A metrical analysis of nouns in Chácobo (Pano)[1]

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Abstract: This paper provides a description of the metrical stress system of Chácobo nouns in the context of Gonzalez' typological overview of metrical systems in Panoan (this volume). I argue that Chácobo has a stress-driven tone system (Hyman 2006) and that nouns are metrically non-cohesive in the sense that they combine iambic and trochaic footing. Based on this analysis, I suggest that optional syllable final truncation in Chácobo can be accounted for by allowing the directionality of foot parsing to be ambiguous; either left-to-right or right-to-left.

Keywords: Panoan, Chacobo, stress, tone, prosody

1. Introduction

Chácobo is a southern Panoan language of the northern Bolivian Amazon. There are approximately 1000 speakers in the department of Beni between the Yata, Benicito, Geneshuaya and Ivon rivers (Iggesen 2007, Córdoba et al. 2012). This paper is based on field research conducted in the (Bolivian) winters of 2011 and 2012 in Riberalta and the Chácobo community of Alto Ivon. Although audio recordings for most of the data presented in this paper were made, this essay uses impressionistic transcriptions. A detailed acoustic analysis is needed to supplement and/or test the metrical analysis presented here.[2] The current article is part of a larger documentation project aiming at a comprehensive reference grammar of the language.

2. Prosodic Description of Nouns

This section describes the prosody of nouns in Chácobo. The data for this section are based on my own impressionistic transcriptions, sometimes

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[2] Hyman (2006: 251) states concerning the relationship between phonological and phonetic analysis: "A major problem… is that one cannot go directly from the phonetic signal to the phonological analysis." Thus, a categorical prosodic analysis, even if preliminary, is necessary in order to engage in acoustic studies of the prosodic system.

supplemented by observation of the pitch tracker in Praat. Chácobo has a relatively small phoneme inventory with 16 consonant phonemes (/p, t, k, ʔ, m, n, ts, tʃ, β, s, ʂ, ʃ, h, ɾ, w, j/) and 4 vowel phonemes (/i, ɨ, o, a/). The syllable structure is (C)V(C). Any consonant can appear in the onset position, but only sibilants /s, ʂ, ʃ/ can occur in the coda position of a syllable.[3]

This analysis is mostly based on individual nouns gathered in elicitation, although the issue of phrasal prosody is briefly discussed when I consider tetrasyllabic forms. Every statement concerning the prosody of nouns can be applied to adjectives.

All Chácobo nouns vary according to prosodic shape. Prosodic shape here is defined as the pattern of surface tones that occur on a given noun. There are no monosyllabic noun stems in Chácobo. Bisyllabic nouns have two prosodic shapes: HL and LH.[4] The former is much more common than the latter.

(1)   HL surface tones
    a.   *míʃpò*   'dust'
    b.   *tsístì*   'charcoal'
    c.   *tʃíʃkà*   'little, cuckoo'
    d.   *ʔískò*   'green winged saltador'

(2)   LH surface tones
    a.   *nàtí*   'flue'
    b.   *nòtí*   'canoe'
    c.   *ʃinó*   'monkey'
    d.   *bàkɨ*   'child'

There are three parameters over which trisyllabic nouns can vary. These are listed below.

(3)a.   prosodic shape
    b.   truncable *vs* non-truncable
    c.   tone shift rule

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[3] There are a few exceptions to these generalizations. There is at least one word with an /f/; *βifara* 'bald head'. In Chácobo myths trilled /r/ and coda /h/ are used when some animals or other speakers of other Panoan languages are being imitated.

[4] The following symbols and glossing conventions are used throughout the paper: CAUS= 'causative'; H = 'high tone'; L = 'low tone'; M = 'mid tone'; NMLZ = 'nominalizer'; TR = 'transitivizer'; __ = 'not attested'; s =' head of a foot'; w = 'nonhead of a foot'; ω= 'prosodic domain mapped over stem'; φ = 'prosodic domain mapped over phrase'; ϕ = 'foot'; σ = 'syllable'.

The prosodic shape of trisyllabic nouns can be described by making reference to an MLL template. An H tone replaces one of the surface tones in the template.

(4)   HLL[5]
   a.   *típòkò*   'goiter'
   b.   *mápàrì*   'bread'
   c.   *βákòşò*   'foam'
   d.   *wíʃtìmà*   'star'

(5)   MHL
   a.   *şōkóβò*   'children'
   b.   *kānápà*   'lightning'
   c.   *kāmánò*   'jaguar'
   d.   *βākíʃì*   'darkness'

(6)   MLH
   a.   *māʃìnɨ*   'sand'
   b.   *pāʔòkí*   'ear'
   c.   *īspàrá*   'temple of head'
   d.   *şīòtí*   'wind'[6]

Many trisyllabic nouns can also truncate their final syllable (i.e., their final vowel is dropped). Bisyllabic nouns do not truncate. When the final CV syllable contains a sibilant only the V is dropped and the sibilant resyllabifies such that its initial consonant becomes a word final coda of the truncated word. The examples in (7) demonstrate that not all trisyllabic nouns can truncate their final syllable (* refers to an unacceptable form).[7]

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[5] Iggesen (2007) transcribed these forms with an HML pattern. Instrumental observation of the pitch contour does not resolve the issue, since the 'M' tone in this case appears to be the dynamic interpolation between H and L tone (Tallman 2013a).

[6] In prevocalic contexts the first vowel is not lengthened. Sometimes a glottal stop is inserted between the first two syllables in cases such as these (*sīʔótí* 'wind'). This phenomenon is completely obligatory in the Pacahuara co-dialect of Chácobo (Ortiz & Tallman 2012). This topic requires instrumental phonetic investigation.

[7] The phrasal and clausal distribution of truncation within truncable nouns is outside the scope of this paper. A few proposals are made in the literature regarding the function of truncation. Córdoba et al. (2012: 47) describe truncation as one of the forms that absolutive nouns can take. While there is a correlation between truncation and absolutive due to the fact that truncation never occurs on nouns that take the high tone ergative post-position, there are clear counterexamples to the claim. Truncated forms can occur within an ergatively marked noun phrase as long as they are not on the right edge.
   (i)a.   [*ína*   *tʃìkɨ́*]NP   *hōni*   *tiʂa-ki*
           dog.TRUN   black=ERG   man   bite-CMPL
           'The black dog saw the man.'

(7)   HLL
  a.   *típò   (típòkò)   'goiter'
  b.   *mápà   (mápàrì)   'bread'
  c.   βákòʂ   (βákòʂò)   'foam'
  d.   wíʃtì   (wíʃtìmà)   'star'

(8)   MHL
  a.   *ʂòkó   (ʂōkóβò)   'children'
  b.   *kàná   (kānápà)   'lightning'
  c.   kàmá   (kāmánò)   'jaguar'
  d.   βàkíʃ   (βākíʃì)   'darkness'

(9)   MLH
  a.   *máʃì   (māʃìnɨ)   'sand'
  b.   *páʔò   (pāʔòkí)   'ear'
  c.   íspà ~ ìspá   (īspàrá)   'temple of head'
  d.   ʂɨ̀ò ~ ʂɨ̀ó   (ʂīòtí)   'wind'

From this point on, I refer to trisyllabic nouns that have bisyllabic variants as "truncable". The short forms of truncable nouns do not have the same prosodic shape as their long counterpart. They follow the distribution of surface tones for bisyllabic nouns stated above; they are either HL or LH. The relationship between the prosodic shape of the long and short forms are given in the diagram below.

(10)   LONG   SHORT
  i.   HLL   →   HL
  ii.   MHL   →   LH
  iii. MLH   →   HL *or* LH

In the case of the MLH forms, we notice that it is not simply a matter of truncating the final syllable with the vowel and its associated tone. The prosodic shape of its corresponding short form is not ML, but HL *or* LH.[8] I

Loos (1973: 141, 1999: 240) describes truncation in Chácobo as a context sensitive rule rather than a marker of absolutives, but does not discuss precisely what the context is. In Loos (1973: 141), no reference is made to truncation in noun phrases larger than one word. Loos (1999: 240) argues that truncation results from "pre-posing to a co-constituent" which includes adjectives and postpositions, but does not describe what happens in other environments and does not make precise what is meant by a co-constituent. It is fairly clear that truncation does not serve a morphosyntactic function. The distribution of truncation in the phrase is complex. It likely falls out of a noun's distribution in relation to phrase-level prosodic domains, rather than being a context sensitive rule that makes direct reference to syntax (*cf.* Tallman 2013b for more details).

8 Study of the phrasal prosody of Chácobo has revealed that this statement is too simplistic (Tallman 2013b). The surface forms of nouns vary from ML, HL and LH depending also on tone sandhi rules.

noted that there was a third parameter of variation in (3c); the parameter of tone shifting. All MLH forms that truncate undergo H tone shift to the first or last syllable in their bisyllabic variants. For instance, if we take the form *īspàrá* 'temple of head' (MLH), its truncated form is not **īspà* (ML), but rather *íspà* (HL) ~ *ìspá* (LH).[9]

I note in passing that the statistical distribution of these patterns do not cluster evenly across the lexicon. Some preliminary statistics of the truncating capacities of Chácobo nouns are given below. MLH forms are far less likely to truncate than the other two prosodic shapes. Furthermore, approximately half of all HLL and MHL forms cannot truncate.

Table 1. Truncation *vs* nontruncation by prosodic shape in trisyllabic nouns

	HLL	MHL	MLH
Non-truncabable word count	8	24	31
Truncable word count	9	25	3
Percentage of truncable words	52.9%	51.0%	8.8%

To sum up, nouns vary in terms of prosodic shape, truncability, and the relationship between the prosodic shape of the long and short forms. What is similar about every single noun is that they all require one and only one H tone and at least one L tone. For example, truncation of MLH forms never results in an ML prosodic shape and truncation of MHL forms never results in an MH prosodic shape.

The analysis presented in this paper is based primarily on bisyllabic and trisyllabic forms. There are a few nouns that appear to be larger than three syllables. In these cases, however, it is difficult to tell whether they should be regarded as noun compounds or tetrasyllabic nouns.

Prosodic criteria do not unambiguously distinguish between compounds and tetrasyllabic or longer nouns. For instance, we might consider obligatory and culminative H tone to be a property of an individual word.[10] However, observation of noun compounds shows that

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In this paper I refer specifically to forms as they occur in isolation. It should be pointed out that some of the generalizations in this paper risk conflating word and phrase-level prosody as a consequence. The issue is discussed in more detail in §3.1 (*cf.* Tallman 2013b, *in progress*).

[9] There seem to be some MHL forms that undergo a type of tone shifting process as well (although thus far I have found some inter-speaker variation and will thus not consider them here).

[10] A property is culminative if it occurs no more than once. It is obligatory if it occurs at least once (Hyman 2006).

obligatory and culminative H tone is a property of the phonological phrase (the prosodic domain that is defined in terms of the noun phrase). In a noun-noun compound the first noun generally appears with an ML prosodic shape regardless of its shape in isolation (*cf.* Iggesen 2007 for more details and discussion).

(11)a. *ʃìnó*   (LH)   'monkey'
   b. *námì*   (HL)   'meat'
   c. *ʃìnò námì* (ML HL)   'monkey meat'

A common and productive process of tone sandhi lowers an H tone to an L tone when it occurs directly after another H tone (*cf.* Iggesen 2006 for a detailed discussion). *ʃìnó* undergoes tone sandhi (H → L/ __H) and surfaces with an M tone on the first syllable. If tetrasyllabic forms do exist many of them have an MLHL prosodic shape which is identical to the most common shape for noun compounds, shown in (12). Some examples of potential tetrasyllabic forms are given below.

(12)   MLHL
   a. *pātìárì*   'chicken'
   b. *tōròtítà*   'mosquito net'
   c. *mōtsàʔámà*   'health'
   d. *sīkàkírà*   'stairs'
   e. *ʃīsìkámì*   'collarbone'
   f. *sīkòmítsà*   'type of plant'

The forms in (13) exhaust the attested tetrasyllabic nouns for which I have truncation data. Two out of six of them can truncate. Truncable nouns have short forms with an MLH prosodic shape.

(13)   MLHL → MLH
   a. **patia*   'chicken'
   b. **toroti*   'mosquito net'
   c. **motsaʔa*   'health'
   d. **sikaki*   'stairs'
   e. *ʃīsìká*   'collarbone'
   f. *sīkòmís*   'type of plant.'

I have almost no data for the rest of the prosodic shapes except MLLH.[11] Most of these are clearly morphologically derived from verbs. They

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[11] There is one MHML form attested in my data: *īβìʂātì* 'sibling'.

contain the nominalizer/purposive marker -*tí* and mark an instrumental function (X for Ving). Some of the forms appear to be lexicalized and the morphological parse is uncertain.[12] Forms that end in -*tí* never truncate.

(14)   MLLH

    a.   *mɨ̄kɨ̀ràtí*   'ring'
        mɨkɨni-raa-ti
        hand-send-NMLZ

    b.   *βṑɨ̀ʂ̀tí*   'comb'
        βoo-ʂi-tí
        hair-clean.with.stick-NMLZ

    c.   *ṑrìkìtí*   'food'
        oriki-ti
        feed-NMLZ

    d.   *ā̀tʃàmàtí*   'latch'
        atʃa-ma-ti
        hold-CAUS-NMLZ

    e.   *kɨ̄nɨ̀ʔàtí*   'razor'
        kɨnɨ-ʔa-ti
        beard-TR-NMLZ

There are only a handful of tetrasyllabic nouns that have other prosodic shapes.[13] Furthermore, it is unclear whether any of these forms should be regarded as compounds or not.

This section has described the prosody of Chácobo nouns. Bisyllabic nouns can be divided into HL or LH forms. Trisyllabic nouns can be distinguished along three parameters; their prosodic shape (HLL, MHL, MLH), whether they truncate, and whether they shift tone to the penultimate in their truncated form. Based on the data gathered thus far, there are six different prosodic classes of trisyllabic nouns. I presented the data on truncation with nouns in isolation. The data on tetrasyllabic nouns are less certain, due to possible conflation with noun compounds. The classification of nouns by prosodic shape and truncation are summarized in Table 2.

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[12] I note in passing that even forms that have no obvious morphological derivation will have an H on their final syllable if they end in *tí* (*nòtí* 'boat', *wɨ̀ʂtí* 'one'). I have no explanation for why this is the case. Thus far the only word which is an exception to the rule is *ìyáwàtī̄* (LHLM) 'ornament'.

[13] I only have one example of a noun that appears to be larger than tetrasyllabic. The pentasyllabic noun *sā˙ràmàtákà* (MLMHL) is truncable *sāràmàtá* 'type of plant'.

Table 2. Noun classes in Chácobo; long and short prosodic shapes

Class	Long	Short
1	HLL	HL
2	HLL	__
3	MHL	LH
4	MHL	__
5	MLH	LH ~ HL
6	MLH	__

In the following section I give a metrical analysis to the Chácobo data presented above. I assume that the relative pitch differences reflect foot based prominence and that the different prosodic shapes are the result of differences in the position of underlyingly specified stress (*cf.* de Lacy 2002 for an OT analysis of the relationship between metrical and tonal systems). I show that the truncation data can also be understood in the context of the foot-based metrical analysis presented below.

3. Metrical Analysis of ω

In the following section I attempt to give a metrical analysis of Chácobo's word level prosodic domain that maps over noun stems. For ease of exposition I refer to this prosodic domain as ω. The reader should keep in mind, however, that nouns and verbs in Chácobo have different prosodic properties and thus a part of speech neutral prosodic domain such as ω may not be legitimate (Tallman 2013b). The issue of how surface tones map onto metrical structure is briefly taken up in §3.1. A foot based metrical analysis is given in §3.2.

3.1. Prominence and Surface Tone

Before discussing the specific metrical properties of the prosodic word, the phonetic expression of prominence needs to be described. Prominence is marked through surface tone variation. H and M are markers of metrically strong syllables and L corresponds to a metrically weak syllable (*cf.* de Lacy 2002). The current analysis conforms to the typological study of de Lacy (2002) that finds a cross-linguistic association between metrical heads and H tone, and non-heads and L tone. The tone mapping rules for Chácobo are thus as follows.

(15)a.   Map H tone onto the rightmost metrically prominent syllable.
   b.   Map L tones onto all metrically weak syllables.
   c.   Map M tone onto all remaining metrically strong syllables.

For instance, if one considers the form below, and we assume that it is parsed from right to left, default footing would appear to be trochaic. Furthermore, the only permissible feet are bisyllabic trochees and monosyllabic feet with one strong syllable (in conformity with Hayes 1995: 71). Tones are mapped onto the word in the following manner (where s=head, and w=non-head of a foot).

(16)   s   s   w
   a. $(ma)_\varphi(tsa.ka)_\varphi$ 'mud'
   b. $(ma)_\varphi(tsá.ka)_\varphi$ (15a)
   c. $(ma)_\varphi(tsá.kà)_\varphi$ (15b)
   d. $(mā)_\varphi(tsá.kà)_\varphi$ (15c)

Note that (16) is simply a tutorial of how the surface tone rules apply, the actual foot-based metrical analysis which these rules make reference to is given in §3.2.

A final note should be made regarding the prosodic level over which the tone mapping rules in (16) apply. (16a) implies that H tone is obligatory and culminative over some prosodic domain.

The behavior of noun compounds suggests that the surface tone assignment rules in (15) apply over a prosodic domain which is larger than ω (the prosodic domain of noun stems). Consider again the example from (11) repeated below as (17).

(17)a.   *ʃinó*   (LH)   'monkey'
   b.   *námì*   (HL)   'meat'
   c.   *ʃĩnò námì*   (ML HL)   'monkey meat'

In isolation each word has an H tone. A compound has only one H tone. This suggests that H tone assignment interacts with a phrase-level prosodic domain. One way of accounting for this is by assuming that H tone is culminative at the ω level, but obligatory at a higher prosodic domain. I refer to this phrase-level prosodic domain as ϕ. For ω there can be *no more than one* H tone, possibly none (obligatoriness). For ϕ there is *at least one* H tone (culminativity). ω and ϕ are conterminous (completely overlap)

when a given nominal is expressed in isolation. But when there is more than one noun in a noun phrase, φ appears is distinct from ω.

(18)a.   [[ʃinó]ω]φ   'monkey'
    b.   [[námì]ω]φ   'meat'
    c.   [[ʃĭnò]ω [námì]ω]φ   'monkey meat'

The precise interaction between ω and φ is not taken up here. For the purposes of this paper ω and φ can be conflated for the most part. I simply note that in isolation it may appear that H tone is a culminative *and obligatory* property of ω, but this is based on phrase-level prosody being coterminous with the ω domain when words are elicited in isolation.

3.2. Foot-based metrical analysis

The prosodic shapes described in §3.1 fall out of the rules for assignment of surface tones and the metrical properties of ω. The metrical properties of ω are as follows.

(19)a.   Bisyllabic feet (iambic and trochaic)
    b.   Right-aligned bisyllabic foot
    c.   Optional initial monosyllabic foot

Chácobo allows both trochees and iambs and is thus non-cohesive like many other Panoan languages (*cf.* González this volume). Iambs arise when lexically determined stress falls on the right edge of a bisyllabic foot. (19b) is an obligatory property of the prosody of Chácobo nouns. This refers to the fact that Chácobo requires a foot of the structure (σσ) on the right edge of a given noun (or on the right edge of ω). (19c) means that monosyllabic feet can only appear at the beginning of the noun. The combination of (19b) and (19c) mean that (σ)(σσ) or σ(σσ) is a possible parse for trisyllabic nouns, but (σσ)(σ), (σ)(σ)(σ), or (σσ)σ are not. If a trisyllabic noun is parsed with a left-aligned bisyllabic foot, as in (σσ)σ, then the final syllable drops so that the bisyllabic foot is right-aligned ((σσ)σ → (σσ)) in the surface form. As for the tone shift property, I argue that this falls out of assuming a default trochee in Chácobo.

In addition to the metrical properties described above, Chácobo prosody is driven by lexical stress. Specifically, metrical prominence within a foot is usually determined by the position of an underlying lexical stress. I mark lexical stress with a diacritic preceding the relevant syllable.

For example, ˈ*inaka* is the underlying representation for *ínàkà* 'dog'. In fact, this is what accounts for Chácobo's metrical non-coherence. Iambs are the result of a bisyllabic foot parsed in such a way that its right-most falls on an underlying stress.

That Chácobo nouns require bisyllabic footing on the right edge is defended in §3.2.1. The issues pertaining to initial monosyllabic footing are described in §3.2.2. Whether Chácobo has a default trochee in ω is defended in §3.2.3. One aspect of the prosody that is not easily accounted for is that some nouns are truncable and some are not. The problem is described in §3.2.4. Throughout this discussion, the issue of whether morae are relevant in the description of Chácobo is taken up.

3.2.1. Right aligned bisyllabic feet

In this section I argue that Chácobo nouns require a bisyllabic foot on their right edge. An important prediction follows from this. First, it should be impossible for free standing monosyllabic nouns to exist. There should be no independent (C)V words in Chácobo (All (C)V words must be clitics, i.e. prosodically dependent). There are some words that are phonetically [CV:] and CVG (where G is a glide). Since these forms are potential counter examples to minimal bisyllabicity, I take them up below. Phonetically [CV:] forms all have falling surface tones.

(20)   Phonetic diphthongs: Vj, Vw
    a.   [maj]   'earth, ground'
    b.   [oj]   'rain'
    c.   [ʂɨj]   'yellow billed cuckoo'
    d.   [ʂaw]   'bone'
    e.   [piw]   'bark'
    f.   [tsɨw]   'air'

(21)   Falling tones
    a.   [nâ:]   'that'
    b.   [kô:] ~ [kó:] 'pus'
    c.   [nî:]   'stopped'

If these are monosyllabic forms they are bimoraic (22a). If they are phonologically bisyllabic, then each vowel or glide has one mora attached to it (22b). The two possible representations are given below.

(22)a.

b.
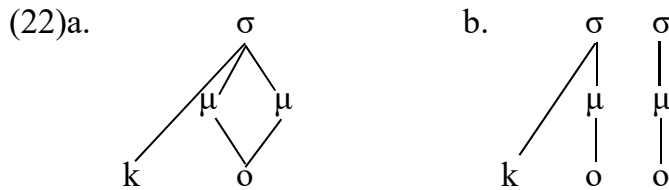
I argue that (22b) is the proper phonological representation of the nouns in (20) and (21). The first argument for this is that in other phonetic combinations there is a clear pause between the vowels.

(23)   HL contour
  a. [tí.à]   'weather'
  b. [mí.à]   'you'
  c. [ʂó.à]   'itch'
  d. [nɨ.à]   'barefaced Curassow'
  e. [pá.ɨ]   'Pae (Chacobo name)'

Furthermore, phonetic diphthongs do not surface when a post-position is added. The spatial case postposition =*no* conditions H tone shift to the final syllable of the noun.

(24)   CVV+*no*
  a. [mā.í.nò] 'by the earth, ground'
  b. [ō.í.nò]   'by the rain'
  c. [ʂɨ̄.í.nō] 'by the yellow billed cuckoo'
  d. [ʂā.ó.nò] 'in the bone'
  e. [pī.ó.nò] 'by the bark'
  f. [tsɨ̄.ó.nò] 'in the air'

(25)   CVV+*no*
  [kō^wónò] 'in the pus'

This demonstrates that Chácobo does not have nouns that have less than two syllables phonologically (*cf.* Lass 1984: 25 for the difference between phonological and phonetic syllables). There is further evidence for the claim to minimal bisyllabicity. This comes from truncation (§3.1). As already noted, truncation can only occur on nouns that are larger than two syllables. The following examples demonstrate that truncation appears to be constrained by minimal bisyllabicity.

(26)a. *óʂɨ* ~ ** oʂ* 'moon'
  b. *bári* ~ **ba* 'sun'
  c. *kɨ́pɨ* ~ **kɨ* 'shore'

    d.   *kíni*   ~ **ki*   'cave'
    e.   *míʃpo* ~ **miʃ* 'dust'
    f.   *tsísti̶* ~ **tsis* 'charcoal'
    g. *tʃíʃka* ~ **tʃiʃ* 'little, cuckoo'
    h. *ʔísko* ~ **ʔis* 'green winged saltador'

Trisyllabic nouns provide evidence that footing must be right-aligned. As for trisyllabic nouns, this basically constricts the possible parsings to σ(σσ) or (σ)(σσ). Whether trisyllabic nouns are parsed as σ(σσ) or (σ)(σσ) will be taken up in §3.2.2. Evidence for foot structure in trisyllabic forms comes from slow pronunciation. If there is a pause in a word, the pause always occurs after the first syllable. The final two syllables in a trisyllabic nominal are pronounced together in slower speech.

(27)a.   [βáˑ...kòʂò]   'foam'
    b.   [māˑ...tsákà] 'mud'
    c.   [māˑ...ʃìní̶]   'sand'

(28)a. *[βáˑkò...ʂò] 'foam'
    b. *[māˑtsá...kà] 'mud'
    c. *[māˑʃì...ní̶]   'sand'

As already discussed above, trisyllabic nouns can truncate their final syllable. If a right-aligned bisyllabic foot is a necessary constraint on nouns, truncation falls out of the analysis *if* the directionality of parsing can occur from either the left or the right side of ω. Assuming at least one bisyllabic foot in a given trisyllabic nominal, the following parses can be given.

(29)i.   σ(σσ)
    ii. (σ)(σσ)
    iii. (σσ)σ
    iv. (σσ)(σ)

(29iv) does not abide by the condition of right aligned feet. There is no evidence for the structure in (29iv). (29iii) does not conform to the constraint either. If one assumes unparsed syllables can be deleted, however, the parse in (29iii) is not only possible but also accounts for the behavior of truncation. A trisyllabic noun is either parsed as (29i), (29ii) or (29iii). If it is parsed as (σσ)σ then the final syllable is dropped; (σσ)σ → (σσ). The difference between (29i) and (29ii) is taken up in the next section §3.2.2.

Thus, assuming an obligatory right-aligned bisyllabic foot accounts for the following: that there are no monosyllabic nouns; that pauses in trisyllabic words occur after the first syllable; and that truncation is limited to trisyllabic nouns. The latter fact falls out of the analysis, if it is assumed that the direction of parsing is ambiguous.

3.2.2. Initial monosyllabic foot

This section considers whether Chácobo nouns are parsed with an initial monosyllabic foot. Based on the constraints proposed thus far trisyllabic nouns can either have (σ)(σσ) or σ(σσ). I simply present each possible analysis, but take no position on the issue in this paper. The difference between the two analyses can be represented by the diagrams below (assume that φ represents a foot). Recall ω represents the prosodic domain projected over noun stems.

(30)   a.   ω   b.   ω   c.   ω

              φ   φ   φ   φ

           σ   σ   σ   σ   σ   σ   σ   σ
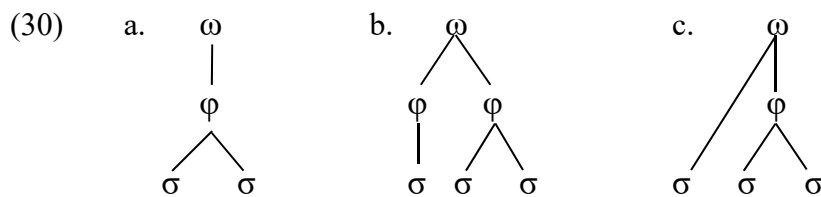
These are the possible structures if right-aligned bisyllabic feet are obligatory.[14] The issue is whether there is any evidence for an intermediate foot between the initial syllable and ω as in (30b), or if the first syllable is better thought of as being attached directly to the ω as in (30c).

Evidence for the (σ)(σσ) parse comes from two related facts. Both arguments are based on the findings of metrical typology. In metrical typology the phonological foot inventories attested in Hayes (1995: 71) are the following (where *l* is a light syllable and *h* is a heavy syllable).

(31)   Foot inventory
   a.   Syllabic trochee   (ˈσ.σ)
   b.   Moraic trochee   (ˈl.l) or (h)
   c.   Iamb   (l.ˈσ) or (h)   (Hayes 1995: 71)

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[14] The amount of structures of course doubles when we consider the structure inside the foot, i.e. whether the bisyllabic feet are iambic or trochaic (§3.3).

Work on Panoan languages has demonstrated that this typology is not sufficient (Elías-Ulloa 2006, González this volume). However, the generalization with regards to monosyllabicity still holds. A monosyllabic foot needs to be heavy. In other words, it needs to contain two morae (Elías-Ulloa 2006). A system of moraic feet requires that each foot have at least two morae. If Chácobo is a moraic foot language then we would expect an initial monosyllabic foot to be lengthened. It could be that word initial syllables are lengthened in order to meet the requirement that feet be bimoraic. Evidence for this appears when one compares vowel length in truncated with non-truncated forms as in (32).[15]

(32)a. (βáˑ)(kò.ʂò)   →   (βákòʂ)   'foam'
    b. (māˑ)(tsá.kà)   →   (mátsà)   'mud'
    c. (māˑ)(ʃì.nɨ́)   →   (máʃì)   'sand'

While this analysis is plausible I am not aware of any other languages that evince the *insertion* of a mora to avoid degenerate (mono-moraic) feet. Furthermore, there is no other evidence for a mora based analysis in Chácobo that I am aware of. Another argument could come from the fact that an M tone is mapped onto the first syllable (when there is no underlying stress present).

Even if Chácobo is not a moraic language, a foot inventory that contains a monosyllabic foot with one head is predicted to occur over one with just a non-head syllable, i.e. feet minimally require heads. M tone would thus be mapped onto any monosyllabic foot that did not receive an H tone (*cf.* 15c).

The σ(σσ) parse is compatible with the data as long as we assume that there is word or phrase initial strengthening. Whether trisyllabic nouns in Chácobo parse exhaustively or not is a question of future research. Henceforth, I assume (σ)(σσ) to be the correct parse, although nothing in the rest of the analysis hinges on the analytic distinction it makes. Future research could discover that σ(σσ) is in fact a preferable analysis.

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[15] I did not present vowel lengthening in the discussion in §2 for expositional purposes. In general there is slight vowel lengthening on initial vowels in trisyllabic forms.

3.2.3. Default Trochee

This section considers whether Chácobo nouns provide evidence for default trochaic footing. Based on the evidence gathered thus far, I conclude that there is no evidence that Chácobo nouns have default trochaic footing. This is in contrast to verbs which provide ample evidence for default trochaic footing (Tallman 2013b, 2013c).

Recall from §3.1 that some Chácobo nouns have an H tone on the penultimate both in their long and in their short forms I referred to this phenomenon "H tone shift". For truncable trisyllabic nouns with an MLH prosodic shape, their short variant is HL, not ML, as would be expected if the H tone was dropped with the syllable. If Chácobo has a default trochee, then the H tone shift phenomenon falls out of the metrical analysis as presented. Recall that trisyllabic nouns are either parsed as (σσ)σ or (σ)(σσ). If the former parse is applied, the final syllable truncates in order to insure that there is a right-aligned bisyllabic foot; (σσ)σ → (σσ). Most truncable nouns demonstrate no distinction in the placement of the H tone when one compares the full with the short variant. Recall from §3.1 that most nouns do not undergo H tone shift, a representative example is given below.

(34)   MH~~L~~   →   LH
    underlying: *ka'mano*   'jaguar'
    long: (kā꞉)(má.nò)
    short: (kà.má)~~no~~

In (34) the long form is parsed with a bisyllabic foot on the right edge. The foot is trochaic by virtue of the lexical stress occurring on the left-most syllable of the foot. H tone is mapped onto the head, L tone onto the metrically weak syllable, and M tone on the initial syllable (*cf.* §3.2.2). In the truncated variant, the bisyllabic foot is right-aligned. Now the lexically determined stress falls on the right-most syllable in this foot. H tone maps to the lexically specified syllable again, and L tone to the weak syllable following the tone mapping rules in (15). The foot in the short form is iambic. Thus, lexically determined stress makes Chácobo non-cohesive (*cf.* González this volume).

This general form of analysis does not completely work for truncable MLH nouns. The reason is that the final syllable is where the lexically determined stress is in the underlying form.

(35)   ML~~H~~   → HL
        underlying: *ispaˈra*   'temple of the head'
        long: (īˑs)(pà.rá)
        short: (ís.pà)~~ra~~

For the long form, a bisyllabic foot appears on the left edge of the word. This foot is an iamb by virtue of the fact that its right-most syllable falls on the lexically specified stress. H tone is assigned to the final syllable, L tone is mapped to the metrically weak syllable, M tone to the initial monosyllable. In the short form, a bisyllabic foot is aligned with the left edge of the word. However, the syllable which contains the lexically determined stress is deleted. The result is that there is no lexically determined stress that H can map onto. If we continue to assume that surface tones reflect metrical prominence, then the short form, in the absence of any lexically assigned stress, occurs with a trochee.

Such examples seem to demonstrate that Chácobo has a default trochee in ω. However, there happens to be speaker variation with regards to whether the H tone falls on the final or the penultimate syllable in these forms. Thus the truncated iambic form *ìspá* is attested as well. For one of my consultants both forms were possible. Thus, it appears that no evidence can be garnered to support a default trochaic foot in the ω in Chácobo from analysis of forms in isolation.[16]

3.2.4. Truncation and Lexical Representation

The metrical analysis proposed thus far accounts for various properties of Chácobo prosody. Obligatory right aligned bisyllabic footing accounts for the fact that there are no monosyllabic nouns. It also accounts for why truncation is restricted to nouns that have at least three syllables and the behavior of truncation generally. Truncation is a response to enforcing this constraint when a trisyllabic noun is parsed as (σσ)σ. Assuming that feet

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[16] Research conducted while this article was going to press suggests that the HL pattern is much more common. Furthermore, many speakers ban truncation on H-tone final form completely.

are, by default, trochaic accounts for apparent H tone shift phenomena in truncable MLH nouns, and truncable nouns that always have H tone mapped to the penultimate (MHL/HL nouns).

The metrical analysis does *not* easily account for the fact that some nouns are truncable and some are not. According to the metrical analysis proposed thus far, non-truncable nouns must always have an (σ)(σσ)/σ(σσ) prosodic shape. There are a few ways of accounting for this problem, but they are all ad hoc. One could propose that non-truncable nouns are "pre-parsed" as σ(σσ) in their lexical representation. This would involve proposing a device that has not yet been proposed in the literature on metrical phonology. Another proposal would mark non-truncable nouns having obligatory *right-to-left* parsing. Either way, the distinction between truncable and non-truncable nouns needs to be marked lexically (Tallman 2013b). As stated in §3.1, Chácobo nouns can be further distinguished according to their tone sandhi properties inside a larger prosodic context (Prost 1960, Iggesen 2007). Further research will investigate the relationship between tone sandhi properties operating at a phrase-level prosodic domain and the classification of nouns in terms of their behavior in isolation.

Tetrasyllabic forms have basically been left out of the analysis. When a more sophisticated analysis of tetrasyllabic forms is achieved, it may warrant a re-evaluation of the metrical analysis proposed here. Note however, that based on the analysis thus far we should only predict that there are *some* truncable nouns of any syllable count.
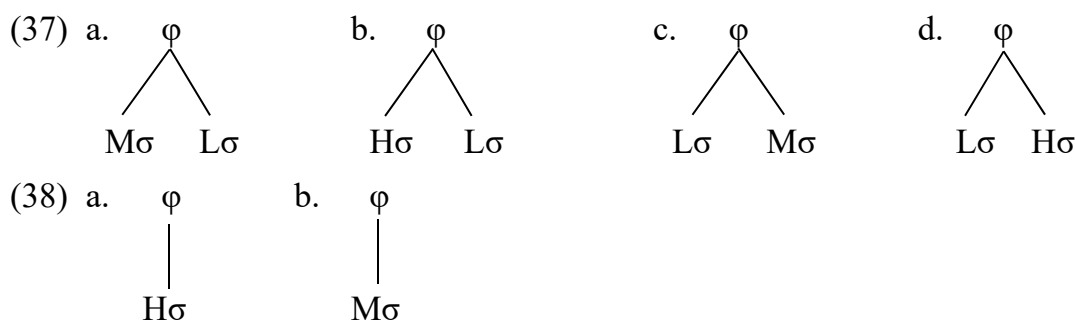
4. Overview and Conclusion

This section provides a global overview of prosodic domains associated with nouns, highlighting some current problems with the analysis. The following prosodic hierarchy has been built up in the discussion above.

Nϕ

(36)   ɸ
              |
              ω
              |
              φ
              |
              σ
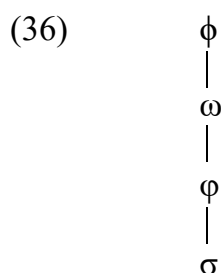
The syllabic constituent is the domain where tones are mapped. We considered whether the syllable could consist of more than one mora timing unit in §3.2.2. It was concluded there was not enough evidence to determine whether Chácobo had any moraic properties. There are four types of bisyllabic feet according to their metrical and tonal properties (37a-d) and possibly two types of monosyllabic feet.

(37) a.   φ   b.   φ   c.   φ   d.   φ
           /\   /\   /\   /\
         Mσ Lσ   Hσ Lσ   Lσ Mσ   Lσ Hσ

(38) a.   φ   b.   φ
            | |
           Hσ   Mσ

Thus far, we have only found that the ML and LM shaped feet are permitted in prosodic constituents larger than ɸ as in (18c) with the form *sĩnò mápò* 'monkey head'.[17] LM feet are furthermore unattested. One prosodic shape that poses an immediate problem is the HLL shape. According to the analysis proposed here, such forms should be parsed as (H)(LL) violating the tone mapping rules. The present analysis has attempted to give a metrical analysis of Chácobo, while previous analyses have relied exclusively on tonal representations and processes (Prost 1960, Iggesen 2007). Conspicuously, my transcription of such forms as HLL does not correspond to Iggesen's transcription, which is HML. Iggesen's (2007) transcription is more in line with the analysis presented here, since ML in this position follows from the tone mapping rules in (16). Only phonetic analysis will be able to determine the correct surface tones.[18] Since tone sandhi rules need to be introduced

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[17] It is also very likely that tetrasyllabic forms (if they exist, *cf.* §2.1) have an ML foot. Most of these surface as MLHL.

[18] I did observe that the penultimate in such forms was often of a higher pitch, however, I attributed this to interpolation between H and L (co-articulation) rather than as being a genuine tonal register.

anyway, the LL shape could result from a rule M → L / H__; however, such a rule requires independent evidence.

The following ω forms are permissible assuming exhaustive foot based parsing. These are the possibilities when bisyllabic feet are obligatorily right-aligned.

(39) a.   ω   b.   ω
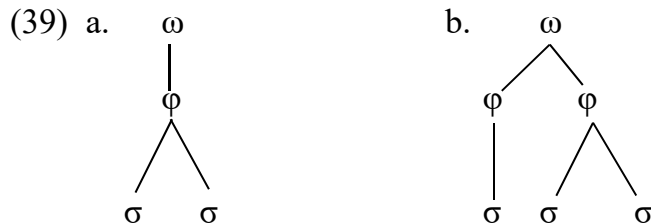
Just considering bisyllabic and trisyllabic forms, if all of the tonal shapes by foot presented in (37-38) were permissible there would be 12 different prosodic shapes associated with ω (4+(2×4)). However, there are only five forms actually attested. The delimitation can be derived from the tone mapping rules themselves and the fact that H-tone is culminative within ω.

As stated above the tonal pattern HLL is not precisely predicted by the current analysis. The trisyllabic noun with initial H tone should either surface as HML or HLM. The reason is that HLL would be parsed as (σ)(σσ), and thus at least one M tone would have to map onto the bisyllabic foot according to the rules in (16). As stated above, Iggesen (2007) transcribes such forms as HML (*cf.* n10). Acoustic analysis is therefore needed in order to determine the correct surface tone formations.

Not enough examples of tetrasyllabic nouns have been found in order to say something definitive about them. Most of the examples I have are of a MLHL shape. The ones that are truncable, like *ʃĩsìkámì* 'collar bone' have a MLH tonal shape (*ʃĩsìmá*) when truncated. According to the current analysis this means that these forms have an underlying stress on their penultimate syllable. But it also demonstrates that there is no inherent preference for bisyllabic footing in Chácobo since otherwise truncation would be barred for words with an even number of syllables.

This paper has attempted to give a metrical analysis of Chácobo. Previous analyses of Chácobo have described it as a tonal system (Prost 1960, Iggesen 2007). I have attempted to contextualize Chácobo with respect to the typological investigation of metrical systems in Panoan

languages done by González (this volume). In this vein, Chácobo nouns are non-cohesive in terms of the direction of their parsing and non-cohesive in terms of the internal structure of feet (trochees or iambs). I attributed truncation to the non-cohesion of directionality and the fact that nouns require a binary foot on their right edge. The analysis of truncation is not yet complete. First a larger sample of nouns is required in order to see whether there are sub-regularities with respect to the patterning of truncation across the lexicon. Secondly the current analysis should be contextualized with respect to the syntactic distribution of truncation since even for truncable nouns it is blocked in some contexts (*cf.* Tallman 2013b for a detailed description of the phenomenon).

Another aspect that requires further research is the issue of moraicity in Chácobo. In this article I have suggested that word initial lengthening might be the result of the insertion of a mora to maintain bimoraicity in the foot. This would require further evidence although the differential behavior of lengthening in long *vs* short forms in trisyllabic nouns in suggestive.

I conclude by pointing out that an acoustic analysis is still needed in order to determine whether the metrical system can indeed be understood completely in terms of surface tones mapping onto metrical positions. Iggesen (2007), approaching the problem from a purely tonal perspective, concluded that Chácobo was losing its tonal system. He observed that "phonetically the distinction of pitch levels is weak (and in many idiolects arguably non-existent)" (Iggesen 2007: 4). Indeed much of the evidence for paradigmatic tonal phenomena arise only from analyzing words in syntactic and morphological context (Iggesen 2007, Tallman 2013a). Future research on Chácobo will attempt to synthesize the tonal and metrical analyses of the language.

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