

Some Notes on Phonological Phrasing in Brazilian Portuguese*

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In this paper, we argue that phonological phrasing in Brazilian Portuguese is determined, among other things, by the interaction of right-alignment of syntactic and phonological phrases (Selkirk 1986) with a eurythmic factor of Uniformity (Ghini 1993), which prefers p-phrases of equal prosodic length. The Uniformity requirement shows some unexpected properties. It is not tied to a preferred length of p-phrases, and it appears to be restricted to p-phrases overlapping with the subject and the verb of the clause.

1. Introduction: Phonological Phrases in Brazilian Portuguese

In this paper, we describe some initial results concerning phonological phrasing in Brazilian Portuguese (BP).

Evidence for phonological phrasing in BP comes from stress retraction under stress clash (Abousalh 1997) and from intonation (Frota and Vigário 2000). This paper focuses on the phenomenon of stress retraction. The phenomenon is comparable to the English rhythm-rule (Lieberman and Prince 1977, Hayes 1989) or stress retraction in standard northern Italian (Nespor and Vogel 1979, 1986, 1989). For example, in BP, café, 'coffee', has final stress in isolation, here marked by underlining (the accent is orthographic). When followed by a word with initial stress, such as quente, 'hot', the word café does not retain its final stress, but retracts it to the left: √ café quente, 'hot coffee'. This judgement, like the other judgements on stress retraction reported in this paper, hold of a normal rate of speech in sentences that convey new information, as in headline news. Slow, deliberate speech leads to additional p-phrase edges and may thus block retraction that otherwise occurs. Retraction on any element can also be blocked by what intuitively feels like special emphasis on an element: The emphasized element will not then tolerate stress retraction. We return to the special emphasis in the section on focus at the end of the paper.^[1]

A variety of other languages have also been shown to exhibit one or another version of this phenomenon, among them Catalan (Nespor and Vogel 1989), Dutch (Visch 1989), Greek (Nespor and Vogel 1989), Polish (Hayes and Puppel 1985), and Turkish (Nespor 1990). European Portuguese, incidentally, does not shift stress in response to stress-clash (Frota 1998). In Brazilian Portuguese, the phenomenon was first noticed by Major (1985), and discussed in more detail in Abousalh (1997), who noticed that it is conditioned by the phonological phrase.^[2]

As in Italian (Nespor and Vogel 1986, 1989) and English (Hayes 1989), retraction does not take place where the two words are separated by the boundary of a phonological phrase (p-phrase or P in the following). We will show below that such a p-phrase boundary is regularly assigned between subject and verb in BP. Accordingly, there is no retraction in (café)_P (queima)_P, 'coffee burns' to *(café)_P(queima)_P. Going back to the first example, the account is coherent if no p-phrase boundary is assigned internal to the NP there: (café quente)_P, 'hot coffee'.

Of subordinate interest in the present paper are the questions of what triggers stress retraction and how the change is formally represented. Since Liberman and Prince (1977), it is usually assumed that stress retraction is triggered by stress clash. In English, it has been argued that the possibility of placing a pitch-accent early in the utterance may additionally trigger stress retraction in the absence of a stress clash (see Hayes 1984, Shattuck-Hufnagel et al. 1994 and references there). We have not so far found a similar effect in BP. Abousalh's data was transcribed taking pitch into consideration and this data suggest that pitch variation plays no role in triggering stress retraction in BP.

Hayes (1984) also argues for a number of eurythmic principles in an investigation of English. A different theory for English is defended in Gussenhoven (1991), where the phenomenon is formalized in terms of the cyclic elimination of an accent surrounded by two other accents.

Lieberman and Prince (1977) and Hayes (1984) argue for a formalization of the rhythm rule in English in terms of a reversal of the strong-weak relations in a metrical tree. Nespor and Vogel (1989) argue with regard to stress retraction in Italian and other languages for a formalization in terms of beat addition and beat deletion in a metrical grid, in response to constraints against clashes and lapses.

An issue that we will return to below is why the p-phrase boundary affects the application of stress retraction. The most straightforward assumption, namely that stress clash is constituted only within p-phrases, was made by Nespor and Vogel (1986). It was later argued against in the more detailed investigation in Nespor and Vogel (1989) (see also Nespor (1999)). In the theory of

Nespor and Vogel (1989), phrasal prosodic domains such as the p-phrase are domains of stress-assignment.^[3] Nespor and Vogel (1989) argue that adjacent word-stress constitutes a stress clash regardless of p-phrases, and that the remedy of stress-clash—beat deletion and addition resulting in apparent retraction—is blocked by the presence of p-phrase stress in the final position of the p-phrase. We illustrate this with our BP example and indicate p-phrase stress by double underlining. Retraction is possible on the word-stress in (café quente)p, but it is blocked by the additional presence of p-phrase stress in (café)p (queima)p. In this theory, the intervening p-phrase boundary between the two elements conditions retraction indirectly, by forcing the assignment of p-phrase stress on the potential target of the retraction. We here adopt this account for BP.

In the more complex syntactic structure in (1) in BP, we can establish the phrasing indicated there: The noun and the adjective of the subject form a p-phrase together, the verb and the short object are phrased together, and a final adverbial is phrased separately. Evidence for this assignment of prosodic structure is shown in (2): The application of stress retraction in (2a) and (2c) gives evidence for the absence of p-phrase edges between N and A and between V and N. At the same time, the inapplicability of stress retraction in (2b) and (2d) provide evidence for the p-phrase boundaries between the subject and the verb, and between the object and the final adverbial.^[4]

(1) ((x) (x) (x)
 [(DET) N X]NP V [(POSS) N]NP [Adv]AdvP

(2) a. (N_A ...
 O café quente queimou a boca ontem. cf. café
 the coffee hot burned the mouth yesterday
 'The hot coffee burned my mouth yesterday.'

(N_A ...
 Um chinês louco cantou samba ontem. cf. chinês
 a Chinese-person crazy sang samba yesterday
 'A crazy Chinese person sang samba yesterday.'

(N_N ...
José Carlos comeu maçãs ontem. cf. José
 José Carlos ate apples yesterday.'

b. (N A)(V ...
 Um frango chinês queimou minha boca ontem.
 a chicken *chinês queimou burned my mouth yesterday
 'A Chinese chicken burned my mouth yesterday.'

similarly in:

(A N)(V ...
 O novo café queima a boca sempre.
 * café queima the new coffee burns my mouth always
 'The new coffee burns the mouth always.'

c. (N A)(V_N ...
 A abelha rainha comeu uvas ontem. cf. comeu
 the bee royal ate grapes yesterday
 'The queen bee ate grapes yesterday.'

(N A)(V_N ...
 O canguru australiano dançou samba ontem. cf. dançou
 the kangaroo Australian danced samba yesterday
 'The Australian kangaroo danced samba yesterday.'

d. (N A)(V N)(Adv)
 A abelha rainha comprou café ontem.
 * café ontem the bee royal bought coffee yesterday
 'The queen bee bought coffee yesterday.'

(N A)(V N)(Adv)
 A abelha rainha mordeu José ontem.
 * José ontem the bee royal bit José yesterday
 'The queen bee bit José yesterday.'

The presence of p-phrase prominence is to some extent accessible to native-speaker intuitions in BP, independent of the evidence for it due to stress-retraction in particular instances. In part, these intuitions seem to stem from the assignment and scaling of tones in the intonational system of BP, to which we briefly return below. Frota and Vigário (2000) show that 94% of the p-phrases in a BP corpus (two speakers each read 20 sentences three times) were assigned a tonal event. (In an analogous European Portuguese corpus, in contrast, only 27% of the p-phrases held a tonal event.) These intuitions support the phrasings derived in this paper. In (2), for example, intuitions about stress and intonation support the result that the examples in (2a-d) are generally phrased and stressed as in (1).

We find that stress retraction provides a reasonably clear way of pinning down the p-phrases, as this phenomenon makes the presence vs. absence of p-phrase edges emerge in judgements of preference between the retracted and the unretracted forms. We thus rely on judgements about stress retraction of six speakers of BP from Southeast Brazil not including the authors. The first author also is a native speaker of this dialect of BP, and her intuitions support the phrasal stress and the intonational patterns that accompany our conclusions from our data on stress

retraction.

How, then, are p-phrases assigned in BP? Across languages, p-phrases are related to syntactic phrases to a certain extent. At the same time, focus, eurythmic and length-effects may enter into the formation of p-phrases, obscuring the relation to syntax to a larger or smaller extent, depending on the language. In BP, syntax, focus, and eurhythmy all seem to enter into the formation of p-phrases. In section 2 we discuss the main effect of syntax on p-phrases. In section 3 we discuss a binary length-preference and its interaction with syntactic structure. Section 4 address an interesting additional eurythmic effect in the phrasing of BP, and in section 4 we demonstrate a syntactic restriction on this eurythmic effect. In section 6 we briefly shows an effect of focus on the prosodic patterns and its interaction with eurhythmy. The results are summed up in section 7.

2. The Main Effect of Syntax

We derive the phrasing in (1) by the constraint in (3) that right-aligns edges of lexical syntactic XPs with edges of p-phrases. Right-alignment of this kind was originally argued for by Chen (1987) for Xiamen Chinese, and generalized by Selkirk (1986) to a universal theory of the syntax-phonology mapping, with special attention to phrasal right-edge alignment in Chi Mwi:ni. Left-alignment of syntactic XPs with p-phrases has been postulated for other languages including Shanghai Chinese (Selkirk and Shen 1990) and Japanese (Selkirk and Tateishi 1991). De Lacy (1999) argues that phrasing in Maori shows the simultaneous effects of left- and right-alignment. [\[5\]](#)

(3) Align-XP,R: The right edge of each lexical XP coincides with the right edge of a p-phrase.

Align-XP,R derives the phrasing in (1) by requiring edges of p-phrases at the right edge of the subject NP, at the right edge of the object NP, and at the right edge of the adverbial phrase. This results in the attested subdivision of this example. No p-phrase edges are assigned between N and A within the subject, and between the verb and its object—these positions do not coincide with the right edges of syntactic XPs.

Given only the structure in (1) above, one might alternatively hypothesize that BP phrases a string by grouping sets of two prosodic words into a phonological phrase from left to right. However, a p-phrase boundary to the right of a lexical XP is regularly found in BP, regardless of the number of words in a p-phrase. Thus, (4) shows the presence of a p-phrase boundary between a subject and a verb with no object. Here an algorithm in terms of grouping of two with no reference to syntax would wrongly group the subject and the verb together, while edge-alignment correctly predicts the separate phrasing.

(4) [N]NP V
 (N)(V)
 Café queima.
 *Café queima
 coffee burns
 'Coffee burns.'
 (N)(V)
 O José dança.
 *O José dança
 the Jose dances
 'José dances.'

(5) and (6) are examples of a subject and a verbal projection with different prosodic length, 1+2 prosodic words in (5) and 2+1 in (6). The impossibility of stress retraction between subject and verb here is evidence of the p-phrase boundary between subject and verb in both cases. (We will show below, however, that the complete phrasing of these cases is also subject to a eurythmic factor that adds an additional p-phrase boundary in each of these cases).

(5) [N]NP V [N]NP
 (N)(V)
 Café queima a boca.
 *Café queima
 coffee burns the mouth
 'Coffee burns the mouth.'
 (N)(V)
 José come uvas.
 *José come
 José eats grapes
 'Joe eats grapes.'

(6) [N A]NP V
 N A)(V)
 O cavalo chinês corre.
 *chinês corre
 the horse Chinese runs
 'The Chinese horse runs.'

similarly in:

A N)(V)
 O novo café queima.
 *café queima
 the new coffee burns
 'The new coffee burns.'

For completeness, (7) shows a case of phrasing with a complex subject followed by a verb and an object. Stress-retraction gives evidence for a p-phrase boundary between subject and verb, predicted on either of the alternatives considered so far.

(7) [DET N A]NP V [N]NP

N A)(V

O cavalo chinês come uvas.
 * chinês come
 the horse Chinese eats grapes
 'The Chinese horse eats grapes.'

similarly in:

A N)(V

O novo café queima a boca.
 * café queima the mouth
 the new coffee burns the mouth
 'The new coffee burns the mouth.'

Further evidence for right-alignment of syntactic and phonological phrases comes from adverbial phrases. In (8), an adverbial phrase intervenes between subject and verb. In (9), the adverbial phrase separates the verb and its object. In both cases, a p-phrase boundary demarcates the right edge of the adverbial phrase, as predicted by Align-XP,R. For (8), this would be unexpected on the hypothesis that groups prosodic words together in sequences of two—the adverb and the following verb would then fall within the same p-phrase in this example.

(8) [DET N A]NP [Adv]AdvP V [N]NP

Adv)(V

A abelha rainha amanhã compra livros.
 * amanhã compra
 the bee royal tomorrow buys books
 'The queen bee buys books tomorrow.'

(9) [DET N A]NP V [Adv]AdvP [N]NP

Adv)(N
 Adv)(N

A abelha rainha comerá amanhã uvas.
 * amanhã uvas
 the bee royal will-eat tomorrow grapes
 'The queen bee will eat grapes tomorrow.'

A note on the syntax of BP: The fact that an adverb can intervene between the verb and its object as in (9) suggests that the verb has moved from its base-position next to the object to a higher functional projection. The adverb in (9) might then be left-adjoined to VP, where it follows the moved verb (Costa 1998: 19-36).^[6] This scenario does not affect the phrasing of the cases derived so far: The right edge of the verb itself, not being phrasal in nature, does not invoke Align-XP,R. At the same time, the right edge of the VP is irrelevant to the phrasings considered here: The right edge of VP is trivially right-aligned with a p-phrase, coinciding either with the right edge of the object or with the right edge of the utterance in the examples in this paper.

3. Binarity and syntactic constituency

We turn to a eurythmic effect in our BP data. While a verb is phrased together with a single-word object as in (10), it is phrased separately from an object with two lexical words as in (11). The position of the object is plausibly the same in both cases, so that this difference cannot directly be derived from alignment with syntactic structure. The constraint Align-XP,R does not derive internal boundaries in either case.

(10) (V_N)
Vengeu livros.
 sold books
 'He sold books'

(V_N)
Ganhou uvas.
 gave grapes
 'He gave grapes (as a present).'

- (11) (V) (N A)
 Vengeu livros novos.
 ?* Vengeu livros
 sold books new
 'He sold new books'
- (V) (N A)
 Ganhou uvas brancas.
 ?* Ganhou uvas
 gave grapes white
 'He gave white grapes (as a present).'

(12) shows that in the latter structure, the elements of the complex object are phrased together.

- (12) (V) (N A)
 Compraram café quente.
 bought coffee hot
 'They bought a hot coffee.'
- Trouxeram um sofá brancos.
 brought a sofa white
 'They brought a white sofa.'

This phenomenon is familiar from the work of Nespor and Vogel (1986) on Italian phrasing, and was further investigated in Italian by Ghini (1993). Nespor and Vogel (1986) analyze it in terms of a two-step algorithm. In a first step, the algorithm assigns separate p-phrases to all words in an Italian pendant of (10) and (11). In a second step, a complement or modifier of a head (in present terms, an element not separated by the right edge of an XP) is optionally restructured with the head into a larger p-phrase. The restructuring is subject to the condition that the complement or modifier not be branching. This derives, for the structures in (10), (V)(N) -> (V N), and for (11), (V)(N)(A) -> (V)(N A). The latter does not then become (V N A), because the complement of the verb, [N A]NP, is branching.

Ghini (1993), in his investigation of this phenomenon in Italian, argues for a reanalysis in terms of eurythmic factors with a notion of prosodic binarity at the core of the analysis. The factors that together derive the case of (V)(N A) are rendered in (13) and (14). Uniformity defines the ideal that a string is parsed into units of the same length. Taken on its own, this part is not directly relevant in the case at hand, but we will return to it below. Average weight defines the ideal length of a p-phrase at an average rate of speech as two prosodic words. In our example, there are two ways of approaching this ideal, (V)(N A) and (V N)(A), both having at least one binary constituent. Among these, Increasing units in (14) decides: The recursive side is on the right in Italian, so that a phrasing with increasing heaviness like (V)(N A) is preferred over one with decreasing heaviness like (V N)(A). ((14) is a rendition of Ghini's formulation that glosses over some details in connection with the reference to asymmetry. They concern a further eurythmic factor Ghini postulates that is not relevant to this paper.)

- (13) Uniformity and average weight (Ghini 1993)
 A string is ideally parsed into same length units; the average weight of the \emptyset s depends on tempo: at an average rate of speech (moderato), a \emptyset contains two phonological words; the number of Ws within a \emptyset increases or decreases by one by speeding up or slowing down the rate of speech.
- (14) Increasing units (Ghini 1993)
 In case of an asymmetric parse, \emptyset s on the recursive side are heavier than \emptyset s on the non-recursive side.

Here we wish to cast this account in constraints that can be seen as part of an analysis of BP phrasing in Optimality Theory (Prince and Smolensky 1993; see also footnote 5). We suggest that Ghini's and Nespor and Vogel's insights be represented by the two constraints in (15) and (16).

- (15) Max-Bin: P-phrases consist of maximally two prosodic words.
- (16) Wrap-XP: Each XP is contained in a p-phrase.

We offer Max-Bin as the constraint enforcing binarity. In defining binarity as a maximum, the constraint correctly rules out the phrasing with a larger than binary p-phrase, (V N A), while allowing the correct phrasing that includes a smaller than binary p-phrase, (V)(N A). (An OT-constraint that requires minimal and maximal binarity at the same time would induce a violation in both these structures, and could not then enforce the insertion of the internal boundary.)

However, other structures are also compatible with Max-Bin, in particular (V N)(A), and (V)(N)(A). We suggest that these are ruled out by Wrap-XP, a constraint independently motivated in Truckenbrodt (1995, 1999). In the BP case at hand, Wrap-XP demands that the object [N A]NP be contained in single p-phrase, which may be coextensive with the object or larger. This demand is met in the correct structure (V)(N A), but not in the other candidates (V N)(A), and (V)(N)(A). Wrap-XP here picks up an element of the analyses of both the syntactically guided algorithm of Nespor and Vogel (1986) and the role of the recursive side in the definition of Increasing units in Ghini (1993): In the actual phrasing (V)(N A), the p-phrase around noun and adjective corresponds to a syntactic constituent. On the whole, the phrasing (V)(N A) is then derived as the phrasing that meets the binarity maximum, and still preserves the integrity of the object NP in the phrasing.^[7]

In the remainder of this paper, Align-XP,R will continue to play a crucial role, while the constraints Max-Bin and Wrap-XP may largely be ignored. With one exception that will be apparent, we limit the discussion to cases in which Align-XP,R alone derives p-phrases of length one or two, in which Max-Bin thus has no further role to play. Wrap-XP, furthermore, is a constraint that can, by its nature, never force the insertion of additional p-phrase boundaries. It can, in principle, prevent p-phrase boundaries, though there is no case in our data where Wrap-XP would inhibit the application of Align-XP,R. Due to some uncertainties about the details of the syntactic analysis, we here have to leave open whether this is due to ranking of Align-XP,R above Wrap-XP, or due to more general restrictions on the syntax-prosody mapping (see footnote 7).

4. Uniformity

We turn to a second eurythmic effect in our BP data, one that has not been observed, to our knowledge, in this particular fashion in other languages. Our analysis will tie this to the suggestion of Uniformity by Ghini (1993) (see (13) above). However, the uniformity effect discussed in Italian by Ghini (1993) is tied to a (binary) length preference, and may be seen as stemming from that length-preference. In this section we present an effect of uniformity in BP that is independent of length preferences. We establish the application of such a uniformity effect in this section, and will show a syntactic restriction on it in section 5.

Consider first (17), phrased as predicted by Align-XP,R. (7) above gave evidence of the p-phrase boundary between subject and verbal projection in such structures. In (17), stress retraction gives evidence for the joint phrasing of N and A within the subject.

- (17) (N_A) (V N)
Café quente queima a boca.
 coffee hot burns the mouth
 'Hot coffee burns the mouth.'

similarly in:

Um chinês louco dançou samba.
 a Chinese-person crazy danced samba
 'A crazy chinese-person danced samba.'

Consider then (18), minimally different from (17) in not having an object to the verb. Though this difference in the presence of overt material is located in the projection headed by the verb, it non-locally affects the phrasing of the complex subject: In (18), unlike in (17), the N and A within the subject are phrased separately, as evidenced by the near-impossibility of stress retraction in this case.^[8] This cannot be derived by anything introduced so far: the complex subject in the examples in (18) is expected to be phrased as single p-phrase, like the complex subject in the examples in (17).

- (18) (N A) (V) -> (N)(A) (V)

(N)(A) (V)
 Café quente queima.
 *? Café quente.
 coffee hot burns
 'Hot coffee burns.'

Café quente sumiu.
 * Café quente
 coffee hot disappeared
 'The hot coffee disappeared'

Um chinês louco morreu.

* Um chinês louco
 a Chinese-person crazy died
 'A crazy Chinese-person died.'

We hypothesize that the unexpected divisions in the subjects in (18) are due to a eurythmic factor of uniformity that favors p-phrases of equal length. Uniformity allows the uniform phrasing of 2+2 prosodic words in (17), but turns the non-uniform phrasing 2+1 into the uniform phrasing of 1+1+1. In (18), and in later examples exhibiting uniformity effects, we highlight this effect by schematically showing the phrasing predicted by Align-XP,R alone as well as the attested phrasing that shows the additional effect of uniformity.

Just as the length of the verbal projection can non-locally affect the phrasing of a complex subject in (17) and (18), so the length of the subject can also non-locally affect the phrasing of a complex verbal projection, as shown in the contrast between (19) and (20). (19) establishes the joint phrasing of a verb and its object, in the presence of a binary subject. In (20), on the other hand, where the subject consists of a single prosodic word, the verb and object are phrased separately..

(19) (N A) (V_N)
 O cangurú australiano dançou samba. cf. dançou
 the kangaroo Australian danced samba
 'The Australian kangaroo danced samba.'

(N A) (V_N)
 A abelha rainha comeu uvas cf. comeu
 the bee royal ate grapes
 'The queen bee ate grapes.'

(20) (N) (V N) -> (N) (V) (N)

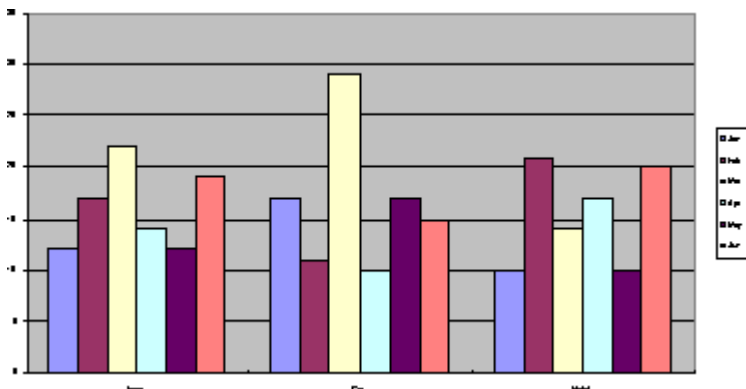
(N) (V) (N)
 O cangurú dançou samba.
 * dançou samba
 the kangaroo danced samba
 'The kangaroo danced samba.'

(N) (V) (N)
 Pedro comeu uvas.
 * comeu uvas
 Pedro ate grapes
 'Peter ate grapes.'

In (20), then, the non-uniform phrasing 1+2 predicted by Align-XP,R is restructured to the uniform phrasing 1+1+1, with p-phrases of equal length.

Notice that the uniformity effect in this data is not tied to a (speech-rate dependent) length preference. At the same rate of speech, 2+2 is acceptable, and 1+2 as well as 2+1 are restructured to 1+1+1. If a length-preference of one prosodic word was crucially involved in BP, we would expect 2+2 to restructure to 1+1+1+1. If, on the other hand, a length-preference of two was crucially involved, 2+2 would correctly remain unaffected, but we would expect that 1+2 and 2+1 remain unchanged. In a first approximation, we therefore capture the uniformity effect of BP with the first clause of Ghini's formulation in (13)—an effect of uniformity that is independent of average weight.

(21) Uniformity: A string is ideally parsed into same length units.

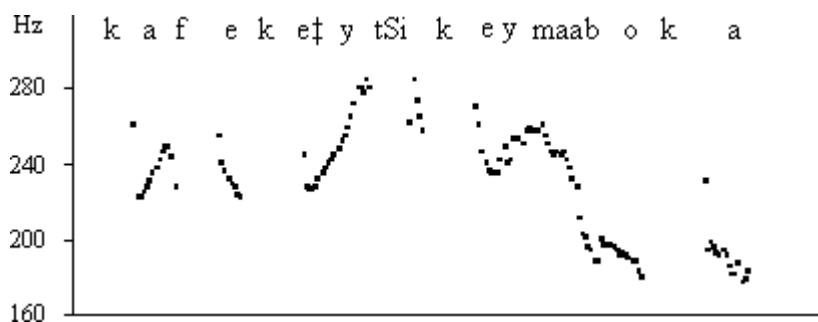


We point out that Uniformity must be stronger than Wrap-XP. In (18), in particular, Wrap-XP will favor a phrasing in which the complex subject [N A]NP is phrased in a single p-phrase. Uniformity is nevertheless able to break up the subject into two p-phrases. An analysis in terms of constraint ranking would thus conclude that Uniformity >> Wrap-XP. Since this is the only clear case of crucial ranking in our data, we will trust that the reader is able to follow our analysis and reasoning, without further formalization.

The reader may have noticed that some of the examples discussed in previous sections do not conform to Uniformity. We will return to these in section 5 below, where we argue for a syntactic restriction on Uniformity.

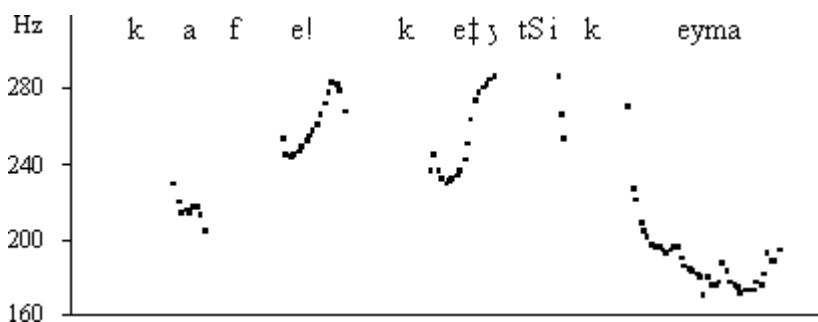
For now, we pause in our investigation of the phrasing in order to illustrate the Uniformity effect with some pitch-tracks we have obtained from one of our speakers. (22) shows a pitch-track of the sentence in (17), phrased (café quente)P(queima a boca)P in our analysis. We believe that each word-stress in non-final position is here associated with a tonal rise, and that the distinction between word-stress and phrasal stress is reflected in the size of the rise: There is a larger rise in (22) on the phrasal stress on quente than on the preceding and following word-stresses.

(22) (Café quente)P(queima a boca)P



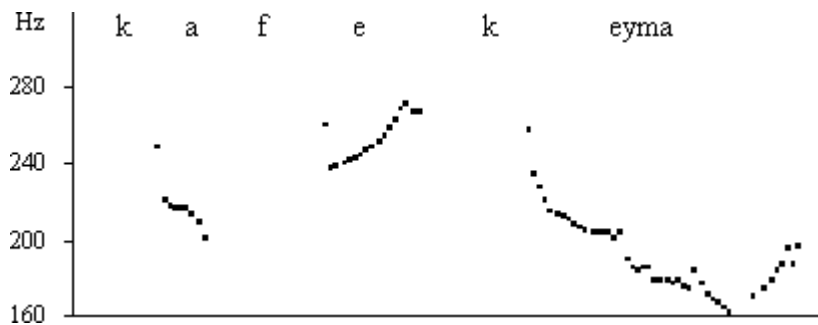
(23) shows a pitch-track for (18), phrased (café)P(quente)P(queima)P in our analysis. Here, unlike in (22), the initial rise on café is not smaller than the rise on quente. This would seem to be the intonational reflexion of the phrasal stress on café in (23), owing to Uniformity, in contrast to the word-stress on café in (22). Note also that the position of stress seems to condition the timing of the rise, which ends with the first vowel of café in (22) but with the second vowel of café in (23), and thus in both cases with the end of the postulated strongest stress of the word. The rises on quente in (22) and (23) and the rise on queima in (22) likewise end with the stressed syllables. These remarks are very tentative. We have not studied these issue in any detail at this point.

(23) (café)P(quente)P(queima)P



A pitch-track for the example in (4) above, phrased (café)P(queima)P, is shown in (24). Phrasal stress on café is again evidenced by a high rise late in the word.

(24) (café)P(queima)P



Notice that the rises in connection with stressed syllables seem to be confined to non-final position in these cases. The position of the final (nuclear) stress seems to be correlated with low f_0 .

5. A Syntactic Restriction on Uniformity

In this section, we argue that Uniformity in fact only applies under limited syntactic conditions in BP, namely between the subject and the verb. This is stated in (25), revised from (21).

- (25) Uniformity, restricted:
Subject and verb are phrased in same length units.

Notice first that (25) allows the uniformity effects in the examples discussed in the preceding section: In (N A)(V N), subject and verb are both contained in p-phrases that are two prosodic words in length. On the other hand, in (N A)(V) and in (N)(V N), subject and verb are members of p-phrases with different prosodic length, one and two prosodic words, while the restructured (N)(A)(V) and (N)(V)(N) phrase both subject and verb in p-phrases of equal length of one prosodic word.

We begin by illustrating the syntactic restriction on Uniformity with examples of the form (N A)(V XP)(YP), where XP and YP are maximal projections. The phrasing here is as predicted by Align-XP,R, and results in the prosodic pattern 2+2+1. Crucially, the presence of a final short p-phrase does not lead to a Uniformity effect in the rest of the string, which would amount to the uniform phrasing 1+1+1+1+1. The phrasing 2+2+1 is unexpected on the unrestricted formulation of Uniformity in (21), but follows from the restricted formulation in (25): Subject and verb are here both contained in p-phrases of length two. The final YP in these structures is neither part of the subject nor of the verb, and thus is not included in the restricted evaluation of Uniformity in (25).

The first such case is the one already discussed in (1)/(2) above, where (N A)(V N)(Adv) is phrased as predicted by Align-XP,R, rather than restructured to (N)(A)(V)(N)(Adv), given the obligatory presence of the final short p-phrase around the adverb.

A further case of this kind that involves an adverbial is the structure (N A)(V Adv)(N), discussed in (9) above, where (9) gave evidence for the p-phrase boundary following the adverbial phrase. In (26), the application of stress-retraction within the subject (26a) and between the verb and the adverbial (26b) is evidence for the absence of p-phrase boundaries within the subject and between the verb and the adverbial. Here again we see the absence of a Uniformity effect that the final short p-phrase would be expected to trigger by (21).

- (26) [N A]NP V [Adv]AdvP [N]NP

- a. (N_A) (V Adv) (N)
Um café quente queimou ontem a boca.
a coffee hot burned yesterday the mouth
'The hot coffee burned my mouth yesterday.'

similarly:

- (N_N) (V Adv) (N)
José Carlos come sempre maçãs.
José Carlos eats always apples
'José Carlos always eats apples.'

Mané Pedro compra sempre livros.
Mané Pedro buys always books.
'José Carlos always buys books.'

- b. (N A) (V_Adv) (N)
A abelha rainha comeu ontem maçãs.
the queen bee ate yesterday apples
'The queen bee ate apples yesterday.'

Given only (1)/(2) and (26), one might wonder whether perhaps adverbs have a special status that might account for these exceptions to Uniformity: One might consider, for example, a derivation in which the adverbs are added late in the derivation (Lebeaux 1988, Chomsky 1995). As shown in (27), the phrasings in (1)/(2) and (9)/(26) could be derived by applying Align-XP and Uniformity before the adverbial is added to the structure (here the uniform 2+2 would be assigned), and by later adding the adverbial and the p-phrase boundary at its right edge.

(27) Align-XP,R, Uniformity Add AdvP, Align-XP,R
 (N A)(V N) -> (N A)(V N)(Adv)
 (N A)(V N) -> (N A)(V Adv)(N)

However, other examples suggest that the restriction on Uniformity is not limited to adverbs or non-selected constituents. Thus, (28) shows structures with two objects, where the same effect is observed: The final short p-phrase on the second object does not lead to a Uniformity effect that shortens the earlier p-phrases.^[9] Here the application of stress retraction between N and A in the subject (28a) and between V and N1 (28b) is evidence for the large p-phrasing earlier in this string.^[10]

(28) [N X]NP V [N1]NP [N2]NP

a. (N N) (V N1) (N2)
 José Carlos deu um café p(a)ra Maria.
 José Carlos gave a coffee to Maria
 'José Carlos gave a coffee to Mary.'

b. (N N) (V_N1) (N2)
 José Carlos comprou tudo p(a)r(a) o filho.
 José Carlos bought everything for the son
 'José Carlos bought everything for his son.'

c. (N N) (V_N1) (N2)
 Ana Maria pegou água da bica.
 Ana Maria took water from-the tap
 'Ana Maria took water from the tap.'

The restriction on Uniformity in (25) has a variety of effects beyond those involving structures of the form (N X)(V XP)(YP). One such effect concerns the phrasing of a verb with a complex object as in (11) and (12) above. The phrasing that was seen there, (V)(N A) is not restructured to the uniform (V)(N)(A), and thus supports the restricted version of Uniformity that does not force propagation of unary length from the verb to its object. This case is telling in a number of respects. First, it provides a further structure that demonstrates that the limits of Uniformity cannot be attributed to the special status of adverbs. Second, it shows that the failure of Uniformity to propagate can be observed both directions: In (30), (26), and (28), Uniformity effects fail to apply from right to left in the pattern 2+2+1, but in the case of (V)(N A), they fail to apply from left to right. Third, one might have pursued the intuition that Uniformity is strong enough to introduce one p-phrase boundary, as in the examples in (18) and (20) above, but that Uniformity is not strong enough to introduce multiple p-phrase boundaries, if that is what it would take to make the string uniform. Thus, one might have reasoned, in 2+2+1, Uniformity does not introduce any additional boundaries, because one boundary would not be enough to achieve complete Uniformity. However, this would not carry over to the case of (V)(N A), where the addition of a single division would achieve uniformity.

Finally, the case of a verb with a complex object allows us to discard another hypothesis about the earlier examples that is similar to the preceding hypothesis, though with a different idea at its core. Perhaps, one might reason, 2+2+1 is preserved because of majority rule: since the longer p-phrases outnumber the shorter ones, perhaps the phrasing is accepted as an imperfect specimen with average length of two, rather than treated as an imperfect specimen with average length one. The formalization of this idea would have to be undertaken in such a way that the cases in which uniformity effects are observed across subject and verb, 1+2 as well as 2+1, would be treated as imperfect specimen of length one, to be restructured into phrasings with a uniform length of one. Such an account therefore would not explain why the Uniformity effect stops at the object in (V)(N A), where the same numerical balance 1+2 obtains.

The case against an account in terms of majority rule can be strengthened by considering examples as in (29), in which a short subject is added to the structure [V [N A]]. (29a) shows that there is a p-phrase boundary separating the subject and the verb, as derived by Align-XP,R in our account. (29b) shows that the verb is still phrased on its own, as derived by Max-Bin and Wrap-XP for the analogous case with no overt subject in (11) above. Here, then, we have a strong test-case for the idea of majority rule: Under majority rule, the two initial unary p-phrases should definitely be able to break up a following single binary p-phrase. However, the Uniformity effect still does not propagate into the complex object. As shown by the application of stress retraction in (29c), N and

A within the object are still phrased together.

- (29) [N]NP V [N X]NP
- a. (N)(V)(N A)
 José bebe café quente.
 * José bebe
 José drinks coffee hot
 'José drinks hot coffee.'
- b. (N)(V)(N A)
 A abelha comeu uvas brancas.
 * comeu uvas
 the bee ate grapes white
 'The bee ate white grapes.'
- c. (N) (V) (N A)
 O canguru bebe café quente.
 the kangaroo drinks coffee hot
 'The kangaroo drinks hot coffee.'
- (N) (V) (N N)
 O homem viu José Carlos.
 the man saw José Carlos
 'The man saw José Carlos.'

This pattern is as expected given the restricted version of Uniformity: The p-phrase boundary following the verb, independently derived by Max-Bin and Wrap-XP, is redundantly reinforced by restricted Uniformity, which demands a unary p-phrase around the verb, given the unary p-phrase of the subject. However, the restricted version of Uniformity does not require the propagation of the unary length from the subject beyond the verb into the object. This case therefore also highlights an additional aspect of the syntactic restriction on Uniformity: The restriction is not, as some other cases would allow one to think, tied to the relation of subject and the projection headed by the verb. Rather, it seems to be the verb alone that enters into the uniformity demands with the subject.

At this point, a number of the cases we have discussed would allow for an alternative explanation by which Uniformity is not syntactically restricted to subject and verb, but is instead prosodically restricted to the first two p-phrases of the utterance. Such an account would also correctly extend to the cases discussed in section 4, where 2+2 is accepted, while 2+1 and 1+2 are rejected. Both rejected phrasings begin with two p-phrases of unequal length, while the result of rephrasing, in both cases 1+1+1, would begin in two p-phrases of equal length. Further, the prosodic restriction on Uniformity would also prevent full enforcement of Uniformity effects in a number of cases that we discussed that are schematically assembled in (30). The patterns 2+2+1 in (30a-c) and the pattern 1+1+2 in (30d) would both be allowed if Uniformity is prosodically limited to the initial two p-phrases.

- (30) a. (N A)(V N)(Adv)
 b. (N A)(V Adv)(N)
 c. (N A)(V O1)(O2)
 d. (N)(V)(N A)

One case in which this prosodic restriction cannot adequately replace our syntactic restriction on Uniformity is (V)(N A) in (11) and (12) above. Given a purely prosodic restriction on Uniformity, this case should be made uniform just as the subject-verb-object structure (N)(V N) is made uniform. There are two additional cases in our data that suggest that the syntactic restriction on Uniformity is empirically superior to the prosodic one. Consider first (31), a structure in which a short adverb intervenes between a long subject and a long verbal projection. The impossibility of retraction in a. and b. establishes the presence of the p-phrase boundaries to the left and to the right of the adverb. These are predicted by Align-XP,R at the right edge of the subject and at the right edge of the adverbial phrase. As shown by the application of retraction in c. and d., no Uniformity effect emanates from the medial short p-phrase of the adverbial into either the preceding subject or the following verbal projection.

- (31) (N X)(Adv)(V N)
- a. (N N)(Adv) (V N)
 O canguru José sempre come maçãs.
 * José sempre
 the kangaroo José always eats apples

'The kangaroo José always eats apples.'

- b. (N A) (Adv) (V N)
A abelha rainha amanhã compra livros.
the royal bee tomorrow buys books
'The queen bee is buying books tomorrow.'
- c. (N_A) (Adv) (V N)
Um café quente ontem queimou minha boca.
a coffee hot yesterday burned my mouth
'A hot coffee burned my mouth yesterday.'
- d. (N A) (Adv) (V_N)
A abelha rainha ontem comeu uvas.
the bee royal yesterday ate apples
'The queen bee ate apples yesterday.'
- e. (N_N) (Adv) (V_N)
José Carlos ontem comeu uva.
José Carlos yesterday ate grapes
'José Carlos ate grapes yesterday.'

If Uniformity applied to the first two p-phrases of the string but not elsewhere, (31) should show restructuring within the subject. This would be expected to be parallel to restructuring within the subject in (20), where (N A)(V) becomes (N)(A)(V).

On the other hand, the syntactic restriction on Uniformity in (25) correctly predicts that the Uniformity effect does not propagate leftward or rightward from the medial adverbial in (31): Subject and verb are each contained in p-phrases of length 2, and the presence of the intervening adverbial is correctly predicted not to change this phrasing.

A further case that allows us to distinguish between the prosodic and the syntactic restriction on Uniformity is given in (32). Here the subject consists of two coordinated conjuncts, for a total length of four prosodic words. Align-XP,R predicts separate phrasing of the conjuncts. However, N and A within the first conjunct are also phrased separately, as evidenced by the blocking of stress retraction in (32).^[11]

(32) [[N X]NP & [N X]NP]NP V

(N A) & (N N)(V) -> (N)(A) & (N)(N) (V)

((N) (A) & (N) (N) (V)

O café quente e a Ana Raquel sumiram.

*? café quente

the coffee hot and the Ana Raquel disappeared

'The hot coffee and Ana Raquel disappeared.'

similarly in:

O José Carlos e a Ana Maria morreram.

*? José Carlos

the José Carlos and the Ana Maria died

'José Carlos and Ana Maria died.'

The phrasing 2+2+1, derived by Align-XP,R, would wrongly be tolerated by the prosodic restriction on Uniformity, as this phrasing begins with two p-phrases of equal length. This prosodic restriction could thus not draw a distinction between (32), were 2+2+1 is not tolerated, and the earlier cases in which the phrasing 2+2+1 was tolerated. (25), however, correctly extends to the case at hand: As the verb is phrased in a short p-phrase, uniformity of phrasing across subject and verb is achieved by assigning short p-phrases across the subject as well. In the case at hand, this affects both conjuncts within the complex subject.

We have shown, then, that Uniformity does not apply in all cases in BP, and that the restrictions on its application can be captured by limiting its domain to subject and verb.

The results of both the preceding sections are unexpected. For one thing, we know of no other case with Uniformity effects that are not tied to length-preferences. For another, we know of no similar case where subject and verb play such a special role. In regard to the latter, theories of phrasing such as Selkirk (1986) and much work following up on it have argued for very limited possibilities of reference by prosodic algorithms to syntactic structure, and they do not include this particular possibility. Given the unexpected nature of our findings, we feel that more work is needed before more general conclusions can be envisaged.

6. Remarks on the Role of Focus

In BP, narrow focus on a word blocks stress-retraction on that word. We illustrate this with a focused rendition of an example in (19) above. Recall that the default phrasing of this example was (N A)(V N). Evidence for the joint phrasing of verb and object in (19) is the stress retraction on the verb, given stress clash. However, when narrow focus is placed on the verb, as in (33), stress retraction does not apply to the verb.

- (33) A abelha rainha comeu ou deu as uvas?
'Did the queen bee eat grapes or give grapes away?'

A abelha rainha comeu uvas
 [foc]
 * comeu uvas
the bee royal ate grapes
'The queen bee ate grapes.'

Our account for why focus blocks stress retraction rests on Nespor and Vogel (1989)'s proposal on the interaction of stress retraction with p-phrases, introduced in section 1 above: the presence of stronger stress at the end of the p-phrase blocks the remedy of stress-clash. This account offers a straightforward explanation of why focus blocks stress retraction: In BP, as in many other languages, narrow focus attracts stress (see Jackendoff (1972) for English). With the presence of p-phrase stress on the focused element, retraction on the focused element is blocked simply by the stress on the focused element. Thus, while word stress may be retracted in (comeu uvas)_P, giving (comeu uvas)_P, focus on the verb will lead to phrasal or higher stress, blocking retraction in comeu.

A question arises as to whether the stress on the focus simply shifts the phrasal stress to the verb, leaving the p-phrasing intact, as in (comeu uvas)_P, or whether it adds stress, leaving the final phrasal stress on the object intact, perhaps giving (comeu uvas)_P. Since, however, prosodic constituents and prominence are often thought to be in a biunique relation (see the Faithfulness Condition of Halle and Vergnaud (1987), Hayes (1995)), the latter scenario would lead us to expect two separate p-phrases for verb and object, thus (comeu)_P(uvas)_P. This latter phrasing might also be derived if BP, like a number of other languages, inserts p-phrase boundaries to the right of a focused element.^[12] The question of rephrasing in response to the addition of stress is testable in BP, by the interaction of phrasing with Uniformity. Consider (34). Here again we focus the verb in a structure otherwise phrased (N A)(V N). In this case, however, we test for retraction within the subject, between N and A. In (17) above, the sentence used in (34) was tested without narrow focus. There, stress retraction applies within the subject, giving evidence for the joint phrasing of N and A in the subject. Interestingly, this retraction within the subject is blocked in (34). This is evidence for the presence of a p-phrase edge between N and A within the subject, when the verb is in narrow focus.

- (34) O que café quente faz com a boca?
'What does hot coffee do to one's mouth?'

(N)(A)(VF ? N)
Café quente queima a boca.
[foc]

* Café quente
coffee hot burns the mouth
'Hot coffee burns the mouth.'

We attribute this change to Uniformity here, and conclude that focus changes the prosodic structure among verb and object in such a way as to trigger a Uniformity effect leftward into the subject. This suggests that the focus does not simply move the stress to an earlier position, turning (queima a boca)P into (queima a boca)P, as the still binary p-phrase could then not give rise to a Uniformity effect. Instead, it seems that the resulting phrasing is (queima)P(a boca)P, where the unary p-phrases apparently forced by the focus then give rise to the Uniformity effect that leads to splitting of the subject. This result is compatible with the intuitive assessment of these focused structures, in which there is stress on the focused verb, followed by another beat of stress on the object.

We conclude the section on focus with a remark on the nature of the stress retraction judgements, in which focus seems to us to play a role. In the cases in which stress retraction is normally preferred, stress retraction is never literally obligatory. Retraction can always be avoided by placing special emphasis on the otherwise retracting element. This is not unexpected, given the preceding discussion, if such special emphasis is in fact focus (or a related means of putting phrasal stress on the element in question): With the presence of phrasal stress on the otherwise retracting element, retraction is blocked in the account of Nespor and Vogel (1989), applied here to BP. [\[13\]](#)

7. Conclusion

In summary, our investigation of BP phrasing in terms of stress retraction allowed us to observe effects of phrasing due to syntactic influences, and others due to eurythmic factors. Two syntactic influences are captured in our account in terms of Align-XP,R and, in a subordinate manner, Wrap-XP. Two eurythmic factors found were captured in the length-restriction Max-Bin, as well as in an unexpected Uniformity requirement. The latter is arguably independent of prosodic length, and syntactically restricted to subject and verb.

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[1] The new information reading of sentences as a whole in our corpus is guaranteed by asking our consultants to judge whether retraction is or is not allowed if the sentences were read as newspaper headlines. This is important because, if focus or emphasis blocks retraction, topicalization of old information forces retraction to occur where otherwise it does not. We add a note on our elicitation technique here. Three consultants were interviewed in person by one of the writers of this paper, while two other consultants were consulted via e-mail, and one consultant underwent both types of tests. The consultations via e-mail were intended to ensure that the presence of a researcher did not interfere with the judgements. Importantly, the judgements converged across the two methods of elicitation. The elicitation of the sentences as new information (newspaper headline) was crucial in that, early in the elicitation process, one consultant was not thus instructed during a personal elicitation, and reported judgements that did not converge with the judgements of the other speakers reported in this paper. Two consultants were consulted more than once in order to test for internal consistency. The judgements were consistent across the two occasions. Note that our corpus manipulates two-syllable words in the retraction environment in order to guarantee that in case of stress clash, stress retraction would be the preferred remedy. Also in Santos 2001 bisyllabic words were selected to guarantee that retraction would be the preferred option to undo stress clashes. For other ways to undo stress clashes see Abousalh (1997). Stressed high vowels were avoided in our corpus because of an apparent tendency not to retract from a high vowel in BP for some speakers (e.g. *cajú branco* -> **cajú branco* 'white cashew fruit').

[2] Abousalh, on the basis of production data, shows that, although cases of stress clash were not abundant in her data, it was possible to notice that clashes were never undone when they occurred at the boundary of phonological phrases. Furthermore, the only cases of stress retraction under stress clash that did occur in her corpus were inside a phonological phrase. The data analyzed by Abousalh correspond to passages from the bible recorded from a catholic mass (first and second readings) broadcast by the TVE television network, Rio de Janeiro, Brazil. This type of data was selected because it presents a formal variety of spoken Brazilian Portuguese with different rates of speech.

[3] See also Hayes and Lahiri (1991) for a similar assumptions in Bengali, and Hsiao 2001 for arguments to this effect in Taiwanese.

[4] The data involving the word chinês 'Chinese' is based on four of our six consultants. The two other consultants generally did not accept stress retraction in the word chinês. The resistance to stress retraction for a subset of the speakers in a word like chinês might be related to the quantity sensitive nature of BP stress assignment, and to the heaviness of the closed second syllable of chinês. For a discussion of BP primary stress assignment see Bisol (1992).

[5] The edge alignment theory was formulated in Optimality Theory (Prince and Smolensky 1993) in Selkirk (1995), where

the notion of edge-alignment from Selkirk (1986) had independently been expanded in the theory of Generalized Alignment (McCarthy and Prince 1993). Truckenbrodt (1995, 1999) supports the claim that phrasal edge-alignment is a ranked and violable constraint in the grammar by showing how its effect may be suppressed by another syntax-prosody mapping constraint, Wrap-XP, in some languages, though in ways that still allow for the detection of the effects of the suppressed Align-XP in special cases. In section 3 we will suggest that Wrap-XP also has a subordinate role to play in BP phrasing.

[6] Costa (1998) argues for European Portuguese that the verb undergoes short distance movement to AgrO/v. In the resulting structure, an adverb may separate the verb and the object.

[7] A fully formalized account would also have to address the question whether Wrap-XP applies to the projection headed by the verb. Here the position of the verb becomes important—its phrasing behavior is predicted to differ depending on whether it heads a lexical projection (VP) or is adjoined to a higher functional projection (see the Lexical Category Condition to which Wrap-XP is subject in the account of Truckenbrodt (1999), following up on Nespor and Vogel (1986), Selkirk and Shen (1990), Selkirk (1995) and other work). We have pointed out above that the word-order facts with adverbs suggest that the verb does move to a higher position, but are unsure of the nature of this position. We therefore will not pursue this question here. We remark only that different assumptions about the syntax of the verb's position lead to coherent accounts of the phrasing here and elsewhere in this paper, though the different assumptions about the syntax will lead to different conclusions about crucial rankings among the constraints we have introduced.

[8] This judgement is sharper for the second and third examples in (18) than for the first example. An explanation for this fact is offered in a short paper by Santos 2001 about this particular issue. Santos argues that stress retraction is sensitive to the transitivity of a verb. According to Galves (1989), BP accepts the empty category *pro* in object position, and Santos compares truly intransitive verbs with verbs that have *pro* as the internal argument. The author concludes that they show different behavior for stress retraction under clash. Note that the verb in the first example in (18) may be construed with an internal argument *pro*, while the verbs of the other two examples may not be so construed.

[9] The second objects here are PPs, and thus binary syntactically. However, we believe that there is no word-stress on the functional prepositions here, and that the second objects thus do not consist of two prosodic words.

[10] Note that the preposition *para* undergoes vowel reduction in BP in a non-formal and non-emphatic speech. The reduced vowels are bracketed. As mentioned before, an emphatic realization, where the preposition bears a primary stress and where it does not undergo reduction, interferes with phonological phrasing and it was avoided.

[11] Stress retraction in a coordinated subject was accepted by one of our consultants if retraction could be applied in both of the coordinated nominal phrases. That is, an example like O *café quente* e o *José Carlos* sumiram 'The hot coffee and José Carlos disappeared' was accepted. We suspect interference from a possible parallelism requirement in the coordinated structure for this consultant, but will not pursue the matter here. The possibility of interference of course weakens the argument made on the basis of this construction.

[12] See, for example, Hayes and Lahiri (1991) for Bengali, Kanerva (1989, 1990), and Truckenbrodt (1999) for Chichewa. For a proposal to derive the insertion of the edge next to the focus from the assignment of prominence on the focus, see Truckenbrodt (1995).

[13] On the other hand, in the cases in which stress retraction is blocked for independent reasons, such as by Align-XP,R or by Uniformity in the account above, focus on the retracting element does not seem to affect the judgements. This is as expected, if the main effect of focus is to add stress, and thus possibly block retraction: Where retraction is blocked on independent grounds, focus will not change that picture.