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The interaction of word stress and phrasal nuclear pitch accent in Chickasaw

The main problem addressed in this paper is the placement of the primary stress and the variable behavior of CV and CVC(C) syllables in word final position in Chickasaw[1].

The primary stress of a word containing a final CV or CVC(C) syllable will surface on this syllable depending on the presence of a long vowel in the word, on the position of the word in the intonational phrase (final vs. nonfinal) and on the nature of the intonational phrase (declarative vs. interrogative). For example, CVVCVC and CVCCVCVC word inputs will surface as CVV'.CVC and CVC.CV.CVC' if they are in nonfinal position in the intonational phrase (for the notational conventions, see fn 2), as CVV.CVC' and CVC.CV.CVC' in declarative final position and as CVV'.CVC and CVC'.CV.CVC in interrogative final position.

As Gordon 2000 proposes, the realization of the word/primary stress on a nonfinal syllable does not seem to be due to nonfinality in Chickasaw, but to *the interaction between word prosody and the phrasal intonational prosody*. The 'word level' constraints partly regulate the placement of the word stress, while the 'phrase level' constraints regulate the placement of the nuclear pitch accent (the head of the intonational phrase) and at the same time require that the word stress and the nuclear pitch accent be realized on the same syllable of the word being in the intonational phrase final position. Thus, the 'phrase level' constraints not only depend on, but can also override the 'word level' constraints on the word stress assignment.

The present paper can be seen as a comprehensive OT execution of this proposal, i.e. as an analysis of the interaction between word and phrasal prosody in Chickasaw with respect to the placement of the primary stress and the behavior of CV and CVC(C) word final syllables.

In order to achieve this goal, a fairly extensive account of Chickasaw word prosody has to be provided. A partly independent achievement is the fact that the analysis makes possible a standard account of the Chickasaw minimal word requirement, while still making correct predictions with respect to the word stress placement.

The phrasal intonational prosody of the language will be explored only to the extent to which it interacts with the word prosody, more specifically with the primary stress assignment.

Section **I** provides the empirical generalizations and informally sketches the analysis. Section **II** develops the account of word prosody. Section **III** offers some elements of Chickasaw intonational (phrasal) phonology and analyzes their interaction with word prosody. Sections **II** and **III** are followed by sizeable appendices, in which additional generalizations are shown to follow from the proposed analyses.

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[1] Chickasaw is a western Muskogean language, closely related to Choctaw.

I. Word stress and phrasal nuclear pitch accent in Chickasaw: the empirical generalizations.

The following generalizations are based on the Chickasaw data and generalizations as given in Gordon 1999a, 1999b, 2000, 2002a, Gordon to appear and, partly, Gordon 2002b. They are not exhaustive, giving only a relatively fine-grained picture of the data; more empirical details will be added as the analysis develops.

1. Word prosody[2].

Unlike other Muskogean languages, Chickasaw is a stress, not a pitch accent language[3], although pitch accent plays a role in the verbal morphophonology (which will be henceforth ignored; for discussion, see Gordon 2002b among others).

Rhythmic lengthening and secondary stress.

Rhythmic lengthening: the second vowel in a sequence of two CV syllables is lengthened, *unless it is word final* (Gordon 1999a: 189): CV.CV.CV.CV…# surfaces as CV.CV𝕍`.CV.CV𝕍`…#. This suggests that there is an iambic foot form at work in Chickasaw. Moreover, the parsing is iterative/exhaustive and left-to-right (LR→), as in other Muskogean languages (e.g. Choctaw, Seminole/Creek).

If the input is of the form CVCV, there is no rhythmic lengthening and the output is stressed on the final light syllable: [(CV.CV')] (see Gordon to appear: 1-2).

Syllables containing a long vowel are always stressed, i.e. the Weight-to-Stress Principle (WSP), requiring that every heavy syllable be stressed, is never violated.

The Weight-By-Position principle (WBP) is generally not violated: closed syllables are always heavy and always bear (at least) secondary stress in declarative and interrogative nonfinal position, i.e. whenever there is no interaction with the phrasal pitch accent (see Gordon to appear: 2 – "…secondary stress …falls on CVV and CVC and on final syllables not carrying primary stress" – and also Gordon 2002b).

Primary stress.

The word/primary stress falls on the rightmost syllable containing a long vowel. If there is no long vowel, it falls on the final syllable (see Gordon to appear: 2, Gordon 2002b).

Thus, the word stress is placed according to a peak prominence constraint Pk-Prom, which enforces the harmonic hierarchy CVV(C)>>CVC(C), CV. Also, the word stress has to be placed on the *rightmost* most prominent syllable in the prosodic word (PrWd).

Minimal word.

There is a minimal word requirement in Chickasaw, as Gordon 2002b: 10 (and fn 6) reports. In the closely related Choctaw, a CV input always surfaces as [(CV𝕍')] (see

[2] I will represent a syllable bearing the word/main/primary stress as σ' and a syllable bearing a secondary stress as σ`. C stands for a consonant, V for a vowel; the syllabic structure of a sequence of segments, for example CVCVC, is represented with dots: CV.CVC. The foot structure is represented with parentheses: (CV.CVC'). A vowel which is underlyingly short, but it is lengthened in the surface form (by mora epenthesis) is represented as V𝕍.

[3] although pitch accents play a role in the verbal morphophonology; cf. Gordon 2002a, b, Gordon to appear, .

Nicklas 1974: 124). The minimal word requirement is also attested in Seminole/Creek (see Tyhurst 1987, Hayes 1995), so it seems to be a fairly common phenomenon in the Muskogean language family. Consequently, I will assume that Chickasaw resolves CV inputs in the same way as Choctaw – and that FtBin, requiring that a foot is binary under moraic or syllabic analysis, is never violated in Chickasaw[4].

This position with respect to FtBin seems to make the wrong predictions for /CVCCV/ and /CVVCV/ inputs (these are paradigmatic cases).

A /CVCCV/ input surfaces with the main stress on the final light syllable and a secondary stress on the closed CVC syllable (see Gordon 2002b: 4 et seqq). This surface form can be straightforwardly generated if FtBin is violated and the final CV syllable is parsed into a 'degenerate' foot (to use the terminology of Hayes 1995).

However, given the reliability of the minimal word requirement, I propose that not FtBin is violated in the surface form, but a constraint enforcing the alignment of the head of the prosodic word Hd(PrWd) with the head of a foot Hd(Ft)[5]. The 'layering' of the various prosodic 'levels' is less harmonic under the pressure of the rightmostness of the word stress. Thus, the input /CVCCV/ is solved as [(CVC`).CV']. WBP is still obeyed and Pk-Prom is not violated, given that CVC and CV are equally harmonic with respect to peak prominence. In this way, we can capture the generalization about the word stress, which is always assigned to the final syllable (not to the rightmost secondary stress!) unless there is a long vowel in the word.

I will further assume that the misalignment of the secondary and primary stress cannot yield structures of the form [(σ`σ')] or [(σ'σ`)], i.e. structures in which, within the same foot, the primary and the secondary stress are misaligned. I take this to be a basic well-formedness condition on foot structure (which would be enforced by GEN in an OT framework). This implies that *the primary and the secondary stress can be misaligned only if there is an unparsed syllable in the word.*

The above generalizations predict that a /CVVCV/ input are solved as [(CVV').CV], as Pk-Prom takes precedence over rightmostness which, in turn, takes precedence over the alignment of the primary and secondary stress; yet, Gordon 2002b: 4 et seqq reports that there is a secondary stress on the final light syllable in the surface form of this input. I will maintain that the output is [(CVV').CV], i.e. the final light syllable is not footed, and suggest that its greater prominence is due to the inherent prominence of the word final position (see Hayes 1995 for some discussion of this assumption).

2. Phrasal prosody and its interaction with word prosody.

Declarative and interrogative intonational melodies.

The tones can dock to/be associated with vocalic moras only (consonantal moras due to WBP cannot be associated with tones). Also, tones have one of the two tonal specifications: high (H) or low (L).

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[4] for an analysis of the minimal word requirement in Latin, see Prince & Smolensky 1993/2002; for a different position with respect to the ranking of FtBin (and Parse-σ) in Chickasaw, see Gordon 2002b.
[5] Alan Prince had a similar suggestion for Latin, class discussion (Seminar in Phonology, Fall 2002).

The tonal difference between declaratives and interrogatives (yes/no- or wh-questions) is the following (based on Gordon 1999b, 2000, 2002b): both declaratives and interrogatives have a H* nuclear pitch accent (NPA); declaratives have a H% (rightmost) boundary tone, while interrogatives have a L% (rightmost) boundary tone. Thus, the tone melodies are: declarative – H*H%, interrogative – H*L%.

I will refer to the NPA as the head tone or the head of the Intonational Phrase (IntP); the NPA will be represented as T* or as σ*, i.e. as the syllable which is associated with the NPA and which is considered to be the head of the IntP; in short, σ* will represent the Hd(IntP).

The boundary tone T% is always aligned with the right edge of the IntP, i.e. it is always associated with the final vowel of the IntP.

Nuclear pitch accent placement and its interaction with word stress.

The NPA always surfaces within the word being in IntP final position, irrespective of the IntP being declarative or interrogative. That is, the Hd(IntP) is rightmost within the IntP (see Gordon 1999b, 2002b).

Moreover, the NPA is always associated with the syllable bearing the primary stress of the IntP final word, i.e. the Hd(IntP) and Hd(PrWd) are always aligned.

The rightmostness of the Hd(IntP) and its alignment with the word stress yield two different environments for the placement of the word stress: when the word is in IntP non-final position, the placement of the Hd(PrWd) will be regulated only by the word prosody; when the word is in IntP final position, its placement will be regulated by the word and phrasal intonational prosody, since the Hd(PrWd) and the Hd(IntP) are always the same syllable.

Finally, the placement of the NPA is regulated by a constraint against the association of complex sequences of tones with the same mora, where *a complex sequence of tones is a sequence of two tones with different tonal specification*, i.e. T_1T_2, $T_1 \neq T_2$ (a sequence is not complex iff the two tones in the sequence have the same tonal specification).

Chickasaw disallows the association of complex tones with the same (vocalic) mora: CV and CVC syllables cannot accommodate complex tones, but CVV syllables can. Also, CV and CVC syllables can be associated with tone sequences, as long as the sequence is not complex, i.e. the two tones have the same tonal specification (HH or LL).

The constraint against complex sequences of tones distinguishes between declarative and interrogative IntPs, since only the interrogative intonational melody is complex.

Summarizing, the placement of the word stress is potentially different, depending on the word being in one of the following three environments:

- declarative/interrogative nonfinal position: the placement of the word stress is regulated only by word prosody;
- declarative final position: the placement of the word stress can depend on the NPA placement (which is rightmost in the IntP);

- interrogative final position: the placement of the word stress can depend on the NPA placement and on the constraint banning the association of complex tone sequences with the same mora;

Throughout the paper, I will assume that the intonational melodies for declaratives or interrogatives are specified in the input; I will represent the input specification as follows:

- /*segmental material*/^{D} stands for /*segmental material*, H*H%/, i.e. a word in declarative final position;
- /*segmental material*/^{Q} stands for /*segmental material*, H*L%/, i.e. a word in question final position;
- /*segmental material*/ stands for a word in IntP nonfinal position.

CV and CVC(C) syllables in declarative final vs. nonfinal position.

An input CVVCVC in declarative nonfinal position will be solved according to the word prosody constraints only. Pk-Prom (CVV>CVC(C), CV) takes precedence over the rightmostness of the primary stress, so the surface form will be: /CVVCVC/ → [(CVV’).(CVC`)].

However, an input CVVCVC in declarative final position will have the word stress on the final syllable, due to the rightmostness of the NPA, which takes precedence over Pk-Prom: /CVVCVC/ → [(CVV`).(CVC’*)].

As noted above, a /CVVCV/ input in IntP nonfinal position is solved as [(CVV’).CV] – and for the same reasons (i.e. Pk-Prom over rightmostness of the main stress). But in declarative final position, /CVVCV/^{D} surfaces as [(CVV`).CV’*], given that Pk-Prom is crucially subordinated to the rightmostness of the NPA; in this way, we reobtain the misalignment of the primary and secondary stress, which is possible whenever Pk-Prom is not relevant (see /CVCCV/ → [(CVC`).CV’) above).

The same contrast is established by a CVCVCV input: in IntP nonfinal position, it surfaces as [(CV.CV𝕍’).CV], while in declarative final position, it is resolved with final word stress and NPA: /CVCVCV/^{D} → [(CV.CV𝕍`).CV’*].

CV and CVC(C) syllables in declarative vs. interrogative final position.

A CVC(C) in interrogative final position behaves differently from the CVC in declarative position: a declarative final CVC(C) will always bear the primary stress and the NPA, while an interrogative final CVC(C) will never bear the primary stress and/or the NPA; in this case, the rightmost most prominent nonfinal syllable bearing secondary stress will also bear the word stress and the NPA.

Thus, we have the following generalizations:

- /CVCCVCVC/^{D} surfaces as [(CVC`).(CV.CVC’*)], while /CVCCVCVC/$^{Q}$ surfaces as [(CVC’*).(CV.CVC`)];
- /CVCV/^{Q} or /CVCVC/^{Q} inputs are resolved as [(CV’*.CV)]^{Q} as [(CV’*.CVC)]^{Q}, with the NPA repelled to the penultimate syllable due to the constraint against complex tone sequences and the primary stress ‘following’ the NPA, with which it is always perfectly aligned; the corresponding declarative inputs do not exhibit this kind of ‘nonfinality’

(and the consequent violation of Iamb and WBP): /CVCV/^{D} → [(CV.CV'*)]^{D}; /CVCVC/^{D} → [(CV.CVC'*)]^{D};

- /CV/, /CVV/ and /CVCVV/ inputs behave as expected, i.e. they surface as [(CVV'*)], [(CVV'*)] and [(CV.CVV'*)] in both interrogative and declarative final position - the rightmost long vowel always bears the primary stress and the nuclear pitch accent.

Summarizing, the behavior of the CV and CVC(C) syllables in IntP nonfinal position and in interrogative and declarative final position suggests that nonfinality of any kind (i.e. nonfinality of the final syllable or of the final consonant or mora) is not 'active' in Chickasaw. Repelling the word stress from the final CVC(C) syllable in interrogatives or in IntP nonfinal words that have a long vowel is due either to peak prominence or to the interaction of word and phrasal prosody. This hypothesis was explicitly proposed in Gordon 2000 (although in a slightly different form) and it underlies the present OT implementation.

II. An OT account of Chickasaw word prosody.

In order to analyze the interaction between word stress and nuclear pitch accent, the first step is to give an account of the word prosody and of the way it determines the placement of the primary stress. By the same token, I will provide an analysis of the word stress and of the word final CV and CVC(C) syllables in the 'neutral', IntP nonfinal environment.

Most of the constraints are already well motivated in the OT literature, so they do not need extensive discussion. All the alignment constraints used in this and the following section are gradient; I will leave as an open question if the effects captured here by the interaction of Rt(σ'), Pk-Prom and Align(σ', σ`) can be also captured with non-gradient alignment (similar problems might appear in section III). The sequence '×σ' following an alignment/nonfinality constraint indicates that the measure of violation is the syllable. The symbol σ' is used for syllables bearing primary/main/word stress; σ` is used for syllables bearing secondary stress in the representation of the output and also in the constraint Align(σ', σ`); in the constraints FtBin/*(L`), GH/*(LL`) and Nf(σ`), σ` stands for any kind of stress (secondary or primary). L, H – when used in foot structure constraints – stand for light and heavy syllables respectively (they will be also used in tone related constraints, where they stand for low and high tones respectively).

The first set of constraints is needed to generate *the foot structure*:

1. **FtBin/*(L')**: feet must be binary under syllabic or moraic analysis, i.e. no feet consisting of light syllables[6];
2. **GH/*(LL')**: no iambic feet consisting of two light syllables. GH stands for Grouping Harmony; I am using only a subpart of it, namely *(LL`), which is meant to capture the harmonic hierarchy (LH`)>(LL`) (see Prince 1991)[7], i.e. the iambic lengthening;

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[6] I am assuming that GEN cannot output feet which have more than two syllables or more than three moras.

[7] I am ignoring the corresponding (LH`)>(H`) (which can be phrased as 'bigger is better for iambs'), since the same effects are 'triggered' anyway by Parse-σ and Align-Feet-Left (at least in this particular case); also, (LH`)>(H`), i.e. *(H`) can in principle trigger WBP or Max-μ violations in HH sequences – which are irrelevant in this particular case, since I assume that Max-μ is undominated and WBP is high ranked.

3. **Iamb**: the right edge of the head syllable of the foot is aligned with the right edge of the foot; this constraint is actually Iamb×σ, since the obvious measure for violation assessment is the syllable;
4. **Parse-σ**: all syllables must be parsed into feet;
5. **Align-Feet-Left×σ**: for any foot, there is a PrWd, such that the left edge of the foot is coincides with the left edge of the PrWd;

The next two constraints are the two most important constraints at the word prosody 'level' that regulate the placement of primary stress in Chickasaw:

6. **Pk-Prom/**cvv'>cvc(c)', cv': if stressed, then 'heavy': the word stress falls on a syllable with a 'branching'/'complex' nucleus (in all the cases we will consider, on a long/bimoraic vowel);
7. **Rt(σ')**: the syllable bearing the word stress is rightmost in the PrWd.

There are two faithfulness constraints crucially needed to obtain the rhythmic lengthening pattern and the way it is different from Pk-Prom and minimal word satisfaction:

8. **Dep- μ**: no mora epenthesis;
9. **Dep- $\mu]_\sigma$#**: no mora epenthesis in the final syllable of the PrWd (positional faithfulness);

The analysis will formally establish that the word stress placement and the behavior of CV or CVC(C) word final syllables are not regulated by nonfinality – the relevant constraints are low ranked and 'inactive' in Chickasaw:

10. **Nf(σ')×σ**: the syllable which is the head of the PrWd must not be final in the PrWd.
11. **Nf(σ\`)×σ**: a head syllable (head of a foot or of the PrWd) must not be final in the PrWd.

The following two constraints do not play any important role in the word prosody by itself; however, they become crucial as soon as the interaction with nuclear pitch accent placement is considered:

12. **Dep- $\#_\sigma[\mu$**: no mora epenthesis in the initial syllable of the PrWd (positional faithfulness);
13. **WBP**: closed syllables (i.e. syllables with nonempty codas) are heavy.

The last alignment constraint provides an account of the word stress placement while still preserving the usual OT analysis of minimal word phenomena (for the analysis, see Prince & Smolensky 1993/2002, ch. 4). This is a constraint regulating the 'layering' of the two prominence levels inside a PrWd, the foot layer/structure and the PrWd layer/structure:

14. **Align(σ', σ\`)**: for any syllable which is the head of the PrWd, there is a syllable which is the head of a foot, such that the right edge of the Hd(PrWd) coincides with the right edge of the Hd(Ft)[8]; the measure for violation is the syllable.

As previously noted, I am assuming that GEN cannot output structures of the form [(σ\`σ')] or [(σ'σ\`)], i.e. structures in which, within the same foot, the primary and the secondary stress are misaligned. I take this to be a basic well-formedness condition on

[8] the left edge of the heads could have been used just as well.

foot structure, which enforces that the primary and the secondary stress can be misaligned only if there is an unparsed syllable in the PrWd.

The following account will assume for simplicity that **WSP** (Weight-to-Stress Principle), **Max-μ**, **Max-V**, **Max-C**, **Dep-C**, **Dep-V** are undominated. I will not consider any candidates that violate these constraints.

I will not provide an analysis of the minimal word requirement, which is relevant only with respect to the ranking of FtBin. The constraints Lx~Pr and M-Parse are considered undominated; more exactly, they have to rank higher than the two positional faithfulness constraints Dep- $\mu]_\sigma\#$ and Dep- $\#_\sigma[\mu$.

Tableau 1 below provides a set of necessary ranking conditions in the format of the comparative tableaux (see Prince 2002). A row of W, L and e (blanks) in the tableau will be referred to as a vector. The shaded vectors are entailed vectors, i.e. a fusion of a set of vectors can be obtained, such that it will entail some of the fused vectors. The fusions are provided at the end of the tableau and the entailment relations are listed afterwards. The vector numbering will make sense once tableau 2 in the Appendix of Section II is considered. Tableau 2 contains an extensive number of Chickasaw generalizations, which are shown to follow from the ranking enforced by tableau 1. Thus, the vectors in tableau 1 express not only necessary, but also sufficient ranking conditions with respect to the Chickasaw word prosody issues that are addressed in this paper.

Vectors 2, 3, 7, 20 and 21 capture the rhythmic lengthening phenomena, the foot structure and part of the word stress behavior.

Vector 26 captures the ranking of FtBin as enforced by the minimal word requirement.

Vector 33 addresses the word stress placement, in particular the interaction between Pk-Prom and Rt(σ').

Vector 35 ranks Iamb and Parse-σ (the ranking is made possible by the assumption that WSP is undominated).

Vector 38 captures the interaction between Pk-Prom and Dep-μ.

Vector 39 ranks WBP with respect to Parse-σ.

Vector 40 addresses the word stress placement, in particular the interaction between Rt(σ'), nonfinality and the 'layering' constraint.

	TABLEAU 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14
		FtBin/ *(L‘)	GH/ *(LL‘)	Iamb	Parse-σ	Align-Feet-Left ×σ	Pk-Prom/ CVV’> CVC(C)’, CV’	Rt(σ’) ×σ	Dep-μ	Dep-$\mu]_{\sigma}\#$	Nf(σ’) ×σ	Nf(σ`) ×σ	Dep-$\#_{\sigma}[\mu$	WBP	Align (σ’, σ`)
	/CVCVCV/→ [(CV.CV𝕍’).CV]														
2	~[(CV.CV𝕍`) (CV𝕍’)]				L	W		L	W	W	W	W			
3	~[(CV.CV’).CV]		W				W		L						
	/CVCV/→ [(CV.CV’)]														
7	~[(CV.CV𝕍’)]		L				L		W	W					
	/CVCVCVCV/→ [(CV.CV𝕍’).(CV.CV`)]														
16	~[CV.(CV.CV𝕍’).CV]		L		W	L		L				L			
	/CVCVCVCVCV/→ [(CV.CV𝕍`).(CV.CV𝕍’).CV]														
20	~[(CV.CV𝕍’).CV.CV.CV]				W	L		W	L						
21	~[CV.CV.(CV.CV𝕍’).CV]				W				L						
	/CV/→[(CV𝕍’)]														
26	~[(CV’)]	W					W		L	L			L		
	/CVVCVCCV/→[(CVV’).(CVC`).CV]														
33	~[(CVV`).(CVC’).CV]						W	L							
	/CVVCV/→[(CVV’).CV)]														
35	~[(CVV’.CV)]			W	L										
	/CVCVCCV/→[(CV.CVC`).CV’]														
38	~[(CV.CV𝕍C’).CV]						L		W						L

	TABLEAU 1 (ctd)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
		FtBin/ *(L‘)	**GH/ *(LL‘)**	**Iamb**	**Parse-σ**	**Align-Feet-Left ×σ**	**Pk-Prom/ CVV’> CVC(C)’, CV’**	**Rt(σ’) ×σ**	**Dep-μ**	**Dep-$\mu]_{\sigma}$#**	**Nf(σ’) ×σ**	**Nf(σ`) ×σ**	**Dep-#$_{\sigma}$[μ**	**WBP**	**Align (σ’, σ`)**
	/CVCCV/ → [(CVC`).CV’]														
39	~[(CVC.CV’)] (with a nonmoraic coda)		W		L									W	L
40	~[CVC’).CV]							W			L	L			L
	2◦3◦7◦16◦40		L		L	L	L	L	L	W	L	L			L
	2◦3◦7◦16◦26◦40	W	L		L	L	L	L	L	L	L	L	L		L
	16◦21◦33◦35◦38◦40		L	W	L	L	L	L	L		L	L			L
	16◦20◦21◦33◦38◦40		L		W	L	L	L	L		L	L			L
	3◦33◦38		W				L	L	L						L
	16◦39		L		L	L		L				L		W	L
33							W	L							
38							L		W						L
40								W			L	L			L

The fusions provided at the end of tableau 1 entail some of the 'primitive' vectors, as follows:

- 16◦39 entails 39;
- 2◦3◦7◦16◦40 entails 2, 7;
- 3◦33◦38 entails 3;
- 16◦20◦21◦33◦38◦40 entails 16, 20, 21;
- 2◦3◦7◦16◦26◦40 entails 26;
- 16◦21◦33◦35◦38◦40 entails 35.

These fusions and the nonentailed vectors repeated at the bottom of the tableau (33, 38, 40) enforce the following ranking conditions:

Constraint ranking:

i. FtBin>>Dep-μ]$_\sigma$#>>Parse-σ>>GH>>Dep-μ>>Pk-Prom>>Rt(σ')>>Nf(σ'), Nf(σ`), Align(σ', s`);
ii. Ft-Bin>>Dep- #$_\sigma$[μ;
iii. Iamb, WBP>>Parse-σ>>Align-Feet-Left.

I have also assumed that:

iv. WSP, Max-μ, Max-V, Max-C, Dep-C, Dep-V are undominated;
v. Lx~Pr, M-Parse>>Dep-μ]$_\sigma$#, Dep- #$_\sigma$[μ (due to the minimal word requirement).

Just as the empirical generalizations suggested, nonfinality does not play any role in the word level prosody of Chickasaw.

Appendix to Section II (An OT account of Chickasaw word prosody).

Tableau 2 below captures an extensive number of generalization, which are shown to follow from the constraint ranking enforced by tableau 1.

The shaded vectors are entailed by the fusions at the bottom of the tableau or by other shaded or non-shaded vectors. The non-shaded vectors are the ones included in tableau 1.

The entailment relations show that tableau 1 provides the entire information about the constraint ranking that is contained in the bigger tableau 2. The purpose of this comprehensive tableau is to establish that the above constraint ranking is not only necessary, but also sufficient with respect to the Chickasaw word prosody generalizations presented in section 1. The tableau also shows that adding the other generalizations does not yield inconsistent ranking conditions.

The generalizations captured in tableau 2:

- vectors 1-6 capture the rhythmic lengthening and the LR→ exhaustive/iterative iambic parsing for sequences of three light syllables (Rhythmic Lengthening: the second vowel in a sequence of two CV syllables is lengthened, unless it is word final); the 'trigger' of rhythmic lengthening is iambic lengthening, i.e. Grouping Harmony – in particular *(LL`);
- vectors 7-11 capture the way in which Chickasaw solves CVCV inputs; vectors 1-11 are also relevant for FtBin and Pk-Prom;
- vectors 12-18 characterize sequences of four light syllables – and take a further look at the rhythmic lengthening phenomenon and its interactions with main stress placement, mora epenthesis (in its various guises) and syllable parsing (into feet);
- vectors 19-25 extend the characterization to sequences of five light syllables – they are needed to factor out the relation between Dep-μ and Parse-σ;
- vector 26 is part of a more general argument for the minimal word phenomenon and the way in which Chickasaw solves it; more precisely, the vector factors out the relation between FtBin and all the three constraints against mora epenthesis;
- vector 27 captures the relation between the alignment of the main stress and nonfinality (it is entailed by 40);
- vectors 28-31, 34, 41 do not bring any new/crucial information; they are paradigmatic cases of word stress-NPA interaction, so they set the stage for the final part of the analysis;
- vectors 32-33 factor out the relation between Pk-Prom and Rt(σ') – the alignment constraint is subordinated;
- vectors 35-37 capture the way in which Chickasaw solves CVVCV inputs, factoring out the relation between Iamb and Parse-σ;
- vector 38 captures the relation between Pk-Prom and Dep-μ, showing that the rhythmic lengthening phenomenon is not due to Pk-Prom, but to iambic lengthening;
- vector 39 ranks WBP with respect to Parse-σ;
- vector 40 addresses the word stress placement, in particular the interaction between Rt(σ'), nonfinality and the 'layering' constraint.

	TABLEAU 2	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
		FtBin/ *(L‘)	**GH/ *(LL‘)**	**Iamb**	**Parse-σ**	**Align-Feet-Left ×σ**	**Pk-Prom/ CVV’> CVC(C)’, CV’**	**Rt(σ’) ×σ**	**Dep-μ**	**Dep-μ]$_{\sigma}$#**	**Nf(σ’) ×σ**	**Nf(σ`) ×σ**	**Dep-#$_{\sigma}$[μ**	**WBP**	**Align (σ’, σ`)**
	/CVCVCV/→ [(CV.CV𝕍’).CV]														
1	~[(CV.CV𝕍`).(CV’)]	W	W		L	W	W	L			W	W			
2	~[(CV.CV𝕍`) (CV𝕍’)]				L	W		L	W	W	W	W			
3	~[(CV.CV’).CV]		W				W		L						
4	~[CV.(CV.CV’)]		W			W	W	L	L		W	W			
5	~[CV.(CV.CV𝕍’)]					W		L		W	W	W			
6	~[(CV𝕍`). (CV.CV𝕍’)]				L	W		L	W	W	W	W	W		
	/CVCV/→ [(CV.CV’)]														
7	~[(CV.CV𝕍’)]		L				L		W	W					
8	~[(CV’.CV)]			W				W			L	L			
9	~[(CV𝕍’). CV]		L		W		L	W	W		L	L	W		
10	~[(CV𝕍`) (CV𝕍’)]		L			W	L		W	W			W		
11	~[(CV𝕍’) (CV𝕍`)]		L			W	L	W	W	W	L	L	W		
	/CVCVCVCV/→ [(CV.CV𝕍’).(CV.CV`)]														
12	~[(CV.CV𝕍`).(CV.CV’)]						W	L			W				
13	~[(CV.CV𝕍’).(CV.CV𝕍`)]		L							W					
14	~[(CV.CV𝕍`).(CV.CV𝕍’)]		L					L		W	W				
15	~[(CV.CV𝕍’).CV.CV]		L		W	L						L			
16	~[CV.(CV.CV𝕍’).CV]		L		W	L		L				L			
17	~[CV.CV.(CV.CV𝕍’)]		L		W	L		L		W	W				
18	~[(CV.CV𝕍’).(CV`.CV)]			W								L			

	TABLEAU 2 (ctd)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
		FtBin/ *(L‘)	**GH/ *(LL‘)**	**Iamb**	**Parse-σ**	**Align-Feet-Left ×σ**	**Pk-Prom/ CVV’> CVC(C)’, CV’**	**Rt(σ’) ×σ**	**Dep-μ**	**Dep-$\mu]_\sigma\#$**	**Nf(σ’) ×σ**	**Nf(σ`) ×σ**	**Dep-$\#_\sigma[\mu$**	**WBP**	**Align (σ’, σ`)**
	/CVCVCVCVCV/→ [(CV.CV𝕍‘).(CV.CV𝕍’).CV]														
19	~[(CV.CV𝕍`).(CV.CV𝕍’).(CV`)]	W	W		L	W						W			
20	~[(CV.CV𝕍’).CV.CV.CV]				W	L		W	L						
21	~[CV.CV.(CV.CV𝕍’).CV]				W				L						
22	~[CV.CV.CV.(CV.CV𝕍’)]				W	W		L	L	W	W	W			
23	~[(CV.CV𝕍`).CV.(CV.CV𝕍’)]					W		L		W	W	W			
24	~[(CV.CV𝕍`).(CV.CV𝕍`).(CV𝕍’)]				L	W		L	W	W	W	W			
25	~[(CV.CV𝕍`).(CV.CV𝕍’).(CV𝕍`)]				L	W			W	W					
	/CV/→[(CV𝕍’)]														
26	~[(CV’)]	W					W		L	L			L		
	/CVVCVV/→[(CVV`).(CVV’)]														
27	~[(CVV’).(CVV`)]							W			L				
	/CVCCVC/→[(CVC`).(CVC’)]														
28	~[(CVC’).(CVC`)]							W			L				
29	~[(CV𝕍C’).(CVC`)]						L	W	W		L		W		
30	~[(CVC`).(CV𝕍C’)]						L		W	W					
	/CVCCV/→[(CVC`).CV’]														
31	~[(CV𝕍C’).CV]						L		W				W		L
	/CVVCVC/→[(CVV’).(CVC`)]														
32	~[(CVV`).(CVC’)]						W	L			W				

	TABLEAU 2 (ctd)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
		FtBin/ *(L‘)	**GH/ *(LL‘)**	**Iamb**	**Parse-σ**	**Align-Feet-Left ×σ**	**Pk-Prom/ CVV’> CVC(C)’, CV’**	**Rt(σ’) ×σ**	**Dep-µ**	**Dep-$\mu]_\sigma$#**	**Nf(σ’) ×σ**	**Nf(σ`) ×σ**	**Dep-$\#_\sigma[\mu$**	**WBP**	**Align (σ’, σ`)**
	/CVVCVCCV/→[(CVV’).(CVC`).CV]														
33	~[(CVV`).(CVC’).CV]						W	L							
	/CVCCVCV/→[(CVC`).(CV.CV’)]														
34	[(CVC’).(CV.CV`)]							W			L				
	/CVVCV/→[(CVV’).CV)]														
35	~[(CVV’.CV)]			W	L										
36	~[(CVV`).(CV𝕍’)]				L	W		L	W	W	W	W			
37	~[(CVV’).(CV𝕍`)]				L	W			W	W		W			
	/CVCVCCV/→[(CV.CVC`).CV’]														
38	~[(CV.CV𝕍C’).CV]						L		W						L
	/CVCCV/ → [(CVC`).CV’]														
39	~[(CVC.CV’)] (with a nonmoraic coda)		W		L									W	L
40	~[CVC’).CV]							W			L	L			L
41	~[(CVC’.CV)]			W	L			W			L	L			L
	2◦3◦7◦16◦40		L		L	L	L	L	L	W	L	L			L
	2◦3◦7◦16◦26◦40	W	L		L	L	L	L	L	L	L	L	L		L
	3◦33◦38		W				L	L	L						L
	16◦20◦21◦33◦38◦40		L		W	L	L	L	L		L	L			L
	16◦21◦33◦35◦38◦40		L	W	L	L	L	L	L		L	L			L
	33◦38◦40						L	L	W		L	L			L

Entailment relations in tableau 2:

- 2 entails 6;
- 16 entails 15 and 17;
- 28, 34 are the same as 27 and they are all entailed by 40;
- 33 entails 12;
- 33◦38◦40 entail 29, 30, 31;
- 38 entails 31;
- 27, 28 and 34 are the same and they are entailed by 40;
- 2◦3◦7◦16◦40 entails 2, 5, 6, 7, 10, 11, 13, 14, 17, 22-25, 30, 36, 37;
- 33 entails 32;
- 2◦3◦7◦16◦26◦40 entails 1, 19, 26;
- 3◦33◦38 entails 4;
- 16◦20◦21◦33◦38◦40 entails 9, 16;
- 16◦21◦33◦35◦38◦40 entails 8, 18, 41.

Hence, the entire tableau 2 reduces to tableau 1.

III. The interaction between word stress and phrasal nuclear pitch accent.

In order to analyze the interaction between word stress and NPA placement, the intonational 'environment' has to be set up adequately and 'preserved' as such. The following constraints, which are relevant only for the intonational phonology of the language, have precisely this effect if they are assumed to be undominated.

- **Dock (T, V)**: the tone can be associated only with vocalic moras;
- **Align-T%-R×σ**: for any boundary tone associated with a mora, there is an IntP, such that the right edge of the syllable containing the 'tonal' mora coincides with the right edge of the Intonational Phrase (IntP);
- **Max-T**: no tone deletion;
- **Dep-T**: no tone epenthesis;
- **Ident-T**: no modification of the input tonal specification (H or L).

Since these constraints do not interact (directly) with the word prosody, I will not include them in tableau 3 below. I ignore **Align-Feet-Left×σ** for the same reason.

As already noted, I will assume that the intonational melodies for declaratives or interrogatives are specified in the input and I will represent the input specification as follows:

- */segmental material/*^{D} stands for */segmental material*, H*H%/;
- */segmental material/*^{Q} stands for */segmental material*, H*L%/

The constraints making reference to the boundary tone or to the head tone (i.e. NPA/Hd(IntP)) do not distinguish between declaratives and interrogatives; the only difference between the two phrases is the different input specification of the intonational melodies.

The definitions of the intonational constraints directly relevant for the word stress-pitch accent interaction (and included in tableau 3 below):

15. **Align (σ*, s')**: for any syllable which is Hd(IntP), there is a syllable which is Hd(PrWd), such that the right edge of the Hd(IntP) is aligned with the right edge of the Hd(PrWd)[9]; the measure for violation is the syllable;
16. **$*[T_1T_2]\mu$, $T_1 \neq T_2$**: complex tones cannot be associated with one mora, i.e. if tone T1 and T2 have different intonational specification, they cannot be associated with the same mora;
17. **Rt(σ*)×σ**: the syllable which is the Hd(IntP) is rightmost in the IntP;
18. **Nf(σ*)×σ**: the syllable which is the Hd(IntP) is nonfinal in the IntP.

Tableau 3 below provides a set of necessary ranking conditions, which establishes the ranking of the four new constraints with respect to the previous (word prosody) ranking. Also, some previously underdetermined relations between word prosody constraints are established. All the new ranking conditions are consistent with the ranking obtained in section II.

The shaded vectors are entailed vectors. The fusions that entail them are provided at the end of the tableau and the entailment relations are listed afterwards. The fusion

[9] choosing the left edge of the two heads yields the same result.

crucially involve vectors obtained in section II. The vector numbering will make sense once tableau 4 in the Appendix of Section III is considered. Tableau 4 contains more generalizations than tableau 3. No systematic attempt is made to reduce tableau 4 to tableau 3, but more or less informal suggestions to this effect are made throughout the Appendix. Thus, it can be argued that the vectors in tableau 3 express not only necessary, but also sufficient ranking conditions with respect to the Chickasaw word prosody-pitch accent interactions that are addressed in this paper.

Vectors 62-65 capture the behavior of CVCVC inputs in interrogative final position; as the fusions at the bottom of tableau 3 show, they enforce that the intonational constraints Align(σ*, σ') and $*[T_1T_2]_\mu$ are highly ranked, as it was expected from the generalizations.

Vectors 71 and 75 factor out the relations between Parse-σ, Pk-Prom, Rt(σ*) and Nf(σ*) by considering CVVCVCV inputs in interrogative final position and CVVCV inputs in declarative final position.

	TABLEAU 3	**1**	**2**	**3**	**4**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
		FtBin/ *(L‘)	**GH/ *(LL‘)**	**Iamb**	**Parse-σ**	**Pk-Prom/ CVV’> CVC(C)’, CV’**	**Rt(σ’) ×σ**	**Dep-μ**	**Dep-$\mu]_\sigma$#**	**Nf(σ’) ×σ**	**Nf(σ`) ×σ**	**Dep-#$_\sigma$[μ**	**WBP**	**Align (σ’, σ`)**	**Align (σ*, σ’)**	***$[T_1T_2]_\mu$, $T_1 \neq T_2$**	**Rt(σ*) ×σ**	**Nf(σ*) ×σ**
	/CVCVC/^{Q} → [(CV’*.CVC)]																	
62	~[(CV.CVC’*)]			L			L			W	W		L			W	L	W
63	~[(CV.CV𝕍C’*)]			L		L		W	W	W	W		L				L	W
64	~[(CV*.CVC’)]			L			L			W	W		L		W			
65	~[(CV𝕍’*).(CVC`)]			L		L		W			W	W	L					
	/CVVCVCV/^{Q} → [(CVV’*).(CV.CV`)]																	
71	~[(CVV`).(CV𝕍’*).CV]		L		W		L	W			L						L	
	/CVVCV/^{D} → [(CVV`).CV’*]																	
75	~[(CVV’*).CV]					L	W			L	L			L			W	L
	33∘75					L	L			L	L			L			W	L
A	16∘20∘21∘33∘38∘40∘71∘75		L		W	L	L	L		L	L			L			L	L
	A∘35		L	W	L	L	L	L		L	L			L			L	L
	A∘35∘62		L	L	L	L	L	L		L	L		L	L		W	L	L
	A∘35∘64		L	L	L	L	L	L		L	L		L	L	W		L	L
	A∘35∘63		L	L	L	L	L	L	W	L	L		L	L			L	L
	A∘35∘65		L	L	L	L	L	L		L	L	W	L	L			L	L

The fusions provided at the end of tableau 3 entail the 'primitive' vectors, as follows:

- 33∘75 entails 75;
- A entails 71;
- A∘35∘62 entails 62
- A∘35∘64 entails 64, 44;
- A∘35∘63 entails 63
- A∘35∘65 entails 65;

The final constraint ranking:

i. FtBin>>Dep-μ]$_σ$#, Dep- #$_σ$[μ>>Iamb, WBP>>Parse-σ>>GH>>Dep-μ>>Pk-Prom>>Rt(σ')>>Nf(σ'), Nf(σ`), Align(σ', s`);
ii. Parse-σ>>Align-Feet-Left;
iii. Parse-σ>>Rt(σ*)>>Pk-Prom, Nf(σ*);
iv. *[T_1T_2]$_μ$, Align(σ*, σ')>>Iamb, WBP

I have also assumed that:

v. WSP, Max-μ, Max-V, Max-C, Dep-C, Dep-V, Dock (T, V), Align-T%-R×σ, Max-T, Dep-T, Ident-T are undominated;
vi. Lx~Pr, M-Parse>>Dep-μ]$_σ$#, Dep- #$_σ$[μ (due to the minimal word requirement).

Two final observations:

- the nonfinality of the phrasal head does not play any role in Chickasaw, just as the nonfinality at the word prosody 'level';
- the ranking Rt(σ*)>>(Pk-Prom>>)Rt(σ') is independently justified by the fact that the NPA is always associated with the word stress of the IntP final word; if the ranking would be reversed, i.e. Rt(σ')>>Rt(σ*), there might be cases in which the NPA, repelled from the final syllable by *[T_1T_2]$_μ$ and forced to be aligned with the word stress due to Align(σ*, σ'), would be associated with the word stress of the penultimate PrWd precisely to insure a better satisfaction of Rt(σ') in the IntP final PrWd. The final ranking correctly predicts that no such cases occur in Chickasaw.

Appendix to section III (The interaction between word stress and phrasal nuclear pitch accent)

The shaded vectors are (presumably) entailed by other shaded vectors or by the vectors and the fusions in tableau 3. The non-shaded vectors are the ones included in tableau 3 and claimed to express not only necessary, but also sufficient ranking conditions with respect to the other generalizations in tableau 4.

The generalizations captured in tableau 4 (and some suggestions about their entailment relations):

- vectors 42-46 show the behavior of CVVCVC inputs in declarative and interrogative final position: vector 42 ranks Rt(σ*) above Pk-Prom (given the information provided by the word prosody ranking); vector 43 does not bring any new information; vector 44 ranks Align(σ*, s') above Pk-Prom; vector 45 ranks *[T_1T_2] above Rt(σ*); vector 46 ranks either Dep- μ or Dep- $\mu]_\sigma$# above Rt(σ*) (the 'minimal' assumption, given the word prosody ranking, is that Dep- $\mu]_\sigma$#>>Rt(σ*));
- vector 47 captures the behavior of CVCCVV input in interrogative final position; it enforces that Nf(σ*) is dominated (as expected); the minimal assumption (given the previous rankings) is that Rt(σ*)>>Nf(σ*);
- vectors 48-49 capture the behavior of CVCVCV interrogative final inputs; no new/crucial information is provided;
- vectors 50-52 show the behavior of CVCVV interrogative final inputs; no new/crucial information is provided;
- vectors 53-57 capture the behavior of CVCV in interrogative final position; vector 53 provides a new ranking condition: FtBin>>Iamb (!); vector 54 ranks Dep- $\#_\sigma[\mu$ over Iamb (given the previous ranking) – and consequently it entails 53 (if taken together with the previous ranking); this vector motivates this positional faithfulness constraint, which did not play a major role in the word prosody; vector 55 ranks *[T_1T_2] over Iamb; vector 56 ranks Dep- $\mu]_\sigma$# over Iamb – providing new information with respect to the constraints considered at the word prosody 'level'; vector 57 provides information about the interaction between Iamb, Align(σ*, σ') and Rt(σ*);
- vectors 58-61 show the behavior of CVCCVC inputs in interrogative final position; vector 58, (entailed by 56 and the previous ranking), provides no new information; vector 59 enforces Align(σ*, σ')>>Rt(σ'); vector 60 entails 45 and enforces *[T_1T_2]>>Rt(σ*) (together with other vectors and the previous ranking); vector 61 is entailed by the previous ranking;
- vectors 62-66 capture the behavior of CVCVC in interrogative final position; vector 62 enforces *[T_1T_2]>>WBP, Iamb (and, together with the previous ranking, entails vector 55); vector 63 enforces Dep- $\mu]_\sigma$#>>WBP, Iamb (and, together with the previous ranking, entails vector 56); vector 64 enforces Align(σ*, σ')>>WBP, Iamb (and, together with the previous ranking, entails vector 57); vector 65 enforces Dep- $\#[_\sigma\mu$>>WBP, Iamb (and, together with the previous ranking, entails vector 54); vector 66 should be ignored; it is presented only to show that NoCoda has to be high ranked, as a

less harmonic syllabification is not a possible way of improving foot structure (NoCoda >> Iamb);

- vectors 67-68 show the behavior of CVVCVV in interrogative final position; vector 67 entails vector 47 and enforces that at least Rt(σ*)>>Nf(σ*); vector 68 does not bring any new information;
- vectors 69-72 capture the behavior of CVVCVCV inputs in interrogative final position; vector 69 enforces (together with the previous ranking) Iamb>>Rt(σ*); vector 70 enforces (together with the previous ranking and other vectors in tableau 4) Align(σ*, σ')>>Rt(σ*) – and is entailed by 69 together with 64; vector 71 enforces (with the previous ranking) Parse-σ>>Rt(σ*) and, given the previous ranking, entails 69; vector 72 does not bring any new/crucial information;
- vectors 73-74 capture the behavior of CVCCVCVC inputs in interrogative final position; no new/crucial information is provided'
- vector 75 shows the behavior of CVVCV inputs in declarative final position; it entails vector 42;
- vector 76 shows the behavior of CVVCV inputs in interrogative final position; no new information is provided;
- vectors 77 and 78 capture the behavior of CVCCV inputs in declarative and interrogative final position; 78 entails 76; no new information is provided.

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	TABLEAU 4	1	2	3	4	6	7	8	9	10	11	12	13	14	15	16	17	18
		FtBin/ *(L‘)	GH/ *(LL‘)	Iamb	Parse-σ	Pk-Prom/ CVV’> CVC(C)’, CV’	Rt(σ’) ×σ	Dep-μ	Dep-$\mu]_\sigma$#	Nf(σ’) ×σ	Nf(σ`) ×σ	Dep-$\#_\sigma[\mu$	WBP	Align (σ’, σ`)	Align (σ*, σ’)	$*[T_1T_2]_\mu$, $T_1 \neq T_2$	Rt(σ*) ×σ	Nf(σ*) ×σ
	/CVVCVC/^{D} → [(CVV`).(CVC’*)]																	
42	~[(CVV’*).(CVC`)]					L	W			L							W	L
43	~[(CVV`).(CV𝕍C’*)]					L		W	W									
44	~[(CVV’).(CVC`*)]					L	W			L					W			
	/CVVCVC/^{Q} → [(CVV’*).(CVC`)]																	
45	~[(CVV`).(CVC’*)]					W	L			W						W	L	W
46	~[(CVV`).(CV𝕍C’*)]						L	W	W	W							L	W
	/CVCCVV/^{Q} → [(CVC`).(CVV’*)]																	
47	~[(CVC’*).(CVV`)]					W	W			L							W	L
	/CVCVCV/^{Q}→ [(CV.CV𝕍’*).CV]																	
48	~[(CV.CV𝕍`).(CV𝕍’*)]				L		L	W	W	W	W						L	W
49	~[(CV.CV𝕍`).(CV’*)]	W			L	W	L			W	W					W	L	W
	/CVCVV/^{Q} → [(CV.CVV’*)]																	
50	~[(CV*.CVV’)]					W	W								W		W	L
51	~[(CV’*).(CVV`)]	W				W	W			L							W	L
52	~[(CV𝕍’*).(CVV`)]						W	W		L		W					W	L

	TABLEAU 4 (ctd)	**1**	**2**	**3**	**4**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
		FtBin/ *(L‘)	**GH/ *(LL‘)**	**Iamb**	**Parse-σ**	**Pk-Prom/ CVV’> CVC(C)’, CV’**	**Rt(σ’) ×σ**	**Dep-μ**	**Dep-μ]$_{\sigma}$#**	**Nf(σ’) ×σ**	**Nf(σ`) ×σ**	**Dep-#$_{\sigma}$[μ**	**WBP**	**Align (σ’, σ`)**	**Align (σ*, σ’)**	***[T$_1$T$_2$]$_{\mu}$, T$_1$≠T$_2$**	**Rt(σ*) ×σ**	**Nf(σ*) ×σ**
	/CVCV/^{Q} → [(CV’*.CV)]																	
53	~[(CV’*).CV]	W		L	W													
54	~[(CV𝕍’*).CV]			L	W	L		W				W						
55	~[(CV.CV’*)]		W	L			L			W	W					W	L	W
56	~[(CV.CV𝕍’*)]			L		L	L	W	W	W	W						L	W
57	~[(CV*.CV’)]		W	L			L			W	W				W		W	L
	/CVCCVC/^{Q} → [(CVC’*).(CVC`)]																	
58	~[(CVC`).(CV𝕍C’*)]					L	L	W	W	W							L	W
59	~[(CVC`*).(CVC’)]						L			W					W			
60	~[(CVC`).(CVC’*)]						L			W						W	L	W
61	~[(CVC’*).CVC]				W						L		W					
	/CVCVC/^{Q} → [(CV’*.CVC)]																	
62	~[(CV.CVC’*)]			L			L			W	W		L			W	L	W
63	~[(CV.CV𝕍C’*)]			L		L		W	W	W	W		L				L	W
64	~[(CV*.CVC’)]			L			L			W	W		L		W			
65	~[(CV𝕍’*).(CVC`)]			L		L		W			W	W	L					
66	(!)~[(CVC’*).(VC`)]			L							W		L					
	/CVVCVV/^{Q} → [(CVV`).(CVV’*)]																	
67	~[(CVV’*).(CVV`)]						W			L							W	L
68	~[(CVV`*).(CVV’)]														W		W	L

	TABLEAU 4 (ctd)	1	2	3	4	6	7	8	9	10	11	12	13	14	15	16	17	18
		FtBin/ *(L‘)	GH/ *(LL‘)	Iamb	Parse-σ	Pk-Prom/ CVV’> CVC(C)’, CV’	Rt(σ’) ×σ	Dep-μ	Dep-$\mu]_{\sigma}\#$	Nf(σ’) ×σ	Nf(σ`) ×σ	Dep-$\#_{\sigma}[\mu$	WBP	Align (σ’, σ`)	Align (σ*, σ’)	$*[T_1T_2]_{\mu}$, $T_1 \neq T_2$	Rt(σ*) ×σ	Nf(σ*) ×σ
	/CVVCVCV/^{Q} → [(CVV’*).(CV.CV`)]																	
69	~[(CVV`).(CV’*.CV)]		L	W		W	L				L						L	
70	~[(CVV`).(CV*.CV’)]					W	L			W					W		L	
71	~[(CVV`).(CV𝕍’*).CV]		L		W		L	W			L						L	
72	~[(CVV`).(CV.CV𝕍’*)]		L				L	W	W	W							L	W
	/CVCCVCVC/^{Q} → [(CVC’*).(CV.CVC`)]																	
73	~[(CVC`).(CV.CVC’*)]						L			W						W	L	W
74	~[(CVC`).(CV’*.CVC)]			W			L				L		W				L	
	/CVVCV/^{D} → [(CVV`).CV’*]																	
75	~[(CVV’*).CV]					L	W			L	L			L			W	L
	/CVVCV/^{Q} → [(CVV’*).CV]																	
76	~[(CVV`).CV’*]					W	L			W	W			W		W	L	W
	/CVCCV/^{D} → [(CVC`).CV’*]																	
77	~[(CVC’*).CV]						W			L	L			L			W	L
	/CVCCV/^{Q} → [(CVC’*).CV]																	
78	~[(CVC`).CV’*]						L			W	W			W		W	L	W
	/CVC/$^{Q/D}$ → Null Parse (apparently)!!!																	

Some (informally presented) entailment relations:

- 43, 61 are entailed by the word prosody ranking;
- 53 is entailed by 54 (or 56) and the word prosody ranking;
- 60 entails 45;
- 62 entails 55;
- 67 entails 47;
- 71 entails 69 (together with the previous ranking);
- 69 and 64 (together with the previous ranking) entail 70;
- 70 entails 59 (together with other vectors and the previous ranking);
- 75 entails 42, 67;
- 78 entails 76;
- A◦35◦64 entails 44;
- A◦35◦62 entails 60;
- A◦35◦63 entails 46.

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