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# Prosody: Theory and Experiment

Studies Presented to Gösta Bruce

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## THE INTERACTION OF CONSTRAINTS ON PROSODIC PHRASING

### 1. INTRODUCTION

The notion that the prosodic phrasing structure of a sentence plays a crucial role in organizing the segmental, tonal and prominence structures of a sentence's phonological representation and its phonetic implementation as well is quite widely assumed in work in both phonology and phonetics. It is also quite widely assumed that this prosodic phrasing structure is independent of, but related to, the syntactic and/or information structure of a sentence. Yet no consensus has emerged within the various traditions of research on prosodic phrasing concerning the nature of the relation between prosodic phrasing and these other distinct types of grammatical representation. Certain approaches foreground the role for syntactic constraints on prosodic phrasing<sup>1</sup>, others the role for constraints appealing to aspects of information structure<sup>2</sup>. There are, moreover, properly phonological constraints on prosodic phrasing which ignore these interface representations<sup>3</sup>. An adequate theory has to recognize the full diversity of constraints on prosodic phrasing, and in addition, make explicit the manner in which these constraints interact<sup>4</sup>.

The study of constraint interaction is at the heart of work in optimality theory (Prince and Smolensky 1993). Optimality theory sees a grammar as a set of ranked constraints on output representations. The constraints are hypothesized to be universal; it is in the ranking of the constraints with respect to each other that languages are claimed to differ. Central to optimality theory is the notion that constraints are in fact violable, but only minimally, and only under pressure from some higher ranked constraint. The claim is that the (grammatical) output representation generated on the basis of an input representation is not necessarily well-formed, in the sense of respecting all constraints, but rather is the *optimal* output representation possible, the one that best satisfies the constraint hierarchy. It is predicted, then, that a constraint may be disobeyed in some grammatical surface representation, but at the same time, that this constraint violation should arise only in order to satisfy some higher ranked constraint.

The aim of this paper is to illustrate potential gains to be made by understanding the functioning of constraints on prosodic phrasing from an

optimality theoretic point of view. First, using data from studies of sentence phonology in various Bantu languages, I would like to show that optimality theoretic constraint rankings provide the basis for an insightful typology of crosslinguistic variation in prosodic phrasing: the rather different patterns of prosodic phrasing attested in different languages can be understood as the consequence of different rankings of the same, putatively universal, constraints. Here the presentation is largely based on work by Truckenbrodt (1995). Then I would like to air some preliminary hypotheses about the hierarchy of constraints on prosodic phrasing in English, looking at the interaction of focus- and syntax-based constraints with each other and with constraints that are properly phonological in character. We will see that including an optimality theoretic ranking as part of the grammar of constraints extends the empirical coverage of a constraint system in highly desirable ways.

## 2

A number of illuminating indepth studies of the sentence phonology of Bantu languages have appeared in the last decade or so. These include works which explicitly investigate the patterns of prosodic phrasing that are revealed in tonal and segmental phenomena. Based in part on the thoroughgoing account by Kisseberth and Abasheikh (1974) of the distribution of contrastive and rule-governed vowel length in ChiMwiini<sup>5</sup>, in Selkirk (1986) I proposed that the syntax-prosodic structure relation is characterized by a set of interface constraints which require that the edge of every constituent of a designated type in the surface syntactic structure of a sentence coincide with (= align with) the edge of a prosodic constituent of a designated type in prosodic structure. In ChiMwiini, the distribution of vowel length was argued to be defined with respect to the major phonological phrase (MaP), and the distribution of major phrases in a sentence was argued to be determined by a constraint aligning the right edge of a maximal projection (XP) in syntactic structure with a MaP edge in prosodic structure<sup>6</sup>. In the McCarthy and Prince (1993) generalized alignment format, this constraint would be expressed as follows<sup>7</sup>:

(1) **Align<sub>R</sub> XP**

Align (XP, R; MaP, R)

"The right edge of any XP in syntactic structure must be aligned with the right edge<sup>8</sup> of a MaP in prosodic structure."

To see the effects of this constraint in ChiMwiini, consider the following examples with input syntactic structure (a) and output major phrase

organization (b). In (2) the subject NP is separated off in a distinct MaP from material in the following verb phrase, as shown by the presence of vowel length in the output: underlying and rule-governed vowel length is realized on the surface only in the penultimate or antepenultimate position of the major phrase.

(2) a. [ [mwa:na [wa [si:mba]<sub>NP</sub>]<sub>PP</sub>]<sub>NP</sub>] [ni [si:mba]<sub>NP</sub>]<sub>VP</sub> ]<sub>S</sub>

b. <sub>MaP</sub>(mwana wa si:mba) <sub>MaP</sub> <sub>MaP</sub>(ni si:mba) <sub>MaP</sub>

'A child of a lion is a lion.'

Note the disappearance of pre-pre-antepenultimate underlying length in *mwa:na* in (b), but the maintaining of underlying length in the penultimate syllable of *si:mba*. The major phrasing in (b) can be ascribed to Align<sub>R</sub> XP, which calls for a MaP edge to coincide with the right edge of the subject NP. Next, in example (3) the verb has two complements.

(3) a. [ [panzi:ze<sub>v</sub> [cho:mbo]<sub>NP</sub> [mwa:mba]<sub>PP</sub>]<sub>VP</sub> ]<sub>S</sub>

b. (panzize cho:mbo) <sub>MaP</sub> (mwa:mba) <sub>MaP</sub>

'He ran the vessel onto the rock.'

The first complement to the verb is joined with the verb in a major phrase, as shown by the absence of surface length in the second vowel in *panzi:ze*, which appears in a preantepenultimate position in the MaP. That *cho:mbo* retains its vowel length shows it is not in the same MaP with the following complement. The systematic presence of MaP breaks at the right (or left) edges of maximal projections, such as seen in examples (2) and (3) from ChiMwiini, are what will be called Align XP effects in what follows.

Investigations of sentence phonology in other Bantu languages have also detected what can be analyzed as Align XP effects. These languages include Chaga (McHugh 1987, 1990), Kimatumbi (Odden 1987, 1990, Truckenbrodt 1995), Kikuyu (Clements and Ford 1981) and Kinyambo (Bickmore 1989, 1990). In Chaga, for example, McHugh (1987) argues that various tonal phenomena take the major phrase as their domain. On the basis of such tonal evidence, the verb phrase in (4a) would be phrased in output structure as (4b), with the direct object NP separated into a distinct MaP from the preceding indirect object.

(4) a. [ [ámúénenga]<sub>v</sub> [prayáni]<sub>NP</sub> [mbúru]<sub>NP</sub> ]<sub>VP</sub>

b. (ámúénenga prayání) <sub>MaP</sub> (mburú) <sub>MaP</sub>

'(S)he has given Brian a goat.'



(8)

[[verb] [noun] <sub>NP</sub> [noun] <sub>NP</sub> ] <sub>VP</sub>	Align <sub>R</sub> XP	Wrap XP
a. ( verb noun ) <sub>MaP</sub> ( noun ) <sub>MaP</sub>		*
b. ( verb noun noun ) <sub>MaP</sub>	*!	

Candidates (a) and (b) both violate some constraint, but candidate (b) violates a higher ranked constraint, so it is candidate (a) which is the better candidate, the *optimal* one. The fatal higher violation is indicated by the exclamation mark. In tableau (9) the ranking of the two constraints is reversed. This is the ranking posited for the type B languages showing no Align XP effects in the basic cases. Now candidate (b) turns out to be optimal.

(9)

[[verb] [noun] <sub>NP</sub> [noun] <sub>NP</sub> ] <sub>VP</sub>	Wrap XP	Align <sub>R</sub> XP
a. ( verb noun ) <sub>MaP</sub> ( noun ) <sub>MaP</sub>	*!	
b. ( verb noun noun ) <sub>MaP</sub>		*

Candidate (a) violates the higher ranked constraint, fatally, and therefore the constraint violation exhibited by (b) is consistent with its optimal status. This, then, is an example of the sort of typology made available in optimality theory, assuming a universal constraint repertoire. Possible cross-linguistic differences are just those that would derive from differences in constraint ranking.

It might seem that an alternative conception would be to say simply that in the Type A languages the grammar includes the constraint Align XP, and in the Type B languages it does not. But it turns out that this alternative is empirically inadequate, precisely in the simplistic presumption that in the Type A languages Align XP is always at play and in the type B languages never at play. The factual situation is more complicated, and an optimality theoretic approach is required in order to model it. It turns out that under the appropriate circumstances the effects of a subordinate, lower-ranked, constraint may emerge, even though in most circumstances this constraint is violated in the language. Truckenbrodt (1995) argues that this is the case in Chichewa, whose phrasing is the subject of a study by Kanerva (1989, 1990).

Chichewa may on the face of it appear to be a language in which Align XP has no effect. Indeed, this is what Kanerva (1989) concluded, based on an

extensive investigation of the sentence phonology of Chichewa. For example, he shows that a verb phrase with multiple complements is prosodically phrased without any breaks within it, at least in conditions where no VP-internal constituents are in Focus:

(10) Chichewa: Neutral Case

a. [ [anaménya]<sub>V</sub> [nyu<sup>m</sup>bá]<sub>NP</sub> ["dí [mwálá]<sub>NP</sub> ]<sub>PP</sub> ]<sub>VP</sub>b. ( anaménya nyu<sup>m</sup>bá "dí mwáála )<sub>MaP</sub>

‘He hit the house with a rock.’

(The assumptions about analysis into major phrases are based on the distribution of vowel length – which is always, and only, found in the penult syllable of a MaP – and on various tonal phenomena.) Truckenbrodt (1995) argues, on the other hand, that in the grammar of Chichewa the constraint Align<sub>R</sub> XP is present, but subordinate to Wrap XP in the constraint hierarchy. This lower rank has the consequence that Align<sub>R</sub> XP is violated in this case:

(11) Chichewa: Neutral Case

[[anaménya] <sub>V</sub> [nyu <sup>m</sup> bá] <sub>NP</sub> ["dí mwálá ] <sub>PP</sub> ]	Wrap XP	Align XP
a. ( anaménya nyu <sup>m</sup> bá "dí mwáála ) <sub>MaP</sub>		*
b. ( anaménya nyu <sup>u</sup> ba ) <sub>MaP</sub> ("dí mwáála ) <sub>MaP</sub>	*!	

A particularly important aspect of Kanerva's study of Chichewa is his systematic examination of the phonological effects of Focus. Using responses to *wh*- questions, sentences with focus-sensitive particles and sentences with constructions calling for contrastive focus, Kanerva found that the right edge of a Focus constituent systematically coincided with the edge of a MaP. For example, the sentence we have been considering would be differently phrased with the direct object in Focus.

(12) Chichewa: Direct Object Focus

a. [ [ anaménya ]<sub>V</sub> [nyu<sup>m</sup>bá ]<sub>NP-FOCUS</sub> ["dí mwálá ]<sub>PP</sub> ]b. ( anaménya nyu<sup>u</sup>ba )<sub>MaP</sub> ( "dí mwáála )<sub>MaP</sub>

‘He hit the HOUSE with a rock’

Let us assume that such Focus effects are due to a constraint Align Focus, as has been suggested by a number of authors (Pierrehumbert and Beckman 1988, Kanerva 1989, Vogel and Kenesei 1990a-b, Hayes and Lahiri 1991, Jun 1993, among others), and that in Chichewa it is the Align<sub>R</sub> XP version that is at play:

(13) **Align<sub>R</sub> Focus<sup>10</sup>**

Align (Focus, R; MaP, R)

"Align the right edge of a Focus constituent in informational or syntactic structure with the right edge of a major phrase (MaP) in the phonological structure."

Truckenbrodt (1995) points out that the presence of these Focus effects in Chichewa shows that the constraint Align<sub>R</sub> Focus is higher ranked than Wrap XP, which is violated in this example. (14) is a tableau showing the effects of this ranking.

(14)

[[anaménya] <sub>V</sub> [nyu <sup>m</sup> bá] <sub>NP-FOCUS</sub> ["dí mwalá"] <sub>PP</sub> ]	Align <sub>R</sub> Focus	Wrap XP
a. (anaményá nyu <sup>m</sup> bá "dí mwáála) <sub>MaP</sub>	*!	
b. (anaményá nyuú <sup>m</sup> ba) <sub>MaP</sub> ("dí mwáála) <sub>MaP</sub>		*

Even though it respects Wrap XP, candidate a, with the violation of the higher ranking Align<sub>R</sub> Focus, is rejected, in favor of candidate b, which instead satisfies Align<sub>R</sub> Focus and thus violates Wrap XP.

Since constraint ranking is transitive, the ranking Align<sub>R</sub> Focus >> Wrap XP plus the ranking Wrap XP >> Align<sub>R</sub> XP gives the composite ranking (15):

(15) **Align<sub>R</sub> Focus >> Wrap XP >> Align<sub>R</sub> XP**

It is precisely this ranking, and, specifically, the inclusion of Align XP in the constraint hierarchy of Chichewa, that permits an explanation for a fact for which Kanerva had no account. The fact is that when the verb is focussed in two-complement VP's like those we have been considering, there appears a MaP break not only at the right of the focussed verb but also at the right of the first complement.

(16) **Chichewa: Verb Focus Case**

a. [ [ anaménya ]<sub>V-FOCUS</sub> [nyu<sup>m</sup>bá ]<sub>NP</sub> ["dí mwalá ]<sub>PP</sub> ]

b. ( anaménya )<sub>MaP</sub> ( nyuú<sup>m</sup>ba )<sub>MaP</sub> ( "dí mwáála )<sub>MaP</sub>

'He HIT the house with a rock'

The MaP at the right edge of the verb is to be expected, given Align<sub>R</sub> Focus. But why should a MaP also appear after the first complement, which is not itself focussed? As Truckenbrodt points out, the presence of this seemingly unexpected phrase break after the direct object is a direct consequence of assuming the constraints and the ranking in (15). This is shown in tableau (17)<sup>11</sup>:

(17)

[[anaménya] <sub>V-FOCUS</sub> [nyu <sup>m</sup> bá] <sub>NP</sub> ["dí mwalá"] <sub>PP</sub> ]	Align <sub>R</sub> Focus	Wrap XP	Align <sub>R</sub> XP
a. (anaménya) <sub>MaP</sub> ( nyuú <sup>m</sup> ba ) <sub>MaP</sub> ("dí mwáála) <sub>MaP</sub>		*	
b. (anaményáa) <sub>MaP</sub> (nyu <sup>m</sup> bá "dí mwáála) <sub>MaP</sub>		*	*!
c. (anaményá nyu <sup>m</sup> bá "dí mwáála) <sub>MaP</sub>	*!		

(The shading in the tableau appears in cells to the right of (i.e. below) a cell containing a fatal violation (\*!), in order to show that any further, lower, constraint violations are irrelevant to the determination of the optimal candidate.) In the tableau we see that candidate (a), which has a phrase break after the direct object in addition to a break after the focussed verb, is optimal. This is because satisfaction of the highest ranked Align<sub>R</sub> Focus constraint forces the violation of Wrap XP. Given that Wrap XP must be violated in any candidate satisfying Align<sub>R</sub> Focus, as seen in candidates a and b, it is no longer determinant in evaluating the relevant candidates, and in that case the effects of the lower ranked Align<sub>R</sub> XP are allowed to emerge. It is the candidate which satisfies Align<sub>R</sub> XP – with the presence of a phrase break after the direct object – that is the optimal output for the input with verb in Focus. So, Truckenbrodt concludes, we must assume that both Wrap XP and Align<sub>R</sub> XP are at play in the grammar of Chichewa.<sup>12</sup>

2.2

Grammaticized in the form of constraints, the cohesional function of Wrap XP and the demarcative function of Align XP are at odds with each other. It is not

possible that in a given prosodic structure the elements of the same maximal projection in syntactic structure be included in the same major phrase, as called for by Wrap XP, and at the same time that the edges of maximal projections within that higher phrase be denoted by major phrase breaks, as called for by Align XP. When it comes to the syntax-prosodic structure interface, languages must opt for a dominant cohesional strategy or a dominant demarcative strategy, as represented by the relative rankings of Wrap XP and Align XP. The constraint Align Focus is also demarcative, and thus at odds with Wrap XP. A language like Chichewa shows that even where a dominant cohesional strategy is chosen, through the ranking Wrap XP >> Align XP, the demarcative strategy takes precedence when it comes to Align Focus, which dominates Wrap XP in the ranking Align Focus >> Wrap XP.

In other realms, cohesional and demarcative strategies are not necessarily opposed. Phonological and phonetic phenomena which are demarcative in the sense of being defined with respect to the edges of prosodic units, coexist happily in the same phrase with other phonological or phonetic phenomena which are defined across the span of the phrase. To take an example from Bruce and his co-workers' work on Swedish phrasal prosody (e.g. Bruce et al. 1991, 1993), the presence of a phrase accent at the edge of a prosodic phrase (construed to be demarcative) in no way precludes the presence of a downstepping pattern across the phrase (construed to be cohesional). It is in characterizing the interface between prosodic structure and other grammatical representations – morphosyntactic or informational – that the cohesional and demarcative functions come into conflict and where a language must apparently 'decide', through constraint ranking, which of the functions will predominate.

### 3.

The facts that we will consider in the following sections give support for hypothesizing (i) that the constraints Align<sub>R</sub> XP, Wrap XP and Align<sub>R</sub> Focus form part of an account of major phonological phrasing in English, and (ii) that phonological constraints on phrasing interact with these interface constraints in providing a full account of English major phrasing. Some of these notions have surfaced in one way or another in previous work, though the manner in which major phrasing in English relates to syntactic structure or information structure has not yet been the subject of any comprehensive investigation<sup>13</sup>. The remarks that follow are rather speculative, pointing to directions for further research, rather than firm results acquired on the basis of systematic study. They are intended to show the gains that are potentially to be made by understanding the grammar of constraints on phrasing in optimality theoretic terms.

### 3.1

The hallmark of the English major phrase (aka intermediate phrase), according to Beckman and Pierrehumbert (1986), is the presence of the phrase accent, a Low or High peripheral tone located at the phrase's right edge, and in what follows we will use the presence or absence of this peripheral tone to diagnose the presence of major phrase breaks<sup>14</sup>. A first observation about phonological phrasing in English is that a fluent, but not particularly rapid rendering of a verb phrase with multiple complements and no VP-internal Focus does not require the presence of a major phrase break within it. For example, the sentences in (18) may all be pronounced with one major phrase. Which is to say that no peripheral phrase accents are necessary between the successive complements.

(18) Available in neutral informational contexts:

- a. (She loaned her róllebldes to Róbin.)<sub>MaP</sub>
- b. (She púshed Sám's bóat into the wáter.)<sub>MaP</sub>
- c. (She gáve Zóe a báckrub.)<sub>MaP</sub>
- d. (She sént her sincere regréts to Luís.)<sub>MaP</sub>

(The acute accent in these sentences stands for a High pitch accent on the relevant syllable, and the presence of a right MaP bracket should be taken as indicating the presence of a L phrase accent, unless otherwise stated.) Let us consider a circumstance in which such utterances, with accents on all the content words and no VP-internal focus, would be appropriate. B comes across a notebook of A's which has a number of one sentence journal entries each describing an event of some day. C asks B to report what A has written, and B utters the sentences in (18). With these utterances, B has made no presumptions about A's point of view, nor has B, as speaker, imposed any particular perspective on the information the utterance contains. The utterances lack a focus or topic structure, and all information is treated as new. These are 'neutral' pronunciations of such sentences. The fact that all these elements of the VP may be included in the same MaP in this case might seem to suggest that Wrap XP dominates Align XP in the grammar of English, as in Chichewa. But if that were so, then there would be no explanation for the fact that there are variants of the utterances in (18) which are produceable in the same 'neutral' circumstances and which *do* show a MaP break after the first complement:



- (19) Also available in neutral informational contexts:
- (She *lóaned* her *róllerblades*)<sub>MaP</sub> ( to *Róbin.*)<sub>MaP</sub>
  - (She *púshed* *Sám's bóat*)<sub>MaP</sub> (into the *wáter.*)<sub>MaP</sub>
  - (She *gáve* *Zóe*)<sub>MaP</sub> (a *báckrub.*)<sub>MaP</sub>
  - (She *sént* her sincere *regréts*)<sub>MaP</sub> (to *Luís*)<sub>MaP</sub>

This is the pattern of phrasing that would be expected with the opposite ordering of Wrap XP and Align<sub>R</sub> XP in the constraint hierarchy. Making the universalist assumption that Wrap XP and Align XP are indeed part of the constraint grammar of English, it must be concluded that they are not ranked with respect to each other, i.e. that they occupy the *same* rank in the English constraint hierarchy, and moreover that no other higher ranked constraint rules in favor of one or the other. As we see in the tableau in (20), when Wrap XP and Align<sub>R</sub> XP are same-ranked (in the notation: separated only by a dotted line), candidates (a) and (b) show the same number and rank of constraint violations, and so are equally optimal.

(20)

[ she [lóaned] [her róllerblades] <sub>NP</sub> [ to Róbin ] <sub>PP</sub> ] <sub>VP</sub>	Wrap XP	Align <sub>R</sub> XP
a. (she <i>lóaned</i> her <i>róllerblades</i> to <i>Róbin</i> ) <sub>MaP</sub>		*
b. (she <i>lóaned</i> her <i>róllerblades</i> ) <sub>MaP</sub> (to <i>Róbin</i> ) <sub>MaP</sub>	*	

Assuming the existence of Wrap XP and Align XP, then, this pattern of variability in the pronunciation of a sentence with the same informational structure requires us to assume no domination of one by the other. On this account, English is a language which simply fails to choose between a cohesional and a demarcative strategy for phrasing.

There is a further fact which requires us to elaborate this explanation for the attested variation between (18) and (19). This is the apparent unacceptability – in the ‘neutral’ informational context under discussion – of the further pattern of phrasing seen in (21), where the verb, the first complement and the second complement all form major phrases on their own. This sort of pronunciation is possible in English, but seems restricted to the case where the verb is focussed (which we will discuss below).

- (21) Unavailable when verb is not focussed:

- (She *lóaned*)<sub>MaP</sub> (her *róllerblades*)<sub>MaP</sub> ( to *Róbin.*)<sub>MaP</sub>
- (She *púshed*)<sub>MaP</sub> (*Sám's bóat*)<sub>MaP</sub> (into the *wáter.*)<sub>MaP</sub>
- (She *gáve*)<sub>MaP</sub> (*Zóe*)<sub>MaP</sub> (a *báckrub.*)<sub>MaP</sub>
- (She *sént*)<sub>MaP</sub> (her sincere *regréts*)<sub>MaP</sub> (to *Luís*)<sub>MaP</sub>

So the grammar must exclude this pronunciation for inputs where the verb is not focussed. It is worth noting at this point that the further logically possible pattern of phrasing in (22), where a phrase break occurs after the verb but not after the first complement, seems not to be available at all.

- (22) a. \*(She *lóaned*)<sub>MaP</sub> (her *róllerblades* to *Róbin.*)<sub>MaP</sub>  
 b. \*(She *púshed*)<sub>MaP</sub> ( *Sám's bóat* into the *wáter.*)<sub>MaP</sub>  
 c. \*(She *gáve*)<sub>MaP</sub> ( *Zóe* a *báckrub.*)<sub>MaP</sub>  
 d. \*(She *sént*)<sub>MaP</sub> (her sincere *regréts* to *Luís*)<sub>MaP</sub>

Consider now the more complete tableau (23), which includes in (c) a candidate from (21) and in (d) the corresponding candidate from (22):

(23)

[ she [lóaned] [her róllerblades] <sub>NP</sub> [ to Róbin ] <sub>PP</sub> ] <sub>VP</sub>	Wrap XP	Align XP
a. (she <i>lóaned</i> her <i>róllerblades</i> to <i>Róbin</i> ) <sub>MaP</sub>		*
b. (she <i>lóaned</i> her <i>róllerblades</i> ) <sub>MaP</sub> (to <i>Róbin</i> ) <sub>MaP</sub>	*	
c. (she <i>lóaned</i> ) <sub>MaP</sub> (her <i>róllerblades</i> ) <sub>MaP</sub> (to <i>Róbin</i> ) <sub>MaP</sub>	*	
d. (she <i>lóaned</i> ) <sub>MaP</sub> (her <i>róllerblades</i> to <i>Róbin</i> ) <sub>MaP</sub>	*	*!

Note that candidate (d) is correctly rejected as nonoptimal. It violates both Wrap XP and Align XP. Having these two violations is fatal, given that the alternative candidates incur only one violation with respect to this constraint pair. The problem here has to do with candidate (c), which is wrongly considered to be just as optimal as candidates (a) and (b). (The ‘bad apple’, with a bite taken out of it, indicates a candidate wrongly considered to be optimal.) It incurs just one violation, of Wrap XP. Recall from the discussion of Chichewa that it is necessary to assume that Wrap XP does not care *how many* major phrases a particular XP is parcelled out into; it is violated whenever it is the case the elements of a particular XP are not all wrapped up in a single MaP. Thus candidate (c), like candidate (b) incurs just one violation of Wrap XP. In both cases the violation is incurred by the VP, which fails to be included in a single MaP in prosodic structure. So the nonoptimality of

candidate (c) in these informational circumstances must be the consequence of some other constraint(s) in the grammar of English.

## 3.2

It has been suggested that constraints on the minimum and maximum size of prosodic constituents are part of the universal repertoire. These size constraints assess the wellformedness of a constituent of a particular level of prosodic structure  $C^i$  in terms of the number of constituents of a particular lower level  $C^{i-1}$  that it contains. Perhaps what rules out the excessive phrasing of candidate (c) in (23) are phonological constraints on the size of the major phrase. Such constraints would assess each MaP for its composition in terms of constituents at the next lower level of phrasing, which I assume to be the minor phrase (aka accentual phrase). I take the defining feature of the minor/accentual phrase to be that it contains an accent.<sup>15</sup> We might suppose that there are two size constraints on major phrases, one that calls for an MaP to consist of *at least* two minor/accentual phrases (call it Binary Minimum (MaP), or BinMin<sub>MaP</sub>), and another that calls for a MaP to consist of *no more* than two minor/accentual phrases (call it Binary Maximum (MaP) or BinMax<sub>MaP</sub>). In what follows, we will simply assume a single binarity constraint, Binary(MaP), given in (24iii), since there is no evidence from the English data to be considered that allows one to ascertain a distinct role for BinMin(MaP) and BinMax(MaP).

- (24) (i) **Binary Maximum(MaP)**  
A major phrase may consist of at most two minor/accentual phrases.
- (ii) **Binary Minimum(MaP)**  
A major phrase must consist of at least two minor/accentual phrases.
- (iii) **Binary(MaP)**  
A major phrase consists of just two minor/accentual phrases.

We will assume that in the unmarked case the accent count of an utterance reflects the number of minor or accentual phrases into which the utterance is organized.

If we add the binary size constraint to the grammar of English phrasing that we are constructing, then we can account for the unacceptability of candidate (c) alongside the availability of both (a) and (b). We see this in tableau (25):

(25)

[ she [lóaned] [her rólleblades] <sub>NP</sub> [ to Róbin ] <sub>PP</sub> ]	Wrap XP	Align <sub>R</sub> XP	BinMaP
☞ a. (she lóaned her rólleblades to Róbin) <sub>MaP</sub>		*	*
☞ b. (she lóaned her rólleblades) <sub>MaP</sub> (to Róbin) <sub>MaP</sub>	*		*
c. (she lóaned) <sub>MaP</sub> (her rólleblades) <sub>MaP</sub> (to Róbin) <sub>MaP</sub>	*		***!
d. (she lóaned) <sub>MaP</sub> (her rólleblades to Róbin) <sub>MaP</sub>	*	*!	*

(The vertical dotted lines indicate that the constraints flanking the lines are same-ranked with respect to each other; the vertical solid line between the interface constraints and the size constraint indicates that the interface constraints are higher ranked than the size constraint.) Candidates (a) and (b) are still both optimal given this expanded constraint hierarchy. (a) incurs a violation of Align XP, and in so doing incurs a violation of Bin(MaP)) as well; (b) incurs a violation of Wrap XP, and in addition a violation of Bin(MaP). Given the same ranking of the members of Wrap XP and Align XP, the marks against these candidates are equivalent. As for (d), its nonoptimality in this candidate set can be traced to its two violations of the interface constraints. But the second violation of the interface constraint pair in (d) would be fatal only if the interface constraint pair were ranked above the size constraint. If the interface constraints and the size constraint were same-ranked, it is the cumulative three violations of constraints in d) (as against the two violations in (a) and (b)) that would be determinate. Candidate (c) comes out much worse than either (a) or (b), and this is because of its three violations of Bin(MaP). Note that these results would be obtained whether or not Binary(MaP) were ranked below the interface constraints. If the constraints were all same-ranked, the constraint violations in each line would simply be summed up, but it would still be the case that candidate (c) was not optimal, since its total number of constraint violations would be greater than those of candidates (a) and (b), which have an equivalent number of total violations. The higher rank of the interface constraints, assumed in the tableau but not crucial to the present argument, will be argued for in the next section.

Considered from the point of view of the size constraint alone, (d) is as optimal as candidates (a) and (b). Like (a) and (b) it incurs just one size constraint violation. This means that an alternative conception of English phrasing based on the notion that phonological size constraints alone account for the phrasing patterns is not adequate. And we saw above that the interface constraints Wrap XP and Align XP are not on their own adequate to provide an

account of the facts of major phrasing in English either. The hypothesis entertained here is that the English constraint hierarchy includes constraints of both general types, and that they together provide the basis of the phrasing patterns seen thus far.

It is not possible to explore much further here the consequences of assuming a role for the constraint Bin(MaP) in accounting for English phrasing patterns. But it should be pointed out that this constraint predicts that small changes in the phonological composition of a sentence can have significant phrasing consequences. For example, suppose that the indirect object of the example sentence discussed above was the phrase *Róbin's sístér*, with two accented words, rather than the the singly accented *Róbin*. This would give the sentence *She lóaned her rólleblades to Róbin's sístér*. As the tableau in (26) shows, the constraint system now predicts that there is only one optimal candidate, the one with an analysis into two perfectly binary major phrases:

(26)

[she [lóaned] [her rólleblades] <sub>NP</sub> [to Róbin's sístér] <sub>PP</sub> ]	Wrap	Align	Bin(MaP)
	XP	XP	
a. (she lóaned her rólleblades to Róbin's sístér) <sub>MaP</sub>		*	*!
b. (she lóaned her rólleblades) (to Róbin's sístér) <sub>MaP</sub>	*		
c. (she lóaned) (her rólleblades) (to Róbin's sístér) <sub>MaP</sub>	*		*!*
d. (she lóaned) (her rólleblades to Róbin's sístér) <sub>MaP</sub>	*	*!	

Candidate (b) violates Wrap XP, but incurs no violation at all of Bin(MaP). It is a better candidate than (a) or any of the others, all of which violate some size constraint in addition to incurring at least one violation of the interface constraints. As the sole optimal candidate, (b) should be the only available pronunciation of the input given. Intuitions suggest that (b) is highly preferred at the fluent, not particularly rapid speech rate at which the other examples above were assessed. This is a promising result, though one, like the others, which would need to be solidified on the basis of non-intuition-based investigation.

## 3.3

Let us consider next cases where one of the constituents of the complex VPs that we have been examining is a Focus. I believe English is like Chichewa in aligning the edge of a major phrase with the right edge of a Focus constituent (cf. Vogel and Kenesei 1990a-b). This effect emerges in varying the position

of Focus in sentences having the verb phrase structure of those examined above, as we see in (27):

(27)

- (i) [ Verb XP YP<sub>FOC</sub> ]<sub>VP</sub>:      She [lóaned [her rólleblades] [to Róbin]<sub>FOC</sub>]<sub>VP</sub>
- a.      (She lóaned her rólleblades to **Róbin**)<sub>MaP</sub>
- b.      (She lóaned her rólleblades)<sub>MaP</sub> (to **Róbin**)<sub>MaP</sub>
- c.      \*(She lóaned)<sub>MaP</sub> (her rólleblades)<sub>MaP</sub> (to **Róbin**)<sub>MaP</sub>
- d.      \*(She lóaned)<sub>MaP</sub> (her rólleblades to **Róbin**)<sub>MaP</sub>
- (ii) [ Verb XP<sub>FOC</sub> YP ]<sub>VP</sub>:      She [lóaned [her rólleblades]<sub>FOC</sub> [to Róbin]]<sub>VP</sub>
- a.      \*(She lóaned her **rólleblades** to Róbin)<sub>MaP</sub>
- b.      (She lóaned her **rólleblades**)<sub>MaP</sub> (to Róbin)<sub>MaP</sub>
- c.      \*(She lóaned)<sub>MaP</sub> (her **rólleblades**)<sub>MaP</sub> (to Róbin)<sub>MaP</sub>
- d.      \*(She lóaned)<sub>MaP</sub> (her **rólleblades** to Róbin)<sub>MaP</sub>
- (iii) [ Verb<sub>Foc</sub> XP YP ]<sub>VP</sub>:      She [lóaned<sub>Foc</sub> [her rólleblades] [to Róbin]]<sub>VP</sub>
- a.      \*(She **lóaned** her rólleblades to Róbin)<sub>MaP</sub>
- b.      \*(She **lóaned** her rólleblades)<sub>MaP</sub> (to Róbin)<sub>MaP</sub>
- c.      (She **lóaned**)<sub>MaP</sub> (her rólleblades)<sub>MaP</sub> (to Róbin)<sub>MaP</sub>
- d.      \*(She **lóaned**)<sub>MaP</sub> (her rólleblades to Róbin)<sub>MaP</sub>

In the representations (a-d) under each different Focus case are the grammaticality judgments assigned to each of the relevant candidates. The available phrasings can be checked out by considering the discourse contexts where they would be felicitously produced. Suppose the same scenario as above, where B has read A's journal entry, e.g. *I have loaned my rollerblades to Robin*, and is reporting it to C. What's different in these cases is that B is imposing an informational structure on the utterance, expressed as a Focus on one or the other of the constituents. What's the same is that all the information is 'new', and hence the pitch accenting is as above. Case (i) involves Focus of the indirect object. Suppose that B is surprised that Robin, of all people, would be the person to whom A would lend her rollerblades. B might then utter the sentence with *Robin* in Focus, as in (27i-a) or (27i-b). The available phrasings in this case actually turn out to be identical to those of (25ab), where *Robin* is not in Focus<sup>16</sup>. This is predicted, since in the case of (27i-ab) the MaP edge required by Align Focus is sentence-final, where a MaP edge is required in any case. Consider next case (ii), where the direct object is in Focus. We have the same journal-entry reporting scenario as above, except that what B finds

surprising is that A would lend Robin her precious rollerblades, of all things. This surprise is articulated in B's report to C by a Focus on *rollerblades*. As indicated in (27ii-b), a phrase break follows the Focus in this case. It is important to underline that *Robin* is new in this discourse, and so is accented; the major phrase following the major phrase which ends in the Focus thus contains an accent itself. The significance of this fact will be discussed below. Finally, consider case (iii), where the verb is in Focus. We have the same journal-reading scenario, with a slightly different twist. C mentions the rumor that A has been getting rid of all her things, and asks B if there is any evidence of that in the journal. B replies with (27iii-c), putting a Focus on *loan*, and wondering if this might be the evidence C is looking for. As above, what follows the verb is informationally new, and hence accented.

What is particularly interesting about this last case with Focus on the verb is the apparent need to locate a MaP break both after the focussed verb and after the direct object as well. The pronunciation in (27iii-c) is preferred to the pronunciation in (27iii-d)<sup>17</sup>, which also respects the Align<sub>R</sub> Focus constraint. My hypothesis here is that the explanation for the phrasing pattern in (27iii) involves ranking Align<sub>R</sub> Focus above the morphosyntactic interface constraints in English, as in Chichewa.

(28) Align<sub>R</sub> Focus >> Wrap XP, Align<sub>R</sub> XP

The tableau in (29) shows that candidates (a) and (b) are both non-optimal because of the violation of high-ranked Align<sub>R</sub> Focus that they each incur.

(29)

[she [lóaned] <sub>V-FOC</sub> [her róllerblades] <sub>NP</sub> [to Róbin] <sub>PP</sub> ]	Align <sub>R</sub> Focus	Wrap XP	Align <sub>R</sub> XP
a. (she <b>lóaned</b> her róllerblades to Róbin) <sub>MaP</sub>	*!		
b. (she <b>lóaned</b> her róllerblades) <sub>MaP</sub> (to Róbin) <sub>MaP</sub>	*!		
c. (she <b>lóaned</b> ) <sub>MaP</sub> (her róllerblades) <sub>MaP</sub> (to Róbin) <sub>MaP</sub>		*	
d. (she <b>lóaned</b> ) <sub>MaP</sub> (her róllerblades to Róbin) <sub>MaP</sub>		*	*!

The remaining candidates, which respect Align<sub>R</sub> Focus, both incur a violation of Wrap XP, and the choice between the two therefore falls to Align<sub>R</sub> XP. Since Align<sub>R</sub> XP is not violated in candidate (c), (c) is optimal. Thus far, then, the explanation for the multiple phrasing under verb Focus within a VP with two complements parallels that for the Chichewa case, despite the fact that Align<sub>R</sub> XP and Wrap XP are same-ranked in English.

Note now that the result that candidate (c) is optimal in case (27iii) will stand only if the Wrap XP-Align XP pair are ranked higher than Bin(MaP), the binary size constraint on major phrases I suggested is playing a role in English. This is because, as we saw above, candidate (c) incurs three violations of Bin(MaP) while candidate (d) incurs just one violation of Bin(MaP). If the size constraint were at the same rank as the morphosyntactic interface constraints, it is (d) that would be ruled optimal. We see this in (30), where the bad apple indicates that the candidate is wrongly ruled optimal.

(30)

[she [lóaned] <sub>FOC</sub> [her róllerblades] <sub>NP</sub> [to Róbin] <sub>PP</sub> ]	Align Foc	Wrap XP	Align XP	Bin (MaP)
a. (she <b>lóaned</b> her róllerblades to Róbin) <sub>MaP</sub>	*!			
b. (she <b>lóaned</b> her róllerblades)(to Róbin) <sub>MaP</sub>	*!			
c. (she <b>lóaned</b> )(her róllerblades)(to Róbin) <sub>MaP</sub>		*		***!
d. (she <b>lóaned</b> )(her róllerblades to Róbin) <sub>MaP</sub>		*	*	*

This then is an argument in favor of ranking the Wrap XP-Align XP pair above Bin(MaP), as in (31):

(31) Align<sub>R</sub> Focus >> Wrap XP, Align<sub>R</sub> XP >> Bin(MaP)

With Bin(MaP) ranked lower, the result that (c) is the optimal candidate is preserved. We see this in tableau (32):

(32)

[she [lóaned] <sub>FOC</sub> [her róllerblades] <sub>NP</sub> [to Róbin] <sub>PP</sub> ]	Align Foc	Wrap XP	Align XP	Bin (MaP)
a. (she <b>lóaned</b> her róllerblades to Róbin) <sub>MaP</sub>	*!			
b. (she <b>lóaned</b> her róllerblades)(to Róbin) <sub>MaP</sub>	*!			
c. (she <b>lóaned</b> )(her róllerblades)(to Róbin) <sub>MaP</sub>		*		***
d. (she <b>lóaned</b> )(her róllerblades to Róbin) <sub>MaP</sub>		*	*!	

Given this ranking, the greater number of violations of Bin(MaP) in candidate (c) are irrelevant; it is the violation of the two higher-ranked morphosyntactic interface constraints in (d) that is fatal.

Finally, let us assure ourselves that the proper patterns of phrasing for the other Focus cases in (27) are obtained with this constraint hierarchy. Tableau (33) shows that in the case of direct object Focus, it is only candidate (b) that is ruled optimal.

(33)

[she [[lóaned] [her róllerblades] ] <sub>NP-FOC</sub> [to Róbin] ] <sub>PP</sub> ]	Align Foc	Wrap XP	Align XP	Bim (MaP)
a. (she lóaned her róllerblades to Róbin) <sub>MaP</sub>	*!			
b. (she lóaned her róllerblades)(to Róbin) <sub>MaP</sub>		*		*
c. (she lóaned)(her róllerblades)(to Róbin) <sub>MaP</sub>		*		**!*
d. (she lóaned)(her róllerblades to Róbin) <sub>MaP</sub>	*!			

The two candidates that respect Align Focus, (b) and (c), both violate Wrap XP; they are therefore distinguished by their number of Bin(MaP) violations, and it is (b) that wins, as desired. In the tableau in (34), we have the case of the sentence-final indirect object focus.

(34)

[she [[lóaned] [her róllerblades] ] <sub>NP</sub> [to Róbin] <sub>FOC</sub> ] <sub>PP</sub> ]	Align Foc	Wrap XP	Align XP	Bin(MaP)
a. (she lóaned her róllerblades to Róbin) <sub>MaP</sub>			*	*
b. (she lóaned her róllerblades)(to Róbin) <sub>MaP</sub>		*		*
c. (she lóaned)(her róllerblades)(to Róbin) <sub>MaP</sub>		*		**!*
d. (she lóaned)(her róllerblades to Róbin) <sub>MaP</sub>		*	*!	

All candidates in this set respect the Align<sub>R</sub> Focus constraint. Candidate (d) fatally violates both Wrap XP and Align<sub>R</sub> XP, leaving it to the Bin(MaP) to determine which of the other candidates are optimal. As before, (c) is ruled out due to the number of violations of Bin(MaP), and so it is (a) and (b), which each violate Bin(MaP) once, that are again both optimal.

To sum up this section, then, the data paradigm above in (27) gives a first round of evidence in favor of the presence in the grammar of English of a constraint aligning the edge of a MaP with the right edge of a Focus constituent, i.e. Align<sub>R</sub>Focus. That constraint plays a crucial role in explaining the patterns available for the verb Focus and direct object Focus cases. The paradigm also gives further evidence in favor of the presence of Align<sub>R</sub>XP in the grammar, in the preference of (c) over (d) in the verb Focus case. It is of interest, then to observe that these alignment constraints are often enough violated in utterances of English. The next section examines such cases.

### 3.4

The grammaticality judgments reflected in the data in (27) and in (18)-(21) crucially involved utterances where the informational content was all new, and as a consequence the content words were all pitch accented. The patterns of phrasing attested would not necessarily be the same under different assignments of pitch accent. Consider now, by contrast, utterances containing a nonfinal Focus which is followed by no accented material. Such an utterance would be naturally produced in the following dialogue, where the material following the focussed verb *lóaned* in B's response is old information:

- (35) A. That Roberta! What a cheapskate! She rénted<sub>FOC</sub> her róllerblades to Róbin!  
B. That's not true. She lóaned<sub>FOC</sub> her rollerblades to Robin.

In B's response, both *rollerblades* and *Robin* would lack an accent. The standard assumption is that the major phrasing (aka intermediate phrasing) of such an utterance would be as in (36)<sup>18</sup>:

- (36) (She lóaned her rollerblades to Robin)<sub>MaP</sub>

Here no MaP edge appears at the right edge of the Focus, rather the first phrase break following the Focus coincides with the end of the sentence. This is not the phrasing predicted by the constraint hierarchy in (31), which as it stands calls for the inappropriate phrasing in (37).

- (37) (She lóaned)<sub>MaP</sub> ( her rollerblades)<sub>MaP</sub> (to Robin)<sub>MaP</sub>

I want to suggest that the choice of the phrasing in (36) is optimal over that in (37) is the consequence of a high-ranking phonological constraint on minor (accentual) phrases which requires that any minor phrase include at least one pitch accent:

(38) **MiPAccent**

A minor phonological phrase (MiP) contains at least one accent.<sup>19</sup>

Since any major phrase must consist of at least one minor phrase<sup>20</sup>, this constraint has the effect of a constraint requiring that any major phrase contain at least one accent. Such a constraint on major (aka intermediate) phrases has been presumed in descriptive generalizations about the properties of English prosodic phrasing (e.g. Pierrehumbert and Beckman 1988) and is elevated to the status of law in the ToBI guidelines (Beckman and Ayers 1994) for transcribing English intonation, which disallow transcriptions where a sequence of intermediate (aka major) phrase breaks flank a string containing no accent.

We will instead want to understand this to be a constraint on minor/accental phrases if we are to maintain our account of the role for size constraints on major phrasing that was sketched above. That account assumed that each accent in the utterance corresponded to a minor/accental phrase. It is the constraint MiPAccent that guarantees that result.

It is enough to assume that the properly phonological constraint MiPAccent is higher ranked than Align<sub>R</sub>Focus, an interface constraint, to ensure that the phrasing attested in (36) is indeed that which would be ruled optimal by the grammar. The tableau in (39) provides the argument for this MiPAccent >> Align<sub>R</sub>Focus ranking. Assume that in the set of candidates considered here each MaP dominates just one minor phrase:  $MaP(MiP(\dots)MiP)MaP$ .

## (39)

[ she [lóaned] <sub>V-FOCUS</sub> [her rollerblades] <sub>NP</sub> [ to Robin ] <sub>PP</sub> ]	MiPAccent	Align Focus
a. (she lóaned her rollerblades to Robin) <sub>MaP</sub>		*
b. (she lóaned her rollerblades) <sub>MaP</sub> (to Robin) <sub>MaP</sub>	*!	
c. (she lóaned) <sub>MaP</sub> (her rollerblades) <sub>MaP</sub> (to Robin) <sub>MaP</sub>	*!*	
d. (she lóaned) <sub>MaP</sub> (her rollerblades to Robin) <sub>MaP</sub>	*!	

In candidate (c), the two MaPs which follow the MaP break at the right edge of Focus each lack an accent, which means that their component MiP's each lack an accent. Each MiP in MaP thus incurs a violation of MiPAccent. Just one violation of MiPAccent is enough to be fatal, since there is another candidate, (a), which shows no violation at all of that constraint. Thus

candidates (b) and (d) are nonoptimal since in each there is one accentless MaP (dominating an accentless MiP) in the representation. We see then that candidate (a) is ruled optimal, even though it violates Align<sub>R</sub>Focus, because the other candidates all show violations of the higher ranked MiPAccent. Here the high rank of the phonological constraint MiPAccent is achieving just the desired effect.

We are not at the end of our account, however, for a further set of candidates must be ruled out, ones which satisfy MiPAccent through the insertion (epenthesis) of a pitch accent. I am assuming that pitch accents are morphemes in English and thus form part of the surface syntactic representation (cf. Gussenhoven 1983, 1984, Selkirk 1984, 1995b, Pierrehumbert and Hirschberg 1990) that is in an interface relation with the phonology. The epenthesis of a pitch accent into the phonological representation (or the deletion of a pitch accent present in the interface syntactic representation) would incur violations of the faithfulness constraints that regulate the relation between interface representations in optimality theory. In the correspondence theory of faithfulness (McCarthy and Prince 1995), there are DEP constraints which penalize epenthesis and MAX constraints which penalize deletion. The intuitions captured are that, ideally, the output is strictly dependent on the input (hence DEP), and that, ideally, the input is maximized in the output (hence MAX). Correspondence theory can also hold of the relation between interface representations. A constraint DEP(Accent), which rules out the presence of any pitch accent in the phonological output that is not in the corresponding interface representation, will complete our account.

(40) **DEP (Accent)**

An accent in the output representation must have a corresponding accent in the interface representation.

Ranking DEP(Accent) above Align<sub>R</sub>Focus will guarantee that the candidate we saw above in (39a) is indeed optimal, in comparison with candidates that insert accents in order to satisfy the high-ranked MaP. This can be seen in the tableau in (41):

(41)

[ she [lóaned] <sub>V-FOCUS</sub> [her rollerblades] <sub>NP</sub> [ to Robin ] <sub>PP</sub> ]	MiP Accent	DEP (Accent)	Align Focus
a. (she lóaned her rollerblades to Robin) <sub>MaP</sub>			*
e. (she lóaned) <sub>MaP</sub> (her róllerblades) <sub>MaP</sub> (to Róbin) <sub>MaP</sub>		*! *	
f. (she lóaned) <sub>MaP</sub> (her róllerblades to Róbin) <sub>MaP</sub>		*! *	
g. (she lóaned) <sub>MaP</sub> (her róllerblades to Robin) <sub>MaP</sub>		*!	
h. (she lóaned) <sub>MaP</sub> (her rollerblades to Róbin) <sub>MaP</sub>		*!	

The violations of the higher ranked DEP(Accent) are fatal, and therefore responsible for the choice of (a) as optimal; candidate (a) retains the lack of input accenting on the verbal complements, in satisfaction of DEP(Accent). Looking at tableaux (39) and (41) together, we see that the violation of Align<sub>R</sub>Focus in the optimal (a) is a consequence of the higher ranking of both MiPAccent and DEP(Accent).

To summarize, we have now augmented the partial constraint ranking in (31) with the addition of MiPAccent, a constraint that is properly phonological and holds of the output representation itself, and DEP(Accent), a faithfulness constraint that regulates the relation between the input and output representations. It is proposed that these two are higher ranked than the interface constraint Align<sub>R</sub> Focus, and by transitivity also higher than the interface constraints Align Focus dominates – Wrap XP and Align<sub>R</sub> XP – as well as the lower ranked phonological constraints on major phrase size, Bin(MaP). Together, the final constraint ranking is hypothesized to be as in (42)<sup>21</sup>:

(42) MiPAccent, DEP(Accent) >> Align<sub>R</sub>Focus >> Wrap XP, Align<sub>R</sub>XP >> Bin(MaP)

This constraint hierarchy predicts that violations of Align<sub>R</sub>Focus and Align<sub>R</sub>XP will be incurred in optimal output candidates which lack the accents to support the phrasing to the right of the MaP break that these constraints call for. Here is a case where the demarcative function satisfied by respect of the alignment constraints is subordinated to the demands of surface phonological wellformedness and faithfulness to underlying phonological form. The optimality theoretic approach allows us to understand that the constraints Align<sub>R</sub>Focus and Align<sub>R</sub>XP are indeed at play in the grammar of English, but

not satisfied in every surface representation, precisely when some other (higher-ranked) constraint of the language would be violated.

## 3.5

The preceding sections lay out a complex hypothesis about the nature of the grammar of constraints on major phrasing in English. Most of the constraints that play a role in the constraint hierarchy proposed have either been independently motivated for English or other languages, or are an instance of a type of constraint that has been independently motivated. The task undertaken here has been to confront a small array of data on English phrasing in order to arrive at an initial hypothesis about how such constraints might be interacting in the grammar of English. In so doing the intent has been to illustrate the workings of a constraint-based grammar conceived in optimality theoretic terms and the sorts of insights to be gained within that framework. The larger goal will be to expand the base of factual generalizations concerning major phrasing in English, ideally through the use of natural speech corpora and/or experimental procedures, and to test the hypothesis embodied in (42) against that base. As this hypothesis suggests, any such investigation will have to control for the morphosyntactic and informational structure of the input sentences as well as for properly phonological factors such as prosodic constituent size and accentuation. Both interface constraints and properly phonological constraints on output representation appear to have an influence on major phrasing in English, and an understanding of the role of each constraint cannot be reached without an understanding of its relation to the others.

## NOTES

<sup>1</sup> For example, Selkirk 1986, Nespor and Vogel 1986, Chen 1987, Inkelas and Zec 1990, 1996.

<sup>2</sup> For example, Bruce 1977, Beckman and Pierrehumbert 1986, Pierrehumbert and Beckman 1988.

<sup>3</sup> These include the constraints on prosodic domination which are collectively referred to as the strict layer hypothesis (see, e.g. Selkirk 1995a), constraints on the size of prosodic phrases (e.g. Gee and Grosjean 1983, Selkirk and Tateishi 1988, Drescher 1994, Ghini 1993, Helsloot 1995, Delais-Roussarie 1996), and constraints on their tonal composition, including the requirement that a peripheral tone be present, that a pitch accent be present, or that the lexical tones present be arrayed in a certain fashion. In the latter case, representative references would be too numerous to cite.

<sup>4</sup> Selkirk and Tateishi 1988, Kanerva 1989, Selkirk 1989, Vogel and Kenesei 1990a-b, Hayes and Lahiri 1991, and Jun 1993, for example, have pointed to the diverse types of constraints on phrasing. It is only in the context of optimality theory, however, that an understanding of the interaction of the various constraint types has become an explicit topic of investigation, as in the work of Nagahara (1994), Helsloot (1995), Selkirk (1995a), Truckenbrodt (1995), Delais-Roussarie (1996), for example.

<sup>5</sup> ChiMwiini is a language closely related to Swahili that is spoken in the town of Brava in Somalia.

<sup>6</sup> There is considerable diversity in the terms used to refer to prosodic constituents larger than the word. The terms *major (phonological) phrase*, *intermediate phrase* and even simply *phonological phrase* have been used by one or another scholar to designate the same level of prosodic structure. Since there are no phonological properties which universally characterize this level of phrasing, a nomenclature which evokes instead the level of syntactic constituency to which this prosodic phrasing is related in the statement of the interface constraint has a desirable mnemonic effect. Hence the term *major phonological phrase* for the level of prosodic phrasing aligned with syntactic *maximal* projections.

<sup>7</sup> Constraints of this type involve universal quantification over the first category and existential quantification over the second, thus they read: "For any XP in the input representation, align its edge (R,L) with the edge (R,L) of some MaP in the output representation".

<sup>8</sup> The requirement that the *right* edge of some MaP be aligned with any XP will typically have the same effects as the requirement that a left edge be aligned, or simply that there be a MaP 'break' at that location. This is because, in the unmarked case at least, the presence of a right MaP bracket implies the presence of an immediately following left MaP bracket, since the utterance is parsed as a sequence of MaP's. See Selkirk (1995a) for a proposal concerning an optimality theoretic treatment of the basic constraints on prosodic structure that are often subsumed under the rubric of the Strict Layer Hypothesis.

<sup>9</sup> Tableau (8) displays only the most relevant two of the potentially large range of candidates that are generable on the basis of the input representation. In principle the constraint system must evaluate all such candidates.

<sup>10</sup> Truckenbrodt (1995) suggests an interesting alternative conception of the correlation between Focus and phrasing which does without the constraint Align Focus which directly relates Focus and phrasing. His suggestion is that the interface of Focus and phonological representation involves a constraint calling for the Focus to correspond to a major phrase prominence. The alignment of phrase edges with Focus would be due to a constraint, widely attested in phonology, calling for a prominence of a constituent to be located at the edge of a constituent. The presence of prominence on Focus would thus

induce the presence of the phrase break. This proposal is a very appealing one. I am not adopting it here, though, in order to simplify this introductory discussion of constraint interaction.

<sup>11</sup> In the row corresponding to candidate (c), which fatally violates the highest-ranked Align<sub>F</sub>Focus constraint, there is a cell to the right of the one containing the fatal violation that is shaded. This shading is a notational device that serves to highlight the fact that any further constraint violations of constraints below the one incurring the fatal violation are irrelevant.

<sup>12</sup> One might want to ask at this point whether Wrap XP and Align XP are the only members of their respective families relevant to sentence phonology. At this point it would seem most fruitful to assume there might be yet further Align and Wrap constraints, which might play a role in characterizing the distribution of intonational phrases or minor phrases, for example. This is an interesting area for research.

<sup>13</sup> Though there have been steps in the direction of an account of English major/intermediate phrasing made by Bing (1979), Gussenhoven (1984), Beckman and Pierrehumbert (1986), Ladd (1986), Vogel and Kenesei (1990a,b), Selkirk (1995a) among others.

<sup>14</sup> There are other reflexes of major phrasing in English. On the basis of material from an FM radio news corpus, Shattuck-Hufnagel et al. (1994) argue that the intermediate phrase (aka major phrase) is the domain with respect to which the phenomenon of early accent, also referred to as rhythmic inversion, is defined. Similarly, Vogel and Kenesei (1990a) had argued that the phonological phrase was the domain of rhythmic inversion in English. Selkirk (1995a) argues that the location of nonaccented function words at the right edge of a MaP is responsible for their appearing there in strong, unreduced form.

<sup>15</sup> Beckman and Pierrehumbert (1986) and Pierrehumbert (1993) reject the notion that the accentual/minor phrase plays a role in English, based on the assumption that an accentual phrase may never have any more than one accent. There exist cases of single words bearing two accents in English. For example, an emphatic rendering can give the pronunciation *Càlifornia*. Since such words do not divide up into two accentual phrases, or two prosodic words, for that matter, Beckman and Pierrehumbert consider them to be evidence that the accentual/minor phrase plays no role in English. Given an optimality theoretic perspective, according to which constraints are violable, this is not an argument. A constraint against more than one accent within an accentual phrase could be violated, and these double-accented words are precisely cases where such a violation would be forced. Suppose that the double accents are part of the input, and that their presence in the output is ensured by a faithfulness constraint which disallows deletion of input accents. Suppose moreover that there were some constraint(s) which prevented noncompound



words in the input from being divided up into two prosodic words in the output (see Selkirk 1995a). All these constraints have independent motivation in the grammar of English. If these constraints were to outrank any constraint(s) calling for accentual phrases to have at most one accent, then it would be predicted that double accenting within accentual phrases would be allowed in just these cases.

<sup>16</sup> This is not to say that the pronunciations in the two cases would be fully identical. In the case where *Robin* is in Focus there is likely to be a greater pitch prominence on the constituent.

<sup>17</sup> The avoidance of a phrasing like that in (27iii-d) in English, where the verb is followed by a phrase break and two complements to the verb are joined in a single prosodic phrase, has been quite generally assumed in earlier work, including Bing 1979, Selkirk 1984 and Hirst 1993.

<sup>18</sup> Beckman and Pierrehumbert (1986) and Beckman and Ayers (1994) analyze sentences like (36), with a nuclear pitch accent at some distance from the end of the sentence, as a single intermediate phrase (aka major phrase). (The sentence is also analyzed as a single intonational phrase. The intonational phrase is one up from major phrase in the prosodic hierarchy, according to Selkirk (1986), Beckman and Pierrehumbert 1986.) This analysis seems right. Note that an alternative analysis, according to which the sentence has a nested MaP structure as in (i) cannot be maintained.

H\*   L-                      L-      L%

$IP_{(MaP)}(MaP(She \text{ loaned} ))_{MaP} \text{ her rollerblades to Robin } )_{MaP} )_{IP}$

This analyses would predict a fall from the H\* pitch accent to the L- phrase tone within the verb. But this is not attested. Rather, it is the syllable *her*, one after the accented syllable, which carries the target low tone following the H\*. This is the position that a L- would take if it spread leftward from the MaP edge at the end of the sentence, as is proposed in Pierrehumbert (1980). The unattested MaP structure in (i) must therefore be ruled out. We assume the nonoptimality of the nested MaP structure in (i) to be due to the high rank of a constraint NonRec(MaP) from the family of NonRecursivity constraints (Selkirk 1995a), which rules out such self-embedding of prosodic constituents from the same level in the prosodic hierarchy.

<sup>19</sup> This constraint will in the end probably not have this formulation. An alternative conception would be to see the constraint as one calling for the most prominent syllable of any MiP to be marked by the presence of an associated pitch accent. This conceptualization is more firmly grounded crosslinguistically.

<sup>20</sup> This follows from the very nature of the prosodic hierarchy, according to which a constituent at one level dominates, or is headed by, a minimum of one constituent of the next level down (cf. Selkirk 1995a).

<sup>21</sup> The comma in (26) and the dotted line between MaPAccent and DEP(Accent) in the tableau indicate that these two constraints are not crucially ranked with respect to each other. However, their position both to the left of Align<sub>R</sub>Focus indicates they are both higher ranked than it.

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