Absence of Stress Culmination and Prosodic Phrasing

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1. Introduction

Selkirk's (1980, 1984, 1995) influential prosodic hierarchy hypothesis assumes culminant prosodic phrases, i.e. phrases with a single head representing the prosodic peak (or 'culmination') of a phrase. Rather than deriving this important property, most Optimality Theory analyses stipulate it via GEN, which is tacitly only allowed to produce prosodically culminant structures. This stipulation is unnecessary because as McCarthy and Prince (1993) observed in their discussion of generalized alignment single-headedness follows from head-alignment constraints whenever no higher constraints force their violation. In particular, if prosodic heads are generated freely within a phrase, then the more heads there are the more violations of head alignment occur, thus favoring culminant phrases against multi-headed ones. This is illustrated in (1) where the three phonological phrases in (a)-(c) incur an increasing number of alignment violations the more heads they contain. Realized prosodic heads are represented as 'x', unrealized ones as '_'.

(1)	a.	(_ _ x)P	Right-alignment satisfied.
	b.	(_ x x)P	Right-alignment violated once.
	c.	(x x x)P	Right-alignment violated three times: twice by the first head and once by the second head.

Since alignment constraints are independently necessary to determine the edgemost position of prosodic heads even when there is only a single head they should also carry the burden of deriving prosodic culminativity, leaving the definition of GEN as unconstrained as possible and allowing for phrases with multiple heads within the candidate set. This raises two issues. First, if non-culminant structures are part of the candidate set, we should consider whether they ever surface as optimal in some language. Second, if we have reasons to believe that they are grammatical in some language, we should consider whether our current constraints on prosodic representation can derive these languages or whether some changes or additions are necessary.

In the following I will claim that the prosody of Nkhotakota Chichewa is consistent with the presence of non-culminant prosodic phrases at the intonational phrase level. I will also show, however, that the amendments to the current model of prosodic phrasing are surprisingly limited, involving only the fine-tuning of existing constraints rather than outright new ones.

In particular, I will show that Chichewa non-culminant intonational phrases follow straightforwardly from Truckenbrodt's (1995) constraints for prosodic parsing provided the following changes are made. First, the StressXP constraint, which requires lexical phrases to express a prosodic head at the phonological phrase level, should be extended across all higher levels of the prosodic hierarchy. As we will see, the multiple prosodic heads favored through this amendment remain restrained by the head alignment constraints, thus letting different rankings determine whether non-culminant phrases are possible at all and, when they are, at which prosodic level they are to be found.

Second, the Stress-Focus constraint, which requires focus to carry the highest available prominence in its domain, should not presuppose that no other items in the same domain can match it. This change makes it possible to derive the prosodic effects of focus in Chichewa along the analyses of Truckenbrodt (1995) and Samek-Lodovici (2005) even in presence of non-culminant phrases.

Finally, the potential presence of multiple heads in a single phrase imposes a finer tuning of the head alignment constraints, which must distinguish between misalignment due to intervening heads and the more familiar misalignment due to intervening unrealized head positions.

I start in section 2 examining Chichewa's non culminant intonational phrases. The necessary constraint amendments are discussed in detail in section 3. The ensuing OT analysis for Chichewa is given in section 4, while section 5 shows that the proposed constraints remain consistent with the existence of culminant languages such as English.

For the sake of simplicity I have omitted utterance phrases from any of the examples and representations examined below. The analysis however extends straightforwardly to non-culminant utterance phrases provided they are treated in the same way examined for non-culminant intonational phrases.

2. Prosodic Phrasing in Nkhotakota Chichewa

The examples in (2)-(4) below show the familiar prosodic phrasing for three sentences of Nkhotakota Chichewa involving broad focus on the entire VP, narrow focus on the object, and narrow focus on the verb respectively (Kanerva, 1990:98). Following Truckenbrodt (1995), I assume that what Kanerva identified as 'focal phrases' are simply phonological phrases. Henceforth 'PP' stands for 'phonological phrase', and 'IP' for 'intonational phrase'.

(2) (([Anaményá nyu^{m}bá ^{n}dí mwáála]$_{focus}$)$_{PP}$)$_{IP}$
S/he-hit house with rock
'She hit the house with a rock'

(3) (([Anaményá nyuú^{m}ba $_{focus}$) (^{n}dí mwáála)$_{PP}$)$_{IP}$
S/he-hit house with rock
'She hit the house with a rock'

(4) ((Anaméenya$_{focus}$)$_{PP}$ (nyuú^{m}ba)$_{PP}$ (^{n}dí mwáála)$_{PP}$)$_{IP}$
S/he-hit house with rock
'She hit the house with a rock'

There are compelling theoretical and empirical reasons supporting Kanerva's phrasing. From a theoretical point of view, the existence of PPs and IPs is mandated by the universal status of the prosodic hierarchy. From an empirical point of view, Kanerva convincingly motivates the above phrasing via a careful examination of the phonetic correlates associated with Chichewa's PPs and IPs. These include the lengthening of the penultimate syllable in each PP and three additional tone doubling and tone retraction operations at the right periphery of a PP. As for IPs, they are associated with phrase-final syllabic lengthening, specific phrase-final tonal contours, and possibly most significantly interruption and resetting of tonal pitch downstep (catathesis) at phrasal right boundaries. The empirical and theoretical evidence supporting Kanerva's phrasing also come together in the analyses of

Truckenbrodt (1995, 1999) where the above phrasing pattern is shown to follow straightforwardly from the interaction of universal constraints on prosodic phrasing with independently required constraints on the prosodic expression of focus.

The issue of prosodic culmination arises when we try to identify the heads of the above prosodic phrases. Following Truckenbrodt (1995), I too maintain that the heads of Chichewa PPs coincide with their lengthened penultimate syllables. This determines the culminant PPs shown in (5)-(7) below where each lengthened syllable heads a PP of its own.

(x) P
(5) [Anaménýá nyu^{m}bá ^{n}dí mwáála]$_{focus}$

(x) (x) P
(6) Anaménýá nyuú^{m}ba$_{focus}$ ^{n}dí mwáála

(x) (x) (x) P
(7) Anaméenya$_{focus}$ nyuú^{m}ba ^{n}dí mwáála

Unfortunately, no similar straightforward assumption is available for Chichewa IPs, whose heads show no obvious phonetic correlate (Downing 2003). Truckenbrodt's original analysis of Chichewa maintains that the head falls on the final item of the VP when the VP is focused, and on the VP-initial verb when the verb is focused (1995, section 5.1.3) but, as Downing, Mtenje, and Pompino-Marschall (2005) point out, this choice of heads is left unmotivated.

An empirically appropriate choice is further complicated by the fact that any attempt to associate IP-headedness with either pitch culmination or syllabic lengthening turns out to be untenable when assessed across the entire focus paradigm.

In particular, pitch height does not constitute a reliable correlate for IP headedness. As Downing, Mtenje, and Pompino-Marschall (2004, 2005) show in their recent study of Ntcheu Chichewa, which is sufficiently similar to Nkhotakota Chichewa to suggest the presence of a similar prosody, the only visible pitch peak for the broad-focus case equivalent to (5) above occurs phrase-initially on the verb rather than on the lengthened syllable signaling the head of the PP. Since under the prosodic hierarchy a head at a higher prosodic level must coincide with a head at the immediately lower level and since no such PP-head is available in (5), the phrase-initial high pitch cannot be a phonetic cue for the IP-head.

The absence of a correlation between pitch and IP-headedness is also supported by Downing, Mtenje, and Pompino-Marschall's observation that the increased pitch height observed on phrase-medial and phrase-final narrowly focused items remains systematically lower than the pitch on the initial verb despite the unfocused status of the latter.[1] This contrasts sharply with the findings by Xu and Xu (2005) for English where the pitch height on narrow focus either forms the absolute pitch maximum of the entire sentence or matches the highest available maximum.

Since pitch provides no cue to IP-headedness, the only other potential phonetic cue would naturally appear to be the focus-independent systematic syllabic

[1] The pitch of focused items carrying only low tones is not raised; see Downing, Mtenje, and Pompino-Marschall (2005) for discussion and an analysis of the focused items' increased pitch in terms of Ladd's register tier (1990, 1993).

lengthening observed by Kanerva on the final two syllables of the IP phrase. This is indeed the assumption followed in Downing, Mtenje, and Pompino-Marschall (2005) for Ntcheu Chichewa, which presents the same kind of syllabic lengthening. According to this hypothesis, a single, right-headed IP applies across all focus contexts yielding the representations in (8) and (9) below for the VP and V focus cases.

```
        (                                   x  ) I
        (                                   x  ) P
(8)     [Anaményá      nyu[m]bá      [n]dí mwáála]focus   (optimal under VP focus)
        (                                   x  ) I
        (       x    )  (    x    )  (       x  ) P
(9)     Anaméenya focus  nyuú[m]bá     [n]dí mwáála       (optimal under verb focus)
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These representations run into serious theoretical problems as soon as we consider how they can be derived from the constraints governing prosodic phrasing. As is easily seen, the prosodic heads of both structures satisfy the head-alignment constraints at both the PP and IP levels. The only difference between them concerns the StressXP and Wrap constraints governing the mapping between prosody and syntax. Structure (8) violates StressXP because the object 'nyu[m]bá' does not express any PP head, whereas structure (9) violates Wrap because no single PP encompasses the entire VP.

When the VP is focused, (8) must beat (9), and therefore Wrap must outrank StressXP. When the verb is focused however, it is (9) that must beat (8), and hence it is StressXP that must outrank Wrap. We thus have a contradiction and one that cannot be easily avoided by any simple changes in the definitions of the involved constraints.

No appeal to StressFocus can solve the problem either, since this constraint cannot distinguish among the above two structures under either focus context: under VP-focus it is satisfied by both structures because the IP-head is contained within the VP in both cases; under V-focus it is failed by both structures because neither of them places the IP-head on the verb. The impossibility of finding a ranking that selects the correct structure across different focus contexts shows that the IP-final syllabic lengthening observed by Kanerva should be seen as a property related to the boundary of the IP but cannot be a cue for its head.

The above discussion leaves only two possible choices for Chichewa's IP-heads: either we ignore the absence of culminative phonetic correlates and simply stipulate that multi-headed IPs are impossible in Chichewa, despite their being possible under GEN for the reasons considered in the introduction, or we take the lack of culminative cues at face value and interpret the lengthened syllables signaling PP-heads as signaling IP-heads as well. Under this latter hypothesis, which is also the least stipulative one, narrow focus of non final-items determines non-culminant IPs. The related structures for VP and V-focus are given below.

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        (                                   x  ) I
        (                                   x  ) P
(10)    [Anaményá      nyu[m]bá      [n]dí mwáála]focus   (optimal under VP focus)
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(x x x) I
(x) (x) (x) P

(11) Anaméenya $_{\text{focus}}$ nyuú^{m}bá ^{n}dí mwáála (*optimal under verb focus*)

These structures raise two questions. First, whether the alternation between culminant and non-culminant IPs can be derived under our current understanding of the constraints governing prosodic phrasing. Second, to what degree positing non-culminant IPs for Chichewa remains consistent with the derivation of culminant phrasing in languages like English within a model entirely based on universal constraints as required by OT. The answer highlights the relevance of constraint fine-tuning and shows how very modest changes in the existing constraints straightforwardly determine the non-culminant structures of Chichewa while still deriving the culminant structures of English.

3. Fine-tuning the Constraints

Building on insights from Liberman and Prince (1977), Prince (1983), Nespor and Vogel (1986), and Selkirk (1995) among others, Truckenbrodt (1995) viewed the prosodic structure of languages showing rightward prosodic head-alignment as governed by the constraints listed below (here slightly adapted). The head-alignment constraints in (12) govern the position of prosodic heads, requiring them to occur as close to the right boundary of their phrases as possible. The syntax-prosody mapping constraints in (13) govern the size of PPs by respectively requiring that lexical projections be wrapped in a PP of their own and that lexical projections express a head of their own at the PP-level. The SF constraint in (14) requires focused constituents to express the highest prosodic prominence in their focus domain, which in the cases examined here is always co-extensive with the entire clause.

(12) Head-P (H-P). Align(Head(PP), R, PP, R).
Align the right boundary of every phonological head with that of its phonological phrase.

Head-I (H-I). Align(Head(IP), R, IP, R).
Align the right boundary of every intonational head with that of its intonational phrase.

(13) Wrap. Each lexically headed XP is contained inside a phonological phrase.

StressXP. Each lexically headed XP must contain a *phrasal stress* (where 'phrasal stress' refers to the head of a phonological phrase).

(14) Stress-Focus (SF). Let XP_f be a focused phrase, then for any unfocused YP in the focus domain of XP_f, XP_f is prosodically more prominent than YP.

The above constraints have successfully been used –with minor divergences in their definitions and in interaction with other constraints– to explain variation in prosodic phrasing both across different languages with respect to a fixed focus context and across different focus contexts within a single language. The analyzed languages include Italian, English, French, German, Icelandic, Japanese, Chi Mwi:ni,

Kimatuumbi, and Chichewa (see among others Truckenbrodt 1995, Samek-Lodovici 2005, Dehé 2004, 2005).

The same constraints, however, cannot derive non-culminant structures of the kind illustrated in (11) above because these structures are inevitably harmonically bounded (henceforth 'h-bounded'), i.e. beaten under any rankings by their non-culminant counterparts. This is shown in T1 below, where the non-culminant structure (11) above, repeated in (a), is h-bounded by the culminant structure in (b), a relation symbolized by the icon '☠' on the bounded structure. The constraints H-P, Wrap, and StressXP are violated the same number of times in both structures, and are therefore irrelevant. In addition, (a) violates SF because the focused verb fails to be more prominent than its arguments, whereas (b) satisfies this constraint. Furthermore, (a) violates H-I three times –twice for the PP-head above V and once for the head above O– whereas (b) violates H-I only twice for the head on V. If we mark as 'W' and 'L' the constraints where (a) fares respectively better and worse than (b), as explained in Prince (2003), we are left with no W-marked constraints favoring (a) and two L-marked constraints favoring (b), signaling the perpetual loser status of (a).

a. ☠ *Chichewa's non-culminant IP*					
(x x x) I	*		*		***
(x)(x)(x) P					
V_f O IO					
T1 – Chichewa verb focus	SF	H-P	Wrap	StressXP	H-I
b. *Culminant IP*					
(x _ _) I			*		**
(x)(x)(x) P	*L*				*L*
V_f O IO					

Chichewa's non-culminant structures can avoid h-bounding only if some constraint favors them against their culminant counterparts. This calls for the introduction of new constraints or the modification of the established ones. At the same time we wish to preserve the existing successful analyses of prosodic parsing in culminant languages. Thanks to the conflict based nature of OT (Prince and Smolensky 1993/2004), this goal can be achieved via the minimal changes in the definitions of StressXP, StressFocus, and head alignment constraints proposed here below.

The new version of StressXP, dubbed $\text{StressXP}_{\text{All}}$ and defined in (15), extends the requirement that lexical projections be prosodically headed at the PP-level to all higher levels of the prosodic hierarchy. This favors structures with multiple IP-heads whenever the relevant IP contains more than one lexical projection, as it is the case in structure (a) in T1 above. The proliferation of heads remains nevertheless kept in check by the head-alignment constraints in any grammar where they outrank $\text{StressXP}_{\text{All}}$.

(15) $\text{StressXP}_{\text{All}}$. A lexically headed XP must contain phrasal stress across all levels of the prosodic hierarchy.

The new StressFocus constraint, dubbed SF' and defined in (16), still requires focus to carry the highest available prominence in the focus domain but no longer

assumes its prominence to be unmatched. This weaker definition is necessary because SF' must remain able to force an IP-head on a focused item while allowing for absence of prosodic culmination.

(16) Stress-Focus (SF'). Let XP_f be a focused phrase, then for any unfocused YP in the focus domain of XP_f, XP_f is at least as prosodically prominent as YP.

As tableaux T2 below shows, the new definitions ensure that the non-culminant structure in (11), repeated again under (a) in T2 below, is no longer h-bounded by its non culminant counterpart in (b). SF' is now satisfied by both structures, hence it no longer favors (b). Moreover, though (a) still loses against (b) on H-I it now beats it on $StressXP_{All}$. The winner of any direct competition between (a) and (b) thus depends on the ranking between $StressXP_{All}$ and H-I.

a. Chichewa's non-culminant IP (x x x) I (x)(x)(x) P V_f O IO			*		***
T2 – Chichewa verb focus	SF'	H-P	Wrap	$StressXP_{All}$	H-I
b. *Culminant IP* (x _ _) I (x)(x)(x) P V_f O IO			*	** *W*	** *L*

The last refinement concerns the head-alignment constraints. Selkirk's strict-layer principle requires that heads of higher prosodic levels be licensed by heads at the immediately lower level. This allows for multi-headed IPs like those shown in (17) and (18), where each IP-head is based on a realized PP-head, and excludes structures likes (19), with its hanging second and third IP-heads.

(x x x) I
(17) (x x x) P

(x x x) I
(18) (x)(x)(x) P

(x x x) I
(19) (x _ _) P

The original alignment constraints H-P and H-I are violated once for every head position intervening between a head and the right boundary of its phrase, whether the head is or is not realized (note that a head-position at the PP-level, whether realized or not, counts as a potential head position for the IP too, since when realized it licenses a head-position in the IP. The IP in (20) below thus violates H-I twice).

(x _ _) I
(x _ _) P
(20) V O IO

Head-alignment constraints however cannot remain insensitive to the realized or unrealized status of intervening heads, otherwise misalignment involving empty head positions could never occur because realizing those positions as heads would

decrease the violations of $StressXP_{All}$ without violating any other constraints. This would effectively and incorrectly prevent languages from having culminant phrases with misaligned heads.

Consider for example the structure for focused verbs in English transitive clauses, shown in (a) below and further discussed in section 5. This structure would be h-bounded by the structure in (b), which avoids one $StressXP_{All}$ violation by providing an IP head for the object.

a. ☠ *English culminant IP* (_ x _) I (x) (x)(x) P S aux [V_f O]		*	*		**
T3 – English verb focus	SF'	Wrap	H-I	H-P	$StressXP_{All}$
b. *Non-culminant IP* (_ x x) I (x) (x)(x) P S aux [V_f O]		*	*		* *L*

The original definitions of H-P and H-I in Truckenbrodt (1995) do not suffer from the above problem because they are sensitive to the amount of intervening prosodic structure calculated across all representational levels. This ensures that the additional head in (b) above gives rise to additional violations of H-I because it adds to the prosodic material at the right of the misaligned IP-head. We may preserve Truckenbrodt's insight while keeping the constraint definitions local to a single prosodic level by assuming that H-P and H-I are sensitive to the amount of prosodic structure intervening between a head and the phrasal boundary at its right. Under this definition a head followed by an empty head position is less misaligned than a head followed by another prosodic head. This change is formalized via the definition of 'alignment violation' here below, leaving unaltered the definitions of H-I and H-P provided in (12) above.

(21) Alignment violation. Alignment violations are proportional to the amount of prosodic material intervening between a head and its phrasal boundary. Intervening heads cause more severe violations than intervening unrealized head positions.

Consider for example the three PPs in (22) below: structure (a) fails H-I once due to the intervening empty head position, henceforth represented as '_'. Structure (b) fails H-I even more due to the intervening realized head, but still less than structure (c) which is two positions away from its right boundary.

Violations caused by unexploited head positions, as in (a), are represented by single stars. The increased amount of violation associated with realized heads is represented via a numeric superscript equal to the number of intervening heads, as shown in (b). This is assumed to always be weighted less than a full star violation, disallowing any trade-off between the two kinds of violations. Since they cannot add up to a star, the numeric violations are only relevant for comparing structures with the same number of stars.

(22) a. (x _) I → H-I: *
b. (x x) I → H-I: $*^{+1}$
c. (x _ _) I → H-I: **

The new definition of head-alignment violation ensures that head-alignment constraints militate against the realization of intervening head-positions and the associated multi-headed phrases that would result from them. It also solves the 'costless head-insertion' problem discussed above because any new head now causes additional misalignment.

An example is provided in T4 below. The competition examined earlier between (a) and (b) now shows the additional head of (b) penalized by proportional increased violations of H-I, which enable (a) to beat (b) under any ranking satisfying the condition H-I>>$StressXP_{All.}$

a. ☞ *Attested culminant IP* (_ x _) I (x) (x)(x) P S aux [V_f O]			*		**
T4 – English verb focus	SF'	Wrap	H-I	H-P	$StressXP_{All}$
b. *Non-culminant IP* (_ x x) I (x) (x)(x) P S aux [V_f O]			$*^{+1}$ *W*		* *L*

With the amended constraints in place we may turn our attention to the derivation of Chichewa focus paradigm and its non-culminant IPs.

4. Chichewa's Non-culmination

Non-culmination significantly expands the set of possible prosodic structures. In order to demonstrate that Chichewa non-culminant structures follow from the interaction of the proposed constraints we must examine any GENerable structures that beat the proposed Chichewa structure on some constraint and show that they are all beaten under some consistent set of ranking relations.

To simplify this task, I will limit the analysis to structures lacking recursive phrasing and showing the canonical <V O IO> word order of the language; this is equivalent to examining only grammars where the constraint NoRecursion against recursive phrasing and the constrain Stay against syntactic movement are sufficiently high in the grammar to block recursion and focus induced syntactic rearrangements. I will also only consider structures with a single IP spanning across the entire sentence. Finally, I will focus my discussion on non h-bounded structures alone, listing only in the appendix all those structures that beat the attested structure on some constraint but are already h-bounded by other competitors.

4.1 Focused VPs

Let us start with the VP-focus case, with the corresponding structure repeated under (a) in T5 below. Besides identifying unrealized heads relevant for assessing right-alignment, the '_' symbol will henceforth also identify unrealized heads that violate $StressXP_{All}$. These may occur to the left of the realized head or heads, as is

the case in (a) below. Remember that $StressXP_{All}$ never requires a head on V because the head for the object O also counts as a head for the entire VP.

Since the entire VP is focused, SF' is satisfied independently of the position of the IP-heads, and we can safely ignore this constraint. Structure (a) satisfies all remaining constraints except $StressXP_{All}$, which is failed twice by the unstressed object in the PP and IP phrases. This is the only weakness that can be exploited by its challengers. The first three of them, in (b)-(d), involve culminant IPs. They beat (a) on $StressXP_{All}$ by providing a PP-head to the object, but pay for this gain through additional violations of H-P and Wrap. These constraints must thus outrank $StressXP_{All}$ as shown in (23) below.

The remaining competitors in (e)-(g) are the non-culminant counterparts of the first three and are eliminated by the ranking relations just established. Note that phrasal stress on the object or indirect object always also counts as phrasal stress for the entire VP, making an additional phrasal head on V unnecessary.

(23) Ranking conditions from T5: {H-P, Wrap} >> $StressXP_{All}$

	H-P	Wrap	$StressXP_{All}$	H-I
a. ☞ *Optimal* (_ x) I (_ x) P [V O IO]$_f$			**	
T5 – VP focus	H-P	Wrap	$StressXP_{All}$	H-I
b. *Culminant IP* (_ x) I (x x) P [V O IO]$_f$	*$^{+1}$ *W*		* *L*	
c. *Culminant IP* (_ x) I (x)(x) P [V O IO]$_f$		* *W*	* *L*	
d. *Culminant IP* (_ x) I (x)(x)(x) P [V O IO]$_f$		* *W*	* *L*	
e. *Non-culminant IP* (x x) I (x x) P [V O IO]$_f$	*$^{+1}$ *W*		 *L*	*$^{+1}$ *W*
f. *Non-culminant IP* (x x) I (x)(x) P [V O IO]$_f$		* *W*	 *L*	*$^{+1}$ *W*
g. *Non-culminant IP* (x x) I (x)(x)(x) P [V O IO]$_f$		* *W*	 *L*	*$^{+1}$ *W*

4.2 Focused Verbs

Next, let us derive narrow focus on the verb. At first sight there might appear to be some ambiguity with respect to which PP-phrasing should be assigned to the corresponding Chichewa sentences, since the structures in (24) and (25) below, the first with three PPs and the second with a single non-culminant PP, are both consistent with the phonetic cues associated with the corresponding Chichewa data.

(24)
(x x x) I
(x)(x)(x) P
V_f O IO

(25)
(x x x) I
(x x x) P
V_f O IO

Only the first structure, however, is consistent with the ranking relations established above for the VP-focus context.

The incorrect representation in (25), repeated in (a) in T6 below, is beaten by the competitor shown in (b), which avoids some H-I and H-P violations by leaving its object unstressed (this also empirically distinguishes (b) from (a) because (b) lacks syllabic lengthening on the object). Eliminating (b) would require $StressXP_{All}$ to outrank H-P and H-I, contradicting the ranking H-P>>$StressXP_{All}$ established for focused VPs. The attested structure for focused VPs and structure (25) thus cannot be optimal in the same grammar. The same is not true for structure (24), which as we will see allows for a ranking consistent with the VP-focus case, and is thus adopted as the representation for the focused verb case.

a. *Representation (25)* (x x x) I (x x x) P V_f O IO		$***^{+3}$			$***^{+3}$
T6 – Chichewa focused verb	SF'	H-P	Wrap	$StressXP_{All}$	H-I
b. *Ungrammatical challenger* (x _ x) I (x _ x) P V_f O IO		$**^{+1}$ *L*		** *W*	$**^{+1}$ *L*

The optimal structure in (24) faces a great variety of challengers generated by GEN which can be grouped into distinct classes to facilitate discussion. I will first consider the challengers that satisfy SF' and then move to those that fail it. Among each group I will first examine competitors with a culminant IP and then those with non-culminant ones.

The first set of competitors is given in T7. Since SF' is satisfied and IP is culminant all competitors show a single IP-head on the focused verb, thus outperforming the optimal structure on H-I. As challenger (b) shows, the gain on H-I is paid by additional violations of $StressXP_{All}$ due to the unrealized IP-heads, forcing the ranking $StressXP_{All}$>>H-I. All remaining challengers differ from (b) only in their PP-phrasing and must be eliminated by the ranking H-P>>Wrap since we already determined that Wrap outranks $StressXP_{All}$. The ranking conditions determined so far are provided in 0 below.

(26) Ranking conditions from T5-T7: H-P >> Wrap >> $StressXP_{All}$ >> H-I

a. ☞ *Optimal*					
(x x x) I (x)(x)(x) P V_f O IO			*		$***^{+3}$
T7 – Verb focus I	SF'	H-P	Wrap	$StressXP_{All}$	H-I
b. *Culminant IP* (x _ _) I (x)(x)(x) P V_f O IO			*	** *W*	** *L*
c. *Culminant IP* (x _ _) I (x x x) P V_f O IO		$***^{+3}$ *W*	*L*	** *W*	** *L*
d. *Culminant IP* (x _ _) I (x _ x) P V_f O IO		$**^{+1}$ *W*	*L*	*** *W*	** *L*
f. *Culminant IP* (x _ _) I (x _ _) P V_f O IO		** *W*	*L*	**** *W*	** *L*

We now turn to challengers with non-culminant IPs. These always involve at least two IP-heads, one of which must fall on the focused verb to satisfy SF'. The structures are listed by increasing PP-size and increasing head misalignment. The intermediate cases, involving two PPs, are all h-bounded and listed in the appendix.

The ranking $StressXP_{All}$>>H-I, established earlier, ensures that any decrease of H-I violations obtained by eliminating IP-heads, as in (b), remains suboptimal.

At the same time the higher rank of H-P relative to Wrap ensures that any attempt to beat (a) via a PP-wrapped VP, as in (b)-(d), fails due to the inevitable additional H-P violations caused by the misaligned PP-head on the focused verb. The overall ranking relations are repeated in 0.

(27) Ranking conditions from T5-T8: H-P >> Wrap >> $StressXP_{All}$ >> H-I

a. ☞ *Optimal* (x x x) I (x)(x)(x) P V_f O IO			*		$***^{+3}$
T8 – Verb focus II	SF'	H-P	Wrap	$StressXP_{All}$	H-I
b. *Non culminant IP* (x _ x) I (x)(x)(x) P V_f O IO			*	*	$**^{+1}$
				W	*L*
c. *Non culminant IP* (x _ x) I (x _ x) P V_f O IO		$**^{+1}$		**	$**^{+1}$
		W	*L*	*W*	*L*
d. *Non culminant IP* (x _ x) I (x x x) P V_f O IO		$***^{+3}$		*	$**^{+1}$
		W	*L*	*W*	*L*
e. *Non culminant IP* (x x x) I (x x x) P V_f O IO		$***^{+3}$			$***^{+3}$
		W	*L*		

Let us turn to challengers that fail SF'. These structures always assign less prominence to the focused verb than to its arguments.

The challengers with culminant IPs, listed in T9 by decreasing PP-size, must place their single IP-head either on the object or the indirect object, thus systematically beating the optimal form on H-I. Most of them are already eliminated by the ranking conditions established earlier due to their additional violations of H-P or $StressXp_{All}$.

The only exception is structure (b) which also outperforms (a) on Wrap and cannot be eliminated via the lower ranked $StressXP_{All}$ constraint. This requires SF' to outrank Wrap, yielding the overall ranking relations in 0.

(28) Ranking conditions from T5-T9: {SF', H-P} >> Wrap >> $StressXP_{All}$ >> H-I

a. ☞ *Optimal* (x x x) I (x)(x)(x) P V_f O IO			*		$***^{+3}$
T9 – Verb focus III	SF'	H-P	Wrap	$StressXP_{All}$	H-I
b. *Culminant IP* (_ x) I (_ x) P V_f O IO	* *W*		*L*	** *W*	*L*
c. *Culminant IP* (_ x) I (x x) P V_f O IO	* *W*	$*^{+1}$ *W*	*L*	* *W*	*L*
d. *Culminant IP* (_ x) I (x)(x) P V_f O IO	* *W*		*	* *W*	*L*
e. *Culminant IP* (_ x) I (x)(x)(x) P V_f O IO	* *W*		*	* *W*	*L*

Finally, we examine the challengers with non culminant IPs; see T10. These structures lack an IP-head for the focused verb but must assign an IP-head to their object and indirect object. They thus outperform the optimal form on H-I and possibly Wrap, but are always beaten on SF', which as we just saw outranks all these constraints.

The relevance of the amended StressFocus constraint is clearly illustrated by (b) and (c), which without this constraint would h-bound the optimal structure in (a). Note the crucial role played by the weaker definition introduced in section 3: if focus were required to be the most prominent item the optimal form in (a) would fail SF' and be h-bounded by (b) and (c).

a. ☞ *Optimal* (x x) I (x)(x)(x) P V_f O IO			*		***$^{+3}$
T10 – Verb focus IV	SF'	H-P	Wrap	StressXP$_{All}$	H-I
b. *Non culminant IP* (x x) I (x)(x)(x) P V_f O IO	*		*		*$^{+1}$
	W				*L*
c. *Non culminant IP* (x x) I (x)(x) P V_f O IO	*		*		*$^{+1}$
	W				*L*
d. *Non culminant IP* (x x) I (x x) P V_f O IO	*	*$^{+1}$			*$^{+1}$
	W	*W*	*L*		*L*

This concludes the derivation of Chichewa. The minimal changes introduced in section 3 let the constraints derive the non-culminant IPs found under Chichewa narrow focus as well as the culminant IPs found under broad VP-focus. The final grammar is repeated in 0 below.

The higher ranked H-P and Wrap constraints determine culminant and VP-wrapping PPs under broad focus which in turn inevitably determine equally culminant and properly aligned IPs due to the licensing relation holding between PP and IP-heads. StressXP$_{All}$ cannot impose any further IP-head, because the corresponding licensing PP-heads would violate either H-P or Wrap.

Under narrow focus, on the other hand, SF' requires focus to be assigned its own IP-head, which in turn forces the presence of a licensing PP-head. This head will have to be properly aligned due to the high-ranked H-P, even when that translates into minimal PPs smalle than VP that violate Wrap. This in turn makes it possible to satisfy StressXP$_{All}$ throughout by inflating the number of PP and IP-heads at the cost of the lowest ranked H-I.

(29) Chichewa: {SF', H-P} >> Wrap >> StressXP$_{All}$ >> H-I

The above grammar also determines the correct structure for the object focus case. Without going through the exhaustive analysis given above we can intuitively see that the highest ranked SF' forces an IP-head on the focused object. The immediately lower PP-head will have to be aligned to satisfy the equally high-ranked H-P, forcing a PP-boundary to the right of the object at the cost of Wrap. This allows for the existence of an additional PP for the indirect object with its own PP-head as required by $StressXP_{All}$. This in turn makes it possible to add an IP-head for the indirect object, further benefiting $StressXP_{All}$ at the cost of the lower ranked H-I. Note that no PP nor IP head is necessary on V, since the VP is already stressed via the phrasal heads on the object. The final structure is given in (30) below, properly fitting both Kanerva's phrasing and the assumptions on Chichewa IP-heads discussed in section 2.

(30)
(x x) I
(x)(x) P
V O_f IO

The same reasoning can be applied to the indirect object focus case, which shows the pattern below identical to that found under VP-focus (Kanerva 1990:98). As in the previous case SF' forces an IP-head on the focused item, but this time the corresponding lower PP-head can be aligned with its PP-boundary and satisfy Wrap at the same time, hence avoiding the multiple PPs characterizing the other narrow focus cases. The high rank of H-P and Wrap also disallows the presence of additional PP-heads despite the lower ranked $StressXP_{All}$. Their absence in turn prevents the existence of additional heads in the IP, deriving the attested structure.

(31)
(_ x) I
(_ x) P
V O IO_f

The only remaining issue is whether the same constraints can also derive the cross-foci culminant representations displayed in languages such as English. As the above tableaux have already shown, structures with culminant PPs and IPs remain part of the overall cross-linguistic typology. What remains to be proven is that there exists a consistent set of ranking relations that derive the appropriate structures for both broad and narrow focus contexts.

5. Culmination in English

The prosodic expression of focus in English sentences is affected by a complex set of pragmatic and thematic factors that go beyond the scope of this work (see among others Bolinger 1972, Schmerling 1976, Gussenhoven 1983, 1984, Nespor & Vogel 1989, Ladd 1996). What interests us here is its generally assumed culminant prosodic structure allowing for a main prominence peak within intonational phrases that we perceive as the sentence main stress. When the sentence is entirely parsed within a single IP its main stress coincides with the head of the IP.

When the entire IP is focused, its head occurs rightmost (Chomsky & Halle 1968, Ladd 1996, Nespor & Vogel 1986, Halle & Vergnaud 1987, Hayes 1995, Selkirk 1995). For example, a simple transitive clause uttered under broad focus is assigned the prosodic structure in (32) below.

(_ x) I
(x) (x) P
(32) [Lee may mimic my niece]$_f$

Under narrow focus the head of the IP shifts onto the focused constituent. This provides focus with intonational prominence but prevents right-alignment of the IP-head; see (33) below. Unlike the corresponding Chichewa structure, no additional IP-head occurs to the right of the IP-head. This observation is confirmed by the study described in Xu and Xu (2005:171) which carefully examines the pitch contour for sentence (33) and other similar sentences across a set of native speakers and clearly shows the culminant nature of the prosodic peak on the focused verb as well as the decreased prosodic prominence available on the post-focus object when compared with the broad focus case corresponding to (32) above.

(_ x _) I
(x) (x) (x) P
(33) Lee may mimic$_f$ my niece

The next two sections examine in detail the derivation of the above two structures under the constraints proposed here. Their underlying transitive clause does not form a minimal pair with the Chichewa ditransitive VP examined in the previous section, yet there are two important reasons supporting their detailed examination in this study. First, like the Chichewa data, the above sentences have been the object of thorough phonetic study in Xu and Xu (2005); this facilitates a comparison of the effects of focus in the two languages with respect to the presence or absence of prosodic culmination.

Second, shifting to a different type of clause affects the assessment of the constraints and therefore further tests their mutual consistency and predictive power. For example, the above English clauses satisfy Wrap under a greater number of phrase assignments than those available for a ditransitive VP would because the VP is reduced to the last two items of the clause. This in turn potentially affects the ranking relations determining the optimal structures. The minimal pair cases, i.e. the prosodic structures determined by a ditransitive VP under different focus contexts, will nevertheless be briefly examined at the end of section 5.2.

5.1 Broad Focus

The culminant nature of English IPs follows straightforwardly from the interaction of the proposed constraints.

Consider for example the derivation of the broad-focus structure in (32) repeated under (a) in T11 below. As in the corresponding Chichewa case we can ignore SF' because any IP-head inevitably falls on the focused sentence. The optimal structure violates StressXP$_{All}$ once because its subject is not IP-headed (remember that VP satisfies StressXP$_{All}$ via the IP-head on the object). The only structure outperforming (a) on some constraint is (b), which satisfies StressXP$_{All}$ through a non-culminant IPs at the cost of H-I. Eliminating (b) requires the ranking H-I>>StressXP$_{All}$, thus reversing Chichewa's ranking of these two constraints. (The unrealized head on V is ignored in (a) but not in (b) because only in (b) it is relevant for constraint assessment, namely right-alignment.)

a. ☞ *Optimal* (_ x) I (x) (x) P [S aux [V O]]$_f$			*	
T11 – Sentence focus I	H-I	H-P	StressXP$_{All}$	Wrap
b. *Non culminant IP* (x _ x) I (x) (_ x) P [S aux [V O]]$_f$	**$^{+1}$ *W*		*L*	

5.2 Verb Focus

As in the corresponding Chichewa case there is a potential ambiguity with respect to the PP-phrasing of the VP containing the focused verb, which could either be as in the adopted representation in (34) or involve a PP-wrapped VP as in the alternative representation in (35).

(_ x _) I
(x) (x) (x) P
(34) Lee may mimic$_f$ my niece

(_ x _) I
(x) (x _) P
(35) Lee may mimic$_f$ my niece

Representation (35) must be rejected for two reasons. First, though severely decreased in height the local prosodic peak associated with the object's PP-head remains discernible in Xu and Xu's study of these cases (2005:177).

Second, this representation of English transitive VPs, repeated under (a) in T12 below, can only beat the adopted representation repeated in (b) under the ranking Wrap>>{H-P, StressXP$_{All}$}. The ranking between Wrap and H-P however contradicts the ranking necessary to derive the prosodic structure attested for English ditransitive VPs in focus neutral contexts. This is shown in the next tableaux T13, where the optimal structure in (a) may only beat the contender in (b) under the ranking H-P>>Wrap.

a. *Rejected representation (35)* (_ x _) I (x) (x _) P Lee may mimic$_f$ my niece			*	*	***
T12 – Focused verb	SF'	Wrap	H-I	H-P	StressXP$_{All}$
b. *Adopted representation (34)* (_ x _) I (x) (x) (x) P Lee may mimic$_f$ my niece		* *W*	*	*L*	** *L*

a. *Attested representation* (_ _ x) I (x) (x)(x) P [S aux V O IO]$_f$		*			**
T13 – Ditrans. in focus neutral context	SF'	Wrap	H-I	H-P	StressXP$_{All}$
b. *Challenger* (_ _ x) I (x (x x) P [S aux V O IO]$_f$		*L*		*W*$^{+1}$	**

With the relevant representation established, we can once again consider its challengers in an orderly fashion starting with the structures satisfying SF' followed by those failing it, and further distinguishing in each group the challengers with a culminant IP from those lacking it.

I will further restrict the number of comparisons by ignoring any structure where the verb and the subject share the same PP as in (a)-(c) in (36) below. As the constraint violations listed on the right-hand side show, these challengers are inevitably h-bounded by any structure with an identical IP and the PP-phrasing shown in (37).

(36)
a. (_ x) (x) P
S aux [V$_f$ O] → *Wrap, *StressXP$_{All}$

b. (x x) (x) P
S aux [V$_f$ O] → *Wrap, *$^{+1}$H-P

c. (x _) (x) P
S aux [V$_f$ O] → *Wrap, *H-P

(37) (x) (x) (x) P
S aux [V$_f$ O] → *Wrap

Likewise, I will ignore any structure wrapping the entire sentence into a single PP. As (a) and (b) in (38) below show, these structures inevitably incur additional violations of H-P or StressXP$_{All}$ depending on whether their subject is or is not phrasally stressed. These violations occur independently from the presence or absence of heads on the following verb and object (hence the '?' symbol). Both types of structure are h-bounded by any competitor consistent with structure (39), which parses the subject in a PP of its own and therefore avoids the above violations with no adverse effects on any other constraints.

(38)
a. (_ ? ?) P
S aux [V$_f$ O] → *StressXP$_{All}$

b. (x ? ?) P
S aux [V$_f$ O] → **H-P

(39) (x) (? ?) P
S aux [V$_f$ O]

The first set of competitors is examined in T14 below. SF' is satisfied and IP culminant, therefore the focused verb carries the only available IP-head incurring the related H-I violation. The only possible improvement over the optimal structure

concerns Wrap, which can be satisfied by wrapping the VP in a single PP. As (b) and (c) show, this causes additional H-P violations because the verbal PP-head is no longer aligned. The alignment displayed by the optimal structure is thus relying on the ranking H-P>>Wrap.

(40) Ranking relations from T14: H-P >> Wrap

a. ☞ *Optimal* (_ x _) I (x) (x) (x) P S aux [V_f O]		*		**	*
T14 – Verb focus I	SF'	H-I	H-P	$StressXP_{All}$	Wrap
b. *Culminant IP* (_ x _) I (x) (x _) P S aux [V_f O]		*	* *W*	*** *W*	 *L*
c. *Culminant IP* (_ x _) I (x) (x x) P S aux [V_f O]		*	$*^{+1}$ *W*	**	 *L*

The next set of challengers involves SF'-compliant structures with non-culminant IPs. As T15 shows, the first two outperform (a) on $StressXP_{All}$ by adding additional IP-heads which cause additional IP-misalignment, thus forcing the ranking H-I>>$StressXP_{All}$.

The remaining three competitors outperform (a) on Wrap via a wrapped VP, but pay with additional violations of H-P. They are all already eliminated by the ranking conditions established thus far and summarized in (41) below.

(41) Ranking relations from T11-T15: H-P >> Wrap; H-I>>StressXP$_{All}$.

a. *Optimal* (_ x _) I (x) (x)(x) P S aux [V_f O]		*		**	*
T15 – Verb focus II	SF'	H-I	H-P	StressXP$_{All}$	Wrap
b. *Non-culminant IP* (_ x x) I (x) (x) (x) P S aux [V_f O]		*$^{+1}$ *W*		* *L*	*
c. *Non-culminant IP* (x x x) I (x) (x) (x) P S aux [V_f O]		***$^{+3}$ *W*		 *L*	*
d. *Non-culminant IP* (_ x x) I (x) (x x) P S aux [V_f O]		*$^{+1}$ *W*	*$^{+1}$ *W*	* *L*	 *L*
e. *Non-culminant IP* (x x _) I (x) (x _) P S aux [V_f O]		***$^{+1}$ *W*	* *W*	** 	 *L*
f. *Non-culminant IP* (x x x) I (x) (x x) P S aux [V_f O]		***$^{+3}$ *W*	*$^{+1}$ *W*	 *L*	 *L*

We proceed with all the challengers that fail SF'. These involve only two structures, one with a culminant and one with a non-culminant IP; all other structures in this group are h-bounded by these two candidates.

Challenger (b) is the structure selected optimal under the focus neutral case. Its wrapped VP and perfectly aligned heads beat (a) on H-I and Wrap. The same holds for StressXP$_{All}$, because the PP and IP heads on the object also count as heads for the entire VP, thus leaving (b) with only the subject unstressed whereas (a) leaves unstressed the object too. These achievements, however, are paid for on SF', which is violated by the lack of prominence on the focused verb. SF' must thus outrank H-I., Wrap, and StressXP$_{All}$.

Competitor (c) is analogous to (b) but for its non-culminant IP, which lets it stress its subject at the cost of additional H-I violations; the ranking conditions necessary for (b) already ensure its elimination as well.

a. *Optimal* (_ x _) I (x) (x) (x) P S aux [V_f O]		*		**	*
T16 – Verb focus III	SF'	H-I	H-P	$StressXP_{All}$	Wrap
b. *Culminant IP* (_ x) I (x) (x) P S aux [V_f O]	* *W*	*L*		* *L*	*L*
c. *Non-culminant IP* (x _ x) I (x) (_ x) P S aux [V_f O]	* *W*	$**^{+1}$ *W*		*L*	*L*

The overall ranking conditions for English are summarized in (42) below. The lower rank of $StressXP_{All}$ relative to H-I keeps English IPs culminant across all focus contexts, while the higher rank of H-P with respect to Wrap ensures that the same holds for PPs, since VP-wrapping does not provide a sufficient reason for misalignment. The only cases where alignment is not respected occur whenever SF' forces an IP-head on a non-final focused item, as in the verb focus case just examined, but even in this case H-I will prevent the addition of further IP-heads to the right of focus, keeping the IP culminant.

(42) English: {SF', H-P}>>Wrap
SF' >> H-I >> $StressXP_{All}$

As further discussed below, the above ranking conditions are also consistent with the selection of the two structures in (43) for focused ditransitive VPs and of structure (44) when the same ditransitive VP contains a narrowly focused verb. These structures match the phonological phrases detected in Selkirk (2000:241,247) for these focus contexts when no constituent is discourse given.

(43) a.
(_ x) I
(_ x) P
[V O IO]$_f$

b.
(_ x) I
(x) (x) P
[V O IO]$_f$

(44)
(x _ _) I
(x) (x) (x) P
V_f O IO

The two structures in (43) arise from the need to satisfy the high-ranked alignment constraints H-P and H-I. The choice between (a) and (b) depends on the ranking of Wrap and $StressXP_{All}$, with Wrap favoring (a) and $StressXP_{All}$ favoring (b). If constraint ties are allowed, as they are in Selkirk's original analysis, both structures emerge as optimal when Wrap ties with $StressXP_{All}$. The lack of a ranking relation between these constraints in (42) above implies that their tied status has no consequences on the detailed derivation discussed in the last two sections.

Structure (44) arises from the need to satisfy SF' by making focus sufficiently prominent. This forces both a PP and an IP-head on the focused verb. At the PP-level, H-P requires alignment, forcing a PP-boundary immediately after the verbal head. This violates the lower ranked Wrap, which in turn allows $StressXP_{All}$ to be satisfied as much as possible independently of its ranking with Wrap, triggering the presence of a PP for both the object and the indirect object. At the IP-level, H-I suffers the violations imposed by the higher ranked SF' but it disallows any additional violations; this leaves the head positions to the right of the verb unrealized at the cost of the lower ranked $StressXP_{All}$, producing a culminant IP in the process.

6. Conclusions

Prosodic culmination can be derived from the constraints on prosodic alignment, and therefore should not be an inviolable property of the structures produced by GEN. The optimal status of non-culminant structures then depends on the theory of CON, i.e. on whether constraints favoring multi-headed prosodic phrases exist and whether their interaction with the other constraints allows for such phrases to emerge as optimal. While further empirical studies in this area are needed, the case of Chichewa suggests that non-culminant phrases might be possible. As I have shown in this paper, their existence is consistent with a view of focus-induced prosodic phrasing entirely based on the prosodic prominence of focus (i.e. adhering to the 'Focus-Prominence Theory' of Selkirk 2004), provided that current prosodic constraints are minimally amended in the way proposed in this study.

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Appendix

The degree of variation required for the generation of non-culminant structures determines a large set of structures that outperform the optimal ones on some constraints and yet determine no additional ranking relations because they are h-bounded by other competitors. These structures are listed below with the corresponding harmonic bounders after the symbol '☠' and indexed by the tableaux and letter identifying them in the main text.

1. Chichewa

The structures below concern Chichewa VP-focus and are listed by increasing PP-size.

T17 – VP focus	H-P	Wrap	StressXP$_{All}$	H-I
a. ☠ T5c (x _) I (x)(x)(x) P [V O IO]$_f$		*	*	*
b. ☠ T5c (_ x) I (x)(x x) P [V O IO]$_f$	*$^{+1}$	*	*	
c. ☠ T5c (x _) I (x)(x x) P [V O IO]$_f$	*$^{+1}$	*	*	*
d. ☠ T5c (x _) I (x)(x) P [V O IO]$_f$		*	*	*
e. ☠ T5e (x x) I (x)(x x) P [V O IO]$_f$	*$^{+1}$	*		*$^{+1}$
f. ☠ T5b (x _) I (x x) P [V O IO]$_f$	*$^{+1}$		*	*

We proceed with narrow verb focus. The first set of structures satisfies SF' and show IP-culmination on the focused verb. The structures are listed by increasing PP-size.

T18 – Verb focus I	SF'	H-P	Wrap	StressXP$_{All}$	H-I
a. ☠ T7b (x _ _) I (x)(_ x) P V_f O IO			*	***	**
b. ☠ T7b (x _ _) I (x)(x _) P V_f O IO		*	*	***	**
c. ☠ T7b (x _ _) I (x)(x x) P V_f O IO		*$^{+1}$	*	**	**
d. ☠ T7b (x _ _) I (x _)(x) P V_f O IO		*	*	***	**
e. ☠ T7b (x _ _) I (x x)(x) P V_f O IO		*$^{+1}$	*	**	**
f. ☠ T7d (x _ _) I (x x _) P V_f O IO		***$^{+1}$		***	**

The next set contains SF'-compliant structures with non-culminant IPs listed by increasing PP-size. This is a large set and is therefore divided into two tableaux.

T19 – Verb focus II	SF'	H-P	Wrap	StressXP$_{All}$	H-I
a. ☠ T8b (x x _) I (x)(x)(x) P V_f O IO			*	*	***$^{+1}$
b. ☠ T8b (x _ x) I (x)(_ x) P V_f O IO			*	**	**$^{+1}$
c. ☠ T8b (x _ x) I (x)(x x) P V_f O IO		*$^{+1}$	*	*	**$^{+1}$
d. ☠ T8b (x _ x) I (x x)(x) P V_f O IO		*$^{+1}$	*	*	**$^{+1}$
e. ☠ T8b (x _ x) I (x _)(x) P V_f O IO		*	*	**	**$^{+1}$
f. ☠ T8b (x x _) I (x)(x _) P V_f O IO		*	*	**	***$^{+1}$
g. ☠ T8b (x x _) I (x)(x x) P V_f O IO		*$^{+1}$	*	*	***$^{+1}$
h. ☠ T8b (x x _) I (x x)(x) P V_f O IO		*$^{+1}$	*	*	***$^{+1}$
i. ☠ T8d (x x _) I (x x x) P V_f O IO		***$^{+3}$		*	***$^{+1}$
k. ☠ T8c (x x _) I (x x _) P V_f O IO		***$^{+1}$		**	***$^{+1}$

The next set includes h-bounded structures violating SF' but with culminant IPs. These structures never show an IP-head 'x' mark on the focused verb. I omitted any structure involving a multi-headed PP with a head on the verb like the one shown in (45) below. In all these cases the corresponding structure without the verbal head, shown in(46), shows better PP-alignment with no effects on any other constraints, thus h-bounding the original structure. As usual the structures are listed by increasing PP-size.

(45) Headed V:

```
(      ?     ?  )  I
( x    x ) (  x  )  P
  Vf   O     IO
```

(46) Removed V-head:

```
(      ?     ?  )  I
(      x ) (  x  )  P
  Vf   O     IO
```

T20 – Verb focus III	SF'	H-P	Wrap	StressXP$_{All}$	H-I
a. ☠ T9e (x _) I (x)(x)(x) P V_f O IO	*		*	*	*
b. ☠ T9e (_ x) I (x)(_ x) P V_f O IO	*		*	**	
c. ☠ T9e (_ x) I (x _)(x) P V_f O IO	*	*	*	**	
d. ☠ T9e (_ x) I (x)(x x) P V_f O IO	*	*$^{+1}$	*	*	
e. ☠ T9e (x _) I (x)(x) P V_f O IO	*		*	*	*
f. ☠ T9e (x _) I (x)(x _) P V_f O IO	*	*	*	**	*
g. ☠ T9e (x _) I (x)(x x) P V_f O IO	*	*$^{+1}$	*	*	*
h. ☠ T9b (x _) I (x _) P V_f O IO	*	*		**	*
i. ☠ T9c (x _) I (x x) P V_f O IO	*	*$^{+1}$		*	*

The final set of structures violates SF' and involves non culminant IPs.

T21 – Verb focus IV	SF'	H-P	Wrap	StressXP$_{All}$	H-I
a. ☠ T10d (x) I (x)(x x) P V_f O IO	*	*$^{+1}$	*		*$^{+1}$
b. ☠ T10d (x) I (x x)(x) P V_f O IO	*	*$^{+1}$	*		*$^{+1}$
c. ☠ T10d (x) I (x x x) P V_f O IO	*	***$^{+3}$			*$^{+1}$

2. English

The only relevant h-bounded structure for the sentence focus case is given in T22 below.

T22 – Sentence focus I	H-I	H-P	StressXP$_{All}$	Wrap
a. ☠ T11b (x _ x) I (x) (x x) P [S aux [V O]]$_f$	**$^{+1}$	*$^{+1}$		

Turning to the verb focus case, the structures that satisfy SF' with a culminant IP and outperform the optimal form on some constraint are never h-bounded, and have already been exhausted in tableau T14.

The h-bounded structures satisfying SF' but involving non-culminant IPs are instead listed below.

T23 – Verb focus I	SF'	H-I	H-P	StressXP$_{All}$	Wrap
a. ☠ T15b (x x _) I (x) (x) (x) P S aux [V_f O]		***$^{+1}$		*	*
b. ☠ T15d (x x _) I (x) (x x) P S aux [V_f O]		***$^{+1}$	*$^{+1}$	*	

The final set involves h-bounded structures that fail SF', with both culminant and non-culminant IPs.

T24 – Verb focus III	SF'	H-I	H-P	StressXP$_{All}$	Wrap
a. ☠ T16b (_ x) I (x) (x)(x) P S aux [V_f O]	*			*	*
b. ☠ T16b (x _ _) I (x) (x)(x) P S aux [V_f O]	*	**		*	*
c. ☠ T16c (x _ x) I (x) (x)(x) P S aux [V_f O]	*	**$^{+1}$			*
d. ☠ T16b (x _ _) I (x) (_ x) P S aux [V_f O]	*	**		*	
e. ☠ T16b (x _ _) I (x) (x _) P S aux [V_f O]	*	**	*	**	
f. ☠ T16b (_ _ x) I (x) (x x) P S aux [V_f O]	*		*$^{+1}$	*	
g. ☠ T16b (x _ _) I (x) (x x) P S aux [V_f O]	*	**	*$^{+1}$	*	
h. ☠ T16c (x _ x) I (x) (x x) P S aux [V_f O]	*	**$^{+1}$	*$^{+1}$		