. Other than intervocalically the bland R occurs only following an obstruent, e.g. [prátû] 'plate'. The strong R, besides intervocalically, occurs in every other environment: that is, either in initial position, e.g. [hátû] 'rat'; or in final position, e.g. [máh] 'sea'; or closing a syllable, e.g. [káhtɑ] 'letter'; or following a closed syllable, e.g. [ishaέw] 'Israel'.

As CAMARA observes, if glides are interpreted as consonantal segments - fitting into the closed syllable pattern CVC - we should find the strong R after a glide. This is because the strong R follows a consonant which occurs in a closed syllable, cf. [ishaέw], i.e. *[israέw]. Nevertheless, we do not find the strong R after a glide but instead the bland R occurs following it, e.g. [pléwrɑ] 'pleura' and

[2] We will transcribe the strong R as [h]. It may also be phonetically manifested as a trill [ɼ], or as a velar fricative [X], or as a retroflex [ɻ] depending on a variety of sociolinguistic factors. For a description and a sociolinguistic analysis of "R" sounds in BP see OLIVEIRA (1983). For further detail on the distribution of "R" sounds in BP see CAMARA (1970), LOPEZ (1979), CAGLIARI (1982), MAIA (1981), SHAW (1986).

[žájrû] 'Jairo'.[3] The fact that the bland R follows a glide supports CAMARA's claim that glides have to be interpreted as vowels. This is because bland Rs occur after a vowel, e.g. [kárû] 'dear', but not after a closed syllable, *[israɛ́w].

Given that within the syllabic system glides behave like vowels, CAMARA (1970) proposes that glides are "positional variants" of the high vowels /i/ and /u/. In other words, he proposes that glides are derived from high vowels. In the following section we discuss his proposal.

[3] A problem with CAMARA's proposal is that he does not explain why strong R's cannot follow a glide, e.g. *[pléwhɑ]. Given that strong R's may follow a vowel, e.g. [káhû] 'car', we should find strong R's following a glide since according to his proposal glides behave like vowels.

4.1.2. Glides Derived from High Vowels

CAMARA (1970) proposes that glides are "positional variants" of the high vowels /i/ and /u/, i.e. he claims that glides and high vowels are in complementary distribution. According to his proposal high vowels are manifested as their corresponding glides when a high vowel is flanked by a stressed vowel, e.g. [gájtα] 'tin fife' and [kwádrû] 'picture', i.e. *[gáitα] and *[kuádrû]. In other environments, i.e. when a high vowel is flanked by a vowel which does not bear primary stress, high vowels are in free variation with glides, e.g. [kaipírα] ˜ [kajpírα] 'bumpkin' and [žuazérû] ˜ [žwazérû] 'Juazeiro'.

Nevertheless, CAMARA's proposal encounters some difficulties. The first one is related to his claim that high vowels flanked by a primary stressed vowel are manifested as a glide, e.g. [kwádrû] but *[kuádrû]. It follows from his proposal that we should not find forms which present a high vowel surrounded by a primary stressed vowel. This is because, according to him, any high vowel surrounded by a primary stressed vowel should be manifested as a glide. Nevertheless, in forms such [kwáλû] ˜ [kuáλû] 'curd' either a glide or a high vowel may be phonetically manifested in a position which immediately precedes a primary stressed vowel. According to CAMARA, a pronunciation such as [kuáλû] would be impossible because in this form the high vowel u immediately precedes a primary stressed vowel. Thus, CAMARA's proposal that glides occur whenever a high vowel is adjacent to a primary stressed vowel does not account for all forms in BP, cf. [kuáλû].[4]

Another problem with CAMARA's analysis involves forms in which glides occur in posttonic position, e.g. [ágwɑ] 'water'. According to CAMARA a high vowel flanked by a vowel which does not bear primary stress is in free variation with its corresponding glide. It follows from this that a form like [ágwɑ] - where a glide is followed by a vowel which does not bear primary stress - should alternate with a form like [ágûɑ] - where a high vowel is pronounced. Nevertheless, this is not the case. A form like [ágwɑ] 'water' cannot be pronounced as *[ágûɑ], i.e. with a posttonic sequence of vowels. According to CAMARA both [ágwɑ] and *[ágûɑ] should be possible pronunciations

[4] In Chapter 6 we consider in detail forms such as [kwádrû] 'picture' - but not *[kuádrû], i.e. where the glide does not alternate with its corresponding glide; and forms such as [kwáλû] ~ [kuáλû] 'curd', i.e. where either a glide or a high vowel may be phonetically manifested.

for 'water'.

We have seen that CAMARA's analysis is problematic in accounting for some forms in BP (cf. [kuáλũ] ~ [kwáλũ] and [ágwɑ]). However, he raises some interesting points. The first is the evidence he provides for the fact that glides must be interpreted as vowels (cf. the discussion on "R" sounds above). The second interesting point he makes is that the role of the primary stressed vowel is fundamental in accounting for when a glide or a high vowel occurs in BP. In the following section we will discuss how glides and high vowels have been analysed within the linear generative framework.

4.2. A Linear Generative View

4.2.0. Introduction

Most of the phonological analysis on BP are based on the linear generative framework (cf. HEAD (1964), NARO (1971), ISTRE (1971), JEROSLOW (1974), REDENBARGER (1976), LOPEZ (1979), BEDDOR (1982), SHAW (1986)). Regarding the phonological interpretation of glides, there has been controversy on whether glides are derived from high vowels or whether glides are underlying present in phonological representations. In this section we will see that either assuming that glides are underlyingly present or that glides are derived from their corresponding high vowels is problematic within the linear generative framework.[5]

[5] We have opted for not discussing any specific work which is based on the linear generative framework. This is because such works aim to provide a general analysis of the phonological system of BP rather than to provide an analysis which deals with a specific topic. Regarding the phonological behaviour of glides and high vowels in BP the authors we have quoted above only state their assumption as to whether glides are underlyingly present or derived from their corresponding high vowels - without presenting arguments.

4.2.1. Glides as Underlying Segments

In this section we consider the proposal that glides are underlyingly present in the phonological system of BP. Within the linear generative framework the difference between high vowels and glides depends on whether a [high] segment is specified as either + or - [syllabic]. In (1) we illustrate the phonological representation of the segments [i,j,u,w].[6]

(1)

$$
\begin{array}{cc}
[\mathrm{i}] & [\mathrm{j}] \\
\begin{bmatrix} +\ \text{syllabic} \\ +\ \text{high} \end{bmatrix} & \begin{bmatrix} -\ \text{syllabic} \\ +\ \text{high} \end{bmatrix} \\
 & \\
[\mathrm{u}] & [\mathrm{w}] \\
\begin{bmatrix} +\ \text{syllabic} \\ +\ \text{high} \end{bmatrix} & \begin{bmatrix} -\ \text{syllabic} \\ +\ \text{high} \end{bmatrix}
\end{array}
$$

Notice that the segments [i,j] and [u,w] differ only with respect to the feature [syllabic]. Whereas the segments [i,u] represent a syllabic peak the segments [j,w] do not. Thus, the segments [i,u] may bear stress whereas the segments [j,w] may not.

A problem with the assumption that glides are underlying present in BP comes from the distribution of posttonic glides in relation to primary stress.

---

[6] In (1) we only specify the relevant features for the representations of these segments.

Primary stress in BP may be either final, penultimate or antepenultimate, e.g. [pará] 'Pará', [kázɑ] 'house' and [sílɑbɑ] 'syllable' (cf. Chapter 2). If we assume that glides are underlying segments in BP then we expect to find antepenultimate stressed forms where a glide follows primary stress. This is because glides do not count as a syllable peak. Thus, nothing should prevent stress from falling on the third-to-last syllable peak, i.e. *[gájtĩkɑ], *[fámĩljɑ] and *[gójɑbɑ], should be possible forms. However, this is not the case. Thus, the proposal that glides are underlying segments in BP does not explain why stress cannot fall on the third-to-last syllable peak in forms where a glide follows primary stress.

In this section we have seen that the proposal that glides are underlying segments in BP does not account for the lack of antepenultimate stressed forms where a glide follows primary stress. In the following section we consider the proposal that glides are derived from high vowels.

4.2.2. Glides Derived from High Vowels

Recall that what distinguishes a high vowel from its corresponding glide is the feature [syllabic] (cf. (1)). Thus, the assumption that glides are derived from their corresponding high vowels leads us to posit a rule which turns a [+syllabic] segment into its [-syllabic] counterpart. Let us first consider the process of deriving prevocalic glides. Consider (2).

(2) $\begin{bmatrix}\text{+high} \\ \text{-stress}\end{bmatrix}$ ----> [-syllabic] / ____[+syllabic]

Rule (2) states that an unstressed high vowel turns into its corresponding glide when it is followed by a vowel.[7] We have seen that whether a glide alternates or fails to alternate with its corresponding high vowel depends on its position with respect to the primary stressed vowel. That is, in pretonic position either a glide or a high vowel may be manifested ([piádɑ] ~ [pjádɑ] 'joke') whereas in posttonic position only a glide may occur ([sábjɑ] 'wise' but *[sábîɑ]).

[7] Rule (2) must define that the high vowel does not bear primary stress. This is because, unlike unstressed vowels, a primary stressed high vowel cannot turn into its corresponding glide, i.e. [píɑ] 'sink' but *[pjɑ] or [asaí] 'Açai' but *[asaj].

In order to express the relationship between the position in which the high vowel occurs with respect to the primary stressed vowel, i.e. whether it occurs pretonically or posttonically, one would have to stipulate awkward and ad hoc constraints to rule (2). This is because within the formalism available in the linear generative framework, a vowel or a [+syllabic] segment is defined as either [+stress] or [-stress]. Thus, to determine whether an unstressed vowel occurs pretonically or posttonically would require the stipulation of awkward and ad hoc constraints. Let us now consider the process of deriving postvocalic glides. Consider (3).

$$(3)\ \begin{bmatrix}+\text{high}\\ -\text{stress}\end{bmatrix} \text{--->} [-\text{syllabic}]\ /\ [+\text{syllabic}]\ \_\_\_\_$$

Rule (3) states that an unstressed high vowel turns into its corresponding glide when it is preceded by a vowel. In a similar way to the proposal of deriving prevocalic glides (cf. (2)), a problem which arises from deriving postvocalic glides from a rule such as (3) is that it would be awkward and ad hoc to express the fact that posttonic postvocalic glides do not alternate with their corresponding high vowel ([gájtɑ] 'tin fife' but *[gáîtɑ]) whereas pretonic postvocalic glides do ([kajpírɑ] ~ [kaipírɑ] 'bumpkin'). In other words, once again the relationship between the position in which the high vowel occurs with respect to the primary stressed vowel, i.e. whether it is pretonic or posttonic, requires the stipulation of awkward and ad hoc constraints to rule (3).

There are further problems with analyses based on the linear generative framework. These problems involve the theoretical assumptions of the model which allows one to express more phonological processes than those found in natural languages as well as in its assumptions a phonological rule does not address explicitly the relationship between an event and the environment in which it takes place.

For example, rules (2) and (3) determine that a high vowel becomes [-syllabic] when it is flanked by another vowel, i.e. a [+syllabic] segment. Taking the processes illustrated in (2) and (3) into consideration, one could ask some of the following questions: Could a high vowel turn into its corresponding glide when it is flanked by a consonant? Why is it that unstressed vowels are subject to the process of gliding and not stressed ones? Why are high vowels subject to the loss of their syllabicity when flanked by another vowel? Could glides turn into their corresponding high vowels?

Without going into theoretical details of the model, let us address some of these questions. For example: could a high vowel turn into its corresponding glide when it is flanked by a consonant? In the formalism available for the linear framework it is possible to formalize processes such as those illustrated in (2) and (3) - according to which a high vowel turns into its corresponding glide when it is flanked by a vowel. It is also possible to formalize a process according to which a high vowel turns into its corresponding glide when it is flanked by a consonant, i.e. [+consonantal] segment. However, a phonological process which turns high vowels into their corresponding glides before or after a consonant does not occur in natural languages. Thus, a linear framework allows one to express phonological processes which are recurrent in natural languages as much as phonological processes which do not occur at all.

Let us now address the question of why only unstressed vowels may turn into a glide unlike stressed ones. The fact that only unstressed vowels may turn into a glide is seen as a stipulation without any connection to the stress system of the language.

Nevertheless, as we have been discussing throughout this Chapter, the processes involving high vowel-glide alternations in BP are closely related to the stress system of the language. However, no connection between the process of gliding and the stress system of BP is established within the linear framework.

In the previous pages we have addressed some problems in analysing phonological phenomena related to high vowel-glide alternations in BP within a linear framework. We have seen that the problems met by such analyses are related to the fact that in a linear framework stress is viewed as a segmental feature attributed to individual segments rather than as a property of a domain. We have also seen that in the formalism available in a linear framework one may express more phonological processes than those which occur in natural languages. Finally, in such framework one does not express the relationship between a phonological event and the environment in which it occurs. In the following section we consider how glides and high vowels have been analysed within a non-linear framework.

4.3. The Non-linear View

4.3.0. Introduction

Within non-linear frameworks a great deal of work has been done on the process of vowel-glide alternations (cf. STERIADE (1984), KAYE AND LOWENSTAMM (1984), KENSTOWICZ AND RUBACH (1987), MAROTA (1988), CARREIRA (1988), BOOIJ (1989)). These works aim to define the phonological representations of falling and rising diphthongs in different languages.

Few works on BP are based on non-linear frameworks. In this section we discuss BISOL's (1989) work which to our knowledge is the only attempt to investigate the phonological representation of diphthongs in BP.[8]

[8] This work reflects the research done during her sabbatical year at Stanford University (1988). In her bibliographical references no other works on the same topic in BP are mentioned.

4.3.1. Bisol's Analysis

The hierarchical structure of phonological representations assumed by BISOL (1989) is illustrated in (4).

```
(4)            .                syllable tier
             /   \
            O     R             rime tier
            |     |
            x     x             prosodic tier
            |     |
[features] [features]           melodic tier
```

She assumes that the so-called rising diphthongs - which consist of a glide followed by a vowel, e.g. [kjábû] 'okra' - are derived from a sequence of rimes. The so-called falling diphthongs - which consist of a vowel followed by a glide, e.g. [páwzɑ] 'pause' - are assumed to be either lexically present or derived. Let us first consider her analysis of falling diphthongs whose phonological representations may be either (5a) or (5b).

```
(5)  a.     R                        b.   R
           / \                            |
          x   x                           x
          |   |                          / \
       [...] [...]                   [...] [...]

     [páwzɑ] 'pause'                 [féjrɑ]   'market'
     [héjnû] 'kingdom'               [péjšĩ]   'fish'
     [sɛ́w]   'sky'                   [kówrû]   'leather'
```

According to BISOL (5a) represents the structure of a heavy diphthong and (5b) represents the structure of a light diphthong.[9] Heavy diphthongs correspond to "true" or phonological diphthongs and are associated to two skeletal positions. Light diphthongs are derived from assimilation processes at the melodic tier (cf. (4)) and are associated to a single skeletal position.[10] According to BISOL's proposal heavy diphthongs differ from light diphthongs in the sense that the former are phonologically present and the latter are derived. Another difference between heavy and light diphthongs is that the former cannot be reduced whereas the latter are likely to be reduced.

BISOL assumes that the same diphthong, e.g. [ej], might have two different phonological representations. That is, a diphthong such as [ej] may have the structure of a heavy diphthong in a form like [héjnũ] 'kingdom' (cf. (5a)) - which, according to her, is a phonological diphthong - and the diphthong [ej] may

---

[9] GP also assumes the notions of heavy and light diphthongs. However, as we will see later (Chapters 5 to 8) the notions of light and heavy diphthongs assumed in GP differ considerably from those assumed by BISOL.

[10] Unfortunately, BISOL neither illustrates how the process of deriving light diphthongs operates nor gives references to any work which would exemplify such phenomenon.

have the structure of a light diphthong in a form like [féjrɑ] 'market' (cf. (5b)) - which is a diphthong derived at the melodic tier. It follows from BISOL's analysis that in a form like [héjnũ] 'kingdom' the diphthong [ej] is not subject to reduction - since it corresponds to a heavy diphthong (cf. (5a)) - whereas in a form like [féjrɑ] 'market' the diphthong [ej] may be reduced to [e], since it corresponds to a light diphthong (cf. (5b)).

BISOL's analysis aims to explain why some falling diphthongs are reduced, i.e. [ow] is reduced to [o] and [ej] is reduced to [e], whereas others are not. In order to solve this problem she proposes two different structures shown in (5). Diphthongs having a structure such as (5a) cannot be reduced whereas those presenting the structure (5b) are subject to reduction.

Let us consider in detail what has been called the process of diphthong reduction in BP (cf. NUNES (1951), NARO (1973), ALVARENGA ET AL (1989)). Basically two diphthongs are said to undergo a reduction process: [ow] is reduced to [o] and [ej] is reduced to [e]. That is, forms such as [kówrũ] 'leather' and [féjrɑ] 'market' may be manifested as [kórũ] and [féra] respectively.

According to BISOL's analysis the phonological representation of diphthongs which may undergo reduction corresponds to the structure (5b), i.e. a light diphthong. As she notes, the assumption that diphthongs which are subject to reduction are derived and therefore have the structure of a light diphthong (cf. (5b)) is problematic (our translation):[11]

> "The correct analysis of these data (diphthongs which may be reduced) is still not totally clear. We will present two different analyses, both of which reveal some problems. Nevertheless, both treatments suggest that the diphthongs under investigation do not exist in the underlying representation of lexical items." (BISOL: 193)

BISOL's proposal that diphthongs which are subject to reduction are derived is indeed problematic. Contrary to BISOL we assume that diphthong reduction in BP reflects a lexical reanalysis process rather than a phonological one. Evidence that diphthong reduction reflects a lexical reanalysis process comes from hypercorrection which occurs in informal dialects of BP. That is, -o- and -

---

[11] "A análise correta desses dados não está totalmente esclarecida. Apresentaremos duas linhas de argumentos, ambas com certos problemas. Todavia os dois tratamentos sugerem que o ditongo em pauta não existe na estrutura profunda de itens lexicais".

e- forms which are not historical diphthongs, e.g. [péra] 'pear' and [póvû] 'people', are (hyper)corrected to -ow- and -ej- as in [péjra] and [pówvû] in informal dialects of BP.

Let us now consider BISOL's proposal that the phonological representation of heavy diphthongs corresponds to the structure illustrated in (5a), i.e. two skeletal positions are associated to the same nuclear constituent. Recall that she claims that heavy diphthongs are underlyingly present. Two problems arise from the claim that heavy diphthongs are lexically present in BP. The first concerns the phonological behaviour of heavy diphthongs with respect to primary stress. Primary stress in BP may be either final, penultimate or antepenultimate, e.g. [pará] 'Pará', [káza] 'house', [sílaba] 'syllable' (cf. Chapter 2). If we assume that heavy diphthongs represent two skeletal positions associated to the same nuclear constituent, then we predict the existence of forms which present antepenultimate stressed heavy diphthongs, e.g. [gájtîkû]. This is because a heavy diphthong would metrically count as a single nuclear head. Thus, a form such as [gájtîkû] would represent an instance of antepenultimate stress. However, forms such as *[gájtîkû] usually do not occur in BP.[12]

The second problem with the assumption that heavy diphthongs are lexically present in BP comes from derived forms which end in a heavy diphthong, e.g. [muzéw] 'museum', and their derived forms, e.g. [muzeɔ́lûgû] 'specialist in museums'. Recall that the final vowel in penultimate and antepenultimate stressed nouns in BP corresponds to the gender suffix which may be spelled out either as [ɑ,û,î], eg. [kázɑ] 'house', [púlû] 'jump', [trístî] 'sad' (Chapter 2). In derived forms the gender suffix is suppressed when a derivative suffix is added to the noun stem, e.g. [kazérû] 'house keeper', [puládû] 'jumped' and [tristézɑ] 'sadness'.

If we consider the derived form [muzeɔ́lûgû] 'specialist in museums' - which is derived from the noun [muzéw] 'museum' - we notice that the final glide is suppressed when the suffix -ɔlûgû is added to the noun stem muzé-. The fact that the glide does not occur in a derived form such as [muzeɔ́lûgû] gives us

[12] There are few forms in BP which present antepenultimate stressed heavy diphthongs, e.g. [náwtîkû] 'nautical' and [fahmaséwtîkû] 'pharmaceutical'. We will show in Chapter 7 that in these forms the heavy diphthong is not lexically present.

evidence that it corresponds to the gender suffix.[13]

In the preceding pages we have considered BISOL's analysis of falling diphthongs. We have seen that her analysis is problematic in the sense that it assumes two distinct phonological structures for the same segmental sequence (cf. (5)). Furthermore, her assumption that vowel-glide sequences are lexically present in BP is problematic because she can neither account for the lack of forms which present antepenultimately stressed heavy diphthongs, i.e. *[gájtîkû], nor for the fact that the glide is suppressed in derived forms, cf. [muséw], [muzeɔ́lûgû].

Let us now consider BISOL's proposal to analyse the so-called rising diphthongs. She proposes that glide-vowel sequences are derived from a sequence of rimes where the high vowel delinks from its rimal position and either spreads into the preceding onset position (cf. (6a)) or into the following rime (cf. (6b)).

[13] An example in which the gender suffix occurs as a vowel rather than as a glide is the form [futúrû] 'future'. When the suffix -ɔ́lûgû is added to the noun stem futur- the gender suffix -û is omitted, i.e. [futurɔ́lûgû] 'fortune teller'.

```
(6)  a.  C V V (C)            b. C V V (C)
          \|                       |/
          [+ high]                [+ high]
          [- stress]              [- stress]
```

According to BISOL the spreading of the high vowel into the preceding onset (cf. (6a)) has priority over the spreading of the high vowel into the following rime (cf. (6b)). Consider (7).

```
(7)  a.  O    R  O  R          b.  O      R
         |\   |  |  |              |\   /|\
         k i  a  b  û              k r  i o w

          CCVCV                     CCVVC

     [kjábû] 'okra'            [krjów] 'created'
```

Notice that BISOL assumes two different derivations for a single process, i.e. the derivation of prevocalic glides. In one case she assumes that the high vowel delinks from its rimal position spreading into its preceding onset, e.g. [kjábû] 'okra' (cf. (7a)), and in another case the high vowel delinks from its rimal position spreading into its following rimal position, e.g. [krjów] 'created' (cf. (7b)).

Although BISOL proposes the derivations illustrated in (7) to derive prevocalic glides, she does not give any argument for her claim that the spreading of the high vowel into its preceding onset (cf. (7a)) has priority over the spreading of the high vowel into its following rimal position (cf. (7b)). In fact, to assume two different derivations for a single process, i.e. the derivation of prevocalic glides, is ad hoc since its aim is to express the same phonological process.

4.4. Conclusion

In this Chapter we have considered how the process of vowel-glide alternations and the phonological representation of diphthongs have been treated within different frameworks. We have seen that these works encounter problems in explaining when a high vowel alternates or fails to alternate with its corresponding glide, and in determining the phonological representation of diphthongs in BP.

In the following Chapter we will discuss governing relations between adjacent nuclear positions. The proposal on governing relations presented in the following Chapter will be applied to our analysis of vowel-glide alternations in BP which is presented in the remaining Chapters of this thesis.

CHAPTER 5

ON GOVERNING RELATIONS BETWEEN NUCLEAR POSITIONS

5.0. Introduction

In this Chapter we will consider governing relations involving a sequence of strictly adjacent nuclear positions. It is important to mention that no major work has dealt specifically with this topic. Therefore, the discussion addressed in this Chapter aims to provide a general discussion on this issue as well as to discuss the theoretical implications of governing relations between nuclear positions within the GP framework. The proposal presented in this Chapter will be applied to our analysis of vowel-glide alternations in BP which is presented in the remaining Chapters of this thesis. Consider (1).

(1)

$$\begin{array}{cccc} O & R & O & R \\ & | & & | \\ & N & & N \\ & | & & | \\ & x & & x \\ & | & & | \\ & V_1 & & V_2 \end{array}$$

(1) illustrates a sequence of adjacent positions which are associated to phonological constituents that belong to the same category, namely nuclei. Given that the adjacent positions in (1) are associated to constituents that belong to the same category (nuclei) we have a sequence of identical phonological units.

It has been argued in the literature that a representation which presents a sequence of identical phonological units is not well-formed. This constraint has been defined as the Obligatory Contour Principle or the OCP. According to this constraint, sequences of identical phonological units are prohibited in phonological representations. Thus, in order to prevent a sequence of identical phonological units from occurring, phonological processes apply.

In the following pages we will discuss the notion of OCP and we will address how governing relations involving a sequence of adjacent nuclear positions have been analysed within the GP framework.

5.1. The Obligatory Contour Principle

In this section we will discuss the notion of the Obligatory Contour Principle (henceforth OCP) since this concept has been applied to the analysis of governing relations between adjacent nuclear positions which we will discuss later in this Chapter. It has been argued in the literature that a sequence of identical phonological units is not a well-formed representation. This constraint is stated in (2).

(2) Obligatory Contour Principle
Sequences of adjacent identical units are prohibited in phonological representations.

OCP was initially proposed by LEBEN (1973) to account for tone simplification in Mende.[1] Consider (3).

[1] GOLDSMITH (1990) provides a general discussion of the OCP, addressing various theoretical issues related to different assumptions of the OCP. For further details on the notion of OCP see also GOLDSMITH (1979), McCARTHY (1986), YIP (1988), ODDEN (1988).

```
(3)  a.    HL
           mbu          'owl'

     b.    LH
           mba          'rice'

     c.    HL   H            HL   H
           mbu  i    ---> mbu   i        'the owl'

     d.    LH     L           LH      L
           mba  ngaa ---> mba   ngaa   'rice(pl)'

     e.    HL     L             H      L
           mbu  ngaa   --->  mbu  ngaa   'owls'

     f.    LH   H               L    H
           mba  i      --->  mba  i      'the rice'
```

(3a-b) illustrate nouns which present a falling and a rising tone respectively. In (3c-f) the nouns given in (3a-b) are followed by a suffix. In (3c-d) the nouns are followed by a suffix whose tone is different from the adjacent tone of the preceding noun. The tonal pattern of forms in (3c-d) corresponds to the tone of the noun followed by the tone of the suffix.

In (3e-f) the nouns given in (3a-b) are followed by a suffix whose tone is identical to the adjacent tone of the preceding noun. In this case the tonal pattern of forms in (3e-f) is simplified. That is, the final tone of the noun which precedes the suffix is deleted. This process is illustrated in (4).

(4) a. HL L ---> H$\cancel{\text{L}}$ L ---> H L
mbu ngaa mbu ngaa mbu ngaa

b. LH H ---> L$\cancel{\text{H}}$ H ---> L H
mba i mba i mba i

(4) shows that in a sequence of identical tonal units the far left tone is deleted. The process of tone simplification illustrated in (4) is accounted for by OCP which prohibits sequences of identical phonological units.

The notion of OCP discussed above has been applied to analyses of governing relations between adjacent nuclear positions. We have seen in (1) that a sequence of adjacent nuclear positions represents a sequence of identical phonological units (because it presents a sequence of skeletal positions which are associated to phonological constituents belonging to the same category, i.e. nuclei). Therefore, we expect a sequence of adjacent nuclear positions to be simplified due to the fact that it is a sequence of identical phonological units, which is prohibited under the OCP. In the following section we will consider how governing relations between adjacent nuclear positions have been analysed within the GP framework.

5.2. Previous Proposals on Governing Relations Between Adjacent Nuclear Positions

5.2.0. Introduction

Recall that government is defined as a binary, asymmetric relationship between adjacent skeletal positions (cf. Chapter 1). The establishment of a governing relation defines a governing domain where one of the positions is the head (or the governor) and the other position is the complement (or the governee).

In a governing domain the head position is filled with a segment which has the adequate charm value to govern the segment in the complement position. In (5) we summarize the governing properties of segments (cf. Chapter 1).

(5)a. Charmed segments may govern; charmless segments may be governed.

b. Charmed segments may not be governed.

c. Charmless segments may govern if they have a complexity greater than their governee.

The governing properties of segments stated in (5) define the potential governing relations between a sequence of adjacent nuclear positions:

(6)

```
O  R  O  R
   |     |
   N     N
   |     |
   x     x
   |     |
   V1    V2
```

a. If V_1 is a charmed segment and V_2 is a charmless segment, a left-headed governing domain is established.

b. If V_1 is a charmless segment which has a complexity greater than V_2, a left-headed governing domain is established.

c. If V_2 is a charmed segment and V_1 is a charmless segment, a right-headed governing domain is established.

d. If V_2 is a charmless segment which has a complexity greater than V_1, a right-headed governing domain is established.

e. If V_1 and V_2 are charmed segments, no governing domain is established.

It follows from (6) that in a sequence of adjacent nuclear positions either a left-headed or a right-headed governing domain is established; or no governing relation is established. In the following pages we will consider CHARETTE and YOSHIDA's proposals on governing relations between adjacent nuclear positions. They claim that a sequence of adjacent nuclear positions is subject to the OCP.

5.2.1. Charette's proposal

According to the theory a sequence of adjacent nuclear positions is subject to an interconstituent governing relation since the nuclear positions are associated to distinct constituents (KLV (1988, 1990)). Thus, a right-headed governing domain is established. CHARETTE (1988) proposes that in a sequence of adjacent nuclear positions the far left nuclear position is deleted by OCP.

Her proposal aims to account for the fact that in French the vowel of the definite article is deleted if the noun which follows it begins with a nuclear position filled with a vowel, e.g. /lɑ + ami/ surfaces as [lami] 'the friend'. If the noun begins with a filled onset the vowel of the article remains, e.g. /lɑ + garsõ/ surfaces as [lɑgarsõ] 'the boy'. In (7) we illustrate the forms [lami] and [lɑgarsõ].

(7) a.

```
O  R  O  R  O  R            O  R  O  R
|  |     |  |  |            |  |  |  |
|  N     N  |  N            |  N  |  N
|  |     |  |  |            |  |  |  |
x  x     x  x  x    --->    x  x  x  x
|  |     |  |  |            |  |  |  |
l  ɑ     a  m  i            l  a  m  i
```

```
b.
O   R   O   R       O   R
|   |   |   |\      |   |
|   N   |   N \     |   N
|   |   |   |  \    |   |
x   x   x   x   x   x   x
|   |   |   |   |   |   |
l   α   g   a   r   s   õ
```

In (7a) we have a sequence of strictly adjacent nuclear positions which is subject to government. Charm requirements define that the noun-initial nuclear position has the property of governing the nuclear position of the article. A right-headed governing relation is established between the adjacent nuclear positions and the deletion of the governed nuclear position, i.e. the article-final nuclear position, takes place as a consequence of the OCP.[2]

Vowel deletion does not take place in (7b) since no sequence of strictly adjacent nuclear positions occurs so that no governing relation holds. In (8) we summarize CHARETTE's proposal on the governing relation between nuclear positions.

[2] Notice that in (7a) the governed nuclear position is deleted but the segmental material which was formerly associated to it, i.e. α, remains as a floating segment. The role of floating segments in phonological representations will be discussed later in this Chapter.

(8) Government — Point deleted by OCP

```
      Government              Point deleted
                              by OCP

         _______                 _______
         ↓     |                 ↓     |
    O    R  O  R            O    R  O  R
         |     |                 |     |
         N     N                 N     N
         |     |                 |     |
         x     x                 x     x
         |     |                 |     |
         V1    V2                V1    V2
```

In the following pages we will consider YOSHIDA's (1990) proposal which deals with left-headed governing relations between adjacent nuclear positions.

5.2.2. Yoshida's proposal

YOSHIDA (1990) proposes that a sequence of strictly adjacent nuclear positions is subject to a process in which the two successive nuclear constituents are fused into one by the application of the OCP. He calls this process "Nuclear Fusion", which is illustrated in (9).

```
(9)  N1    N2           N    N         N
     |     |            |    ≠         | \
     x     x    --->    x    x  --->   x  x
```

According to YOSHIDA (1990:344)

> "When the two nuclei are merged into one, a branching nucleus is formed and a constituent governing relation will be established between the two nuclear points. In order for this process to be induced, there must be no intervening non-nuclear segment between the two nuclei, and the same segmental requirements imposed on branching nuclei must be satisfied."

YOSHIDA's proposal illustrated in (9) aims to account for the fact that Japanese forms which present a long vowel immediately followed by a geminated consonant in careful speech; e.g. kootta, are frequently reduced. Either the loss of the first half of the gemination, e.g. koota, or vowel shortening, e.g. kotta, occurs. In (10) we illustrate YOSHIDA's analysis of the forms kootta, koota and kotta.

```
(10) a.   O  R  O  R     O  R
          |  |     |\    |  |
          |  N     N \   |  N
          |  |     |  \  |  |
          x  x     x   x x  x
          |    \ /      \|  |
          k     o        t  a

     b.   O  R       O  R
          |  |\      |  |
          |  | \     |  |
          |  N  \    |  N
          |  |\  \   |  |
          x  x x (x) x  x
          |   \/    \|  |
          k   o      t  a

     c.   O  R       O  R
          |  | \     |  |
          |  |  \    |  |
          |  N   \   |  N
          |  |\   \  |  |
          x  x (x) x x  x
          |   \/    \|  |
          k   o      t  a
```

In (10a) there are two distinct nuclei linked to the segment *o*. In careful speech no change occurs and the form *kootta* - which presents a long vowel followed by a geminated consonant - is derived.

(10b) illustrates the representation of the form *koota* in which the long vowel remains but the first half of the gemination is lost. According to YOSHIDA the sequence of adjacent nuclear positions undergoes nuclear fusion and a branching nucleus is formed so that the successive vowels *oo* become a true long vowel. Notice that in (10b) the strict adjacency condition (which determines that the head must be strictly adjacent to its complement (cf. Chapter 1)) is violated. This is because the underlined head of the rimal constituent is not strictly adjacent to the rimal complement (which is associated to the first half of the gemination). To avoid a violation of the strict adjacency condition, YOSHIDA proposes that the rimal position (in parenthesis) is deleted. The form koota is derived.

In (10c) we illustrate the representation of the form kotta which displays vowel shortening while retaining gemination. YOSHIDA proposes that the nuclear complement (in parenthesis) is deleted, so that the underlined head of the rime can govern the rimal complement. Once the nuclear complement is deleted the governing head and the rimal position are adjacent so that the strict adjacency condition is respected.

In sum, YOSHIDA's proposal on "Nuclear Fusion" (cf. (9)) argues that in a sequence of strictly adjacent nuclear positions where the far left one has the property of governing the nuclear position to the right a constituent governing relation is established and the two nuclear constituents are fused into a branching nucleus governing domain by OCP effects.

In the following section we will address some theoretical issues involving governing relations between nuclear positions which arise from CHARETTE and YOSHIDA's proposals. Then, in the final section of this Chapter we will extend the previous proposals discussed earlier in this section and propose a general analysis of governing relations between nuclear positions.

5.2.3. Conclusion

CHARETTE and YOSHIDA's proposals aimed to account for French and Japanese phenomena respectively. However, neither of these works specifically addresses the theoretical issues which arise from their analysis. In the following pages we will see that CHARETTE and YOSHIDA's proposals are in conflict with a basic principle of GP, namely the projection principle. We will also see that their works fail to define the conditions under which the OCP applies to a sequence of adjacent nuclear positions.

We have seen that CHARETTE (1988) claims that in a right-headed nuclear governing domain the governed nuclear position is deleted by OCP effects (cf. Section 5.2.1). Nevertheless, to assume that the establishment of a governing relation between nuclear position causes the deletion of the governed nuclear position violates one of the basic principles of the theory, namely the projection principle.

(11) Projection Principle
Governing relations are defined at the level of lexical representation and remain constant throughout a phonological derivation. (KLV (1990:221))

According to the projection principle, a government relationship remain constant throughout phonological derivations. That is, a governing relation is an inalterable relationship.

CHARETTE's proposal that a governed nuclear position is deleted violates the projection principle. This is because if the governed nuclear position is deleted, the previously defined governing relation no longer exists. Thus, a governing relation is destroyed during the derivation violating the projection principle.

YOSHIDA's proposal also encounters problems with the projection principle. According to his proposal, either the complement of a branching nucleus or the rimal complement is deleted during the process of deriving the reduced forms koota and kotta (cf. (10b,c)). Since a complement of a governing domain is deleted during the derivational process the projection principle is also violated in his analysis.

We have just seen that CHARETTE and YOSHIDA's proposals are in conflict with the projection principle. Nevertheless, their proposals explain French and Japanese phenomena which involve sequences of adjacent nuclear positions. Furthermore, their proposals also support the analysis of vowel-glide alternations in BP which is presented later in this thesis.

Whether it is the projection principle or CHARETTE and YOSHIDA's proposals that need to be revised in order to avoid theory-internal conflict remains a topic for future theoretical investigation. Throughout this thesis we will adopt their proposals on governing relations between adjacent nuclear positions with some amendments which are presented in the following section. These amendments concern the conditions under which the OCP applies.

We have seen that the OCP has been proposed to account for phonological phenomena at the prosodic level (cf. section 5.1). However, CHARETTE and YOSHIDA's proposals assume that the OCP applies at the skeletal and constituent levels. If the OCP applies at the skeletal and constituent levels in a sequence of adjacent nuclear positions, we have to determine the conditions under which it applies. This is because there are cases in which a sequence of adjacent nuclear positions occurs in phonological representations (cf. for example (10a)) and remain as such throughout the derivation. Therefore, the OCP does not apply at random to all sequences of adjacent nuclear positions. In the following pages we will expand CHARETTE and YOSHIDA's proposals defining the conditions under which the OCP applies to a sequence of adjacent nuclear positions.

5.3. Internuclear Government

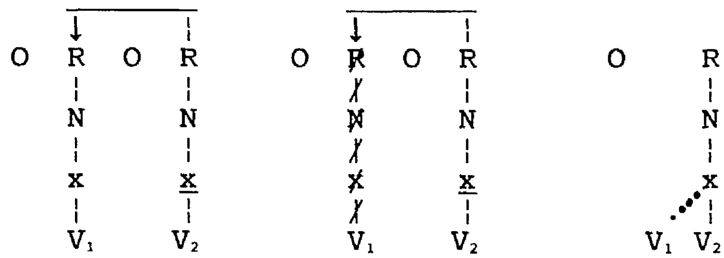
In this section we will present a general proposal for the analysis of governing relations between adjacent nuclear positions. We will refer to these governing relations as instances of internuclear government.

We propose that in a sequence of strictly adjacent nuclear positions the OCP (which prohibits a sequence of identical phonological units from occurring) applies under government conditions. We argue that once a governing domain is established between a sequence of adjacent nuclear positions the OCP applies so that no sequence of adjacent nuclear positions is present. If no governing relation holds between a sequence of adjacent nuclear positions, the OCP (which we claim applies under government) does not apply and a sequence of adjacent nuclear positions is allowed to occur.

An internuclear governing domain may be either right or left-headed. In (12) we consider a right-headed internuclear governing domain.

(12)

a. Government b. Point deleted under government c. Light diphthong formation



For a right-headed internuclear governing relation to be established, the segment associated to the governing position, i.e. V_2, must either be a positively charmed segment or a complex charmless segment. The segment associated to the governed position, i.e. V_1, must either be a complex charmless segment or a simplex charmless segment or the governed nuclear position is empty.[3] If V_1 and V_2 are both complex charmless segments then V_2 - which is the governor - must have a complexity greater than V_1 - which is the governee (cf. Chapter 1).

We propose that the OCP applies under government. Thus, the governed nuclear position is deleted by OCP effects (cf. (12b)), so that no sequence of identical phonological units, i.e. no sequence of adjacent

[3] For details of governing properties of nuclear segments cf. Chapter 1. A summary of the governing properties of nuclear segments is presented in (5).

nuclear positions, is present.

Notice that the segmental material which was formerly associated to the governed nuclear position, i.e. V_1, remains as a floating segment. We propose that if the floating V_1 is a simplex charmless segment it relinks to the governing nuclear position forming a light diphthong (cf. (12c)).[4] If the floating V_1 is a complex charmless segment, it remains a floating segment which has no effect over phonological representations.[5]

The fact that only simplex charmless segments - not complex charmless segments - may relink to the governing nuclear position to form a light diphthong (cf. (12c)) follows from the segmental requirements imposed on light diphthongs. Light diphthongs require the left member of the segmental sequence, i.e. V_1, to be a simplex charmless segment, i.e. [î,û,ɨ]. The

[4] A light diphthong corresponds to what has been called in the literature a rising diphthong. According to KAYE (1985:289) "a light diphthong is simply a non-branching nucleus associated with two segments. For details on light diphthongs within the GP framework see KAYE (1985, 1990b), KAYE & LOWENSTAMM (1984) and CHARETTE (1988).

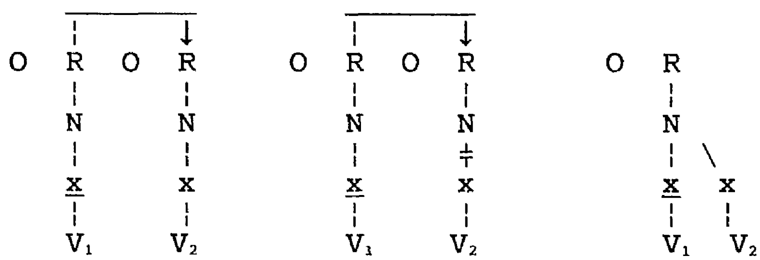
[5] French illustrates instances of right-headed internuclear governing relations where the floating segment is a complex charmless segment, i.e. <u>a</u>, which has no effect over phonological representations (cf. (7a)).

right member of the segmental sequence in a light diphthong, i.e. V_2, may either be a complex charmless segment or a positively charmed segment.[6]

Let us now consider a left-headed internuclear governing domain. Consider (13).

(13)

a. <u>Government</u> b. <u>Constituent dissociation under government</u> c. <u>Branching nucleus formation</u>



For a left-headed internuclear governing relation to be established, the segment associated to the governing position, i.e. V_1, must either be a charmed segment or a complex charmless segment. The governed position, i.e. V_2, must either be filled with a simplex charmless segment or must be an empty nuclear position.

[6] For details on segmental requirements imposed on light diphthongs within the GP framework see KAYE (1985,1990b) and KAYE & LOWENSTAMM (1984).

We propose that the OCP applies under government. Thus, the governed position dissociates from its nucleus and relinks to the governing nucleus forming a branching nucleus (cf. (13b)). Notice that according to this process no sequence of identical phonological units, i.e. no sequence of adjacent nuclear positions, occurs. Indeed, we have two nuclear positions bound together within a branching nucleus governing domain.

When the governed position in a left-headed internuclear governing domain is empty the branching nucleus corresponds to the representation of a long vowel where the governing segment V_1 spreads over the governed position. When the governed position in a left-headed internuclear governing domain is filled with a simplex charmless segment the branching nucleus corresponds to the representation of a heavy-diphthong.[7]

Let us now consider the cases in which a sequence of adjacent nuclear positions is not subject to government. Consider (14).

---

[7] Heavy-diphthongs represent what has been referred to in the literature as falling diphthongs, i.e. vowel-glide sequences. A detailed discussion of heavy-diphthongs in BP is provided in Chapter 7.

(14)
$$\begin{array}{cccc} O & R & O & R \\ & | & & | \\ & N & & N \\ & | & & | \\ & x & & x \\ & | & & | \\ & V_1 & & V_2 \end{array}$$

In a sequence of adjacent nuclear positions such as in (14) where V_1 and V_2 are both charmed segments, no governing relation is established (because charmed segments cannot be governed). We propose that in a sequence of adjacent nuclear positions the OCP applies under government. Thus, if no governing relation holds between a sequence of adjacent nuclear positions the OCP does not apply so that a sequence of adjacent nuclear positions is allowed to occur.

A sequence of adjacent nuclear positions is also allowed to occur if V_1 governs V_2, i.e. a left-headed governing domain is defined, but V_2 (which is the governee) is a complex charmless segment. This is because the establishment of a left-headed internuclear governing domain (which yields a branching nucleus formation) requires that the governed nuclear position be filled with a simplex charmless segment (cf. (13)). If the governed position were filled with a complex charmless segment, charm requirements imposed on branching nuclei would be violated, yielding an illicit representation.

Let us finally address the relationship between the metrical structure and the establishment of internuclear governing relations. We argue that metrical trees are built onto the projection of nuclear heads after the application of phonological processes (cf. Chapter 2). We assume that only the nuclear heads which are not governed are projected to the level of nuclear projection where the metrical structure, i.e. secondary stress and word trees, is built.

Notice that the establishment of an internuclear governing relation triggers either the deletion of the governed nuclear position (when a right-headed internuclear governing domain is defined (cf. (12)) or the governed nuclear position is incorporated into a branching nucleus structure (when a left-headed internuclear governing domain is established (cf. (13)). Therefore, given that a governed nuclear position is either deleted or incorporated into a branching nucleus structure it will not be projected onto the level of nuclear projection where the metrical structure is built. In Chapters 6 to 8 - where we address the processes of vowel-glide alternations in BP - we will illustrate how the metrical structure is built after phonological processes involving internuclear governing relations have taken place.

In this section we have set out the conditions under which an internuclear governing relation may or may not be established. We have proposed that a right-headed internuclear governing relation yields a light diphthong formation and that a left-headed internuclear governing relation yields a branching nucleus formation. We have also seen that a sequence of adjacent nuclear positions is allowed to occur, i.e. no internuclear governing relation is established when either both nuclear positions are filled with a charmed segment or the potential governed position in a left-headed internuclear governing domain is filled with a complex charmless segment. We have also argued that the metrical structure is built onto the level of nuclear projection after the application of phonological processes.

5.4. Conclusion

In this Chapter we have considered governing relations between adjacent nuclear positions. We have discussed earlier proposals on this topic and the theoretical issues which arise from them.

Then, we presented our proposal on internuclear government which is an expansion of the earlier treatments of governing relations between adjacent nuclear positions. We claimed that in a sequence of adjacent nuclear positions the OCP applies under government. The proposal presented in this Chapter will be applied to the analysis of vowel-glide alternations in BP in the remaining Chapters of this thesis.

CHAPTER 6

PREVOCALIC GLIDES AND PREVOCALIC HIGH VOWELS

6.0. Introduction

In this Chapter we will investigate forms in which prevocalic high vowels and prevocalic glides occur in BP. We will refer to these forms as iV and uV sequences, where V stands for any vowel. We aim to define the conditions under which a prevocalic high vowel alternates or fails to alternate with its corresponding glide and we will also determine how glides are syllabified in BP.

In the first section we discuss the phonological representation of prevocalic high vowels and prevocalic glides and in the following sections we consider the behaviour of iV and uV sequences in relation to primary stress.

6.1. The Phonological Representation of Prevocalic Glides and Prevocalic High Vowels

In this section we investigate the phonological representation of prevocalic glides and prevocalic high vowels. According to the theory, neutrally charmed elements such as I° and U° (which correspond to the simplex charmless segments î/û) may occur either in a nuclear head position or in a position which is not a nuclear head. If î/û occupy a nuclear head position a lax high vowel is realized, i.e. [î,û], whereas if î/û occupy a position other than a nuclear head a glide is manifested, i.e. [j,w]. Consider the representations in (1).

```
(1)  a.O   N          b.   O   N          c. O        N
           |               |   |             | \      |
           x               x   x             x  x     x
          / \              |   |             |  |     |
       î/û   V            î/û  V             C î/û    V

     d. O    N         e. O  N    O  N
        |    |               |       |
        x    x               x       x
       / \   |               |       |
      C î/û  V              î/û      V
```

Let us consider in detail each structure in (1). (1a) represents a light diphthong. According to KAYE (1985:289) "a light diphthong is simply a non-branching nucleus associated with two segments". More precisely, it consists of two segments associated to a single skeletal position. In metrical terms a light diphthong behaves as a short vowel, i.e. as a single nuclear position.[1] Light diphthong require the left member of the segmental sequence to be a simplex charmless segment, i.e. [î,û,ɨ]. The right member of the segmental sequence in a light diphthong may be either a complex charmless segment or a positively charmed segment. Although two segments occupy a nuclear position in the representation of a light diphthong, only the far right member of the segmental sequence has the properties of a nuclear head. Stress must be assigned to nuclear heads. Considering light diphthongs, it is the far right segment which will bear stress. Therefore, in a light diphthong the far right member of the segmental sequence is the nuclear head, and the far left one occurs in a position which is not a nuclear head.

(1b) illustrates a sequence of onset-nucleus in which the simplex charmless segments î or û occupies the onset position. According to the theory, a non-governing onset position may be filled either with a

[1] A light diphthong corresponds to what the phonological literature has called a rising diphthong. We refer the reader to Chapter 7 where another type of diphthong, namely the heavy diphthong (i.e. falling diphthong), is discussed. For a detailed discussion on light diphthongs see KAYE (1985,1990b).

negatively charmed segment or with a charmless segment (cf. Chapter 1).[2] Given that the segments î/û are charmless they satisfy charm requirements for segments occurring in onset positions.

(1c) illustrates a branching onset immediately followed by a nuclear position which is filled with a vowel. The governing onset position must be filled with a negatively charmed segment (which is represented by C in (1c)). The governed position in a branching onset must be filled with a charmless segment. Given that the segments î/û are charmless, they satisfy charm requirements for segments occurring in the governed position of a branching onset.

(1d) illustrates an onset position filled with a complex consonant immediately followed by a nuclear position that is filled with a vowel. In the representation of a complex consonant illustrated in (1d) the segments î or û together with a consonantal segment are both associated to a single onset position. Complex consonants present restrictions with respect to which segments may occur in the consonantal

---

[2] A governing onset position, i.e. an onset position which is the head in a branching onset governing domain, must be filled with a negatively charmed segment (cf. Chapter 1).

position, i.e. C.[3]

(1e) illustrates a sequence of adjacent nuclear positions where the far left nuclear position is filled with either the segment ĩ or with the segment ũ. Notice that the two nuclear positions in (1e) are adjacent to each other, given that the onset which intervenes between them does not dominate a skeletal position.

Concerning the phonetic characteristic of the structures illustrated in (1) it is important to mention that (1a-d) have the same interpretation. That is, in (1a-d) the simplex charmless segments ĩ and ũ - whose internal representations consist of the elements I° and U° respectively - are pronounced as a glide, i.e. [j,w]. On the other hand in (1e) the simplex charmless segments ĩ/ũ are phonetically manifested as lax high vowels, i.e. [ĩ,ũ].

What phonologically distinguishes the representation in (1e) from the representations in (1a-d) is that in the former case the segments ĩ/ũ are the head of a nuclear constituent whereas in the

[3] In section 6.3 we will discuss in detail the representation of complex consonants.

latter cases they are not. That is, in (1e) the segments î/û occupy a nuclear head position thus they are manifested as lax high vowels, i.e. [î,û], whereas in (1a-d) the segments î/û occupy a position which is not a nuclear head thus they are manifested as glides, i.e. [j,w].

In the previous pages we have seen that lax high vowels, i.e. [î,û], represent the cases in which the elements I°/U° occupy a nuclear head position. Concerning the phonological interpretation of the tense high vowels, i.e. [i,u], they represent the cases in which the elements I°/U° together with the ATR element I^{+} combined in a phonological expression, i.e. $(\text{I}^{+}.\underline{I}^{\circ})^{+}$ and $(\text{I}^{+}.U^{\circ})^{+}$, occupy a nuclear head position. In the following sections we will consider BP forms in which glides and high vowels occur followed by a vowel.

6.2. <u>Pretonic Prevocalic Glides and Pretonic Prevocalic High Vowels</u>

In this section we consider forms in which pretonic high vowels and pretonic glides are followed by a vowel. We will refer to these forms as pretonic <u>iV</u> and <u>uV</u> sequences. We will determine the conditions under which a high vowel alternates or fails to alternate with its corresponding glide as well as how prevocalic glides are syllabified in BP. Consider forms in (2).

(2)	a.	[iátû]	'hiatus'
	b.	[iódû]	'iodine'
	c.	[uáj]	'expression of surprise'
	d.	[uê]	'expression of doubt'
	e.	[iemãžá]	'Iemanjá'
	f.	[iugoslávû]	'Yugoslav'
	g.	[uatú]	'Uatú (river)'
	h.	[uerekémɑ]	'Amazonian Indian group'

Forms in (2) illustrate cases in which a sequence of the type <u>iV/uV</u> occurs word initially. In (2a-d) the <u>iV/uV</u> sequences present the high vowel immediately followed by a primary stressed vowel. In (2e-h) the <u>iV/uV</u> sequences occur before a primary stressed vowel.

In (3) we list <u>iV/uV</u> sequences preceded by a consonant occurring in word initial position. With respect to the immediately following vowel, as in (2), the high vowel is either followed by a primary stressed vowel (cf. (4a-d)) or immediately followed by an unstressed vowel (cf. (4e-h)).

(3)	a.	[piádɑ]	'joke'
	b.	[diɛ́tɑ]	'diet'
	c.	[kuáʎû]	'curd'
	d.	[duétû]	'duet'
	e.	[violínû]	'violin'
	f.	[diurɛ́tîkû]	'diuretic'
	g.	[žuazérû]	'Juazeiro'
	h.	[žueʎádɑ]	'blow with the knee'

All forms given in (2) and (3) have two possible pronunciations. This is illustrated in (4).

(4)	a.	[iátû]	~	[játû]
	b.	[ué]	~	[wé]
	c.	[iemãžá]	~	[jemãžá]
	d.	[uatú]	~	[watú]
	e.	[piádɑ]	~	[pjádɑ]
	f.	[kuáʎû]	~	[kwáʎû]
	g.	[violínû]	~	[vjolínû]
	h.	[žueʎádɑ]	~	[žweʎádɑ]

In the left column in (4) the <u>iV/uV</u> sequences are pronounced as a sequence of vowels whereas in the right column a sequence glide-vowel is realized. Given the alternations between a high vowel and a glide illustrated in (4), eg. [iV,uV] ~ [jV,wV], one could posit the existence of two different lexical representations for a single form. If this were the case we would have to assume that in one case the high vowel would be understood as a nuclear head (when it is pronounced as a vowel, i.e. [iV,uV]), whereas in another case the high vowel would be understood as not being the head of a nuclear constituent (when it is realized as a glide, i.e. [jV,wV]).

Notice that cases which involve lexical alternations do not reflect a recurrent process in a given language. For example, the word <u>either</u> in English presents two lexical representations among many English speakers. That is, it is pronounced either as [i:δɑr] or as [ajδɑr]. However, the alternation between <u>i:</u> (as in [i:δɑr]) and <u>aj</u> (as in [ajδɑr]) is not a recurrent alternation in English. For example, the word <u>sea</u> must be pronounced as [si:], but not *[saj] and the word <u>shy</u> must be pronounced as [šaj], but not *[ši:].

We claim that the alternation between a syllabic and a non-syllabic <u>i/u</u> in BP, i.e. [i] ~ [j] and [u] ~ [w], does not reflect a case of lexical alternation. This is because this alternation consists of a recurrent process in BP. In fact, every form of the type show in (2-4) may be pronounced either as a glide-vowel sequence or as a sequence of vowels. Thus, we claim that the process of vowel-glide alternations in BP is not a lexical alternation, but a phonological one.

In order to derive forms in (4) where a vowel-vowel sequence alternates with a glide-vowel sequence, we have to establish the lexical representation from which they are derived. We propose that the lexical representation of iV/uV sequences in BP corresponds to a sequence of adjacent nuclear positions where the far left nuclear position is filled with either the element I° or with the element U° and the immediately following nuclear position is filled with any BP vowel. The lexical representation of iV/uV sequences in BP is illustrated in (6).

```
(6)      O   R   O   R
             |       |
             N       N
             |       |
             x       x
             |       |
           I°/U°     V
```

From the lexical representation illustrated above we will determine the conditions under which a high vowel or a glide is phonetically manifested. We will argue that it is the governing relations established between strictly adjacent nuclear positions that will determine whether a high vowel or a glide occurs.

Recall that government involves a relationship between two strictly adjacent positions (cf. Chapter 1). In the representation illustrated in (6), we have a sequence of strictly adjacent nuclear positions, given that the onset which intervenes between them dominates no skeletal position. Therefore, they are subject to government.

In a governing domain one of the positions is the governor - or the head - and the other position is the governee - or the complement (cf. Chapter 1). The property of a skeletal position to govern another skeletal position is determined by the charm value of the segments which occupy the adjacent positions. That is, the governing position must be filled with a segment which has the adequate charm value to govern the segment associated to the governed position.

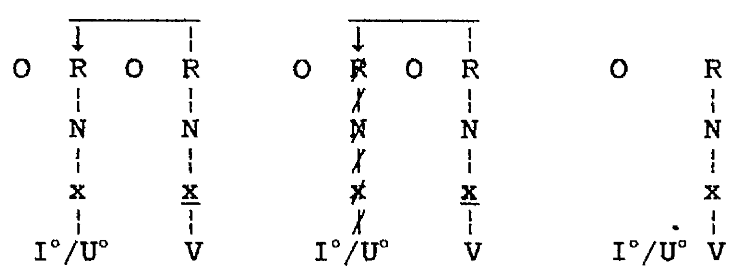
Notice that the far left nuclear position in (6) is filled with either of the simplex charmless segments <u>î/û</u> - whose internal representation consists of the element I° and U° respectively. We have seen in Chapter 1 that the simplex charmless segments [î,û] may be governed by any other vowel of BP, i.e. [a,e,ɛ,i,o,ɔ,u,û,î,ɑ]. Thus, in the representation illustrated in (6) the far right nuclear position - which is filled with any vowel of BP - is the governor and the nuclear position to the left - which is filled with either of the elements I°/U° - is the complement.

A right-headed internuclear governing domain is established.

In Chapter 5 we proposed that the establishment of a right-headed internuclear governing relation results in the deletion of the governed nuclear position, causing its segmental material to relink to the governing nuclear head position forming a light diphthong. This process is illustrated in (7).

(7)

a. <u>Government</u> b. <u>Point deleted under government</u> c. <u>Light diphthong formation</u>



According to our proposal - illustrated in (7) - the phonological representation of glide-vowel sequences in BP corresponds to the structure of a light diphthong. That is, either the element I° or U° together with the vowel are both associated to the same nuclear position. Given that in (7) the elements I°/U° occupy a position which is not a nuclear head, i.e. they occur as the left-member of the segmental sequence in a light diphthong, they are phonetically manifested as a glide, i.e. [j,w].

In the following pages we will provide evidence for this proposal, i.e. we will show that glide-vowel sequences in BP correspond to the structure of a light diphthong. We will then determine the conditions under which a glide or a high vowel occurs.

Let us first consider the phonological interpretation of word-initial glide-vowel sequences, e.g. [játû] 'hiatus' and [werekémɑ] 'Amazonian Indian group'. Evidence that word-initial glide-vowel sequences in BP correspond to the structure of a light diphthong comes from a phonological process which takes place in the Carioca dialect of BP (spoken in the state of Rio de Janeiro). In this dialect s-final nouns are phonetically manifested with a final palatal fricative, e.g. /mes/ --> [méš] 'month'.[4] When an s-final noun is followed by a noun which begins with a filled onset, e.g. /mes + pasádû/ 'last month', the final s of the first noun appears as a palatal fricative, i.e. [mešpasádû]. In other words, an s-final noun is realized as a palatal fricative when it is followed by a noun whose initial onset is filled

[4] In the Belo Horizonte dialect an alveolar fricative occurs word-finally, e.g. /mes/ --> [més] 'month'.

with segmental material.[5]

On the other hand, if an s-final noun is followed by a noun which begins with a nuclear position, e.g. /mes + interũ/ 'whole month', the final s of the first noun is realized as an alveolar fricative, i.e. [mezĩtérũ], but *[mešĩtérũ] or *[mežĩtérũ].

Let us consider the cases in which glide-initial nouns are preceded by an s-final noun. Notice that if the glide occupies an onset position, we expect that, as in forms which present an initial filled onset, the final s of the first noun will be phonetically manifested as a palatal fricative (cf. /mes + pasadũ/ --> [mešpasádũ]). On the other hand, if the glide occupies a nuclear position we expect the final s of the initial noun to behave like a vowel-initial noun, i.e. the final s of the first noun will appear as an alveolar fricative (cf. /mes + interũ/ --> [mezĩtérũ]).

Considering sequences of nouns such as /tres + jatũs/ 'three hiatus' or /tres + werekémas/ 'three

---

[5] Indeed, an s-final noun occurs as a palatal fricative when it is followed by a noun which begins with any possible word-initial consonant of BP, i.e. [p,t,k,b,d,g,m,n,f,v,s,z,š,ž,h,l].

Uerekemas' - where an s-final noun is followed by a glide-vowel sequence - we observe that the final s of the first noun is phonetically manifested as an alveolar fricative, i.e. [trezjátũš] and [trezwerekémaš]. The fact that the final s of the first noun is realized as an alveolar fricative when it is followed by a glide-initial noun, i.e. [trezjátũš] and [trezwerekémaš], is evidence that the phonological representation of word-initial glide-vowel sequences in BP corresponds to the structure of a light diphthong. That is, both the glide and the vowel are associated to a single nuclear position. This is because glide-initial nouns behave like vowel-initial nouns when they are preceded by an s-final noun. In both cases the final s of the first noun is phonetically manifested as an alveolar fricative, e.g. [mezĩtérũ] 'whole month' and [trezjátũš] 'three hiatus'; [trezwerekémaš] 'three Uerekemas'.

In (8) we illustrate the representation of the forms [játũ] 'hiatus' and [werekêma] 'Uerekema', where the glide-vowel sequence is syllabified in the representation of a light diphthong.

(8)

```
O  R  O  R                              O  R  O  R  O  R  O  R
   |  |  |                                 |  |  |  |  |  |  |
   N  |  N                                 N  |  N  |  N  |  N
   |  |  |                                 |  |  |  |  |  |  |
   x  x  x                                 x  x  x  x  x  x  x
  / \ |  |                                / \ |  |  |  |  |  |
 I°  a t  û                              U°  e r  e  k  e  m  ɑ
```

Let us now consider the phonological interpretation of glide-vowel sequences preceded by a consonant, e.g. [piádɑ] 'joke' [kwáλû] 'curd'. In (9) we illustrate the possible representations of these forms.

(9)

```
a.O   R  O  R      b. O     R  O  R      c. O  R    O  R
  |   |  |  |         |\    |  |  |         |  |    |  |
  |   N  |  N         | \   N  |  N         |  N    |  N
  |   |  |  |         |  \  |  |  |         |  |    |  |
  x   x  x  x         x   x x  x  x         x  x    x  x
 / \  |  |  |         |   | |  |  |         | / \   |  |
 p I° a  d  ɑ         p  I° a  d  ɑ         p I° a  d  ɑ
 k U° a  λ  û         k  U° a  λ  û         k U° a  λ  û
```

(9a) illustrates the case where the element I° or U° together with a consonantal segment occurs in the representation of a complex consonant. (9b) illustrates the case where the element I° or U° occupies the governed position in a branching onset. (9c) illustrates the case where the element I° or U° occurs in the representation of a light diphthong. In all representations in (9) the elements I° and U° are phonetically manifested as a glide since they do not occur in a nuclear head position.

We have seen that word-initial glide-vowel sequences correspond to the structure of a light diphthong (cf. (8)). Similarly, we expect glide-vowel sequences preceded by a consonant to correspond to the structure of a light diphthong (cf. (9c)). Thus, we have to show that representations like (9a-b) do not correspond to the structure of glide-vowel sequences preceded by a consonant in BP.

If glide-vowel sequences correspond to the representation of a complex consonant - as illustrated in (9a) - we expect to find segmental restrictions imposed on the consonant-glide sequence. This is because complex consonants present restrictions with respect to the segmental materials, which may occupy their skeletal position. However, this is not the case. That is, no segmental restriction is imposed on consonant-glide sequences where the glide alternates with its corresponding high vowel.[6] In fact any consonant of BP may precede a glide-vowel sequence which alternates with a sequence of vowels.

---

[6] In the following section we will consider forms which present consonant-glide sequences where the glide does not alternate with its corresponding high vowel, e.g. [kwádrʊ̃] but *[kuádrʊ̃] 'picture'. We will see that in this case segmental restrictions are imposed on the consonant-glide sequence.

Given that there is no segmental restriction as to which consonantal material may precede the glide-vowel sequence (where the glide alternates with its corresponding high vowel) we exclude the structure of a complex consonant - illustrated in (9a) - for forms which present glide-vowel sequences preceded by a consonant.

Let us now consider the representation illustrated in (9b). If glide-vowel sequences preceded by a consonant represent the element I° or U° syllabified in the governed position of a branching onset we do not expect to find forms where the onset which precedes the glide-vowel sequence is branching, e.g. [krjádû] or [brwákɑ]. This is because constituents are maximally binary (cf. Chapter 1). Thus, in a form where the glide-vowel sequence is preceded by a branching onset, the glide cannot be syllabified in the onset position, which is already branching, i.e. the onset is maximised. That is, a representation like (10) is impossible for forms such as [krjádû] and [brwákɑ].

```
(10)   *  O          R   O   R
          |\ \       |   |   |
          | \ \      N   |   N
          |  \ \     |   |   |
          x  x  x    x   x   x
          |  |  |    |   |   |
          k  r  I°   a   d   û
          b  r  U°   a   k   α
```

However, forms presenting branching onsets followed by glide-vowel sequences do occur in BP, as illustrated below.

(11)	a.	[krjádû]	'servant'
	b.	[frjéza]	'coldness'
	c.	[bibljotêkα]	'library'
	d.	[proprjedádî]	'property'
	e.	[brwákα]	'saddle-bag'
	f.	[flwétî]	'fluent'
	g.	[krwewdádî]	'cruelty'
	h.	[mẽstrwádα]	'menstruating'

The fact that glide-vowel sequences may be preceded by branching onsets in BP is evidence that the phonological representation of glide-vowel sequences preceded by a consonant does not correspond to the structure of a branching onset. This is because if glide-vowel sequences preceded by a consonant corresponded to the structure of a branching onset, we would not find forms where a branching onset precedes the glide-vowel sequence. That is not the case, as illustrated by forms in (11).

The fact that glide-vowel sequences preceded by a consonant do not correspond to the representation of a complex consonant (cf. (9a)), neither to the representation of a branching onset (cf. (9b)) is evidence that glide-vowel sequences preceded by a consonant correspond to the structure of a light diphthong. That is, both the glide and the vowel occupy a single nuclear position (cf. (9c)). In (12) we illustrate the representations of the forms [pjádα] 'joke' and [brwákα] 'saddle-bag', which present a glide-vowel sequence preceded by a consonant.

```
        (12)
a.      O    R   O   R              b.   O         R    O   R
        |    |   |   |                   |\        |    |   |
        |    N   |   N                   | \       N    |   N
        |    |   |   |                   |  \      |    |   |
        x    x   x   x                   x   x     x    x   x
        |   / \  |   |                   |   |    / \   |   |
        p  I°  a d   α                   b   r  U°   a  k   α
```

In the preceding pages we have seen that glide-vowel sequences in BP correspond to the structure of a light diphthong. Recall that any form which presents pretonic glide-vowel sequences may also occur as a sequence of vowels, i.e. [jV] ~ [iV] and [wV] ~ [uV] (cf. (4)).

We have argued that the process of vowel-glide alternations in BP takes place as a consequence of the establishment of a governing relation between adjacent nuclear positions (cf. (7)). In the following pages we will consider the derivation of the forms [piádα] ~

[pjádα] 'joke'. We assume that any form which presents a pretonic prevocalic glide that alternates with a pretonic prevocalic high vowel is derived in a similar manner. Consider the lexical representation of the forms [piádα] ~ [pjádα] 'joke' given in (13).[7]

(13)

```
             /    \
            s      w
O   R   O   R   O   R
|   |       |   |   |
|   N       N   |   N
|   |       |   |   |
x   x       x   x   x
|   |       |   |   |
p   î       a   d   α

    I°      A+
```

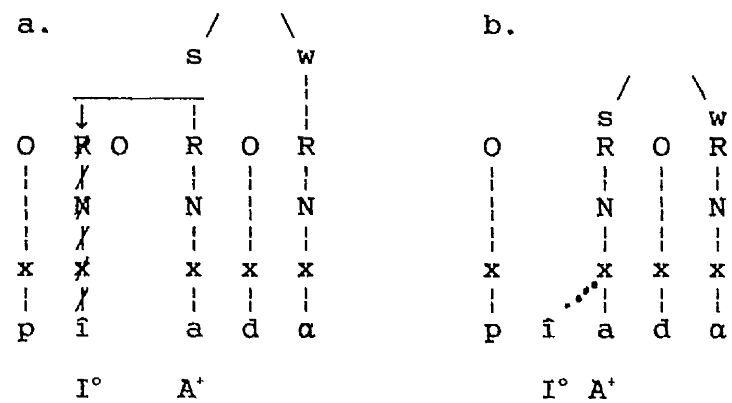
From the lexical representation illustrated in (13) we will determine the conditions under which a glide-vowel sequence, i.e. [pjádα], or a sequence of vowels, i.e. [piádα], occurs. Let us first consider the case in which a glide-vowel sequence occurs, i.e. [pjádα].

We propose that glide-vowel sequences in BP are derived from the establishment of a right-headed

[7] Recall that primary stress is lexically assigned (cf. Chapter 2). Secondary and word level stress are assigned after phonological processes take place. Therefore, the final metrical structure is built onto derived forms. The phonological expressions which appear below the segments associated to the nuclear positions in (13) correspond to the internal representation of those segments.

internuclear governing relation (cf. (7)). The establishment of right-headed internuclear governing relation results in the deletion of the governed nuclear position. Then, the segmental material which formerly occupied the governed nuclear position relinks to the governing nuclear position forming a light diphthong. This process is illustrated in (14).[8]

(14)



In (14b) the segment î occupies a position which is not a nuclear head, i.e. it occurs as the left member of the segmental sequence in a light diphthong. Given that the element I° occupies a position which is not a nuclear head, it appears as a palatal glide. The form [pjádɑ] - which presents a glide-vowel sequence -

[8] In pretonic iV and uV sequences we will have a nuclear position filled with either the simplex charmless segments î/û immediately followed by a nuclear position filled with either a complex charmless segment, or a positively charmed segment. Given that complex charmless segments and positively charmed segments have the property of governing a simplex charmless segment, a right-headed internuclear governing domain is established.

is derived and the metrical structure is built onto the projection of nuclear heads. This is illustrated in (15).

(15)

```
               s                  word tree level
      ______________________
               |‾‾‾‾‾‾‾‾‾‾‾‾‾
               s            w     foot level
               |            |
               R̄            R̄     nuclear projection
               |            |
      O        R      O     R
      |        |      |     |
      |        N      |     N
      |        |      |     |
      x        x      x     x
      |       / \     |     |
      p      î    a   d     α

             I°   A+
```

Let us now consider the derivation of the form [piádα], i.e. where a sequence of vowels occurs. We reproduce its lexical representation in (16).

(16)

```
                          /      \
                         s        w
      O    R    O        R    O   R
      |    |             |    |   |
      |    N             N    |   N
      |    |             |    |   |
      x    x             x    x   x
      |    |             |    |   |
      p    î             a    d   α

           I°            A+
```

Recall that a sequence of adjacent nuclear positions is subject to government (cf. (14)). In (16) we have a sequence of strictly adjacent nuclear positions where the nuclear position which is filled with the segment [a], has the property of governing the nuclear position to the left, which is filled with the segment i̲. A right-headed internuclear governing relation may potentially be established. According to our proposal, the establishment of a right-headed internuclear governing relation triggers the deletion of the governed nuclear position (cf. (14a)). Thus, the governed nuclear position in (16) should be deleted.

However, in a form such as [piádα] there are three nuclear positions, i.e. the same as in its lexical representation. That is, no nuclear position is deleted. Thus, we have to explain why in the process of deriving the form [piádα] from the lexical representation illustrated in (16), no nuclear position is deleted.

We claim that in order to prevent the loss of a nuclear position (which would take place under the establishment of a right-headed internuclear governing relation (cf. (14)) the ATR element is added to the internal representation of the simplex charmless segment [ī]. This in turn yields the positively charmed segment [i] - whose internal representation is

$(I^{+}.\underline{I}^{\circ})^{+}$.[9] This process is illustrated in (17).

(17)

```
                          /   \                          /   \
                         s     w                        s     w
a.   O   R   O   R   O   R       b. O   R   O   R   O   R
     |   |       |   |   |          |   |       |   |   |
     |   N       N   |   N          |   N       N   |   N
     |   |       |   |   |          |   |       |   |   |
     x   x       x   x   x   --->   x   x       x   x   x
     |   |       |   |   |          |   |       |   |   |
     p   î       a   d   α          p   i       a   d   α

         I°      A+                     I°      A+
                                        |
                                        I+
```

In order for a governing relation to hold, one of the positions must be filled with a segment which has the property of governing the segment that occurs in the other position. In the sequence of adjacent nuclear positions in (17b) the far right nuclear position is filled with the positively charmed segment [a]. The nuclear position which immediately follows [a] is filled with the positively charmed segment [i].[10] Recall that positively charmed segments may govern a charmless segment, but not another positively

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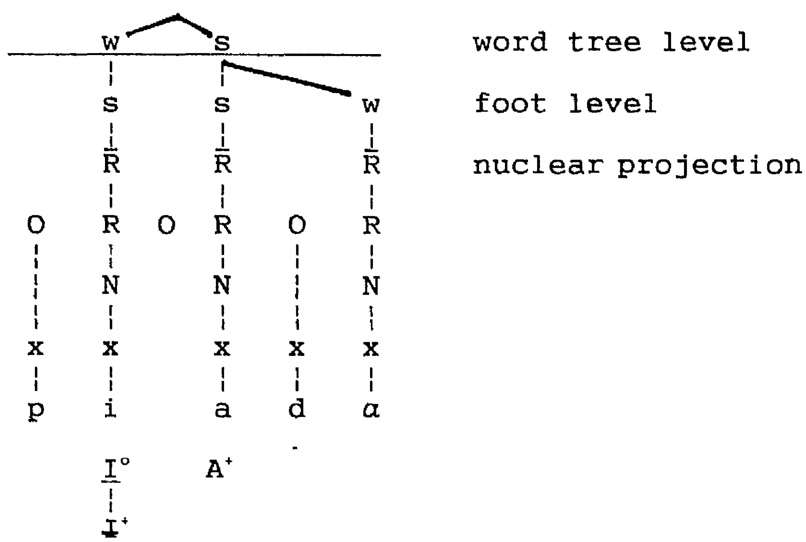
[9] In the case the ATR element is added to the internal representation of the simplex charmless segment [û] the positively charmed segment [u] - whose internal representation is $(I^{+}.\underline{U}^{\circ})^{+}$ - is manifested.

[10] Recall that pretonic nuclear heads must be filled with positively charmed segments (cf. Chapter 3). In (17b) the nuclear position filled with the tense high front vowel [i] - which is a positively charmed segment - occurs in pretonic position so that charm requirements are satisfied.

charmed segment (cf. Chapter 1). That is, positively charmed segments cannot be governed. Thus, given that the adjacent nuclear positions in (17b) are both filled with positively charmed segments, a governing relation cannot hold between them. Given that no governing relation holds between the adjacent nuclear positions in (17b), no nuclear position is deleted and a sequence of strictly adjacent nuclear positions is allowed to occur. The form [piádɑ] is derived and the metrical structure is built onto the projection of nuclear heads. This is illustrated in (18).

(18)



In this section we have considered the derivation of forms which present pretonic prevocalic glides, e.g. [pjádɑ], and pretonic prevocalic high vowels, e.g. [piádɑ]. Whether a prevocalic glide or a prevocalic high vowel is phonetically manifested depends on whether or not a right-headed internuclear governing relation is established. More specifically, we showed that pretonic iV/uV sequences are subject to the following processes:

a) A right-headed internuclear governing domain is established resulting in the deletion of the governed nuclear position. The segmental material which was formerly associated to the governed position, i.e. the high vowel, relinks to the governing position forming a light diphthong. A glide-vowel sequence is realized.

b) In order to prevent the loss of a nuclear position (which we claim takes place under the establishment of a right-headed internuclear governing domain) the ATR element is incorporated into the internal representation of the high vowel. A tense high vowel - which is a positively charmed segment - is realized. No governing relation holds between the adjacent nuclear positions, and no nuclear position is deleted. A sequence of adjacent nuclear positions is allowed to occur, and a sequence of vowels is realized.

In this section we have seen that pretonic iV/uV sequences may appear either as a sequence of vowels, i.e. [iV,uV], or as a glide-vowel sequence, i.e. [jV,wV]. If all forms which present pretonic glide-vowel sequences behave in exactly the same way, we can expect any form which presents a pretonic glide-vowel sequence to alternate with a form in which a sequence of vowels occurs.

There are however some forms where a pretonic glide-vowel sequence occurs and the glide does not alternate with its corresponding high vowel. A sample of these forms is given in (19).

(19)

a.	[kwádrũ]	*[kuádrũ]	'picture'
b.	[akwarɛ̃lα]	*[akuarɛ̃lα]	'water colour'
c.	[gwáhdα]	*[guáhdα]	'guard'
d.	[gwahdanápũ]	*[guahdanápũ]	'serviette'

In the following section we will consider forms such as the ones illustrated in (19). We will show that in the cases where a pretonic glide does not alternate with its corresponding high vowel, i.e. [kwádrũ] but *[kuádrũ], the glide-vowel sequence is not derived from a sequence of adjacent nuclear positions, but rather the glide presents a special type of syllabification.

6.3. The Syllabification of the Glide [w]

In this section we will consider forms where the glide w corresponds to the element U° lexically associated to a position other than a nuclear head. Consider the possible syllabifications of the glide w in (20).

```
(20) a.O  R      b.   O       R    c.   O    R
          |           |\      |         |    |
          N           | \     N         |    N
          |           |  \    |         |    |
          x           x   x   x         x    x
         / \          |   |   |        / \   |
       U°   V         C   U°  V       C   U° V
```

The representations in (20) illustrate the element U° syllabified in a position which is not a nuclear head. Thus, it will be phonetically manifested as a glide, i.e. [w]. In (20a) the element U° occurs in the representation of a light diphthong.[11] In (20b) the element U° occurs in the governed position of a branching onset. In (20c) the element U° together with a consonant is associated to a single onset position forming a complex segment.

---

[11] Recall that when the element U° occurs as the left member of the segmental sequence in a light diphthong it does not have the properties of a nuclear head, e.g. it does not bear stress. Thus, although in the representation of a light diphthong the element U° occurs in a nuclear position it does not occupy a position which is a nuclear head (cf. Section 6.1).

In the following pages we will investigate which of the structures in (20) correspond to the syllabification of the glide [w] in forms such as [kwádrû] 'picture' (cf. (19)). Let us first consider (20a) where the glide-vowel sequence corresponds to the structure of a light diphthong. If in a form like [kwádrû] the glide-vowel sequence corresponds to the structure of a light diphthong, we have a lexical representation as in (21).

```
(21)        /           \
            s            w
    O       R    O       R
    |       |    |\      |
    |       N    | \     N
    |       |    |  \    |
    x       x    x   x   x
    |      / \   |   |   |
    k     U°  a  d   r   û
```

We claim that (21) does not correspond to the lexical representation of [kwádrû]. The first argument against a structure like (21) comes from the lack of restrictions concerning the vowel in the glide-vowel sequence. This is because in languages which present lexical light diphthongs there are constraints with respect to the vowel in glide-vowel sequences which correspond to light diphthongs (cf. KAYE (1989e)).

Let us consider French which is a language that has lexical light diphthongs.[12] Interestingly, in the glide-vowel sequences that correspond to a light diphthong in French there are restrictions with respect to which vowels can occur in the glide-vowel sequence. That is, the vowel can only be [a,ẽ,õ] as in [wat] 'wad of cotton', [lwẽ] 'far' and [lwõ] 'we rent'.[13]

If in forms like [kwádrũ] the glide-vowel sequence corresponded to the structure of a light diphthong - as proposed in (21) - then there would be constraints concerning which vowels can follow the glide. Consider (22).[14]

(22)	a.	[gwáhdɑ]	'guard'
	b.	[kãgwétɑ]	'stool-pigeon'
	c.	[sekwɛ́lɑ]	'sequel'
	d.	[lĩgwísɑ]	'sausage'
	e.	[akwózũ]	'aqueous'
	f.	[kwɔ́tɑ]	'quota'

[12] Evidence for lexical light diphthongs in French is given in KAYE & LOWENSTAMM (1984); CHARETTE (1988) and KAYE (1989b).

[13] Light diphthongs in French which are manifested as palatal glide-vowel sequences may present other vowels than <u>ã,ẽ,õ</u> in the vowel position, e.g. [jɔd] 'iodine'.

[14] In all forms illustrated in (22) the glide-vowel sequence does not alternate with a sequence of vowels, i.e. [wV] does not alternate with [uV]. Therefore, forms in (22) illustrate cases where the glide [w] corresponds to the element U° lexically associated to a position other than a nuclear head.

Forms in (22) show that a back glide can be followed by any BP vowel.[15] We assume that the lack of constraints concerning the vowel in the glide-vowel sequence in (22) - namely that any vowel can follow the glide - provides us with evidence that the glide-vowel sequence does not correspond to the structure of a light diphthong. This is because if the glide-vowel sequence corresponded to the structure of a light diphthong, there would be constraints with respect to which vowels could follow the glide, which is not the case.

More evidence that glide-vowel sequences do not correspond to the structure of a light diphthong comes from the fact that glide-vowel sequences in BP cannot be preceded by branching onsets, e.g. *[krwádrũ].[16]

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[15] In (22) the vowel which follows the glide bears primary stress. Recall that in primary stressed positions the following vowels occur in BP: [a,ɛ,e,i,o,ɔ,u] (cf. Chapter 3). The only constraint in forms in (22) is that the glide cannot be followed by the vowel [u], i.e. *[wu].

[16] Recall that glide-vowel sequences which alternate with a sequence of vowels may be preceded by branching onsets, e.g. [brwákɑ] ~ [bruákɑ] 'saddle-bag' (cf. Section 6.2). As we have seen, in these forms the glide is derived from a sequence of nuclei. In this section we are analysing forms where the glide [w] corresponds to the element U° lexically associated to a position other than a nuclear head. In these forms the glide-vowel sequence does not alternate with a sequence of vowels.

Recall that in a light diphthong both the glide and the vowel are associated to the same nuclear position. Thus, given that the glide occurs in a nuclear position there should be no restriction on whether the preceding onset is branching or not. That is, we should find forms where the glide-vowel sequence is preceded by a branching onset, e.g. *[krwádrũ] - which is not the case.[17]

The facts we have just discussed show that lexical glide-vowel sequences in BP do not correspond to the structure of a light diphthong. That is, a representation as the one illustrated in (20a) is excluded.

Let us then consider (20b) which presents the element U° syllabified in the governed position of a branching onset. If in a form like [kwádrũ] the glide is syllabified in the governed position of a branching

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[17] If we consider French which is a language that has lexical light diphthongs, we notice that a glide-vowel sequence which corresponds to the structure of a light diphthong can be preceded by a branching onset, e.g. [trwa] 'three'. The representation of [trwa] is illustrated below.

```
O        R
|\       |
| \      N
|  \     |
x   x    x
|   |   / \
t   r  U°  a
```

onset, we have a representation such as the one illustrated below.

(23)

```
         /         \
        s           w
O       R   O       R
|\      |   |\      |
| \     N   | \     N
|  \    |   |  \    |
x   x   x   x   x   x
|   |   |   |   |   |
k   U°  a   d   r   û
```

Assuming that the glide w represents the element U° syllabified in the governed position of a branching onset - as illustrated in (23) - we can expect that whenever the glide w occurs it will be preceded by a consonant (which will be the head of the branching onset governing domain). Indeed, a consonant always precedes the glide in all forms where the glide w corresponds to the element U° lexically associated to a position other than a nuclear head (cf. (19,22)). That is, a consonant-glide sequence, i.e. Cw, occurs.

Recall that constituents are maximally binary (cf. Chapter 1). That is, branching constituents are at the most associated to two skeletal positions. Thus, if in a form like [kwádrû] the glide represents the element U° syllabified in the governed position of a branching onset, the presence of the glide maximises the onset. Given that constituents are maximally binary, we expect not to find any forms where the glide w is preceded by a branching onset. That is, a form like *[krwádrũ] would not occur - and that is exactly the case.[18] Thus, if we assume that the glide w represents the element U° syllabified in the governed position of a branching onset (cf. (23)), we account for the lack of forms where a branching onset precedes the glide w, i.e. *[krwádrũ].

If we assume that the glide w corresponds to the element U° syllabified in the governed position of a branching onset, we expect forms which present a consonant-glide sequence to behave like any branching onset in BP. Let us consider a phonological process which involves branching onsets in BP.[19] In (24) we illustrate forms which present branching onsets, i.e. obstruent-liquid sequences, followed by a primary stressed vowel.

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[18] Once again we stress that the cases under discussion in this section involve those glide-vowel sequences which do not alternate with a sequence of vowels (cf. (19,22)). According to our proposal in these forms the glide w corresponds to the element U° lexically associated to a position other than a nuclear head. Recall that derived glide-vowel sequences may be preceded by branching onsets, e.g. [brwákα] ~ [bruákα] 'saddle-bag'.

[19] For more details of this process see SILVA (1989b).

(24) a. [prátû] 'plate'
b. [frévû] 'frevo (dance)'
c. [brɛ́vî] 'brief'
d. [krímî] 'crime'
e. [grósû] 'thick'
f. [trɔ́kɑ] 'change'
g. [blúzɑ] 'blouse'

Forms in (24) show that obstruent-liquid sequences can be followed by any BP primary stressed vowel. In (25) we illustrate forms where the obstruent-liquid sequence occurs followed by a nuclear position which does not bear primary stress.

(25) a. [ezẽ́plû] 'example'
b. [ótrû] 'other'
c. [sẽ́prî] 'always'
d. [lívrû] 'book'

e. [flamẽ́gû] 'Flamengo'
f. [brazilérû] 'Brazilian'
g. [kõprimídû] 'tablet'
h. [kõplikádû] 'complicated'

Forms in (25a-d) illustrate cases in which the obstruent-liquid sequence occurs in a position that follows the primary stressed vowel. Forms in (25e-h) illustrate cases in which the obstruent-liquid sequence occurs in a position that precedes the primary stressed vowel. In all forms illustrated in (25), i.e. where an obstruent-liquid sequence is followed by a vowel that does not bear primary stress, the obstruent-liquid sequence may occur as a single consonant, i.e. only the onset head is realized. This process is illustrated in (26).[20]

(26)	a.	[ezẽ́plû]	~	[ezẽ́pû]
	b.	[lívrû]	~	[lívû]
	c.	[brazilérû]	~	[bazilérû]
	d.	[kõplikádû]	~	[kõpikádû]

Forms in the left column in (26) illustrate the cases where an obstruent-liquid sequence is pronounced. Forms in the far right column illustrate the cases where only the obstruent is phonetically manifested.

The process illustrated in (26) (where an obstruent-liquid sequence alternates with an obstruent) takes place only if the vowel which follows the obstruent-liquid sequence does not bear primary stress. In cases where obstruent-liquid sequences are followed by a primary stressed vowel, e.g. [prátû] 'plate' (cf. (24)), an obstruent-liquid sequence must be phonetically manifested, i.e. *[pátû].

As we have just seen, a branching onset, i.e. an obstruent-liquid sequence, alternates with a non-branching onset, i.e. an obstruent. This happens if the vowel which follows the branching onset does not

[20] The examples in (26) represent a sample of forms given in (25). All forms in (25) may undergo the process illustrated in (26).

bear primary stress. Consider forms in (27), which present consonant-glide sequences.

(27)	a.[gwahdanápû]	*[gahdanápû]	'serviette'
	b.[akwarɛ́lɑ]	*[akarɛ́lɑ]	'water colour'
	c.[lĩgwɑ]	*[lĩgɑ]	'language'
	d.[iníkwɑ]	*[iníkɑ]	'iniquitous'

Forms in (27) illustrate consonant-glide sequences followed by a nuclear position which does not bear primary stress. In (27a-b) the consonant-glide sequence is followed by a nuclear position that precedes primary stress, and in (27c-d) the consonant-glide sequence is followed by a nuclear position that follows primary stress.

If the consonant-glide sequences in (27) corresponded to the structure of a branching onset - as illustrated in (23) - we would expect consonant-glide sequences to alternate with a consonant when they are followed by a vowel that does not bear primary stress. However, this is not the case, as illustrated in forms in the far right column in (27). Thus, the fact that the consonant-glide sequences in (27) do not alternate with a consonant is evidence that the phonological representation of consonant-glide sequences do not correspond to the structure of a branching onset.

A second argument against the branching onset hypothesis is that in consonant-glide sequences there are restrictions with respect to which consonant can precede the glide.[21] If we consider any form where the glide in the consonant-glide sequence corresponds to the element U° lexically associated to a position other than a nuclear head (cf. (19,22,27)), we notice that in all these forms the consonant which precedes the glide is a velar stop, i.e. either [k] or [g]. The constraint with respect to the consonant in the consonant-glide sequence (only a velar stop can occupy the consonantal position) provides us with further evidence that the consonant-glide sequence does not correspond to the structure of a branching onset - as illustrated in (23). If the consonant-glide sequences corresponded to the structure of a branching onset, we would expect other consonants - besides the velar stops [k,g] - to precede the glide. This is because we find obstruent-liquid sequences - which correspond to branching onsets - presenting other consonants besides

[21] Recall that in this section we are analysing consonant-glide sequences where the glide corresponds to the element U° lexically associated to a position other than a nuclear head. In consonant-glide sequences where the glide is derived from a sequence of nuclei so that either a glide-vowel sequence or a sequence of vowels occurs, e.g. [kwáʎû] ~ [kuáʎû] 'curd', there is no constraint with respect to the consonant which precedes the glide. That is, any BP consonant may precede the glide.

velar stops, e.g. [plánũ] 'plan', [trígũ] 'wheat'. Therefore, we expect that if consonant-glide sequences corresponded to the structure of branching onsets, the consonant-glide sequence would present other consonants - besides the velar stops [k,g] - in the consonantal position. That is, *[pw] and *[tw] would be possible sequences. This is not the case.

The facts we have just discussed above show that a consonant-glide sequence - where the glide corresponds to the element U° lexically associated to a position other than a nuclear head - does not correspond to the structure of a branching onset. We propose that the syllabification of consonant-glide sequences in BP - which represent a labio-velar consonant - correspond to a complex segment as illustrated in (28).

```
(28)      O    R
          |    |
          |    N
          |    |
          x    x
         / \   |
        C  U°  V
```

A complex segment presents two segments associated to a single onset position. Thus, in the representation of consonant-glide sequences both the velar stop and the glide w (whose internal representation consists of the element U°) are associated to the same onset position.[22]

In this section we have considered the syllabification of the glide w when it represents the element U° lexically associated to a position other than a nuclear head. In the following section we return to the discussion of iV/uV sequences. More specifically we will consider forms in which iV/uV sequences occur posttonically.

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[22] For theoretical issues concerning the representation of complex consonants and some constraints imposed on complex consonants in BP see SILVA (1992).

6.4. Posttonic Prevocalic Glides and Posttonic Postvocalic High Vowels

In this section we consider forms in which iV/uV sequences occur in the final nuclear positions in antepenultimate stressed nouns. That is, the weak positions in the antepenultimate stress pattern sww. Consider (29).

(29) a. [sábjα] 'wise'
b. [famílja] 'family'
c. [ɔ́ljû] 'oil'
d. [edifísjû] 'building'

e. [ágwα] 'water'
f. [ĩgénwα] 'ingenuous'
g. [tẽnwî] 'tenuous'
h. [kõgrwî] 'congruous'

Forms in (29) illustrate glide-vowel sequences occurring in a position which follows primary stress. Recall that in posttonic position the following vowels occur: [α,î,û] (cf. Chapter 3). Therefore, we expect any of the posttonic vowels [α,î,û] to occupy the vowel position in posttonic iV/uV sequences.

In the iV sequences illustrated in (29a-d) the vowel position is filled with either of the segments [α,û] and in the uV sequences illustrated in (29e-h) the vowel position is filled with either of the segments [ɑ,ȋ].[23]

It is important to mention that unlike pretonic iV/uV sequences - which may occur either as a glide-vowel sequence or as a sequence of vowels, e.g. [pjádɑ] ˜ [piádɑ] 'joke' and [kwáʎȗ] ˜ [kuáʎȗ] 'curd' (cf. Section 6.2) - posttonic iV/uV sequences do not alternate with their corresponding high vowel. That is, in posttonic iV/uV sequences (which are exemplified by the forms in (29)) a glide-vowel sequence must be realized, e.g. [sábjɑ] but *[sábȋɑ] and [ágwɑ] but *[ágȗɑ]. As we will see in the following pages, such a result is predicted by our analysis based on GP.

In the following pages we will provide evidence that in a similar way to pretonic iV/uV sequences (which are manifested as glide-vowel sequences, cf. section 6.2.) a posttonic iV/uV sequence (which occurs as a glide-vowel sequence) is derived from a sequence

[23] In Chapter 8 (where governing relations between high vowels are addressed) we will consider in detail forms presenting a glide followed by a high vowel (cf. (29c-d);(29g-h)), and forms presenting posttonic iV/uV sequences where a sequence of identical high vowels occurs.

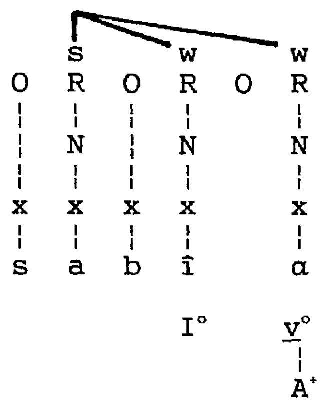
of adjacent nuclear positions.[24] Evidence that posttonic iV/uV sequences (which are realized as glide-vowel sequences) are derived from a sequence of adjacent nuclear positions comes from the behaviour of glide-vowel sequences with respect to the primary stressed vowel.

Primary stress in BP may be final, penultimate or antepenultimate (cf. Chapter 2). Interestingly, in forms which present posttonic glide-vowel sequences, primary stress must fall on the nuclear position which immediately precedes the glide-vowel sequence, i.e. [famíljɑ] but *[fámîljɑ] and [ĩgẽnwɑ] but *[ígẽnwɑ]. The fact that primary stress must fall on the nuclear position which immediately precedes the glide-vowel sequence is evidence that posttonic glide-vowel sequences are derived from a sequence of nuclear positions. This is because the nuclear position which immediately precedes the glide-vowel sequence corresponds to the third-to-last nuclear position, fitting into the antepenultimate stress pattern.

[24] There are cases in which the glide in posttonic glide-vowel sequences is syllabified in the representation of a complex consonant. In these cases a velar stop-glide sequence must occur, e.g. [lĩgwɑ] 'language'. These forms are discussed later in this section.

Let us then consider how posttonic glide-vowel sequences are derived.[25] The lexical representation of the form [sábjα] 'wise' is illustrated in (30).

(30)



Following our proposal we assume that posttonic glide-vowel sequences are derived from the establishment of a right-headed internuclear governing relation (cf. Chapter 5). The establishment of a right-headed internuclear governing relation triggers the deletion of the governed nuclear position, leaving its segmental material to relink to the governing nuclear position forming a light diphthong. This process is illustrated in (31).[26]

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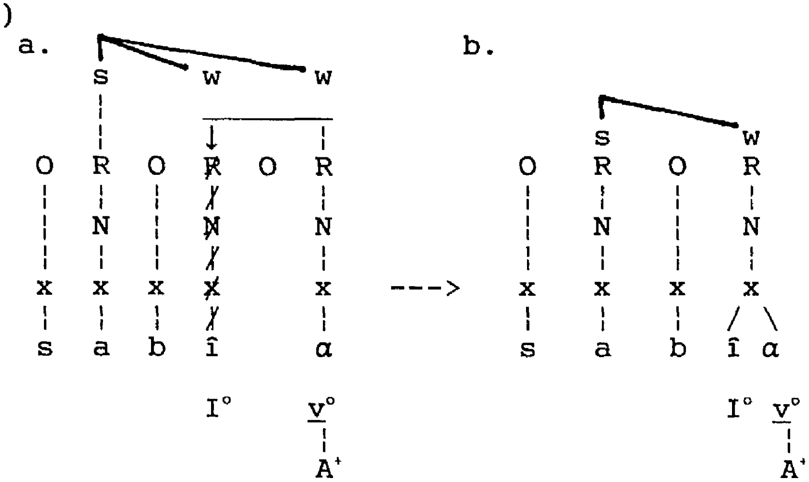
[25] We assume that any form in (29) - presenting posttonic iV/uV sequences which occur as glide-vowel sequences - is analysed in like manner.

[26] Recall that in a governing domain one of the positions must have adequate charm value to govern the segment occurring in the other position. The final nuclear position in posttonic iV/uV sequences (which may be filled with either [α,û,î]) has the property of governing the immediately preceding nuclear position, which is filled with either of the simplex charmless

(31)



In (31) a right-headed internuclear governing relation is established and a light diphthong is formed. The form [sábjα] 'wise' - which presents a posttonic glide-vowel sequence - is derived.

In the beginning of this section we pointed out that posttonic iV/uV sequences must be phonetically manifested as a glide-vowel sequence, i.e. [sábjα] but *[sábîα] and [ágwα] but *[ágûα]. The fact that posttonic iV/uV sequences must be phonetically manifested as a glide-vowel sequence is indeed predicted by our analysis. Recall that posttonic nuclear positions must be filled with charmless segments (cf. Chapter 3). Thus, in posttonic iV/uV sequences the nuclear position which immediately

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segment î/û. For details on governing properties of nuclear segments see Chapter 1.

precedes the vowel must be filled with the charmless segment <u>î</u> or <u>û</u>. On the other hand, the final nuclear position in posttonic <u>iV/uV</u> sequences - which corresponds to the vowel position - may be filled with any of the segments [α,û,î].

The simplex charmless segment <u>î</u> and <u>û</u> may be governed by any other nuclear segment of BP (cf. Chapter 1).[27] Therefore, we predict that in posttonic <u>iV/uV</u> sequences a governing relation will always hold between the nuclear position filled with the vowel and the preceding nuclear position - which is filled with the simplex charmless segment <u>î</u> or <u>û</u>. A right-headed internuclear governing domain is defined yielding a light diphthong formation (cf. (31)), so that a glide-vowel sequence is manifested.

The fact that in posttonic <u>iV/uV</u> sequences the nuclear position associated to the high vowel will be filled with one of the simplex charmless segments <u>î/û</u> - which may be governed by any other nuclear segment of BP - explains why a glide-vowel sequence must occur posttonically. That is, the establishment of a right-

[27] The fact that the simplex charmless segments, i.e. <u>î/û</u>, may govern each other is addressed in Chapter 8, where governing relations between high vowels are discussed.

headed internuclear governing relation in posttonic <u>iV/uV</u> sequences must take place so that a glide-vowel sequence will occur.

In the following pages we will consider the phonological interpretation of forms which present posttonic glide-vowel sequences preceded by a velar stop consonant. Consider (32).

(32)	a.	[iníkwɑ]	'iniquitous'
	b.	[lĩgwɑ]	'language'
	c.	[inɔ́kwɑ]	'innocuous'
	d.	[ágwɑ]	'water'

Forms in (32) present posttonic glide-vowel sequences. Notice, however, that in all these forms the glide-vowel sequence is preceded by a velar stop consonant so that a velar stop-glide sequence occurs. We have seen that a velar stop-glide sequence may be interpreted as a complex consonant, i.e. both the velar stop and the element U° are syllabified in the same onset position (cf. Section 6.3). Therefore, one could question whether the glide in the glide-vowel sequences illustrated in (32) corresponds to the element U° syllabified in the representation of a complex consonant, or whether the glide represents the element U° syllabified in the representation of a light diphthong (as a consequence of the establishment of a right-headed internuclear governing relation). These two possibilities are illustrated in (33).

```
(33) a.    O   R                    b.   O   R
           |   |                         |   |
           |   N                         |   N
           |   |                         |   |
           x   x                         x   x
          / \  |                         |  / \
         C  U° V                         C  U° V
```

In order to determine how the glide <u>w</u> is interpreted in posttonic velar stop-glide-vowel sequences, we have to consider derived forms where the velar stop-glide-vowel sequence occurs in pretonic position.

Recall that in cases where a pretonic glide is derived from a sequence of adjacent nuclear positions it alternates with its corresponding high vowel, e.g. [kwáλû] ~ [kuáλû] 'curd' (cf. section 6.2). On the other hand if the pretonic glide corresponds to the element U° syllabified in the representation of a complex consonant, it cannot alternate with its corresponding high vowel, e.g. [kwádrû] but *[kuádrû] 'picture' (cf. section 6.3). Consider forms in (34).

(34)

a.[inikwidádî]	*[inikuidádî]	'iniquity'
b.[lĩgwístîkα]	*[lĩguístîkα]	'linguistics'
c.[inokwidádî]	~ [inokuidádî]	'innocuousness'
d.[agwádû]	~ [aguádû]	'watered'

(34) illustrates derived forms of the nouns listed in (32). Forms in (34a-b) show that the pretonic glide cannot alternate with its corresponding high vowel. Forms in (34c-d) show that either a pretonic high vowel or a pretonic glide may occur.

The derived forms illustrated in (34) lead us to determine the correct phonological interpretation of the glide in forms which present posttonic velar stop-glide-vowel sequences - as illustrated in (32).

That is, in forms such as (32a-b), i.e. [iníkwɑ] and [lĩgwɑ], the glide corresponds to the element U° syllabified in the representation of a complex consonant. This is why in the derived forms [inikwidádĩ] and [lĩgwístĩkɑ] (cf. (34a-b)) the pretonic glide cannot alternate with its corresponding high vowel; i.e. *[inikuidádĩ] and *[lĩguístĩkɑ].

On the other hand, in forms such as (32c-d), i.e. [inɔ́kwɑ] and [ágwɑ], the glide corresponds to the element U° syllabified in the representation of a light diphthong (as a consequence of the establishment of a right-headed internuclear governing relation). This is why in the derived forms [inokwidádĩ] ~ [inokuidádĩ] and [agwádû] ~ [aguádû] the pretonic glide alternates with its corresponding high vowel (cf. (34c-d)).

In this section we have considered forms which present posttonic <u>iV/uV</u> sequences. We have seen that posttonic <u>iV/uV</u> sequences must be phonetically manifested as a glide-vowel sequence. Such a requirement, i.e. that a glide-vowel sequence must occur posttonically, follows from charm requirements with respect to the position of primary stress and the establishment of a right-headed internuclear governing relation.

We have seen that the glide in posttonic <u>iV/uV</u> sequences may either be derived from a sequence of adjacent nuclear positions or it may correspond to the element U° syllabified in the representation of a complex consonant.[28] In the following section we

[28] Our argument that posttonic <u>uV</u> sequences are derived from a sequence of nuclei is based on the behaviour of glide-vowel sequences with respect to the primary stressed vowel. That is, primary stress must fall on the nuclear position which immediately precedes the glide-vowel sequence, i.e. [ĩgénwɑ] 'ingenuous' but *[ĩgenwɑ]. In (32) we illustrated forms which present posttonic glide-vowel sequences. According to our proposal in (32a-b) the glide corresponds to the element U° lexically associated to a position other than a nuclear head and in (32c-d) the glide is derived from a sequence of nuclear positions. Notice that we expect to find forms in which the glide corresponds to the element U° lexically associated to a position other than a nuclear head

consider iV/uV sequences where the nuclear position filled with the high vowel bears primary stress.

6.5. Prevocalic Primary Stressed High Vowels

In the previous sections we analysed iV/uV sequences where a glide alternates with a high vowel, i.e. in pretonic position (cf. Section 6.2); and iV/uV sequences where a glide must occur, i.e. in posttonic position (cf. Section 6.4). In this section we will see that in primary stressed iV/uV sequences either a sequence of vowels or a vowel-glide sequence may be realized. Consider (35).

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where primary stress falls on the second-to-last nuclear position which precedes the glide. That is, [íniÎkwɑ] should be a possible form. This is because if the glide is not derived from a sequence of nuclei - but it rather represents the element U° together with the velar stop consonant associated to an onset position - nothing should prevent stress from falling on the second-to-last nuclear position which precedes the glide. However, such forms have not been reported in BP. That is, in forms which present posttonic glide-vowel sequences primary stress must fall on the nuclear position which immediately precedes the glide, i.e. [iníkwɑ] 'iniquitous' but *[íniÎkwɑ]. For the metrical constraints imposed on complex consonants in BP see SILVA (1992).

(35) a.	[píα]		'sink'	
b.	[ekonomíα]		'economy'	
c.	[húα]		'street'	
d.	[kakatúα]		'cacatua (bird)'	
e.	[maníαka]		'maniac'	
f.	[olĩpíαdα]		'Olympiad'	
g.	[híû]	~	[híw]	'river'
h.	[asovíû]	~	[asovíw]	'whistle'
i.	[períûdû]	~	[períwdû]	'period'

Forms in (35a-f) illustrate cases in which a primary stressed high vowel is immediately followed by the segment [α]. In (35a-d) the high vowel bears penultimate stress and in (35e-f) the high vowel bears antepenultimate stress.[29]

Forms in (35g-i) illustrate cases in which a primary stressed high front vowel is immediately followed either by the segment [û] or by the segment [w]. In (35g-h) the high front vowel bears penultimate stress and in (35i) the high front vowel bears antepenultimate stress.[30]

Let us first consider the derivation of forms in which a primary stressed high vowel is followed by the

[29] Forms which present antepenultimate stressed high back vowels followed by a schwa have not been reported, i.e. *[manúαka].

[30] Forms in which a primary stressed high back vowel is followed by a palatal glide, e.g. [flújdû] ~ [fluídû] 'fluid', will be considered in Chapter 8, where governing relations between high vowels are addressed.

segment [α], e.g. [píα] 'sink' and [húα] 'street'.[31] In (36) we illustrate the lexical representation of the form [píα].[32]

```
(36)      /     \
          s      w
     O    R   O  R
     |    |      |
     |    N      N
     |    |      |
     x    x      x
     |    |      |
     p    i      α

          I°     v°
          |      |
          I+     A+
```

In (36) we have a sequence of strictly adjacent nuclear positions which is subject to government. In a governing domain the governing position must be filled with a segment which has the adequate charm value to govern the segment associated to the governed position. Let us then consider the governing properties of the segments which occupy the adjacent nuclear positions in (36).

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[31] Forms such as the ones illustrated in (35g-i) - in which a primary stressed high front vowel is followed either by [û] or [w] - will be addressed later in this section.

[32] We assume that any form which presents a primary stressed high vowel immediately followed by a schwa (cf. (35a-f)) is derived in like manner.

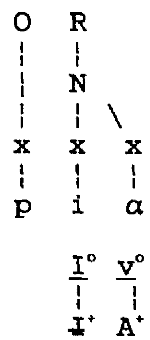
The far left nuclear position is filled with the positively charmed segment [i] and the nuclear position to the right is filled with the complex charmless segment [α]. We have seen in Chapter 1 that positively charmed segments have the property of governing complex charmless segments. Thus, the far left nuclear position in (36) - which is filled with the positively charmed segment [i] - has the property of governing the following nuclear position - which is filled with the complex charmless segment [α]. That is, a left-headed internuclear governing domain shall be established.

In Chapter 5 we proposed that the establishment of a left-headed internuclear governing domain yields a branching nucleus formation. That is, both nuclear positions are associated to a single nuclear constituent. In order for a left-headed internuclear governing relation to hold, the same segmental requirements imposed on branching nuclei must be satisfied. In the case of long vowels the same segmental material occupies both nuclear positions. In the case of heavy diphthongs the far left nuclear position - which is the governor - must be filled with either a complex charmless segment or with a positively charmed segment. The far right nuclear position - which is the governee - must be filled with a simplex charmless segment, i.e. [î,û,ɨ].

Let us then consider if the segments which occupy the adjacent nuclear positions in (36) satisfy charm requirements imposed on branching nuclei. The far left nuclear position in (36) - which is the potential governor - is filled with the positively charmed segment [i]. The governing nuclear position in a heavy diphthong governing domain may be filled with either a positively charmed segment, or with a complex charmless segment. Given that the segment [i] is positively charmed, it satisfies charm requirements imposed on the governing nuclear position of heavy diphthongs.

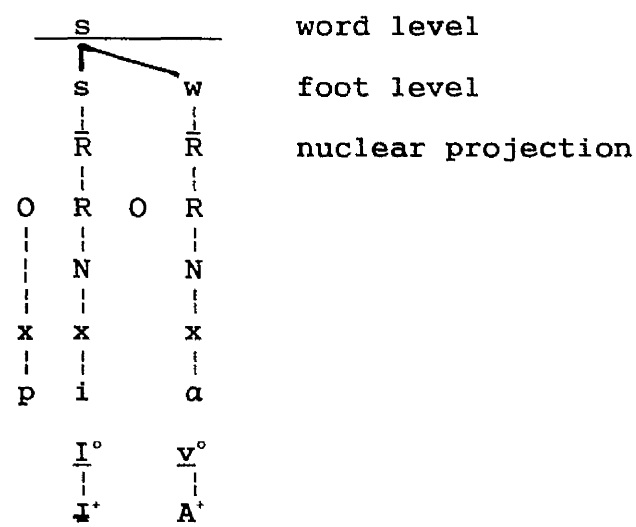
The far right nuclear position in (36) - which is the potential governee - is filled with the complex charmless segment [α]. The governed nuclear position in a heavy diphthong must be filled with a simplex charmless segment, i.e. [î,û,ɨ]. Given that the charmless segment [α] is complex it cannot occupy the governed position in a heavy diphthong. Therefore, a heavy diphthong cannot be formed between the adjacent nuclear positions in (36) because the governed position would be filled with a complex charmless segment, i.e. [ɑ], yielding an ill-formed representation which is illustrated in (37).

(37) *



In order to prevent an ill-formed representation - such as the one illustrated in (37) - we propose that a sequence of adjacent nuclear positions is allowed to occur (cf. Chapter 5). The derivation of the form [píɑ] 'sink' is illustrated in (38).

(38)



In (38) we have a sequence of adjacent nuclear positions where the far left one has the property of governing the nuclear position to the right. A left-headed internuclear governing domain should be established. The establishment of a left-headed internuclear governing relation yields a representation in which both nuclear positions are associated to the same constituent, i.e. a heavy diphthong. However, the establishment of a left-headed internuclear governing relation between the adjacent nuclear positions in (38) would yield an ill-formed representation (cf. (37)). Thus, in order to prevent this phenomenon we propose that a sequence of adjacent nuclear positions is allowed to occur - as illustrated in (38).

Let us now consider the derivation of forms in which a primary stressed high vowel is followed by either the segment [û] or by the segment [w] (cf. (35g-h)). These forms are reproduced in (39).

(39)	a.	[híû]	~	[híw]	'river'
	b.	[asovíû]	~	[asovíw]	'whistle'
	c.	[períûdû]	~	[períwdû]	'period'

Forms on the left in (39) illustrate cases in which a primary stressed high front vowel is followed by a high back vowel, i.e. [û]. Forms on the right in (39) illustrate cases in which a primary stressed high front vowel is followed by a back glide, i.e. [w]. Let us consider the derivation of forms illustrated in (39). In (40) we present the lexical representation of the forms [híû] ~ [híw] 'river'.[33]

```
(40)       /   \
           s     w
       O   R  O  R
       |   |     |
       |   N     N
       |   |     |
       x   x     x
       |   |     |
       h   i     û

           I°    U°
           |
           I+
```

In (40) we have a sequence of strictly adjacent nuclear positions which is subject to government. In order for a governing relation to hold, the governing nuclear position must be filled with a segment which has the adequate charm value to govern the segment associated to the governed position.

The far left nuclear position in (40) is filled with the positively charmed segment [i] and the nuclear position to the right is filled with the simplex charmless segment [û]. We have seen that positively charmed segments have the property of

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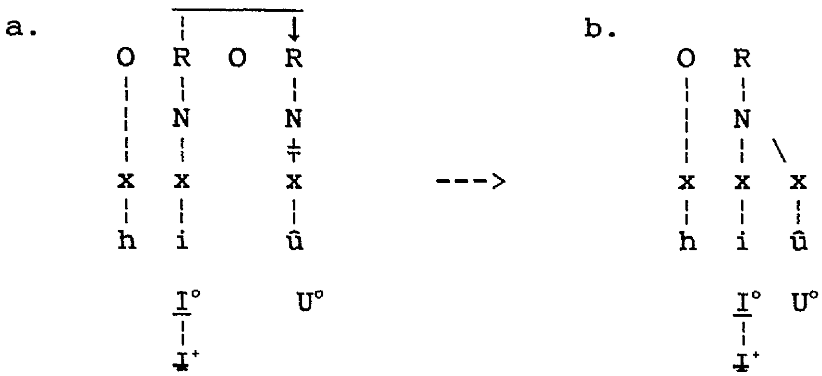
[33] We assume that any form which presents a primary stressed high front vowel immediately followed by a high back vowel or a back glide is derived in like manner.

governing simplex charmless segments (cf. Chapter 1). Therefore, the far left nuclear position in (40) - which is filled with the positively charmed segment [i] - has the property of governing the nuclear position to the right - which is filled with the simplex charmless segment û. A left-headed internuclear governing domain shall be established.

In Chapter 5 we proposed that the establishment of a left-headed internuclear governing domain yields a branching nucleus formation where the same segmental requirements imposed on branching nuclei must be satisfied.

The far left nuclear position in (40) - which is the potential governor - is filled with the positively charmed segment [i]. The segment [i] is positively charmed and thus it satisfies charm requirements imposed on the governing nuclear position of heavy diphthongs. The far right nuclear position in (40) - which is the potential governee - is filled with the simplex charmless segment û. The governed nuclear position in a heavy diphthong must be filled with a simplex charmless segment, i.e. [î,û,ɨ]. Given that the simplex charmless segment û occupies the potential governed position (cf. (40)), charm requirements imposed on branching nuclei are satisfied so that a left-headed internuclear governing relation holds. This process is illustrated in (41).

(41)



(41a) illustrates the establishment of a left-headed internuclear governing relation. In Chapter 5 we proposed that the establishment of a left-headed internuclear governing relation yields a branching nucleus formation. In (41b) a branching nucleus, or more specifically a heavy diphthong governing domain, is established. In (41b) the segment <u>û</u> - whose internal representation consists of the element U° - occupies a position which is not a nuclear head. That is, it occupies the governed position in a heavy diphthong. Given that the element U° occupies a position which is not a nuclear head, it is phonetically manifested as a glide, i.e. [w]. The form [híw] 'river' - in which a primary stressed high front vowel is followed by the glide [w] - is derived.

We have seen that forms in which a primary stressed high front vowel is followed by a glide, e.g. [híw], may present an alternative pronunciation in which a sequence of vowels occurs, i.e. [híû] (cf. (39)). In (41) we have accounted for the pronunciation of the form [híw], i.e. where a vowel-glide sequence occurs. Let us now consider the derivation of the form [híû] where a sequence of vowels occurs. For convenience its lexical representation presented in (40) is reproduced in (42).

```
(42)        /    \
            s     w
       O    R  O  R
       |    |     |
       |    N     N
       |    |     |
       x    x     x
       |    |     |
       h    i     û

            I°     U°
            |
            I+
```

We have seen that a representation such as the one illustrated in (42) is subject to government. More precisely a left-headed internuclear governing relation holds so that a branching nucleus is formed, and a vowel-glide sequence is manifested (cf. (41)).

Notice, however, that in the process of deriving the form [híû], i.e. where a sequence of vowels occurs, the segment [û] remains associated to a nuclear head position, thus appearing as a vowel. We assume that the derivation of the form [híû] 'river' corresponds to its lexical representation, i.e. the structure presented in (42). Although charm requirements are satisfied, a left-headed internuclear governing relation does not hold between the adjacent nuclear positions in (42) so that no vowel-glide sequence is realized.

The reasons why a left-headed internuclear governing relation may or may not hold between adjacent nuclear positions which are both filled with a high vowel (cf. (41,42)) - will be discussed in detail in Chapter 8, where the governing relations between high vowels are addressed. Suffices to say here that whether a governing relation holds or not, involves sequences of adjacent nuclear positions which are both filled with high vowels.[34]

[34] In Chapter 7 we will see that a left-headed internuclear governing relation must hold between a primary stressed nuclear position filled with a positively charmed segment other than [i], i.e. [a,e,o,u], and its immediately following nuclear position filled with a lax high vowel. Therefore, a vowel-glide sequence must be realized. That is, unlike a form such as [híw] - which may also occur as [híû] - in a form such as [pâw] 'stick' a vowel-glide

6.6. Conclusion

In this Chapter we have considered the derivation of forms which present high vowels and glides followed by a vowel, i.e. iV/uV sequences. The lexical representation we propose for iV/uV sequences is illustrated in (43).

```
(43)  O   R   O   R
          |       |
          N       N
          |       |
          x       x
          |       |
         î/û      V
```

We have shown that a representation such as (43) is subject to the establishment of a right-headed internuclear governing relation, since the far right nuclear position - which is filled with any BP vowel - has the property of governing the nuclear position to the left - which is filled with either of the simplex charmless segments î/û.

We propose that iV/uV sequences - which are manifested as a glide-vowel sequences - are derived from the establishment of a right-headed internuclear governing relation, which causes the deletion of the

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sequence must occur, i.e. *[páû].

governed nuclear position. Thus, the segmental material which was formerly associated to the governed nuclear position relinks to the governing nuclear position forming a light diphthong. This process is illustrated in (44).

```
(44)       _________
           ↓        ¦
       O   R        R                    O  R
           ¦        ¦                       ¦
           N        N                       N
           ¦        ¦                       ¦
           x        x        --->           x
           ¦        ¦                    .·'¦
          î/û       V                   î/û V
```

We have seen that in pretonic iV/uV sequences either a high vowel or a glide may be phonetically manifested, e.g. [piádα] ˜ [pjádα] 'joke' and [kuáλû] ˜ [kwáλû] 'curd' (cf. section 6.2.). We propose that pretonic iV/uV sequences which are manifested as a sequence of vowels, e.g. [piádα] and [kuáλû], represent the case where the loss of a nuclear position is prevented. Thus, the positively charmed ATR element is incorporated to the internal representation of the high vowel yielding the positively charmed segments [i,u]. This process is illustrated in (45).

(45)
```
           __//__
           ↓     |
      O    R  O  R
           |     |
           N     N
           |     |
           x     x
           |     |
          i/u    V
```

Given that the far left nuclear position in (45) is filled with either of the positively charmed segments [i,u] - which cannot be governed - a governing relation does not hold between the adjacent nuclear positions. No nuclear position is deleted and a sequence of vowels is realized.

We have also seen that in posttonic iV/uV sequences a glide-vowel sequence must be phonetically manifested, e.g. [sábjɑ] but *[sábîɑ] 'wise' and [ágwɑ] but *[ágûɑ] 'water'. Such a requirement (that a glide-vowel sequence must be phonetically manifested in posttonic iV/uV sequences) follows from the fact that posttonic nuclear heads must be filled with simplex charmless segments, and that the establishment of a right-headed internuclear governing relation in posttonic iV/uV sequences is obligatory.

Concerning iV/uV sequences where the high vowel bears primary stress, e.g. [píɑ] 'sink'; [húɑ] 'street' and [híû] ~ [híw] 'river', we have seen that a primary stressed nuclear position filled with a high vowel may govern the following nuclear position. Thus a left-headed internuclear governing relation may hold. We propose that the establishment of a left-headed internuclear governing relation yields a branching nucleus formation.[35]

In a branching nucleus governing domain, the far left nuclear position - which is the head - must be filled with either a positively charmed segment, i.e. [a,e,i,o,u], or with a complex charmless segment, i.e. [ɛ,ɔ]. The far right nuclear position - which is the governee - must be filled with a simplex charmless segment, i.e. [î,û,ɨ]. If the segmental requirements imposed on branching nuclei are not satisfied when a left-headed internuclear governing domain may potentially hold, then a sequence of adjacent nuclear positions is allowed to occur.

We have also considered forms in which a velar stop-back glide sequence occurs, i.e. <u>kw</u> and <u>gw</u>. We showed that the syllabification of the back glide in BP may correspond either to the element U° syllabified

[35] Left-headed internuclear governing relations are discussed in detail in the following Chapter.

in the representation of a light diphthong (as a consequence of the establishment of a right-headed internuclear governing relation) or to the element U° together with a velar stop consonant associated to a single onset position (in the representation of a complex consonant). In (46) we illustrate the representation of a complex consonant.

(46)
```
      O   R
      |   |
      |   N
      |   |
      x   x
     / \  |
    C  U° V
```

We have claimed that when the back glide is phonologically interpreted as the element U° syllabified in the representation of a complex consonant (cf. (46)), it corresponds to the cases when the element U° is lexically associated to a position other than a nuclear head. In the following Chapter we will consider forms in which either a postvocalic high vowel or a postvocalic glide is realized.

CHAPTER 7

POSTVOCALIC GLIDES AND POSTVOCALIC HIGH VOWELS

7.0. Introduction

In this Chapter we consider forms which present vowel-glide sequences, i.e. [Vj,Vw], and forms which present a sequence of vowels where the far right member is a high vowel, i.e. [Vi,Vu].

In the first section we discuss the phonological representation of vowel-glide sequences. In section 2 we provide evidence that vowel-glide sequences in BP are derived from a sequence of adjacent nuclear positions and we determine how postvocalic glides are syllabified in BP. In section 3 we will consider the phonological behaviour of vowel-glide sequences, and sequence of vowels in BP in relation to primary stress. We will determine the conditions under which a vowel-glide sequence alternates or fails to alternate with a sequence of vowels.

7.1. The Representation of Vowel-Glide Sequences

In this section we consider the phonological representation of vowel-glide sequences. Glides represent the cases in which the simplex charmless segments î/û occupy a position other than a nuclear head. Therefore, when representing vowel-glide sequences we will have a vowel occupying a nuclear head position immediately followed by either of the simplex charmless segments [î,û] occupying a position other than a nuclear head. In (1) we illustrate the potential syllabifications of vowel-glide sequences.

```
(1)  a.  O    R               b. O   R   O   R
              |                      |   |   |
              N                      N   |   N
             / \                     |   |   |
            x   x                    x   x   x
            |   |                    |   |
            V  î/û                   V  î/û
```

(1a) illustrates a heavy-diphthong governing domain. In a heavy diphthong governing domain the governor, i.e. the far left nuclear position, must be filled with either a positively charmed segment, e.g. [a,e,i,o,u], or with a complex charmless segment, e.g. [ɛ,ɔ].[1] The governed position in a heavy diphthong

[1] In Chapter 1 we have seen that the complex charmless segments in BP are [ɛ,ɔ,ɑ]. Cases in which a complex charmless segment occupies the governing position in a heavy diphthong, only the complex charmless segments [ɛ,ɔ] may fill this position. The

must be filled with a simplex charmless segment. In (1a) the governed position of the heavy diphthong is filled with either of the simplex charmless segments î/û. Notice that in (1a) the segments î/û occur in a position which is not a nuclear head, i.e. they occupy the governed position in a heavy diphthong. Given that the segments î/û occur in a position other than a nuclear head they are manifested as glides. (1a) is realized as a vowel-glide sequence, i.e. [Vj,Vw].

(1b) illustrates the case where a nuclear position filled with a vowel is immediately followed by an onset position filled with either of the simplex charmless segments î/û. According to the theory, a non-governing onset position may be filled with either a negatively charmed segment or with a charmless segment (cf. Chapter 1). Given that the segments î/û are charmless, they satisfy charm requirements for segments occurring in onset positions. Notice that in

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fact that the complex charmless segment [α] cannot occupy the head position in a heavy diphthong, i.e. *[αj], follows from "la contrainte de Kryocéphalie" (cf. LOWENSTAMM (1986)). This constraint prevents a segment that has the cold element as its head to be the head of a governing domain (cf. Chapter 3). A heavy diphthong represents a governing domain where the nuclear position is the head. Thus, given that the segment [α] - whose internal representation is $(A^{+}.\underline{v}^{\circ})^{\circ}$ - has the cold element as its head, it cannot occupy the governing position in a heavy diphthong governing domain, i.e. *[αj].

(1b) the segments <u>î/û</u> occupy a position other than a nuclear head, i.e. they occur in an onset position, being thus realized as a glide. (1b) is realized as a glide-vowel sequence.[2] In the following section we will consider the phonological interpretation of vowel-glide sequences in BP.

[2] In this section we are considering cases in which a vowel-glide sequence occurs. Therefore, in (1b) the final nuclear position is empty so that a vowel-glide sequence is realized. Whenever an onset position filled with a simplex charmless segment is immediately followed by a filled nuclear position we have intervocalic glides, i.e. [VjV,VwV]. Intervocalic glides are addressed in Chapter 8.

7.2. The Phonological Interpretation of Vowel-Glide Sequences in BP

In this section we will argue that vowel-glide sequences in BP are derived from a sequence of adjacent nuclear positions. We will also determine how vowel-glide sequences, i.e. postvocalic glides, are syllabified in BP. Consider (2).[3]

(2)	a.	[erɔ́j]	'hero'
	b.	[muzéw]	'museum'
	c.	[gájtɑ]	'tin fife'
	d.	[káwzɑ]	'cause'
	e.	[kajpírɑ]	'bumpkin'
	f.	[bawrú]	'Baurú'

Forms in (2) illustrate instances of vowel-glide sequences.[4] Concerning the phonological interpretation of forms in (2), one could posit two hypothesis. In one case it would be assumed that the glide is

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[3] It is important to mention that in most BP dialects there is a process of l-vocalization. This process yields a lateral consonant that is phonetically manifested as a back glide either when it occupies a rimal position, e.g. /altûrɑ/ --> [awtúrɑ] 'height', or when it is followed by a final empty nucleus, e.g. /salØ/ --> [sáw] 'salt'. The forms we consider in this work which present back glides exclude those which are related to the process of l-vocalization.

[4] Forms which present pretonic postvocalic glides, e.g. [kajpírɑ] (cf. (2e-f)), present an alternative pronunciation in which a sequence of vowels occurs, i.e. [kaipírɑ]. The conditions under which a postvocalic glide or a postvocalic high vowel is manifested are discussed in the following section.

lexically present, whereas in another case it would be assumed that the glide is derived from its corresponding high vowel. Therefore, we have to determine whether postvocalic glides in BP are lexically present, or whether they are derived from their corresponding high vowels. In the following pages we will argue that the proposal that postvocalic glides are lexically present in BP cannot be sustained.

We have seen in section 7.1 that postvocalic glides may represent either the cases where a simplex charmless segment is syllabified in the governed position of a heavy diphthong (cf. (1a)), or the cases where a simplex charmless segment occupies an onset position (cf. (1b)). Let us first assume that postvocalic glides in BP are lexically present and that they correspond to a simplex charmless segment syllabified in the governed position of a heavy diphthong. According to this proposal a form such as [muzéw] 'museum' is syllabified as in (3).

```
(3)  O   R   O   R
     |   |   |   |
     |   N   |   N
     |   |   |   | \
     x   x   x   x   x
     |   |   |   |   |
     m   u   z   e   û
```

Heavy diphthongs present two nuclear positions associated to the same nuclear constituent. In metrical terms a heavy diphthong counts as a single nuclear head.

Evidence that vowel-glide sequences in BP do not correspond to the structure of a lexical heavy diphthong - as illustrated in (3) - comes from the behaviour of vowel-glide sequences with respect to primary stress. Primary stress in BP may be either final, penultimate or antepenultimate, e.g. [pará] 'Pará', [kázɑ] 'house' and [sílɑbɑ] 'syllable' (cf. Chapter 2). If vowel-glide sequences were lexically present in BP and they corresponded to the structure of a heavy diphthong - as illustrated in (3) - then we would expect to find antepenultimate stressed vowel-glide sequences, e.g. [náwtĩkũ]. This is because a heavy diphthong metrically counts as a single nuclear head. Thus, a form such as [náwtĩkũ] would illustrate an instance of antepenultimate stress. However, forms such as [náwtĩkũ], i.e. which present antepenultimate stressed vowel-glide sequences, are not representative of the BP lexicon.[5]

[5] It is worth mentioning that although we do not find many forms presenting antepenultimate stressed vowel-glide sequences, e.g. [náwtĩkũ], forms presenting antepenultimate stressed branching rimes are very recurrent in BP, e.g. [plástĩkũ] 'plastic',

There are few forms which present antepenultimate stressed vowel-glide sequences, e.g. [náwtîkû] 'nautical' and [fahmaséwtîkû] 'pharmaceutical'. These forms apparently support the hypothesis that vowel-glide sequences are lexically present, i.e. they would illustrate instances of antepenultimate stressed vowel-glide sequences. Nevertheless, the forms which present antepenultimate stressed vowel-glide sequences are quite rare in BP and so we cannot assume that vowel-glide sequences are lexically present. We propose that forms which present antepenultimate stressed vowel-glide sequences, e.g. [náwtîkû] and [fahmaséwtîkû], are analysed as exceptional. They belong to a small set of forms which allow primary stress to fall on the fourth-to-last syllable, e.g. [tɛ́kînîkɑ] 'technical' and [hítîmîkɑ] 'rhythmic'.[6] Thus, forms such as [náwtîkû] and [fahmaséwtîkû] - whose lexical representations we assume are /naûtîkû/ and /fahmaseûtîkû/ respectively - are exceptionally

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[sɔ́hdîdû] 'sordid'. Forms presenting antepenultimate stressed branching rimes, e.g. [plástîkû], show that BP allows antepenultimate stressed heavy syllables. Therefore, the fact that we do not find many forms presenting antepenultimate stressed vowel-glide sequences, e.g. [náwtîkû], is not related to any constraint which does not allow antepenultimate stressed forms in BP to present heavy syllables.

[6] For reasons which are not yet clear all forms which are exceptionally stressed on the fourth-to-last syllable are derived forms which present the suffix -îk.

stressed on the fourth-to-last syllable.

There is further evidence that vowel-glide sequences are not lexically present in BP, and that glides do not correspond to a simplex charmless segment syllabified in the structure of a heavy diphthong (cf. (3)). This evidence comes from the phonological behaviour of languages which have lexical heavy diphthongs. In such languages there is usually a contrast between short and long vowels, and there are also segmental restrictions concerning the vowel in the vowel-glide sequences which correspond to heavy diphthongs. More specifically, a reduced set of vowels from the language may occupy the vowel position in the vowel-glide sequences which correspond to heavy diphthongs.

Thus, if vowel-glide sequences in BP corresponded to lexical heavy diphthongs - as illustrated in (3) - there would be constraints concerning which vowels could precede the glide. Consider (4).

(4)	a.	[gájtɑ]	'tin fife'
	b.	[olɛ́jkû]	'oleic'
	c.	[séjtɑ]	'sect'
	d.	[mójtɑ]	'thicket'
	e.	[bezɔ́jkû]	'benzoic'
	f.	[flújdû]	'fluid'[7]
	g.	[káwzɑ]	'cause'
	h.	[hubɛ́wlɑ]	'rubella'
	i.	[déwzɑ]	'goddess'
	j.	[períwdû]	'period'
	k.	[kówrû]	'leather'

Forms in (4) show that any BP vowel may precede the glide in the glide-vowel sequences.[8] The lack of segmental restrictions concerning which vowels may occur in vowel-glide sequences in BP - as illustrated in (4) - provides us with evidence that vowel-glide sequences in BP do not correspond to the structure of a lexical heavy diphthong. This is because if vowel-glide sequences corresponded to the structure of a lexical heavy diphthong, there would be constraints on which vowels could precede the glide, which is not the case.

We have just seen that BP does not display the typical behaviour of languages which have lexical

[7] A form such as [flûjdû] may also be pronounced as [fluídû]. In Chapter 8 we discuss these forms in detail, where the governing relations between high vowels are addressed.

[8] The only segmental restriction we find in vowel-glide sequences in BP is that the segment [ɔ] cannot precede the back glide, i.e. *[ɔw].

heavy diphthongs, since there is no segmental restriction concerning the vowels in vowel-glide sequences (cf. (4)). Furthermore, when considering BP vowels we observe that no contrast between short and long vowels is attested.[9]

We have just seen that the proposal that vowel-glide sequences are lexically present in BP and that they correspond to the structure of a heavy diphthong (cf. (3)) cannot be sustained. Let us now consider the proposal that vowel-glide sequences are lexically present in BP and that the glide in the glide-vowel sequence corresponds to a simplex charmless segment syllabified in an onset position (cf. (1b)). According to this proposal a form such as [muzéw] 'museum' is syllabified as in (5).

```
(5)  O  R  O  R  O  R
     |  |  |  |  |  |
     |  N  |  N  |  N
     |  |  |  |  |  |
     x  x  x  x  x  x
     |  |  |  |  |
     m  u  z  e  û
```

We argue that the glide in the vowel-glide sequences in BP does not correspond to a simplex charmless segment syllabified in an onset position -

[9] We refer the reader to Chapter 2 where we provide evidence that BP has no long vowels.

as illustrated in (5). Evidence that postvocalic glides in BP do not correspond to a simplex charmless segment syllabified in an onset position, comes from the behaviour of derived forms of finally stressed vowel-glide sequences.

Recall that the morphological structure of nouns in BP corresponds to a noun stem followed by the gender suffix, e.g. /trabaʎ + ʊ̂/ --> [trabáʎʊ̂] 'work' (cf. Chapter 2). The gender suffix corresponds to a nuclear position which may be filled with either [ɑ,ʊ̂,ɪ̂], e.g. [kázɑ] 'house', [ládʊ̂] 'side' and [bɔ́dɪ̂] 'goat'. In derived forms the noun stem is followed by one or more suffixes which are then followed by the gender suffix nuclear position, e.g. /trabaʎ + ad + ɑ/ --> [trabaʎádɑ] 'worked' and /trabaʎ + ad + or + ɑ/ --> [trabaʎadórɑ] 'worker (F)'. Consider the derived forms in (6).

(6)	a.	[muzéw] [muzeɔ́lʊ̂gʊ̂]	'museum' 'specialist in museums'
	b.	[iskahsɛ́w] [iskahseádʊ̂]	'swell (of waves)' 'swelled'
	c.	[erɔ́j] [eroísmʊ̂]	'hero' 'heroism'

In each pair of words illustrated in (6) the first form corresponds to an underived noun, and the second one corresponds to one of its derived forms.

All the underived nouns in (6), i.e. [muzéw], [iskahsέw], [erɔ́j], present a final stressed vowel-glide sequence. Notice that in the derived forms, i.e. [muzeɔ́lûgû], [iskahseádû], [eroísmû], no vowel-glide sequence occurs.

In derived forms the suffixes are added directly to the noun stems, i.e. the gender suffix is suppressed, and is added after the last suffix. The derived forms illustrated in (6) are evidenceq that glides in word-final vowel-glide sequences do not belong to the noun stem. Instead, the glides correspond to the gender suffix nuclear position. This is because in all derived forms in (6) the word-final glide of the underived noun is suppressed when a suffix is added to form a derived form. Therefore, the fact that word-final glides correspond to the gender suffix leads us to assume that vowel-glide sequences in BP do not correspond to the segments î/û lexically syllabified in an onset position (cf.(5)).[10]

---

[10] The reasons why the gender suffix nuclear position is phonetically manifested as a glide rather than as a vowel will be presented in the following section. Below we illustrate derived forms which present the suffixes illustrated in (6), i.e. -ɔlug, -ad, -ism, where the gender suffix surfaces as a vowel rather than as a glide:

[futúrû]	'future'	[futurɔ́lûgû]	'future teller'
[úzû]	'use'	[uzádû]	'used'
[komúnα]	'commune'	[komunísmû]	'communism'

In the preceding pages we have provided evidence that the glide in vowel-glide sequences in BP does not represent a simplex charmless segment lexically associated to a position other than a nuclear head. That is, the glide in vowel-glide sequences does not represent either a simplex charmless segment lexically syllabified in the governed position of a heavy diphthong (cf. (3)), nor does it represent a simplex charmless segment lexically syllabified in an onset position (cf. (5)). Therefore, postvocalic glides are not lexically present in BP.

We propose that postvocalic glides in BP are derived from a sequence of strictly adjacent nuclear positions, where the far left nuclear position is filled with any BP vowel and the far right one is filled with either of the simplex charmless segment î/û. In (7) we illustrate the lexical representation of postvocalic glides, i.e. vowel-glide sequences, in BP.

```
(7)  O  R  O  R
        |     |
        N     N
        |     |
        x     x
        |     |
        V    î/û
```

(7) illustrates a sequence of strictly adjacent nuclear positions. Recall that adjacent nuclear

positions are subject to government (cf. Chapter 1). In a governing domain the governing position must be filled with a segment which has the adequate charm value to govern the segment associated to the governed position. Let us then consider the governing properties of the segments which occupy the adjacent nuclear positions in (7).

The far left nuclear position in (7) is filled with any BP vowel and the far right nuclear position is filled with a simplex charmless segment. Recall that simplex charmless segments may be governed by any other nuclear segment (cf. Chapter 1). Therefore, the far left nuclear position in (7) - which is filled with the vowel - is the governor and the nuclear position to the right - which is filled with either of the simplex charmless segment <u>î/û</u> - is the governee. A left-headed internuclear governing domain is established.

In Chapter 5 we proposed that the establishment of a left-headed internuclear governing domain yields a branching nucleus formation. That is, the governed nuclear position dissociates from its nuclear constituent and relinks to the governing nucleus. This process is illustrated in (8).

(8)

a. Government b. Constituent dissociation under government c. Branching nucleus formation

```
       ________         ________
       |      ↓         |      ↓
    O  R   O  R     O   R   O  R        O  R
       |      |         |      |           |
       N      N         N      N           N
       |      |         |      ǂ           | \
       x      x         x      x           x  x
       |      |         |      |           |  |
       V     î/û        V     î/û          V î/û
```

In a left-headed internuclear governing domain the segments which occupy the adjacent nuclear positions must satisfy charm requirements imposed on branching nuclei. That is, the governing nuclear position must present either a positively charmed segment or a complex charmless segment. The governed position must be filled with either a simplex charmless segment or it must be an empty nuclear position.[11]

In (8) the governed nuclear position is filled with a simplex charmless segment, i.e. î/û, so that

[11] When the governed position in a left-headed internuclear governing domain is empty, the branching nucleus corresponds to the representation of a long vowel. This is where the governing segment - which occupies the far left nuclear position - spreads over the governed position. In this section we are considering left-headed internuclear governing domains where the governing position is filled with a vowel and the governed position is filled with a simplex charmless segment (cf. (8)), so that a vowel-glide sequence is manifested rather than a long vowel.

charm requirements imposed on the governed position of branching nuclei are satisfied. The governing nuclear position in (8) may be filled with any positively charmed or complex charmless nuclear segment from BP, i.e. [a,e,i,o,u,ɛ,ɔ]. Thus, charm requirements imposed on the governing position of branching nuclei are also satisfied.

According to our proposal presented in (8) vowel-glide sequences in BP are derived from the establishment of a left-headed internuclear governing relation, which yields a branching nucleus formation. In the following section we will consider the phonological behaviour of BP vowel-glide sequences and BP sequences of vowels in relation to primary stress. We will see that in some environments a vowel-glide sequence may alternate with a sequence of vowels, i.e. [kajpírɑ] ~ [kaipírɑ] 'bumpkin', while in other environments a vowel-glide sequence must be realized, e.g. [gâjtɑ] 'tin fife' but *[gâîtɑ]. We will determin the conditions under which a vowel-glide sequence alternates or fails to alternate with a sequence of vowels.

7.3. Postvocalic Glides and Postvocalic High Vowels

Consider forms in (9):

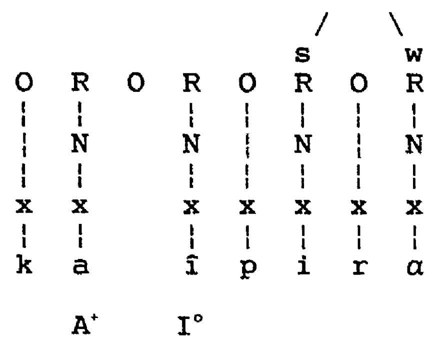
(9) a.	[erɔ́j]			'hero'
b.	[papáj]			'daddy'
c.	[páw]			'stick of wood'
d.	[muzéw]			'museum'
e.	[gájtɑ]			'tin fife'
f.	[mójtɑ]			'thicket'
g.	[káwzɑ]			'cause'
h.	[hubɛ́wlɑ]			'rubella'
i.	[kajpírɑ]	~	[kaipírɑ]	'bumpkin'
j.	[depojmẽtũ]	~	[depoimẽtũ]	'deposition'
k.	[bawrú]	~	[baurú]	'Baurú'
l.	[hewniɑ̃w]	~	[heuniɑ̃w]	'meeting'

(9a-d) illustrate forms in which a primary stressed vowel is followed by a glide occurring word-finally. (9e-h) illustrate forms in which a penultimate stressed vowel is followed by a glide. (9i-l) illustrate pretonic postvocalic glides. In the latter cases the posttonic glide may also be manifested as a high vowel (cf. forms on the far right column in (9i-l)). In the following pages we will consider the derivation of the forms [kajpírɑ] ~ [kaipírɑ] 'bumpkin'. Consider (10).[12]

---

[12] Recall that primary stress is lexically assigned (cf. Chapter 2). Secondary and word level stress are assigned after phonological processes apply. The final metrical structure is built onto derived forms. The phonological expressions which appear below the segments associated to the nuclear positions in (10) correspond to the internal representation of these segments.

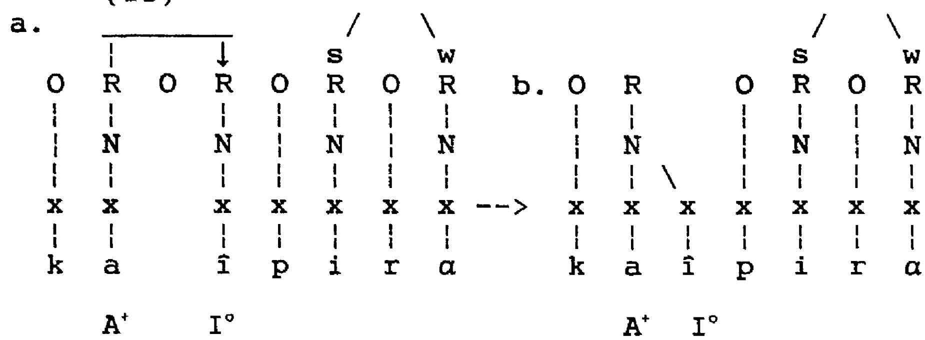
(10)



(10) illustrates the lexical representation of the forms [kajpíra] and [kaipíra] 'bumpkin'. Let us first consider the derivation of the form which presents a vowel-glide sequence, i.e. [kajpíra].

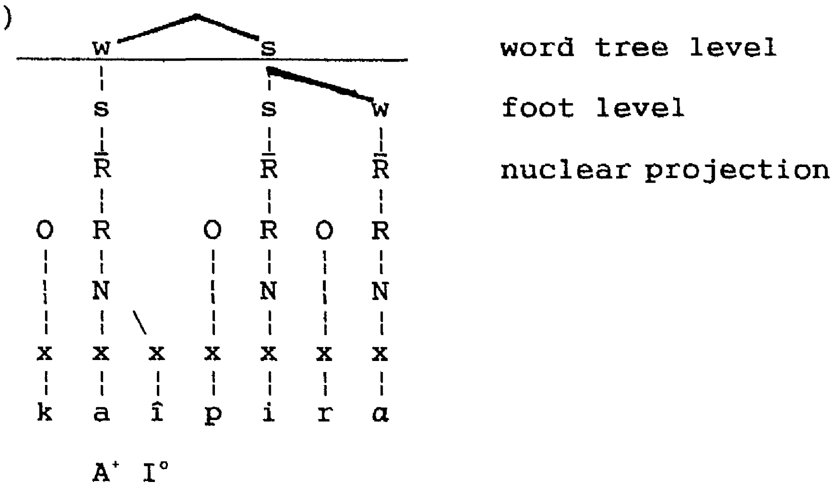
We propose that vowel-glide sequences in BP are derived from a left-headed internuclear governing relation yielding a heavy diphthong formation (cf. (8)). In (10) we have a sequence of adjacent nuclear positions where the far left nuclear position - which is filled with the positively charmed segment [a] - has the property of governing the nuclear position to the right - which is filled with the simplex charmless segment [î]. Therefore, a left-headed internuclear governing domain is established between the adjacent nuclear positions in (10), and a heavy diphthong is formed. This process is illustrated in (11).

(11)



In (11) a left-headed internuclear governing domain is established yielding a heavy diphthong formation. The form [kajpíra] (which presents a vowel-glide sequence) is derived, and the metrical structure is built onto the projection of nuclear heads. This is illustrated in (12).

(12)



Let us now consider the derivation of the form [kaipíra] in which a sequence of vowels (rather than a vowel-glide sequence) occurs. We have to explain why in the process of deriving the form [kaipíra] (from the lexical representation illustrated in (10)), the pretonic nuclear position filled with the high vowel remains associated to a nuclear head position. This occurs rather than the pretonic nuclear position filled with the high vowel being incorporated into the structure of a branching nucleus (cf. (11)). We propose that in order to allow a pretonic high vowel to occur as a nuclear head, the ATR element I^{+} is added to the internal representation of the simplex charmless segments [î,û]. Thus, yielding the positively charmed segments [i,u].[13] This process is illustrated in (13).

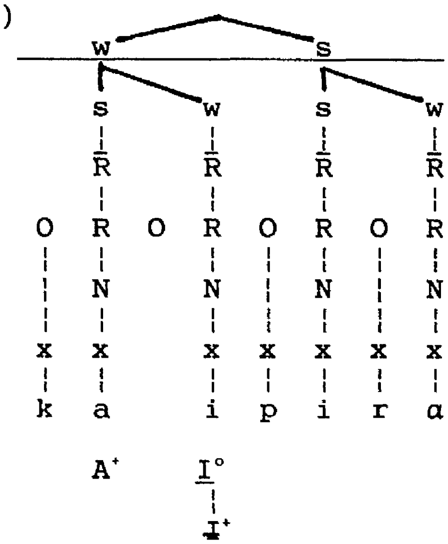
```
      (13)          /   \                        /   \
                    s     w                        s     w
a.O  R  O  R  O  R  O  R    b. O  R  O  R  O  R  O  R
  |  |     |  |  |  |  |       |  |     |  |  |  |  |
  |  N     N  |  N  |  N       |  N     N  |  N  |  N
  |  |     |  |  |  |  |       |  |     |  |  |  |  |
  x  x     x  x  x  x  x -->   x  x     x  x  x  x  x
  |  |     |  |  |  |  |       |  |     |  |  |  |  |
  k  a     î  p  i  r  ɑ       k  a     i  p  i  r  ɑ

     A+    I°                     A+    I°
                                        |
                                        I+
```

In (13b) we have a sequence of adjacent nuclear positions where both nuclear positions are filled with positively charmed segments, i.e. [i,a]. Given that

[13] Recall that pretonic nuclear heads must be filled with positively charmed segments (cf. Chapter 3). The segments [i,u] are positively charmed, so that charm requirements imposed on pretonic nuclear heads are satisfied.

positively charmed segments cannot be governed (cf. Chapter 1), no governing relation holds between the adjacent nuclear positions in (13). Thus, a sequence of nuclear position is allowed to occur and a sequence of vowels is realized. In (14) we illustrate the final derivation of the form [kaipíra], after the metrical structure is built.

(14)



word tree level

foot level

nuclear projection

In the preceding pages we have accounted for forms in which a pretonic postvocalic glide alternates with a pretonic postvocalic high vowel, i.e. [kajpíra] ~ [kaipíra]. Posttonic postvocalic glides cannot alternate with their corresponding high vowel, e.g. [muzéw] 'museum' but *[muzéũ] (cf. (9a-h)). The fact that this does not occur follows from charm constraints imposed on BP nuclear segments and the establishment of a left-headed internuclear governing relation. Posttonic nuclear heads in BP must be filled with charmless segments (cf. Chapter 3). Therefore, a posttonic nuclear position filled with either of the simplex charmless segments î/û - will be governed by an immediately preceding nuclear position filled with any BP vowel. A left-headed internuclear governing relation always holds between a posttonic nuclear position filled with a simplex charmless segment, i.e. î/û, and the immediately preceding nuclear position which may be filled with any BP vowel. A posttonic postvocalic glide occurs.

7.4. Conclusion

In this Chapter we have considered the derivation of forms which present postvocalic glides, and forms which present postvocalic high vowels. We have seen that whether a postvocalic glide or a postvocalic high vowel is manifested depends on whether or not a left-headed internuclear governing relation is established.

Cases in which a postvocalic glide occurs illustrate instances where a left-headed internuclear governing relation is established, yielding a heavy diphthong formation. Cases in which a postvocalic high vowel occurs illustrate instances where a high vowel acquires the ATR element, appearing thus as a positively charmed segment, i.e. [i,u]. A sequence of adjacent nuclear positions is allowed to occur since a positively charmed segment cannot be governed. In the following Chapter we consider forms which present intervocalic glides and forms which present a sequence of high vowels.

CHAPTER 8

INTERVOCALIC GLIDES AND SEQUENCES OF HIGH VOWELS

8.0. Introduction

In this Chapter we will analyse forms in which a glide is flanked between two vowels, e.g. [méjɑ] 'half', and forms presenting sequences of high vowels.

In the first section we determine how intervocalic glides are phonologically interpreted in BP. In the remaining sections we consider forms which present sequences of high vowels, determining which of the high vowels in the sequence may be phonetically manifested as a glide.

8.1. Intervocalic Glides

Consider forms in (1).

(1)	a.	[sájɑ]	'skirt'
	b.	[idɛ́jɑ]	'idea'
	c.	[kújɑ]	'calabash gourd'
	d.	[méjû]	'middle'
	e.	[apójû]	'support'
	f.	[gojábɑ]	'guava'
	g.	[majó]	'bathing suit'
	h.	[bajúkɑ]	'small tavern'
	i.	[fejózû]	'uglyish'
	j.	[bajonétɑ]	'bayonet'

Forms in (1) illustrate intervocalic glides. In (1a-e) the intervocalic glide occurs posttonically.[1] In (1f-j) the intervocalic glide occurs in a pretonic position.

In the following pages we will consider how intervocalic glides are phonologically interpreted in BP. The simplest hypothesis one can posit is to assume that intervocalic palatal glides represent cases in which the segment <u>î</u> - whose internal representation consists of the element I° - occupies an onset position.

[1] In our research we found that forms which present intervocalic back glides are all names whose origin comes from Amerindian languages. Considering they are not representative, we did not incorporate them in our data. The data presenting intervocalic back glides we found are: [mawá] 'Mauá (town)', [ananĩdéwɑ] 'Ananindéua (town)', [piawí] ~ [pjawí] 'Piauí (state) and [kawé] 'Cauê (cement factory)'.

We have seen that when the element I° occupies a position other than a nuclear head it is phonetically manifested as a palatal glide. Thus, in cases where the element I° occupies an onset position - which is not a nuclear head position - it appears as a palatal glide. According to this proposal, a form such as [sájɑ] 'skirt' will have the following representation.

```
(2)  O  R  O  R
     |  |  |  |
     |  N  |  N
     |  |  |  |
     x  x  x  x
     |  |  |  |
     s  a  I° ɑ
```

If intervocalic palatal glides represent the element I° syllabified in an onset position - as illustrated in (2) - we can expect to find antepenultimate stressed forms which present posttonic intervocalic glides. That is, [lákɑjû] would hypothetically be a possible form. Thus, in a form such as [lákɑjû] stress would fall on the third-to-last nuclear position, corresponding to the antepenultimate stress pattern. Forms such as [ézîtû] 'success' and [lákɑjû] would represent the same stress pattern. In the form [ézîtû] the final onset is filled with the segment <u>t</u> and in the form [lákɑjû] the final onset is filled with the segment <u>î</u>.

However, forms such as *[lákajû] do not occur in BP. Whenever an intervocalic glide occurs preceding the gender suffix vowel, i.e. the final unstressed vowel of a noun, primary stress falls on the vowel which precedes the glide, i.e. [lakájû] 'lackey'. The lack of forms such as *[lákajû] seems to give us evidence that intervocalic glides do not represent the element I° syllabified in an onset position (cf. (2)). This is because if palatal glides were syllabified in an onset position nothing would prevent stress from falling on the second-to-last nuclear position which precedes the glide, i.e. *[lákajû] should be a possible form.

Nevertheless, for reasons which are not yet clear, BP does not allow palatal consonants to occupy the final onset position in antepenultimate stressed nouns. That is, forms such as *[mánîλα], *[gálîñα], *[kúrûžα] and *[búlašα] are not possible in BP. Whenever a palatal consonant occupies the final onset position in a noun, primary stress falls on the nuclear position which precedes the palatal consonant, e.g. [maníλα] 'shackle', [galíñα] 'hen', [kurúžα] 'owl', [bulášα] 'biscuit'.[2]

---

[2] The strong R - which we have transcribed as [h] - is also not allowed to occur in such a position, i.e. *[sígahû] is not a possible form in BP. Whenever

We may then propose a constraint according to which palatal consonants cannot occupy the final onset position in antepenultimate stressed nouns in BP. According to this constraint forms such as *[mánĩλα], *[gálĩñα], *[kúrũžα] and *[búlαšα] are prevented from occurring. Notice that this constraint may also account for the lack of forms which present posttonic intervocalic glides, e.g. *[lákαjũ], if we assume that the palatal glide corresponds to the element I° syllabified in an onset position (as proposed in (2)). This is because the palatal glide would correspond to a palatal consonant and therefore it could not occupy the final onset position in antepenultimate stressed nouns.

Therefore, the proposal that palatal glides correspond to the element I° syllabified in an onset position - as illustrated in (2) - appears to be correct. The lack of forms which present posttonic intervocalic glides, e.g. *[lákαjũ], would reflect a general constraint according to which palatal consonants cannot occupy the final onset position in antepenultimate stressed nouns in BP, i.e. *[mánĩλα],

---

the strong R occupies the final onset position in a noun, primary stress falls on the nuclear position which immediately precedes it, i.e. [sigáhũ] 'cigarette'(cf. Chapter 2).

*[gálîña], *[kúrûža], *[búlaša], *[lákajû] are not possible forms.

On the other hand palatal consonants can occupy the onset position immediately following antepenultimate stressed vowels, e.g. [káñamû] 'hemp', [mɛ́šîkû] 'Mexico' and [frížîdû] 'frigid'.[3] Therefore, if intervocalic glides represent the element I° syllabified in an onset position - as illustrated in (2) - we expect to find antepenultimate stressed forms where the glide immediately follows the primary stressed vowel, i.e. [gójaba] would be a possible form. This is because other palatal consonants can occupy the onset position immediately following antepenultimate stressed vowels, e.g. [frížîdû] 'frigid'. Then, nothing would prevent the palatal glide - which would correspond to the element I° syllabified in an onset position - from occupying such a position.

Nevertheless, forms where intervocalic palatal glides occur immediately after an antepenultimate stressed vowel, i.e. *[gójaba], do not occur in BP.

---

[3] In our research we have not found forms in which a palatal lateral occupies the onset position immediately following an antepenultimate stressed vowel, e.g.[páλasû].

Whenever an intervocalic glide occurs preceding the final nuclear position of a noun stem, primary stress falls on the nuclear position which immediately follows the glide, e.g. [gojába] 'guava'.[4]

Thus, the lack of forms where intervocalic glides occur immediately after an antepenultimate stressed vowel, i.e. *[gójaba], provides us with evidence that the phonological representation of intervocalic palatal glides does not correspond to the element I° syllabified in an onset position. This is because if palatal consonants may occupy the onset position which immediately follows antepenultimate stressed vowels, i.e. [fríʒîdû], nothing would prevent us from finding antepenultimate stressed forms where the intervocalic glide followed antepenultimate stressed vowels. That is, *[gójaba] should be a possible form - which is not the case.

If intervocalic palatal glides do not represent the element I° syllabified in an onset position - as illustrated in (2) - we have to determine what the

[4] Recall that the morphological structure of nouns in BP consists of a stem followed by the gender suffix. Therefore, in a form such as [gojába] 'guava', the final nuclear position of the noun stem is the one which precedes the gender suffix vowel, i.e. the final vowel of the noun (cf. Chapter 3).

phonological interpretation of palatal glides is. Recall that palatal glides represent cases in which the element I° occupies a position other than a nuclear head. In (3) we illustrate some other possible representations of intervocalic glides.

```
(3)  a. O  R  O  R           b. O  R  O  R
           |     |                 |     |
           N     N                 N     N
           |\    |                 |     |
           x  x  x                 x     x
           |  |  |                 |    / \
           V  I° V                 V   I°  V
```

In (3a) we have two nuclear positions associated to the same nuclear constituent, i.e. a heavy diphthong governing domain. The element I° occupies the governed position in the heavy diphthong and is phonetically manifested as a palatal glide. The heavy diphthong governing domain in (3a) is immediately followed by a nuclear position which is filled with a vowel. Therefore, (3a) is phonetically manifested as a vowel-glide-vowel sequence.

In (3b) we have a nuclear position filled with a vowel which is immediately followed by a light diphthong. The element I° occurs as the left member of the segmental sequence in a light diphthong (which is not a nuclear head position). Thus, it is realized as a palatal glide. In (3b) a vowel-glide-vowel sequence is phonetically manifested.

Both representations in (3) correspond to vowel-glide-vowel sequences and are therefore potential representations for intervocalic glides. We have proposed in the preceding Chapters that both heavy and light diphthongs in BP are derived from a sequence of adjacent nuclear positions (cf. Chapters 6-7). That is, glides are derived from a nuclear position filled with either of the simplex charmless segment î/û whose internal representation consists of the elements I° and U° respectively.

We can assume that either of the representations illustrated in (3) correspond to the structure of vowel-glide-vowel sequences in BP. If this is the case, then the lexical representation of vowel-glide-vowel sequences presents a sequence of three consecutive nuclei. This is because according to our proposal heavy and light diphthongs are derived from a sequence of adjacent nuclear positions.

The assumption that intervocalic palatal glides are derived from a nuclear position filled with the element I° accounts for the distribution of primary stress in forms which present intervocalic glides. We have seen that BP does not allow for antepenultimate stressed forms in which a posttonic palatal glide occurs, i.e. *[lákɑjũ] and *[gójɑbɑ]. The lack of antepenultimate stressed forms presenting posttonic intervocalic glides is accounted for by assuming that the intervocalic glide corresponds to the element I° lexically associated to a nuclear head position.

Thus, in a form such as /lakaĩũ/ --> [lakájũ] 'lackey' primary stress falls on the nuclear position which immediately precedes the glide, because otherwise stress would fall on the fourth-to-last nuclear position, i.e. *[lákɑjũ], which is not possible in BP. In a form such as /goĩabɑ/ --> [gojábɑ] 'guava' primary stress falls on the nuclear position which immediately follows the glide, because otherwise stress would fall on the fourth-to-last nuclear position, i.e. *[gójɑbɑ], which is not possible in BP.

If the proposal that intervocalic palatal glides are derived from a nuclear position is correct, we can expect to find forms where an intervocalic high vowel bears primary stress, e.g. [baíɑ] 'bay' Indeed, this is exactly the case.[5]

In the preceding pages we have proposed that intervocalic palatal glides correspond to either the structure of a heavy diphthong followed by a nuclear position filled with a vowel (cf. (3a)), or to the structure of a light diphthong preceded by a nuclear position filled with a vowel (cf. (3b)). According to our proposal, light and heavy diphthongs are both derived from a sequence of strictly adjacent nuclear positions (cf. Chapter 6 and 7). Therefore, if intervocalic glides correspond to either structure illustrated in (3) we have to assume that in its lexical representation the palatal glide corresponds to the element I° associated to a nuclear position.

---

[5] We did not find forms in which an intervocalic high vowel bears antepenultimate stress, i.e. *[baíɑkɑ] or *[baúɑkɑ]. Nevertheless, for reasons which are still obscure, BP does not allow for antepenultimate stressed high vowels to be preceded by a vowel, i.e. *[baíkɑkɑ] or *[baúkɑkɑ]. Apparent counter examples to this constraint involve forms that present analytic morphology, more specifically, forms which present the analytic suffix -isîm. In these forms an antepenultimate stressed front high vowel may be immediately preceded by another vowel, e.g. [feísîmû] 'ugliest'. As we have shown (cf. Chapter 3), in forms which involve analytic morphology, the noun and the suffix are analysed as independent morphological domains. Therefore, given that forms which present the analytic suffix -isîm involve independent morphological domains, they are only apparent counter examples to this constraint. Forms which present antepenultimate stressed high back vowels immediately preceded by a vowel have not been found, i.e. [naútîkû] (cf. [náwtîkû] 'nautical').

In the following pages we will derive the form [sájα] 'skirt' assuming that any form which presents intervocalic glides is derived in like manner. Consider the lexical representation of the form [sájα] 'skirt' in (4).

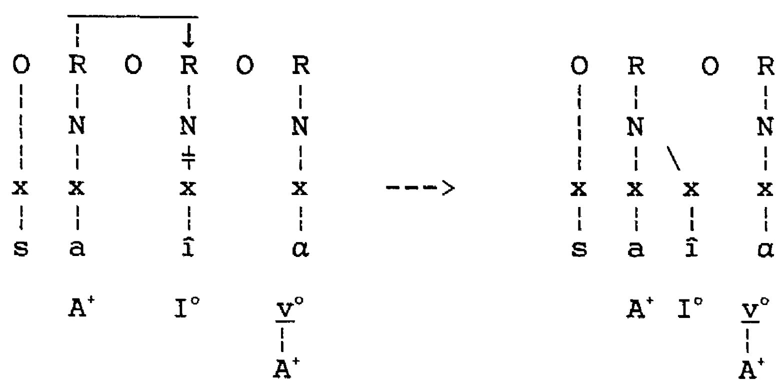
(4)
$$
\begin{array}{cccccc}
O & R & O & R & O & R \\
| & | & & | & & | \\
| & N & & N & & N \\
| & | & & | & & | \\
x & x & & x & & x \\
| & | & & | & & | \\
s & a & & \hat{\imath} & & \alpha \\
 & & & & & \\
 & A^{+} & & I^{\circ} & & \underline{v}^{\circ} \\
 & & & & & | \\
 & & & & & A^{+}
\end{array}
$$

In the lexical representation illustrated in (4) we have a sequence of three consecutive adjacent nuclear positions which are subject to government. Recall that government is a binary relationship between two strictly adjacent skeletal positions (cf. Chapter 1). Given that government is a binary relation, i.e. it involves two skeletal positions, we have to show which two strictly adjacent nuclear positions in (4) interact in a governing relation.

In order for a governing relation to hold, one of the positions must be filled with a segment which has the adequate charm value to govern the segment occurring in the other position (cf. Chapter 1).

Recall that the simplex charmless segment <u>î</u> may be governed by any other nuclear segment of BP (cf. Chapter 1). Therefore, an intervocalic nuclear position filled with the simplex charmless segment <u>î</u> may be governed either by the immediately preceding nuclear position - when a left-headed internuclear governing domain is established - or by the immediately following nuclear position - when a right-headed internuclear governing domain is established. In (5) we illustrate the derivation of the form [saj.ɑ] where the glide is understood as belonging to the initial syllable.

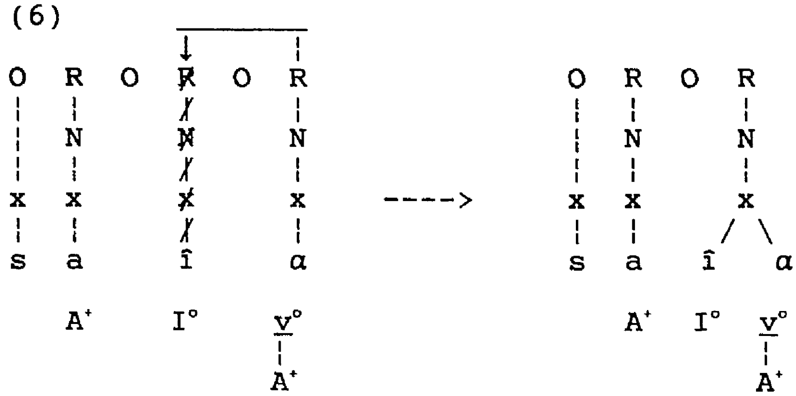
(5)



(5) illustrates the establishment of a left-headed internuclear governing domain yielding a heavy diphthong. The heavy diphthong in (5) is immediately followed by a nuclear position filled with the segment [ɑ], so that an intervocalic palatal glide occurs. In (6) we illustrate the derivation of the form [sa.jɑ]

where the glide is understood as belonging to the final syllable.

(6)



(6) illustrates the establishment of a right-headed internuclear governing relation yielding a light diphthong. The light diphthong in (6) is immediately preceded by a nuclear position filled with the segment [a], so that an intervocalic palatal glide occurs.

In this section we have argued that intervocalic palatal glides are derived from a nuclear position filled with the simplex charmless segment î. We showed that an intervocalic nuclear position filled with the simplex charmless segment î is subject to the following processes:

a) It is governed by the immediately preceding nuclear position. A left-headed internuclear governing domain is established. A heavy diphthong is formed so that a vowel-glide sequence, e.g. [saj.ɑ], is realized (cf. (5)).

b) It is governed by the immediately following nuclear position. A right-headed internuclear governing domain is defined. A light diphthong is formed so that a glide-vowel sequence, e.g. [sa.jɑ], is realized (cf. (6)).

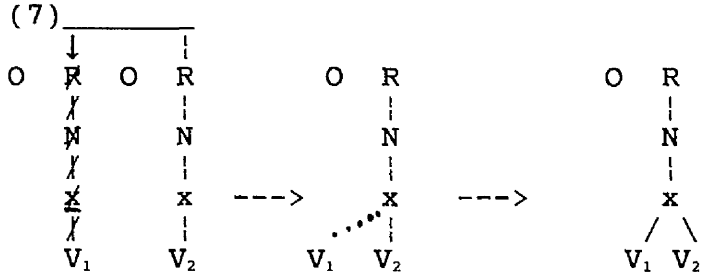
In the following sections we will consider governing relations between adjacent nuclear positions both filled with a high vowel.

8.2. Sequences of High Vowels

8.2.0. Introduction

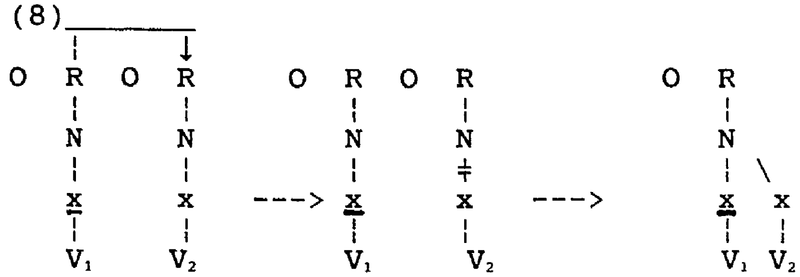
In the previous Chapters we have discussed governing relations between adjacent nuclear positions. We have shown that glide-vowel sequences in BP correspond to the structure of a light diphthong. Light diphthongs in BP are derived from the establishment of a right-headed internuclear governing relation, as illustrated in (7).

(7)



We have also shown that vowel-glide sequences in BP correspond to the structure of a heavy diphthong. Heavy diphthongs in BP are derived from the establishment of a left-headed internuclear governing relation, as illustrated in (8).

(8)



In a governing domain one of the positions is the governor (or the head) and the other position is the governee (or the complement). The property of a skeletal position to govern or to be governed is given by the charm value of the segments which are linked to the skeletal positions.

We argued that the underlying representation of high vowels in BP corresponds to the lax high vowels î and û - which are simplex charmless segments (cf. Chapter 3). We have seen that simplex charmless segments may be governed by positively charmed segments and complex charmless segments (cf. Chapter 1). A charmless segment governs another charmless segment if it has a complexity greater than its governee. That is, the charmless segment which has a greater number of elements in its internal representation is the governor. It follows from this that neither of the simplex charmless segments î and û (which have the same degree of complexity since their internal representation consists of the elements

I° and U° respectively) should govern the other.

However, as we will see in the following pages, a simplex charmless segment may govern another simplex charmless segment. Evidence that this occurs follows from light and heavy diphthong formation in BP. That is, whether a prevocalic glide, i.e. a light diphthong, or a postvocalic glide, i.e. a heavy diphthong, is manifested depends on the governing properties of the simplex charmless segments $\underline{\hat{\imath}}$ and $\underline{\hat{u}}$.

8.2.1. Pretonic Sequences of High Vowels

In this section we will analyse forms presenting pretonic sequences of high vowels. We will see that these forms may present alternative pronunciations: either a pretonic glide-vowel sequence or a pretonic vowel-glide sequence is phonetically manifested. Consider (9).

(9)	a.	[žuizádũ]	'judgeship'
	b.	[ĩtuitívũ]	'intuitive'
	c.	[siuméra]	'jealousy'
	d.	[miudéza]	'littleness'

Forms in (9a-b) illustrate cases in which a pretonic high back vowel is immediately followed by a pretonic high front vowel, i.e. [ui]. Forms in (9c-d) illustrate cases in which a pretonic high front vowel is immediately followed by a pretonic high back vowel, i.e. [iu]. Forms in (9) have also the following pronunciations:

(10)	a.	[žwizádũ]	~	[žujzádũ]
	b.	[ĩtwitívũ]	~	[ĩtujtívũ]
	c.	[sjuméra]	~	[siwméra]
	d.	[mjudéza]	~	[miwdéza]

Forms in the left column in (10) are pronounced with a pretonic glide-vowel sequence. In the right column a pretonic vowel-glide sequence is realized.

According to our proposal, glide-vowel sequences and vowel-glide sequences are derived from a sequence of strictly adjacent nuclear positions (cf. (7,8)). It follows from this that the lexical representation of forms in (10) present a sequence of strictly adjacent nuclear positions. In (11) we illustrate the lexical representation of the forms [žwizádû] ˜ [žujzádû] 'judgeship' and [mjudéza] ˜ [miwdéza] 'littleness' respectively.

```
(11)a.                        /    \
                             s      w
          O   R   O   R   O   R   O   R
          |   |       |   |   |   |   |
          |   N       N   |   N   |   N
          |   |       |   |   |   |   |
          x   x       x   x   x   x   x
          |   |       |   |   |   |   |
          ž   û       î   z   a   d   û

              U°      I°

     b.                       /    \
                             s      w
          O   R   O   R   O   R   O   R
          |   |       |   |   |   |   |
          |   N       N   |   N   |   N
          |   |       |   |   |   |   |
          x   x       x   x   x   x   x
          |   |       |   |   |   |   |
          m   î       û   d   e   z   α

               I°      U°
```

Both adjacent pretonic nuclear positions in (11) are filled with a simplex charmless segment, i.e. <u>î/û</u>. We have seen that pretonic nuclear heads must be filled with a positively charmed segment (cf. Chapter

3). Therefore, the pretonic nuclear positions in (11) should be filled with a positively charmed segment, i.e. [i,u]. We propose that the ATR element is added to the internal representation of one of the pretonic nuclear positions in (11) so that it is filled with a positively charmed segment. When the far left pretonic nuclear position in the sequence of adjacent nuclear positions is filled with a positively charmed segment, a left-headed internuclear governing relation holds. This is because the governing position filled with the positively charmed segment governs the immediately following nuclear position which is filled with a simplex charmless segment. A branching nucleus is formed. The forms presenting pretonic vowel-glide sequences, i.e. [žujzádû] and [miwdéza], are derived in (12).

(12)

```
a.  _________      /    \                           /    \
    |       ↓   s       w                       s       w
O   R   O   R   O   R   O   R       O   R       O   R   O   R
|   |       |   |   |   |   |       |   |       |   |   |   |
|   N       N   |   N   |   N       |   N       |   N   |   N
|   |       |   |   |   |   |       |   | \     |   |   |   |
x   x       x   x   x   x   x  -->  x   x   x   x   x   x   x
|   |       |   |   |   |   |       |   |   |   |   |   |   |
ž   u       î   z   a   d   û       ž   u   î   z   a   d   û

    U°      I°                          U°  I°
    |                                   |
    I+                                  I+
```

```
b.  _________          /    \                          /    \
    |        ↓         s     w                         s     w
O   R   O    R   O     R  O  R      O   R        O     R  O  R
|   |        |   |     |  |  |      |   |        |     |  |  |
|   N        N   |     N  |  N      |   N        |     N  |  N
|   |        |   |     |  |  |      |   |  \     |     |  |  |
x   x        x   x     x  x  x -->  x   x   x    x     x  x  x
|   |        |   |     |  |  |      |   |   |    |     |  |  |
m   i        û   d     e  z  ɑ      m   i   û    d     e  z  ɑ

    I°       U°                         I°  U°
    |                                   |
    I+                                  I+
```

When the far right pretonic nuclear position in the sequence of adjacent nuclear positions is filled with a positively charmed segment, a right-headed internuclear governing relation is established. This is because the nuclear position filled with the positively charmed segment governs the immediately preceding nuclear position which is filled with a simplex charmless segment. A light diphthong is formed. Forms presenting pretonic glide-vowel sequences, i.e. [žwizádû] and [mjudézɑ], are derived in (13).

```
(13)
a.  _________          /    \                          /    \
    ↓        |         s     w                         s     w
O   R   O    R   O     R  O  R      O     R      O     R  O  R
|   |        |   |     |  |  |      |     |      |     |  |  |
|   N        N   |     N  |  N      |     N      |     N  |  N
|   |        |   |     |  |  |      |     |      |     |  |  |
x   x        x   x     x  x  x -->  x     x      x     x  x  x
|   |        |   |     |  |  |      |    / \     |     |  |  |
ž   û        i   z     a  d  û      ž   û   i    z     a  d  û

    U°       I°                         U°  I°
             |                          |
             I+                         I+
```

```
b.  ________           /     \                      /     \
    ↓       |          s      w                     s      w
O   R   O   R   O   R   O   R       O   R   O   R   O   R
|   |       |   |   |   |   |       |   |   |   |   |   |
|   N       N   |   N   |   N       |   N   |   N   |   N
|   |       |   |   |   |   |       |   |   |   |   |   |
x   x       x   x   x   x   x  -->  x   x   x   x   x   x
|   |       |   |   |   |   |       |  / \  |   |   |   |
m   î       u   d   e   z   α       m  î  û d   e   z   α

    I°      U°                         I° U°
            |                          |
            I⁺                         I⁺
```

When both adjacent pretonic nuclear positions are filled with positively charmed segments, no governing relation holds (because positively charmed segments cannot be governed). Forms presenting a pretonic sequence of vowels, i.e. [žuizádû] and [miudézα], are derived in (14).

```
(14)
a.                     /     \     b.                     /     \
                       s      w                           s      w
O   R   O   R   O   R   O   R      O   R   O   R   O   R   O   R
|   |       |   |   |   |   |      |   |       |   |   |   |   |
|   N       N   |   N   |   N      |   N       N   |   N   |   N
|   |       |   |   |   |   |      |   |       |   |   |   |   |
x   x       x   x   x   x   x      x   x       x   x   x   x   x
|   |       |   |   |   |   |      |   |       |   |   |   |   |
ž   u       i   z   a   d   û      m   i       u   d   e   z   α

    U°      I°                         I°      U°
    |       |                          |       |
    I⁺      I⁺                         I⁺      I⁺
```

In the preceding pages we have considered the derivation of forms presenting pretonic light and heavy diphthongs (which are derived from the establishment of a governing relation between adjacent nuclear positions filled with high vowels) and forms presenting pretonic sequences of high vowels. The following pages will be devoted to the discussion of other environments where governing relations between nuclear positions filled with high vowels are observed.

8.2.2. Posttonic Sequences of High Vowels

In this section we will consider forms in which a sequence of high vowels occurs in the final nuclear positions in antepenultimate stressed nouns. That is, the weak positions in the antepenultimate stress pattern ssw. Consider forms in (15).

(15)	a.	[sábjû]	'wise'
	b.	[edifísjû]	'building'
	c.	[tẽnwî]	'tenuous'
	d.	[kõgrwî]	'congruous'

Forms in (15) illustrate cases in which glide-vowel sequences occur in a position which follows primary stress. In (15a-b) a palatal glide is followed by the high back vowel [û]. In (15c-d) the back glide is followed by the high front vowel [î].[6]

We have seen that glide-vowel sequences in BP correspond to the structure of a light diphthong, which is derived from the establishment of a right-headed internuclear governing relation.[7] Therefore,

[6] Forms in (15) illustrate posttonic sequences of high vowels where one is a high front vowel and the other one is a high back vowel. Forms which present sequences of identical high vowels also occur in BP. These forms will be addressed later in this section.

[7] In Chapter 6 we showed that posttonic prevocalic glides may correspond to the element U° syllabified in the representation of a complex consonant. In this

forms illustrated in (15) - which present glide-vowel sequences - are derived from the establishment of a right-headed internuclear governing relation yielding a light diphthong. The derivation of the forms [sábjû] and [tẽnwî] - which present glide-vowel sequences - is given in (16).

(16) a.

```
               __________
               ↓         |
O    R    O    R    O    R         O    R    O    R
|    |    |    |         |         |    |    |    |
|    N    |    N         N         |    N    |    N
|    |    |    |         |         |    |    |    |
x    x    x    x         x   -->   x    x    x    x
|    |    |    |         |         |    |    |   / \
s    a    b    î         û         s    a    b  î   û

               I°        U°                     I°  U°
```

b.

```
               __________
               ↓         |
O    R    O    R    O    R         O    R    O    R
|    |    |    |         |         |    |    |    |
|    N    |    N         N         |    N    |    N
|    |    |    |         |         |    |    |    |
x    x    x    x         x   --->x x    x    x    x
|    |    |    |         |         |    |    |   / \
t    ẽ    n    û         î         t    ẽ    n  û   î

               U°        I°                     U°  I°
```

In the governing domain illustrated in (16a) the high back vowel û governs the high front vowel î. In the governing domain illustrated in (16b) the high front vowel î governs the high back vowel û. Given this, we predict that a left-headed internuclear

---

case the glide is always preceded by a velar stop consonant. The forms discussed in this section exclude those presenting velar stop-glide sequences.

governing relation may also hold between posttonic nuclear positions filled with high vowels. We have seen that the establishment of a left-headed internuclear governing relation yields a heavy diphthong, so that a vowel-glide sequence occurs (cf. (8)). Therefore, the establishment of a left-headed internuclear governing relation between posttonic nuclear positions filled with a high vowel would yield vowel-glide sequences. Forms such as [sábîw] and [tẽnûj] - which present posttonic vowel-glide sequences - would illustrate cases in which a left-headed internuclear governing relation holds between a posttonic sequence of high vowels.

Nevertheless, forms such as *[sábîw] and *[tẽnûj] do not occur in BP. The lack of forms presenting posttonic vowel-glide sequences is accounted for by the fact that heavy diphthong nuclear heads must be filled either with a positively charmed segment or with a complex charmless segment (c.f. Chapter 7).

Posttonic nuclear heads filled with a high vowel in BP must be filled with the simplex charmless segments <u>î</u> and <u>û</u>. This is to fulfil charm requirements which define that posttonic nuclear heads must be filled with a charmless segment (cf. Chapter 3). Being that the segments î and û are simplex and charmless they are unable to head a heavy diphthong governing domain. Thus, we predict that posttonic vowel-glide sequences should not occur in BP, i.e. *[sábîw] and *[tẽnûj]. This is exactly the case.

In (16) we discussed the derivation of forms which present posttonic sequences of different high vowels. That is, one of the high vowels is back and the other is front. Sequences of identical high vowels may also occur in BP. In the following pages we will show that a posttonic sequence of identical high vowels is realized as a single vowel. Let us then analyse sequences of adjacent nuclear positions filled with identical high vowels. Consider (17).[8]

```
(17) O  R  O  R
        |     |
        N     N
        |     |
        x     x
        |     |
        î     î
```

(17) presents a sequence of adjacent nuclear positions which are both filled with the simplex charmless segment î. Sequences of adjacent nuclear positions are subject to government according to the

[8] A posttonic sequence of nuclear positions where both nuclei are filled with the simplex charmless segment û is subject to the same process discussed for the representation in (17).

governing properties of the segments which occupy the adjacent nuclear positions. We have seen that a nuclear position filled with the simplex charmless segment î may govern a nuclear position filled with another simplex charmless segment, i.e. û (c.f. (16b)). Let us assume that a nuclear position filled with the simplex charmless segment î may also govern another nuclear position filled with the simplex charmless segment î. That is, the simplex charmless segment î governs itself. In (18) we illustrate the establishment of a right-headed internuclear governing relation yielding a light diphthong.[9]

```
(18)
             _________
             ↓       |
    a. O     R   O   R        b.    O  R
             |       |                 |
             N       N                 N
             |       |                 |
             x       x   --->          x
             |       |                / \
             î       î               î   î
```

[9] In this section we are considering governing relations between posttonic sequences of nuclear positions. We have shown that posttonic sequences of nuclear positions are subject to a right-headed internuclear governing relation yielding a light diphthong (c.f. (16)). On the other hand, a left-headed internuclear governing relation yielding a heavy diphthong cannot hold between posttonic sequences of nuclei. Therefore, in the following pages we will restrict our discussion to the establishment of right-headed internuclear governing relations in posttonic sequences of identical high vowels.

In the light diphthong illustrated in (18b) we have a single nuclear position associated to two identical segments - namely a sequence of the simplex charmless segment î. A light diphthong where the two members of the segmental sequence consist of the same segment is interpreted as a single vowel (cf. KAYE (1985, 1989e)). Thus, the light diphthong illustrated in (18b) is understood as a single short vowel, i.e. [î]. Consider forms in (19).

(19)	a.	[mulɛ́kî]	'mischievous'
	b.	[góstû]	'taste'
	c.	[kárî]	'dental cavity'
	d.	[vákû]	'vacuous'

(19) illustrates forms in which a posttonic simplex charmless segment occurs. In the following pages we will show that the posttonic simplex charmless segments in (19a-b) are lexically associated to a single nuclear position. On the other hand, the posttonic simplex charmless segments in (19c-d) are derived from a sequence of posttonic nuclear positions which are both filled with either of the segments î or û.[10]

[10] Forms (19c-d) may be pronounced as [kárii] and [vákuu], i.e. with a posttonic sequence of identical vowels, in careful speech. Forms in (19a-b) must be pronounced as [mulɛ́kî] and [góstû] in any style.

In derived forms the final unstressed nuclear position corresponding to the gender suffix is suppressed when a derivative suffix is added to the noun stem, e.g. (trabaλ + û) --> [trabáλû] 'work' and (trabaλ + ad + û) --> [trabaλádû] 'worked'(cf. Chapter 3).[11] If we consider derived forms of (19a-b), i.e. (mulɛk +î) --> [mulɛ́kî] 'mischievous' and (gost + û) --> [góstû] 'taste', we observe that the final nuclear position corresponding to the gender suffix is suppressed when a derivative suffix is added to the noun stem, e.g. (mulek + ad + ɑ) --> [mulekádɑ] 'mischief' and (gost + oz + û) --> [gostózû] 'tasteful'.

On the other hand, derived forms of (19c-d), i.e. [kárî] 'dental cavity' and [vákû] 'vacuous', require that the final vowel (which appears to correspond to the gender suffix) remains in derived forms, e.g. [kariádû] 'carious' and [vakuózû] 'vacuousness'.[12] The final vowel of forms (19c-d) will appear in derived forms because they belong to the noun stem, i.e. (karî

---

[11] In derived forms the gender suffix follows the derivative suffix.

[12] These forms may also be pronounced as [karjádû] and [vakwozû], i.e. with a glide-vowel sequence. The derivation of these forms was given in Chapter 6 where we showed that glide-vowel sequences in BP are derived from the establishment of a right-headed internuclear governing relation.

+ ad + û) and (vakû + oz + û). Indeed, the morphological structure of forms illustrated in (19c-d) are (karî + î) and (vakû + û). That is, the final vowel of the noun stem is followed by an identical vowel which corresponds to the gender suffix.

Forms (19c-d) are realized with a posttonic single vowel as a consequence of the establishment of a right-headed internuclear governing relation. More precisely, the final nuclear position - which corresponds to the gender suffix - governs the final nuclear position of the noun stem. A light diphthong whose segmental sequence is a sequence of either of the simplex charmless segments <u>î/û</u> is realized as a single vowel (c.f. (18)). In this section we considered forms in which sequences of high vowels occupy the final nuclear positions in antepenultimate stressed nouns.

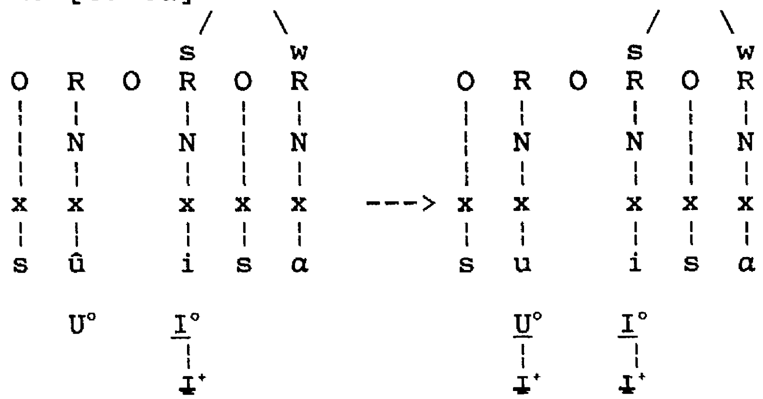
8.2.2. Primary Stressed High Vowels

In this section we will consider forms presenting sequences of high vowels in which one bears primary stress. First we will consider forms where a primary stressed high vowel is preceded by another high vowel. Then, we will discuss forms in which a primary stressed high vowel is followed by another high vowel. Consider (20).

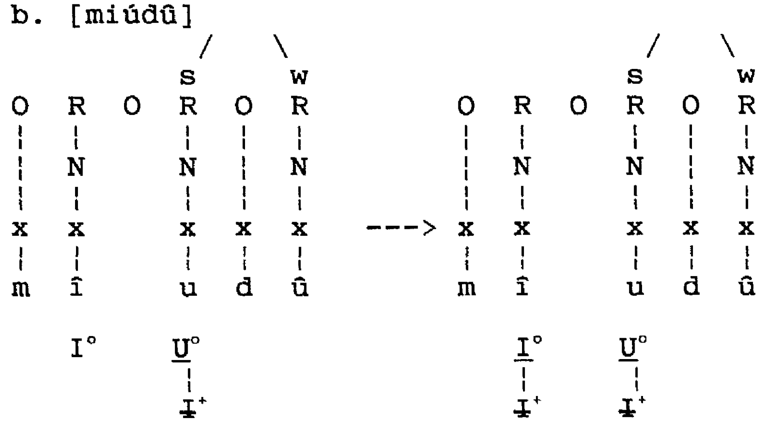
(20)	a.	[suísɑ]	~	[swísɑ]	'Swiss'
	b.	[žuízû]	~	[žwízû]	'judgment'
	c.	[siumî]	~	[sjumî]	'jealous'
	d.	[miúdû]	~	[mjúdû]	'little'

(20a-b) illustrate cases where a primary stressed high front vowel is preceded by a high back vowel. (20c-d) illustrate cases where a primary stressed high back vowel is preceded by a high front vowel. Forms in (20) show that a primary stressed high vowel may either be preceded by another high vowel (cf. forms on the left) or by a glide (cf. forms on the right). In (21) we illustrate the derivation of the forms given in (20a) and (20c), i.e. [suísɑ] ~ [swísɑ] 'Swiss' and [miúdû] ~ [mjúdû] 'little'.

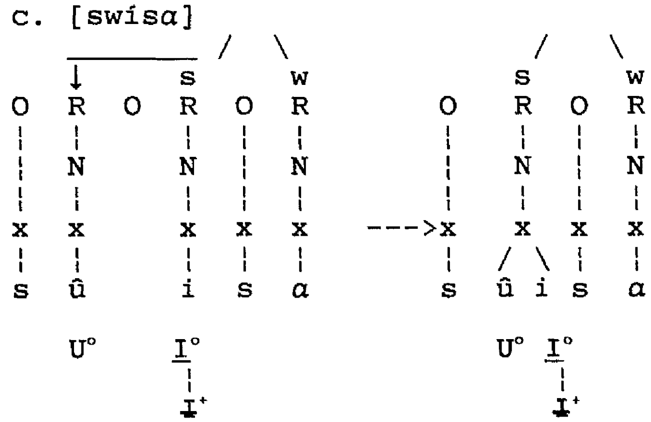
(21) a. [suísα]



b. [miúdû]



c. [swísα]



d. [mjúdû]

```
         _______  /   \              /     \
         ↓      s      w             s       w
   O     R   O  R   O  R       O     R   O   R
   |     |      |   |  |       |     |   |   |
   |     N      N   |  N       |     N   |   N
   |     |      |   |  |       |     |   |   |
   x     x      x   x  x  --->x      x   x   x
   |     |      |   |  |       |    / \  |   |
   m     î      u   d  û       m   î   u d   û

         I°    U°                 I°  U°
               |                      |
               I+                     I+
```

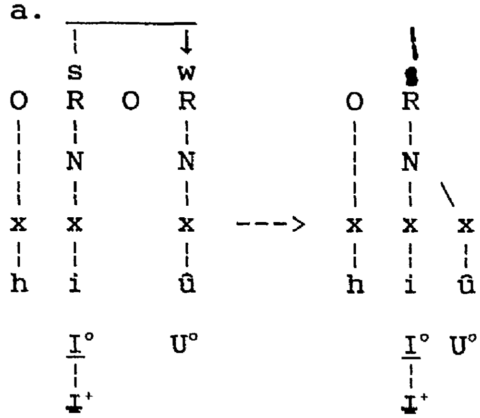
Forms presenting sequences of vowels and forms presenting glide-vowel sequences are derived from a sequence of strictly adjacent nuclear positions. Therefore, the lexical representation of forms such as [suísɑ] ~ [swísɑ] 'Swiss' and [miúdû] ~ [mjúdû] 'little' present a sequence of strictly adjacent nuclear positions. This is illustrated in the representations on the left in (21). The derivations in (21a-b) illustrate cases in which a sequence of vowels occurs, i.e. [suísɑ] and [miúdû]. We propose that pretonic nuclear heads filled with the simplex charmless segments <u>î</u> and <u>û</u> receive the ATR element yielding the phonetic manifestation of the tense high vowels [i] and [u]. Our proposal follows from the fact that pretonic nuclear heads must be filled with positively charmed segments (cf. Chapter 3). Given that positively charmed segments cannot be governed (cf. Chapter 1), no governing relation holds between the adjacent nuclear positions in (21a-b). Therefore, a sequence of adjacent nuclear positions is allowed to occur. The derivations in (21c-d) illustrate cases in which a glide-vowel sequence occurs, i.e. [swísα] and [mjúdû]. We propose that glide-vowel sequences in BP are derived from the establishment of a right-headed internuclear governing relation yielding a light diphthong (cf. Chapter 6). Let us now consider cases in which a primary stressed high vowel is followed by another high vowel. Consider (22).[13]

(22)	a.	[híw]	'river'
	b.	[períwdû]	'period'
	c.	[flújdû]	'fluid'
	d.	[gratújtû]	'free'

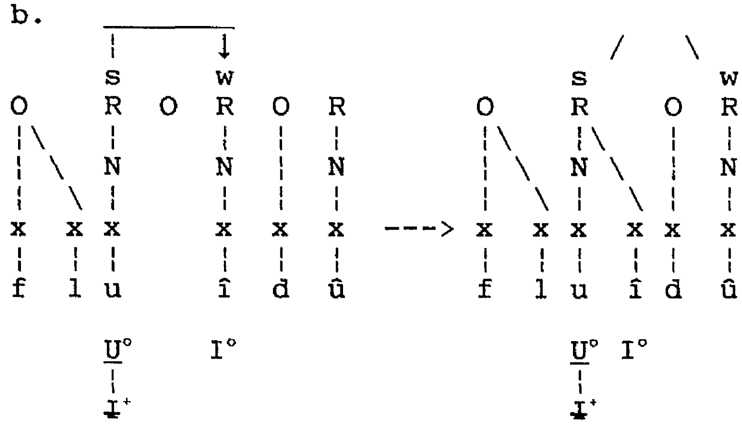
Forms in (22) illustrate vowel-glide sequences. We propose that vowel-glide sequences in BP are derived from the establishment of a left-headed internuclear governing relation yielding a heavy diphthong (cf. Chapter 7). In (23) we illustrate the derivations of the forms [híw] 'river' and [flújdû] 'fluid' - which present vowel-glide sequences.

[13] Forms in (22) may present an alternative pronunciation where the glide is phonetically manifested as a high vowel. These alternative pronunciations will be presented and discussed in the following pages.

(23) a.



b.



The representations on the left in (23) illustrate the establishment of a left-headed internuclear governing relation yielding a heavy diphthong - as illustrated in the representations on the right in (23). Forms which present posttonic postvocalic glides preceded by a high vowel - as illustrated in (22) - may present an alternative pronunciation in which the glide is phonetically manifested as a vowel. This is illustrated in (24).

(24)	a.	[híw]	~	[híû]	'river'
	b.	[períwdû]	~	[períûdû]	'period'
	c.	[flújdû]	~	[fluídû]	'fluid'
	d.	[gratújtû]	~	[gratuítû]	'free'

The data in (24a-b) show that forms presenting a primary stressed high front vowel followed by a back glide, may have an alternative pronunciation where the glide is manifested as a lax high back vowel. The data in (24c-d) show that forms presenting a primary stressed high back vowel followed by a palatal glide, may have an alternative pronunciation in which a sequence of vowels - rather than a vowel-glide sequence - occurs. Notice that in the forms on the right in (24c-d), primary stress does not fall on the high back vowel - as illustrated in the forms on the left - but rather the high back vowel occurs in pretonic position.[14] Let us consider the forms of (24) in more detail.

Vowel-glide sequences in BP are derived from a sequence of adjacent nuclear positions. Therefore, forms on the left in (24) - which present vowel-glide

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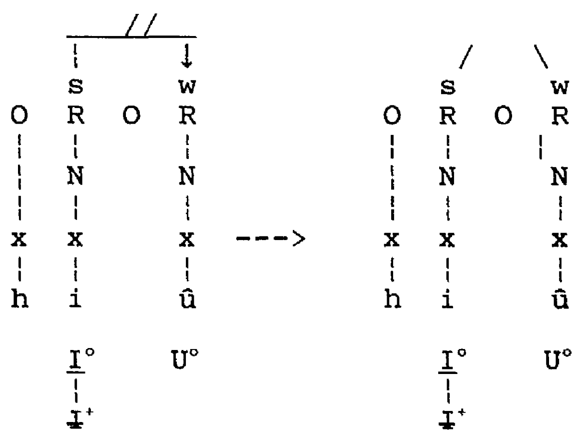
[14] Forms in (24c-d) may also be pronounced as [flwídû] and [gratwítû], i.e. where a glide-vowel sequence is phonetically manifested. The derivation of these forms was given in Chapter 6 where we showed that glide-vowel sequences are derived from the establishment of a right-headed internuclear governing relation.

sequences -are derived from a sequence of adjacent nuclear positions. The derivation of these forms was given in (23). Let us now consider the derivation of forms on the right in (24), i.e. where the glide is manifested as its corresponding high vowel. First we will discuss forms illustrated in (24a-b), i.e. where a posttonic postvocalic back glide is phonetically manifested as a lax high back vowel, e.g. [híû] 'river'. We assume that in the process of deriving the form [híû] - which presents a sequence of high vowels - a governing relation between adjacent nuclear positions is prevented from holding. This process is illustrated in (25).

(25)



In (25) we have a sequence of adjacent nuclear positions where the far left nuclear position (which is filled with the positively charmed segment i) has the property of governing the immediately following nuclear position (which is filled with the simplex charmless segment û). Therefore, a governing relation - more precisely a left-headed internuclear governing relation - should hold between the adjacent nuclear positions in (25). This is not the case.

The reasons why a governing relation does not hold between the adjacent nuclear positions in (25) are still obscure.[15] What is important to mention is that such a property, i.e. a simplex charmless segment not governed by a positively charmed segment, is restricted to sequences of adjacent high vowels. Forms presenting posttonic postvocalic glides where the glide is preceded by a non-high vowel, e.g. [páw] 'stick'; [déwzɑ] 'goddess', do not present an alternative pronunciation where the glide is phonetically manifested as a lax high vowel, i.e. *[páû] and *[déûzɑ] are not possible forms in BP.

Let us now discuss forms illustrated in (24c-d), e.g. [flújdû] ~ [fluídû] 'fluid'. In these forms a primary stressed high back vowel followed by a palatal glide presents an alternative pronunciation in which a sequence of vowels - rather than a vowel-glide sequence - is phonetically manifested.

[15] Unfortunately, for the time being we can only observe this phenomenon without providing an explanation for it.

Forms presenting a vowel-glide sequence, e.g. [flújdû], are derived by the establishment of a left-headed internuclear governing relation so that a vowel-glide sequence is realized. (cf. (23b)). Forms presenting a sequence of vowels, e.g. [fluídû], illustrate the case where a pretonic nuclear head filled with the simplex charmless segment û acquires the ATR element. It is thus manifested as a tense high vowel, i.e. [u]. A sequence of vowels, i.e. [fluídû], is manifested.[16]

We expect that forms presenting a primary stressed high back vowel followed by a palatal glide, e.g. [flújdû], will present an alternative pronunciation in which a sequence of vowels is phonetically manifested, i.e. [fluídû]. This is exactly the case. It remains to be seen why forms presenting a high back vowel followed by a primary stressed high front vowel, e.g. [žuízû] 'judgment', cannot be phonetically manifested as a vowel-glide sequence, i.e. *[žújzû].

[16] A form such as [fluídû] may also be pronounced as [flwídû]. Forms presenting a glide-vowel sequence are derived from the establishment of a right-headed internuclear governing relation yielding a light diphthong (cf. Chapter 6).

8.3. Conclusion

In this Chapter we considered forms presenting intervocalic glides. We showed that intervocalic palatal glides are derived from a nuclear position filled with the simplex charmless segment [î]. We also considered forms presenting a sequence of high vowels, and showed that whether a high vowel or a glide is phonetically manifested depends on the governing relations established between adjacent nuclear positions.

We have seen that the simplex charmless segment î may govern the simplex charmless segment û and vice-versa (cf. [sábjû] and [tẽnwî] in section 8.2.2). Considering the definition of government, i.e. a binary, asymmetric relation between adjacent positions, we do not expect a governing segment to be governed. This is because if a given segment may either govern or be governed, the asymmetric nature of government is violated. Further research is still needed for a better understanding of the governing properties of simplex charmless segments and the asymmetric nature of government. The process of vowel-glide alternations presented in this Chapter aims to throw some light on the discussion of this issue.

CONCLUSION

In this thesis we have considered phonological phenomena involving nuclear positions. Specifically, we considered vowel coalescence in BP with emphasis on the processes of vowel-glide alternations.

We defined how word stress is assigned in BP showing that primary stress is lexically determined where feet may be either binary or ternary. We have also claimed that metrical trees are built onto the level of nuclear projection and we stated the metrical constraints imposed on posttonic constituents in BP.

We have shown that the occurrence of certain vowels in BP depends on their position with respect to primary stress. We thus proposed that the distribution of vowels in BP is accounted for by charm constraints imposed on nuclear segments.

A review of the literature on the process of vowel-glide alternations in BP was presented showing that earlier works encounter problems in explaining the conditions under which a high vowel alternates or fails to alternate with its corresponding glide, and in determining the phonological representation of diphthongs in BP. Therefore, further research on the process of vowel-glide alternations in BP is still needed.

Our proposal which accounts for the process of vowel-glide alternations in BP was then presented. Such a proposal is an expansion of the earlier treatments of governing relations between adjacent nuclear positions. We claimed that in a sequence of adjacent nuclear positions the Obligatory Contour Principle (OCP) applies under government.

Forms presenting prevocalic glides, i.e. [jV,wV], and forms presenting prevocalic high vowels, i.e. [iV,uV], were discussed. Evidence was provided showing that glide-vowel sequences in BP correspond to the representation of a light diphthong. Light diphthongs in BP are derived from the establishment of a right-headed internuclear governing relation. Prevocalic high vowels represent the cases where an internuclear governing relation is prevented from holding.

We also considered forms in which a velar stop-glide sequence occurs, i.e. <u>kw,gw</u>. The back glide in BP may correspond either to the element U° syllabified in the representation of a light diphthong or to the element U° together with a velar stop consonant syllabified in the representation of a complex consonant. We claimed that when the back glide is phonologically interpreted as the element U° syllabified in the representation of a complex consonant, it corresponds to the cases where the element U° is lexically associated to a position other than a nuclear head.

Forms presenting postvocalic glides, i.e. [Vj,Vw], and forms presenting postvocalic high vowels, i.e. [Vi,Vu], were then considered. Evidence was provided showing that vowel-glide sequences in BP correspond to the representation of a heavy diphthong. Heavy diphthongs in BP are derived from the establishment of a left-headed internuclear governing relation. Postvocalic high vowels represent the cases where an internuclear governing relation is prevented from holding.

Finally, we analysed forms presenting intervocalic glides and forms presenting sequences of high vowels. Intervocalic palatal glides are derived from a nuclear position filled with the simplex charmless segment $\underline{\text{i}}$. Concerning forms which present sequences of high vowels we determined which of the high vowels in the sequence may be realized as a glide. The manifestation of a high vowel or a glide depends on the governing relations that adjacent nuclear positions contract with each other.

Our research provides a general account of the occurrence of high vowels and glides and determines how glides are phonologically interpreted in BP.

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