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1 Introduction

The theory of PROSODIC CIRCUMSCRIPTION (McCarthy & Prince 1990a) is a general approach to the problem of limiting the domain of rules to less than a morphological constituent. For example, in the Arabic singular/plural pairs *ǰundub/ǰanaadib* 'locust' and *sulṭaan/salaaṭiin* 'sultan', vowel length in the final syllable remains unaltered despite significant changes in the shape of the rest of the word. Prosodic circumscription theory partitions the singular base into affected (*ǰun*, *sul*) and unaffected (*dib*, *ṭaan*) portions, with only the affected portion mapped onto a light–heavy (or iambic) template.

The system of stem gradation or ablaut in Muskogean languages, originally discovered by Haas (1940), bears some resemblance to the templatic morphological system of Arabic. In this article, we will show that one Muskogean gradation process, the so-called *y*-grade of Choctaw, calls upon prosodic circumscription as well. The Choctaw *y*-grade displays a complex system of interdependence between base and derivative, while at the same time requiring a cross-categorial invariant like the Arabic iambic template.

Our investigations of Choctaw have been guided almost entirely by Nicklas's (1974, 1975) penetrating studies of this language. Nicklas provides a clear and evidently exact description of the complex phonology and morphology of this language. We have also benefited from Ulrich's (1986) more recent treatment of a somewhat different dialect. Our primary focus, however, has been on the body of internally consistent material presented by Nicklas.

In the remainder of this article, we proceed as follows. §2 provides a brief overview of the essentials of prosodic circumscription theory. §3 discusses the prosodic phonology of Choctaw, taking in turn syllable structure, foot structure and minimal-word effects. §4 introduces the *y*-grade formation. Subsequent sections turn to details of the analysis, seeking additional confirmation or clarification where appropriate. §5 discusses the relation between two distinct uses of the iamb in the *y*-grade, as prosodically circumscribed base and as target for template-mapping. §6 discusses the process of medial gemination in the *y*-grade, arguing that it is formally independent of template-mapping. §7 takes up the phenomenon of final syllable extraprosodicity, finding that it has a pervasive role in this language. Some speculations on truncating morphology are also included. The article concludes with a summary of the formal basis of *y*-grade formation.

2 Outline of prosodic circumscription theory

The basic intuition of prosodic circumscription theory is that a morphological operation can apply to a prosodically delimited constituent within a morphological base rather than to the morphologically delimited base as a whole. For example, the Arabic pluralisation *ǰundub* → *ǰanaadib* is seen as a morphological operation on the heavy syllable (moraic trochee) *ǰun* rather than on the entire singular stem *ǰundub*. The prosodically circumscribed domain *ǰun* is subjected to the morphological operation of mapping to an iambic template, yielding *ǰVnVV*; the remainder *dub* is unaffected by this template-mapping, and so its CVC shape remains unchanged.

Prosodic circumscription calls upon a parsing function Φ(C, E) applied to a base B, where C is a prosodic constituent and E an edge (left or right). We denote the parsed-out constituent as B:Φ (that is, the C within B at edge E) and the remainder as B/Φ, recruiting familiar notation for this purpose. Then the following identity holds, where * stands for the relation of left- or right-concatenation between the parsed-out constituent and the remainder:

(1) $B = B{:}\Phi * B/\Phi$

A morphological operation O applying under prosodic circumscription may make one of two uses of this factoring of the base. It can apply to the remainder, in what is usually known as extrametricality or extraprosodicity:

(2) $O/\Phi(B) = B{:}\Phi * O(B/\Phi)$

Or a morphological operation can apply to the parsed-out constituent, as the Arabic operation of mapping to an iambic template does:

(3) $O{:}\Phi(B) = O(B{:}\Phi) * B/\Phi$

Thus, a complete characterisation of an operation applied under a constraint of prosodic circumscription requires, besides a specification of the operation itself, a constituent, an edge and a choice between the two modes of circumscription defined by (2) and (3). Further elaboration is possible by composing one type of prosodic circumscription with another; as we will see, this composition of operations plays a fundamental role in the analysis of Choctaw.

3 Choctaw prosodic structure

We make several assumptions about the theory of prosody, following McCarthy & Prince (1986, 1988, 1990a, b). The units of prosody are the mora (μ), syllable (σ), foot (F), and prosodic word (Wd). These are arranged in a hierarchy of inclusion:

(4) *Prosodic hierarchy*

Prosodic word	Wd
	|
Foot	F
	|
Syllable	σ
	|
Mora	μ

The relation Wd contains F in (4) entails that the smallest or MINIMAL word consists of a single foot. This relation also entails the Non-exhaustiveness Condition on extrametricality (Prince 1983: 80). Since every Wd must contain at least one F, foot assignment cannot fail in any Wd, as it would if all syllables were extrametrical with respect to foot assignment. As we will see later, though, there is no prohibition against exhaustive extrametricality with respect to operations other than foot assignment.

Syllables consist normally of one or two moras (though perhaps there is a trimoraic option). In the unmarked case cross-linguistically, closed and long-vowelled syllables are bimoraic or heavy, while open, short-vowelled syllables are monomoraic or light. The Onset Rule (Steriade 1982; Itô 1989) requires that all syllables begin with a consonant, either relatively (when a consonant is available in some domain) or absolutely.

Feet fall into three distinct types, as argued by McCarthy & Prince (1986) and Hayes (1987). The syllabic trochee is a left-headed maximally disyllabic foot. The moraic trochee is also left-headed, but it consists maximally of two moras rather than two syllables. Thus, two light syllables or a single heavy syllable constitute a moraic trochee. The iamb is the only right-headed foot of the typology and it is also the only asymmetric one. Its maximal expansion is a light syllable–heavy syllable sequence.

We will now review an array of evidence for the place of Choctaw within this theory of prosody, starting with moraic and syllabic structure, then proceeding up the prosodic hierarchy to foot structure and the minimal word.

3.1 Syllable structure

With rare exceptions, syllables in Choctaw are of the form CV, CVC or CVV. A considerable amount of evidence shows that CVC and CVV syllables are opposed to CV syllables as heavy to light, the unmarked pattern cross-linguistically.

The CVC/CVV equivalence appears under various phonological and morphological conditions, all of which will be discussed in greater detail below.[1]

(i) The infixes *l* 'passive' and *h* 'instantaneous' induce closed-syllable shortening of a preceding long vowel (Nicklas 1974: 111, 113; 1975: 242): /waaya/ 'to grow (of plants)' → /wáahya/ → *wáhya*; /aapitta/ 'to put into a container' → /aalpitta/ → *alpitta*.

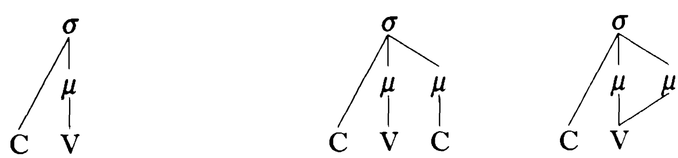
(ii) The rule of Alternate Lengthening lengthens the vowel of every other CV syllable, but not CVC or CVV (Nicklas 1974: 117f; 1975: 242): /či + pisa + či + li/ 'thee + see + cause + I' → *čipiisačiili*.

(iii) Deletion of a syllable-final nasal triggers compensatory lengthening only in a resulting open syllable (Nicklas 1974: 14; 1975: 244) (cf. Hayes 1989): /ɬabaNka/ 'to snore' → *ɬabããka vs.* /biyónkko/ 'strawberry' → *biyṍkko*.[2]

(iv) A morphological category called the 'lengthened grade' lengthens the vowel of an open penult but not a closed one: compare *tákči* 'to tie' and *faláama* 'to return'. The *y*-grade shows the same pattern: *táyyakči vs. fállaama*.

Regularities like these are familiar from languages where CVC and CVV syllables are heavy; they have a straightforward characterisation in prosodic terms. The equivalence between CVC and CVV syllables is established at the moraic level of representation, schematised as follows:

(5) a. *Light syllables* b. *Heavy syllables*



The observations in (ii), (iii) and (iv) involve the failure of vowel-lengthening rules to apply in closed syllables. Since vowel lengthening is the addition of a mora, it is blocked in any syllable which is already bimoraic. Finally, in case (i) the consonantal infixes usurp the second mora of a long vowel, shortening it automatically.[3]

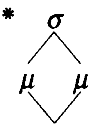
Word-finally, CVVC syllables occur under some conditions, including the output of compensatory lengthening: /hallons/ → *hallõõs* 'leech' (Nicklas 1974: 14). This evidence suggests that final consonants are extraprosodic, permitting a preceding vowel to be long. This conjecture finds confirmation in Nicklas's (1974: 22) observation that all monosyllabic nouns are of the pattern CVVC: *book* 'river', *waak* 'cow', *paaš* 'slap'. We argue below that the minimal word is bimoraic; if the final consonant is extraprosodic, CVV(C) monosyllables satisfy minimality, but CV(C) monosyllables do not. On the other hand, it does not appear to be the case that Alternate Lengthening applies to final CVC syllables, although clear evidence of this is hard to come by in our sources.

The schemata in (5) also require that the maximal word-medial cluster is CC. Infixation of *l* or *h* may create triconsonantal clusters which are then resolved by insertion of a copy of the preceding vowel after the infix (Nicklas 1975: 244; Ulrich 1986: 40): /takči/ → /talkči/ → ***talakči***, /hoyya/ 'to be dripping' → /holyya/ → ***holoyya***; ***tahákči***, ***hohóyya***. Cases with both infixes also occur, in which case epenthesis applies twice: *talahákči*.

Word-initially, onsetless syllables are permitted. With four exceptions (Nicklas 1974: 18), onsetless syllables within the stem + suffix complex are prohibited, with hiatus resolved by deletion of the first vowel (Nicklas 1975: 242): /čokfi + óši/ 'rabbit + DIM' → *čokfóši*. Hiatus is evidently tolerated at the prefix + stem boundary, as in /či + a + h/ 'you + are' → *či.ah* (Nicklas 1974: 21).[4] This perhaps should be related to a more general opacity of prefixes to phonological processes to which we return below: resyllabification of prefix-final consonants is blocked with bases longer than two syllables (*iš.a.pi.la* 'for you (*iš*) to help') and prefixes are only sometimes in the domain of the Alternate Lengthening rule (Nicklas 1975: 243). Subject to further clarification of these issues, it seems that the Onset Rule is absolute only within the domain of the stem + suffix complex.

Word-finally, only short vowels can occur (Nicklas 1974: 18). The prohibition of final long vowels is enforced actively on the result of Alternate Lengthening. From /čipisači/ we would expect **čipiisačii* (cf. *čipiisačiili*); the short final vowel of the actually occurring *čipiisači* is explained by this more general prohibition.[5] The prohibition is apparently enforced at all levels of phonological structure, since there is no evidence of a stem-final vowel length contrast even at underlying representation. We formulate it as follows:

(6) *



One complication in Choctaw syllable structure remains, the treatment of preconsonantal (and some word-final) nasals (Nicklas 1974: 14–15, 21, 127–129; 1975: 244–245). Recall that these nasals delete, nasalising and, if possible, lengthening the preceding vowel. The conditions are as follows:

(i) A word-final nasal deletes, nasalising the preceding vowel (but not lengthening it, because of (6)). Nasals behaving in this way are affixal (e.g. /ma + n/ 'that' (OBJ) → *mã*); the word-final nasals that are retained are part of a small number of noun roots, some of which are loans: *niškin* 'eye', *tákkon* 'peach', *yolkon* 'mole'.

(ii) Word-internally, a preconsonantal nasal deletes with vowel nasalisation and compensatory lengthening (when syllable structure permits). Morpheme-internal cases: /áNpo/ → *ã́ãpo* 'dish'; /oNsi/ → *õõsi* 'eagle';

/okčaNk/ → *okčããk* 'melon'.[6] Cases with the /am/ 'my' prefix (cf. /am + issi/ → *amissi* 'my deer'): *ããpala* 'my lamp', *ããtabi* 'my cane', *ããmĩĩko* 'my chief'. Cases with the *N* infix: /ó*N*na/ → *óõna* 'to arrive there', /hó*N*mi/ → *hóõmi* 'bitter', /wáa*N*ya/ → *wããya* 'to grow', /tá*N*kči/ → *tã́kči* 'to tie'.

(iii) Tautomorphemic geminate nasals, whether underlying like those in *onna* 'dawn' or *homma* 'red' or derived by morphological gemination in the *y*-grade like that in *bínniili* 'to sit' (Nicklas 1974: 129), remain unchanged. Furthermore, nasal deletion is inapplicable to geminates, even heteromorphemic ones, resulting from assimilation, as in the *l*-infixed (passive) form *tanna*, from /talna/ 'to weave' (Nicklas 1974: 130).

Thus, syllable-final nasals are preserved only when part of a true geminate. As Ulrich (1986: 62) notes, the latter observation is a familiar effect of the Linking Condition (Hayes 1986) or the Uniform Applicability Condition (Schein & Steriade 1986). The distinction noted in (i) has no ready explanation; perhaps it should be related to final consonant extraprosodicity, or perhaps the few roots retaining word-final nasals are simply lexical exceptions. In all other circumstances, though, a syllable-final nasal is lost, the vowel nasalises, and there is compensatory lengthening if syllable structure allows.

There are two different approaches to this process, by Piggott (1987) and Trigo (1988). Either is compatible with our analysis of Choctaw prosody. Since Trigo addresses the Choctaw data directly, we will essentially follow her account below.

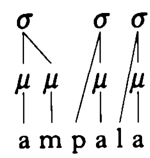
Trigo's account relies on debuccalisation (loss of place of articulation) rather than deletion of the nasal consonant. Disregarding the limited and ambiguous evidence of word-final nasals, we formulate it as a rule applying to nasals in coda position (that is, when dominated by a mora):

(7) *Nasal Debuccalisation*

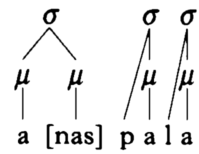
$$\text{Place} \rightarrow \emptyset \;/\; \left[\begin{array}{c} \overset{\mu}{\overset{|}{\_\_}} \\ \text{nas} \end{array}\right]$$

The Place-less nasal created by Debuccalisation is an *anusvara*, or nasal glide. The *anusvara* then coalesces with the preceding vowel by mechanisms discussed by Trigo (1988: 121–123). The result of this coalescence, as in similar cases of vowel coalescence (see de Haas 1988: 93), preserves the weight of the original syllable. Thus, we have the following derivation of *ããpala* from /am + pala/:

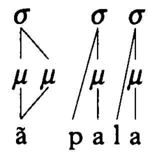
(8) Underlying



Nasal Debuccalisation



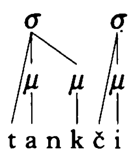
Coalescence



The nasal infix, like the other 'aspectual' infixes of Choctaw, is inserted after the vowel of the penultimate syllable. (We explore this further below.) When the penult is a CV syllable, as in /homi/ → /hó*n*mi/ → ***hṍõmi*** 'bitter', the treatment of the nasal infix is the same as in /ampala/. More instructive is the case of /takči/ → /tá*n*kči/ → ***tã́kči*** 'to tie', where the nasal infix seems to create a CVCC syllable at an intermediate stage of the derivation. This putative CVCC syllable cannot be trimoraic, since we would then expect compensatory lengthening to yield ****tã́ãkči***. This accords with our claim that the normal upper bound on the contents of a syllable in Choctaw is CVV or CVC and with the observation that underlying CVNC (surface CṼC) syllables are not found in Choctaw, disregarding a few isolated exceptions.[7]

The immediate result of infixation of *n* in /takči/ is the following:

(9)



This representation is ill-formed by any account – the unsyllabified *n* is internal to a syllable. We assume that the representation is immediately restructured so that the *n* is linked to *μ* but *k* is not, so that there are no syllable-internal stray segments. The *n* will then debuccalise by rule (7) and merge with the preceding vowel. At that point, closed syllable shortening (that is, syllabification of the stray *k*) will apply to yield ***tã́kči***.

This leaves infixed forms like /wáaya/ → ***wã́ãya*** 'to grow', where the nasal infix falls on a CVV syllable. Like CVCC syllables, CVVC (including CVVN) are outside the normal canon of Choctaw syllabification. Automatic restructuring by closed syllable shortening from /waanya/ to /wanya/ puts the nasal in coda position, where it debuccalises. With coalescence (including compensatory lengthening), vowel length is restored in the result.

3.2 Foot structure

Although stress prominence does not seem to be a feature of Choctaw phonetics, the language nevertheless has the typical characteristics of an iambic metrical system. Evidence of iambicity comes from the properties of the rule of Alternate Lengthening (Nicklas 1974: 117f; 1975: 242f; Munro & Ulrich 1984; Ulrich 1986: 53ff).

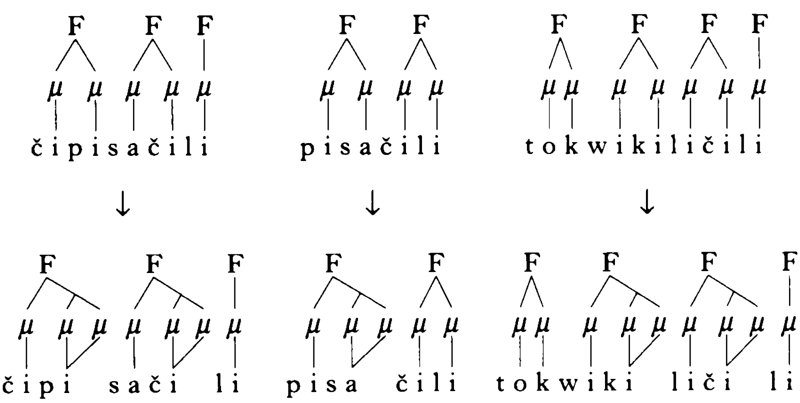
In a sequence of monomoraic syllables, every even-numbered syllable, counting from the left, lengthens its vowel. Consider the following examples, composed of the roots /habina/ 'receive a present' and /pisa/ 'see', the prefix /či/ 'thee', and the suffixes /či/ 'causative', -∅ 'he' and /li/ 'I':

(10)	habiina	pisa
	čihaabina	čipiisa
	habiinali	pisaali
	čihaabinaali	čipiisali
	habiinači	pisaači
	čihaabinaači	čipiisači
	habiinačiili	pisaačili
		čipiisačiili

Word-final vowels do not lengthen, even when they have the right parity, because of condition (6). Heavy syllables interrupt the parity count; compare *čipiisačiili* with *tokwikiiličiili* from /tokwikiličili/ 'I shine a light'.

Alternate Lengthening is a consequence of assignment of an iambic foot from left to right (cf. Munro & Ulrich 1984; Ulrich 1986). The normative (unmarked) iamb is light–heavy; Choctaw enforces a heavy right branch actively, requiring vowel lengthening when the right branch is light. For a few representative examples, the derivation then proceeds as follows:

(11)



Because of (6), final syllables do not lengthen.

There are peculiarities of Alternate Lengthening in prefixed forms. One involves evident cyclic application, as argued by Munro & Ulrich (1984) and Ulrich (1986: 53ff). The other, which bears more directly on our concerns, is the observation that vowel-initial stems of three syllables or more appear to be unable to take a single prefixal syllable into the scope of Alternate Lengthening. For example, from underlying /iš + apila/ 'you help him' we would expect **išaapila*, but *išapiila* is the correct form. Disyllabic vowel-initial stems do bring a single prefixal syllable into the domain of foot assignment, shown by examples like /čim-iši/ → *čimiiši* or /ha + čim + iši/ → *hačimiiši* 'to take it for thee/you'.

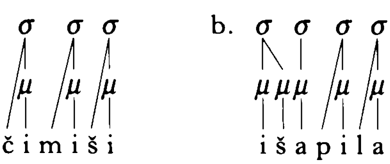
This peculiarity of trisyllabic vowel-initial stems with respect to Alternate Lengthening correlates with another oddity of such words, described by Nicklas in the following passages:

> When a prefix is attached to a word of more than two syllables, the syllable boundary follows the prefix, and syllable boundaries occur within the prefix according to the general rule. Examples are *iš.a.pi.la* 'for you (*iš-*) to help (*apila*),' *im.al.ta.ha* 'for him (*im-*) to be ready (*altaha*),' *iš.i.mi.ši* 'for you (*iš-*) to take (*iši*) for him (*im*),' and *ha.čim.al.ta.ha* 'for you all (*hačim-*) to be ready (*altaha*)'.
>
> (Nicklas 1974: 21–22)

> A syllable final consonant ranges in length from short in normal rapid speech to the length of geminates in careful slow speech. For example, *pakti* 'mushroom' is pronounced [pakkti] in careful speech. The syllable boundaries of prefixes outside the scope of the vowel lengthening sound change fall at morpheme boundaries. As a result, prefix final consonants outside the scope sound like geminates in careful speech. For example, the scope of *iš-im-iši* 'you take it for him' is *iš*| *imiši*|, giving the pronunciation [iššimiiši] in careful speech. The scope of *iš-im-apila* 'you help him' is *išim* | *apila*|, pronounced [iššimmapiila] in slow speech.
>
> (Nicklas 1974: 121–122; similarly 1975: 243)

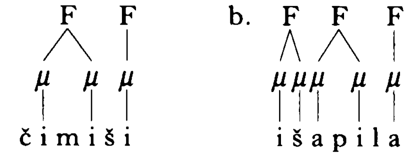
We can now explain the curious conjunction of properties relevant to determining the scope of Alternate Lengthening. A single prefix before a disyllabic vowel-initial stem is taken into the scope of the rule ([*čim* + *ii*]*ši*, with the foot bracketed). But even a single prefix is not in the domain of Alternate Lengthening before a trisyllabic vowel-initial stem (*iš* + [*apii*]*la*). These forms also differ in syllabification: *či.mii.ši* and *iš.a.pii.la*. We take the difference in syllabification as primary and derive the Alternate Lengthening effects from that. The representations submitted to Alternate Lengthening are then as follows:

(12) a. b.



The initial heavy syllable of (12b) will cause foot assignment to apply differently in that case, leading to a difference in consequent vowel lengthening:

(13) a. b.



There is, then, no difference in the scope of Alternate Lengthening between the two examples; instead, the difference depends on syllabification.

This explanation presupposes that trisyllabic stems, but not disyllabic stems, are somehow a barrier to the Onset Rule. (Once a disyllabic stem has a single prefix, of course, it is treated as trisyllabic when additional prefixes are added.) A basis for this difference in syllabification based on stem size will be suggested in the next section.

3.3 The minimal word

As we noted earlier, the prosodic hierarchy, in which Wd (prosodic word) dominates F (foot), asserts that the minimal word W_{min} is a single foot. Since we have shown that the foot in Choctaw is an iamb, we expect the minimal word to be an iamb as well. The iamb has various licit expansions – L–H (light–heavy), L–L, H and L – so there is a certain ambiguity in the claim that the minimal word is an iamb. We will see later in §5 that this ambiguity is reflected quite systematically in the use of the iamb in prosodic circumscription.

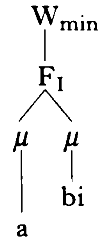
All verb stems must end in a vowel. Nicklas (1974: 63–64; 1975: 240) observes that apparent VCV verb stems divide into two types. Normal VCV stems retain the initial vowel after prefixes as in *ani* 'to fill', *išani* 'for you to fill'. Stems exhibiting this behaviour may begin with any vowel: *iši* 'to fill', *ona* 'to arrive there', *ani*. Abnormal VCV stems lose the initial vowel after prefixes, as in *abi* 'to kill', *išbi* 'for you to kill', *čibi* 'to kill you'. Abnormal VCV stems can begin only with the vowel *a*: *abi*, *ala* 'to arrive here', *amo* 'to gather (a crop)', *apa* 'to eat'. Nicklas's interpretation of these observations is that normal VCV stems are true vowel-initials, but abnormal VCV stems are actually CV at underlying representation, a stem type that otherwise would not exist. When there is no prefix, as he puts it, a prosthetic *a* steps in instead.

This analysis seems to us essentially correct, although we would like to make the conditions for prosthetic *a* more precise. Underlying CV stems are monomoraic (and monosyllabic); prosthetic *a* renders them bimoraic (and disyllabic). This sort of patterning is typical of cases involving a minimal word requirement. (For examples, see McCarthy & Prince 1986, 1990a, b.)

Since the minimal word of Choctaw must be an iamb, we need to know which expansion of the iamb is required. For verbs at least, the minimal word can be analysed as a canonical L–H iamb which surfaces as bimoraic L–L because final vowel length is prohibited. Prefixed forms like /iš-bi/

or /či-bi/ fulfil bimoraicity directly, but unprefixed forms like /bi/ contain only a single mora. The minimal word requirement is enforced actively by inserting the prosthetic vowel *a*:

(14)



Default vowel

There are other effects of the minimal word in Choctaw. One is Nicklas's (1974: 22) observation that monosyllabic nouns all have the canonical pattern CVVC: *book* 'river', *waak* 'cow', *tiik* 'female' and *paaš* 'slap'. The minimal noun is the H expansion of the iamb. Of the theoretically possible monosyllabic nouns, CV nouns are obviously monomoraic and so subminimal, while CVV nouns contravene condition (6). If the final consonant is extraprosodic, as we have suggested, CVC nouns will have only a single intrametrical mora, and so they are subminimal too. CVCC is not a licit syllable. Thus, CVVC is the only monosyllabic shape that meets all the requirements of Choctaw prosody.

Another consequence of the minimal word involves the blocking of the Onset Rule described in the preceding section. Recall that a prefix to a trisyllabic base does not undergo the Onset Rule, even when other conditions are met: *iš.+apila vs. či.m+iši* (prior to Alternate Lengthening). We argue below that final syllables are extraprosodic, a proposal that is not implausible in light of (6). With final extraprosodicity, these forms differ in their scansion by the bimoraic minimal word: *iš[api](la) vs. [čimi](ši)*. The domain of the Onset Rule, then, can be characterised as the minimal word within the stem, modulo final extraprosodicity. As it happens, this is also the domain of several important morphological processes, to which we now turn.

4 The Choctaw *y*-grade

Choctaw morphology includes a process for forming completive verbs, dubbed the *y*-grade by Nicklas (1975: 240–241) or the intensive by Nicklas (1974: 77, 91–96). Representative examples of the diverse results of the *y*-grade formation follow:

(15)		*Base*	y-*grade*	
	a.	talakči	tállakči	'to be tied'
		kobaffi	kóbbaffi	'to break'
		atobbi	áttobbi	'to pay'

b.	binili	bínniili	'to sit'
	falama	fállaama	'to return'
	kobafa	kóbbaafa	'to break'
	okčamali	okčámmaali	'blue, green'
	tokwikili	tokwíkkiili	'to shine'
	atokoli	atókkooli	'to elect'
c.	takči	táyyakči	'to tie'
	šaali	šáyyaali	'to carry'
	čompa	čóyyompa	'to buy'
d.	pisa	píyyiisa	'to see'
	pila	píyyiila	'to throw'
	lawa	láyyaawa	'many'
	ona	óyyoona	'to arrive there'
e.	oktabli	oktáyyabli	'to dam up'
	nokšoopa	nokšóyyoopa	'afraid'
f.	toksali	toksáyyaali	'to work'
	čokkowa	čokkóyyoowa	'to enter'
	akkowa	akkóyyoowa	'to climb down'[8]

The forms of the *y*-grade are obviously quite diverse, although there are some constants. To establish these, we have schematised the examples in (15) according to the canonical pattern of input and output (X = C or V):

(16)	*Input*	*Output*
a.	$\ldots CV_iCV_jX\sigma$	$\ldots C\acute{V}_iC_kC_kV_jX\sigma$
b.	$\ldots CV_iCV_j\sigma$	$\ldots C\acute{V}_iC_kC_kV_jV_j\sigma$
c.	$CV_iX\sigma$	$C\acute{V}_iyyV_iX\sigma$
d.	$CV_i\sigma$	$C\acute{V}_iyyV_iV_i\sigma$
e.	$\ldots VXCV_iX\sigma$	$\ldots VC\acute{V}_iyyV_iX\sigma$
f.	$\ldots VXCV_i\sigma$	$\ldots VXC\acute{V}_iyyV_iV_i\sigma$

The following observations are immediately apparent. First, the final syllable is entirely unaffected by the *y*-grade morphology, and no property of the final syllable conditions any aspect of the *y*-grade. Second, a *y* is inserted in the derived form when the input has no antepenult (16c, d) or when the input antepenult is heavy (16e, f). No *y* is inserted when the input antepenult is light (16a, b). Third, in just those cases where there is an inserted *y*, both penult and antepenult of the output have the same vowel as the penult of the input. Fourth, the *y*-grade penult is always heavy, even if the input penult is light (16b–f). Fifth, there is always a geminate consonant between the penult and antepenult of the *y*-grade.

This rich array of regularities turns out to have a fairly straightforward interpretation within prosodic theory, once the requisite parameters of the analysis are recognised. We will now review each of them briefly in turn, and later we will characterise and support them in greater detail.

The inertia of the final syllable – its complete failure to participate in *y*-grade morphology – we interpret as final syllable extraprosodicity. In terms of prosodic circumscription theory, the *y*-grade first imposes a condition $\Phi(\sigma$, Right) on the input base which returns the base minus its final syllable. The final syllable is therefore outside the scope of subsequent *y*-grade operations.

Medial gemination – doubling of the consonant at the juncture of antepenult and penult – figures in all the variations of the *y*-grade. We argue below that phonological theory must recognise medial gemination, obtained through insertion of a mora under prosodic circumscription, as a licit morphological operation. We can therefore abstract away from it in considering the other aspects of the *y*-grade.

The iambic foot – the minimal word and the source of Alternate Lengthening in Choctaw – plays two distinct roles in the *y*-grade system. More obviously, it functions as a template, requiring that the antepenult + penult of the derived form be a canonical L–H iambic foot (disregarding the independent effects of medial gemination). Thus, forms like (16c, d), which lack an antepenult in the input, are supplied with one in the output. The empty onset of this iambic template is occupied by a default *y* and vowel spreading fills both syllables. Similarly, forms with a light penult at input (16b–f) emerge with a heavy penult by lengthening the penultimate vowel, to satisfy the L–H requirement of iambicity.

There is another, more subtle aspect to the iamb in the Choctaw *y*-grade. Consider in particular cases (16e, f), where the antepenult is heavy. Their behaviour in the *y*-grade (specifically, insertion of *y* and vowel spreading) is identical to that of (16c, d), which lack an antepenult entirely. This equivalence between a heavy antepenult and a missing one is given by the iambic foot, if it is regarded as *the prosodic base for template mapping*. To be more precise, mapping to the iambic template is applied to the prosodically characterised (iambic) subpart of the input. Iambic base circumscription cannot parse the H–H or H–L antepenult–penult substring of (16e, f); therefore only the penult (H or L) is within the scope of template mapping.[9]

To sum up, the Choctaw *y*-grade circumscribes a maximally iambic base and maps it onto a template consisting of a canonical iamb. This is positive prosodic circumscription as defined above in (3). The parsing function Φ has as arguments Iamb and Right: Φ(Iamb, Right). This conforms to McCarthy & Prince's (1990a) observation that the parsed-out constituent in positive prosodic circumscription is the minimal word, although we will later see an exception to this. We have established above that the Choctaw foot required for Alternate Lengthening is iambic and have found further evidence of iambicity in minimal word effects. Thus, the proposal leads us to results with considerable internal consistency.

Finally, examples like *takči/táyyakči* (15c) and *oktabli/oktáyyabli* (15e) reveal a subtlety of template mapping. The prosodic bases of these examples are *tak* and *tab*. From unadorned left-to-right association of these prosodic bases to the iambic template, we would expect intermediate forms (prior to medial gemination) like **takaa* and **tabaa*, rather than *ta*(*y*)*ak* and *ta*(*y*)*ab*. The attested pattern exemplifies the edge-in mode of association of McCarthy (1984: 313), Heath (1987: 11), Yip (1988), Hoberman (1988) and Hewitt & Prince (1989), in which peripheral consonants link to peripheral templatic positions.

We are now ready to summarise this first, relatively informal pass through the analysis. Schematically, the *y*-grade involves the following sequence of rules:

(17) a. *Final Syllable Extraprosodicity*
$\sigma \rightarrow (\sigma) / \_\_]$

b. *Prosodic Base Circumscription*
Φ(Iamb, Right)

c. *Template Mapping*
'Edge-in' association to iambic template
Vowel spreading

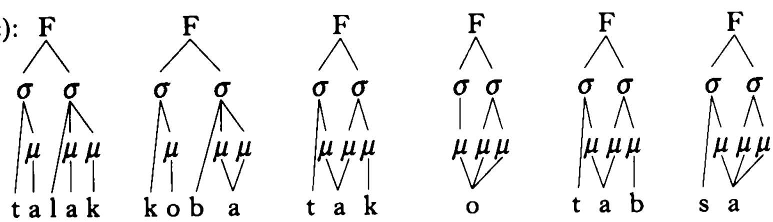
d. *Default Onset Rule*
$\emptyset \rightarrow y$ when required by syllabic well-formedness

e. *Medial Gemination/Accentuation*
To be discussed below

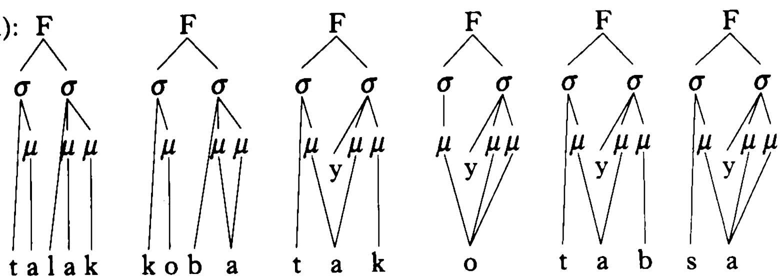
Derivations (disregarding the accent) proceed as follows:

(18)	a. talakči	b. kobafa	c. takči	d. ona	e. oktabli	f. toksali
(17a):	talak	koba	tak	o	oktab	toksa
(17b):	talak	koba	tak	o	tab	sa

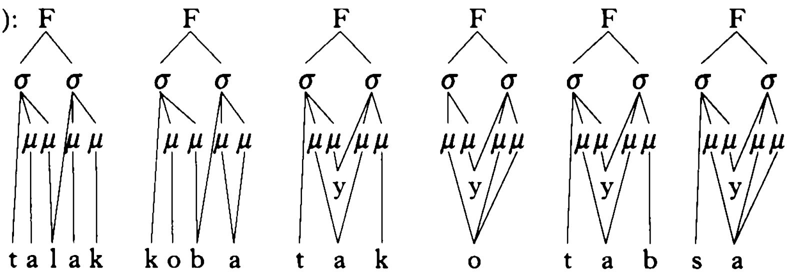
(17c):



(17d):



(17e):



tallakči kobbaafi tayyakči oyyoona oktay-yabli toksay-yaali

With 'restoration' of the portions of the base suppressed by final extraprosodicity and prosodic base circumscription, we obtain the desired surface forms.

Our analysis of the Choctaw *y*-grade calls upon a number of premises: final extraprosodicity, mapping of a prosodic base to an iambic template and a morphological operation of medial gemination. We now turn to a closer look at these phenomena in Choctaw and other languages.

5 The prosodic base and iambic template

The Choctaw *y*-grade is formed by mapping a prosodically characterised base onto a template. Both base and template are iambs, the minimal word and metrical foot of Choctaw. From iambic base circumscription, we obtain the result that heavy and light antepenults result in different *y*-grade forms. From the iambic template, we obtain the fixed canonical pattern of *y*-grades derived from various input representations.

Prosodic base circumscription and the template treat the iamb in two different ways. The iambic base can be any possible expansion of an iamb: maximally L–H, but also L–L, H or even L. These expansions of the iamb are exactly those required in stress systems. Moreover, also as in stress systems (e.g. the Maximality Condition of Halle & Vergnaud 1987), the largest possible expansion of the iamb is taken in case of ambiguity. Thus, *{talak}či* has the bracketed L–H iambic base, rather than a non-maximal H base **ta{lak}či*. The iambic template, though, is an invariant, canonical iamb L–H.

These two senses of the iamb are directly precedented in comparable cases discussed by McCarthy & Prince (1990a). The iambic base, maximally L–H but with smaller expansions as required, is essential to the analysis of the possessive infix in Ulwa. This infix, *-ka* in the 3rd person singular, is suffixed to the iambic base within the actual morphological base. In the following examples, the iambic base is italicised:

(19)	*Base*	*Possessed*	
a.	al	*al*ka	'man'
	bas	*bas*ka	'hair'
	kii	*kii*ka	'stone'
	suulu	*suu*kalu	'dog'
	kuhbil	*kuh*kabil	'knife'
	baskarna	*bas*kakarna	'comb'
b.	sana	*sana*ka	'deer'
	siwanak	*siwa*kanak	'root'
c.	amak	*amak*ka	'bee'
	sapaa	*sapaa*ka	'forehead'
	anaalaaka	*anaa*kalaaka	'chin'
	karasmak	*karas*kamak	'knee'

In (19a), the iambic base is expanded as a single heavy syllable. In (19b) it is a sequence of two light syllables, while in (19c) it has its maximal L–H expansion. Minimal word effects ensure that there are no monomoraic stems in Ulwa; thus, we can exhibit no cases where the iamb is minimally expanded as L. The function picking out the prosodic base in Ulwa is Φ(Iamb, Left), identical to that of Choctaw except for the edge at which parsing is initiated.

In contrast to the variability of the iambic base, the iambic template of Choctaw is exceptionlessly L–H. In this respect, the Choctaw *y*-grade is closely paralleled by the Arabic broken plural. The broken plural is formed on an iambic template which is also fixed at L–H (to which unaffected portions of the corresponding singular noun are adjoined). In the following examples, the templatic portion of the broken plural is italicised:

(20)	*Singular*	*Plural*	
a.	nafs	*nufuu*s	'soul'
	qidħ	*qidaa*ħ	'arrow'
	ħukm	/*ħakaa*m/	'judgement'
b.	ʔasad	*ʔusuu*d	'lion'
	rajul	*rijaa*l	'man'
	ʕinab	/*ʕanaa*b/	'grape'
c.	saħaab+at	*saħaa*ʔib	'cloud'
	jaziir+at	*jazaa*ʔir	'island'
d.	faakih+at	*fawaa*kih	'fruit'
	ʔaanis+at	*ʔawaa*nis	'cheerful'
e.	xaatam	*xawaa*tim	'signet-ring'
	jaamuus	*jawaa*miis	'buffalo'
f.	jundub	*janaa*dib	'locust'
	sulṭaan	*salaa*ṭiin	'sultan'

Examples (20d, e) reveal another similarity with Choctaw. In these cases, the default consonant *w* is inserted to fill the vacant onset position medially in the iambic template. Choctaw inserts the glide *y* under precisely the same conditions.

We see, then, that the two senses of the iambic foot required by Choctaw are precedented under parallel conditions in Ulwa and Arabic. The iambic foot as prosodic base is maximally L–H in both Ulwa and Choctaw, reverting to other licit (smaller) expansions of this foot under the impetus of the phonological material to be parsed out. In this respect, parsing by prosodic circumscription is identical to parsing by a rule of stress assignment. The iambic foot as template is invariably L–H in Arabic and Choctaw. A template, then, returns the canonical expansion of the specified prosodic category, but a prosodic base, like the parsing of metrical feet in stress systems, adapts itself to the requirements of the form to which it is applied.

The Ulwa and Arabic examples are instructive for another reason. They show the independence of prosodic base circumscription and template mapping. In Ulwa, the prosodic base is the input to suffixation rather than template mapping. In Arabic, as McCarthy & Prince (1990a, b) argue, the prosodic base is a moraic trochee, the minimal word of Arabic, while the template is an iamb. The two mechanisms – base circumscription and the operation applied to the circumscribed base – are formally distinct.

This difference between base circumscription and the morphological operation is important in Choctaw, since the prosodic base and the operation seem quite similar; both retrieve an iambic foot, though in two distinct senses as outlined above. Prosodic theory, as illustrated by Ulwa, Arabic and other examples in McCarthy & Prince (1990a), does not permit us to conflate these two mechanisms into a single operation of base circumscription/template mapping, and various additional arguments support this view.

First, prosodic base circumscription never forces the parsed-out constituent to expand to the canonical shape of some prosodic category. Such cases would be easy to identify; consider what Ulwa would look like if it exhibited this property. The possessive morpheme would be suffixed to the parsed-out iambic base, but as part of the parsing-out function the base would be expanded to fit a canonical iamb: *kuhbil* → {*kuXuh*}*bil* → *kuXuhkabil*, where 'X' is some default, onset-filling consonant. This phenomenon is not known. There are some cases where minimal word effects in compound-like structures produce the illusion of such an expansion (Spring 1989; Tateishi 1989; Myers 1987; Mutaka & Hyman 1990), but these are analysable by well-established, independently motivated means.

Second, the 'edge-in' association observed in Choctaw examples like *takči*/*táyyakči* presents serious problems for conflating base circumscription and template mapping into a single process. Base circumscription allows us to identify the edges that are then subject to template mapping; we cannot associate inward from the edges until we know what the edges are.[10]

Third, there is a variant of the Choctaw *y*-grade in which prosodic circumscription retrieves a *syllable* rather than an *iamb*. This alternant pattern is only attested twice in the speech of Nicklas's consultants: *talakči*, *taláyyakči* (Nicklas 1974: 93) and *kobafa*, *kobáyyaafa* (cited by Ulrich 1986: 210).[11] In these forms, only the penultimate syllables *lak* and *ba* are mapped onto the iambic template. Thus, circumscription of an iamb must be independent of mapping to an iamb.

Finally, if prosodic base circumscription were to always return a canonical instance of the desired category, as the conflated analysis of Choctaw would require, then languages like Ulwa, which lack such accommodation, simply could not be described. This problem assumes particular importance when we look below in §6 at Choctaw's relative Alabama, which has iambic base circumscription but not the iambic template. We could, of course, enrich the theory by adding a parameter to distinguish the two cases, but the independently required composition of prosodic base circumscription with template mapping obtains the same result.

6 Medial gemination

In our account, the CVCCVX shape-invariant of the *y*-grade is not specified directly in the grammar, but rather is derived from a combination of an iambic template and an operation of medial gemination applied to that template. This decomposition of the shape-invariant seems to complicate the grammar gratuitously – wouldn't it be better to analyse the shape-invariant as something like a sequence of two heavy syllables? Setting aside various theory-internal considerations that militate against this (no elementary prosodic constituent describes the shape-invariant and the iambic template conforms to the minimal word), we will present evidence that an operation of medial gemination is called for independently. Medial gemination is supported directly by data from the related language Alabama, and examples from two Austronesian languages display medial gemination where template mapping is impossible.

The rule of medial gemination applies to the canonical iamb obtained by template mapping (indicated below as Base 1). The gemination rule prefixes a mora to a base (indicated by Base 2 below) created by making the first mora of Base 1 extraprosodic. The prefixed mora is then filled by spreading of the adjacent consonant:

(21)

	a. takči	b. falama	c. pisa	d. talakči
Base 1	tayak	falaa	piyii	talak
Circumscription of Base 2	yak	laa	yii	lak
μ-prefixation	μ + yak	μ + laa	μ + yii	μ + lak
Spreading	yyak	llaa	yyii	llak
	tayyakči	fallaama	piyyiisa	tallakči

As is apparent, there is no need for a rule which specifies association of the consonant, rather than the preceding vowel, to the prefixed mora. At the point in the derivation when the mora is prefixed, the vowel is outside the scope of the prosodically circumscribed Base 2; the consonant is the only adjacent segment, and thus the mora can only be filled by spreading from the consonant.

Additional evidence for this analysis of the gemination rule comes from the formation of the imperfective in the related language Alabama, which is the subject of a valuable study by Hardy & Montler (1988). The Alabama imperfective involves gemination in certain cases, but in other cases there is vowel lengthening:

(22)	*Base*	*Imperfective*	
a.	balaaka	bállaaka	'lie down'
	cokooli	cókkooli	'sit down'
	ilkowatli	ilkówwatli	'move'
	afinapli	afínnapli	'lock up'
b.	hocoba	hóccoba	'big' (PL)[12]
c.	hofna	hóofna	'smell'
	isko	íisko	'drink'
d.	coba	cóoba	'big' (SG)
	noci	nóoci	'fall asleep'
	isi	íisi	'take, catch'
e.	ibakpila	ibakpíila	'turn upside down'
	campoli	campóoli	'taste good'

Despite the superficial differences, Alabama can be analysed as having the same rule of gemination as Choctaw.

Alabama also parses out an iambic base, with the final syllable disregarded as extraprosodic. Alabama, unlike Choctaw, does not map the result of base circumscription onto an iambic template. Thus, from iambic base circumscription alone, we obtain the representative Base 1 forms in (23):

(23)	*Stem*	*Base 1* (*iambic base*)
a.	balaaka	balaa
b.	hocoba	hoco
c.	hofna	hof
d.	coba	co
e.	ibakpila	pi

Then Medial Gemination is applied to these bases. The first mora is made extraprosodic, so that the Base 2 forms to which the μ is prefixed are as follows:

(24)	*Residue*	*Base 2*	*Prefixation*
a.	ba	laa	μ + laa
b.	ho	co	μ + co
c.	ho	f	μ + f
d.	co	$\emptyset$	$\mu + \emptyset$
e.	pi	$\emptyset$	$\mu + \emptyset$

There are, then, three cases to consider – where Base 2 is a syllable, a single (moraic) consonant, or the null string – and these yield two different realisations of the prefixed mora – consonant gemination or vowel lengthening.

When a mora is prefixed to a syllabic Base 2, as in (24a, b), the result is consonant gemination by spreading, as in Choctaw. But when Base 2 consists of a single moraic consonant (24c), consonant gemination is phonotactically impossible. The immediate result of μ-prefixation to the prosodic base *f* of (24c) is as follows:

(25)
$$\begin{array}{ccc} \mu & + & \mu \\ & & | \\ & & \mathrm{f} \end{array}$$

Spreading of the melodic element *f*, which is already a mora, onto the prefixed mora is phonotactically impossible in Alabama (if not in all languages). The mora must therefore remain unfilled until restoration of the residue *ho*, at which point it is satisfied by spreading the preceding vowel.[13]

In (24d, e), the entire string has been rendered extraprosodic, so the prefixed mora cannot be filled at this point. It too must await the restoration of the extraprosodic residue, at which point it is filled in the only possible way, by spreading the preceding vowel. Nothing in prosodic circumscription theory prohibits cases like this one, where an entire form is extraprosodic. As we noted in § 2, the Non-Exhaustiveness Condition on extrametricality really reduces to the requirement that foot assignment succeed in all words. Thus, non-exhaustiveness is relevant only in stress, not, as here, in morphological circumscription.

In all cases, the mora is filled by spreading from an adjacent segment as soon as accessible melodic material is available. In cases (24a, b), this results in consonant gemination, because the mora is adjacent to a consonant as soon as it is prefixed. In case (24c), gemination is ruled out by general conditions of syllabic well-formedness. In cases (24d, e), when the mora is first prefixed, it is not adjacent to any melodic material, and remains empty. At the next step in the derivation, where Base 2 and residue are concatenated, the mora is adjacent to the preceding vowel and is filled by spreading from that segment.

This analysis of the Alabama imperfective provides a kind of minimal pair with the Choctaw *y*-grade. In Choctaw, by our analysis, the derivation includes the following three distinct steps: iambic base circumscription, mapping to an iambic template and medial gemination. The parallel derivation of the Alabama imperfective involves only the first and third steps. The contrast with Alabama allows us to place our conclusions about Choctaw on an even more secure footing. One question about Choctaw is whether circumscription and template-mapping should be conflated into a single operation, since both call on the iambic template. Apart from arguments noted above in § 5, Alabama shows that it would be wrong to conflate the two: Alabama has the iambic base without the iambic template. Another important issue in the analysis of Choctaw was raised at the beginning of this section: since the iambic template is always obscured by medial gemination, why posit the iambic template at all? The answer again is that Alabama has medial gemination, but without the iambic template. In both respects, the Alabama facts show that phenomena that could be conflated in Choctaw are in fact formally independent in a related language.

We now turn to independent support for the analysis of medial gemination, first by an examination of accentual phenomena in the Choctaw *y*-grade and Alabama imperfective and then by a look at unrelated languages.

According to Nicklas (1974: 12), accent in Choctaw is an unpredictable property of some words or morphological patterns. It is realised by high tone. The accent in Alabama evidently has similar properties. The *y*-grade and imperfective are two morphological categories with distinctive accentual characteristics:

(26) a. *Choctaw*

talakči	tállakči	'to be tied'
binili	bínniili	'to sit'
takči	táyyakči	'to tie'
pisa	píyyiisa	'to see'
oktabli	oktáyyabli	'to dam up'
toksali	toksáyyaali	'to work'

b. *Alabama*

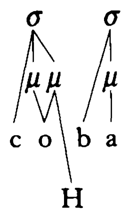
balaaka	bállaaka	'lie down'
hocoba	hóccoba	'big' (PL)
hofna	hóofna	'smell'
coba	cóoba	'big'
HHσ	*no examples cited*	
ibakpila	ibakpíila	'turn upside down'

In every case in (26), the syllable receiving the accent in the derived form is also the syllable that contains the mora inserted by the medial gemination rule. We account for this observation as follows.

First, we note that neither Choctaw nor Alabama has a contrast in the position of accent in heavy syllables.[14] Second, we posit an accent – that is, a high tone – lexically linked to the mora prefixed by the medial gemination rule. In other words, this morpheme is lexically accented:

(27)
$$\begin{array}{c} \mathrm{H} \\ | \\ \mu \end{array}$$

Combining the hypothesis in (27) with the general observation that accentual position does not contrast, we obtain the desired result. The mora inserted in the *y*-grade/imperfective bears an accent. Because of the lack of contrast in accentual position, the accent is realised on the syllable as a whole (or perhaps its head, the first mora; Poser 1988), rather than on the mora that directly bears the accent. Thus, the following representation is realised as *cóoba*:

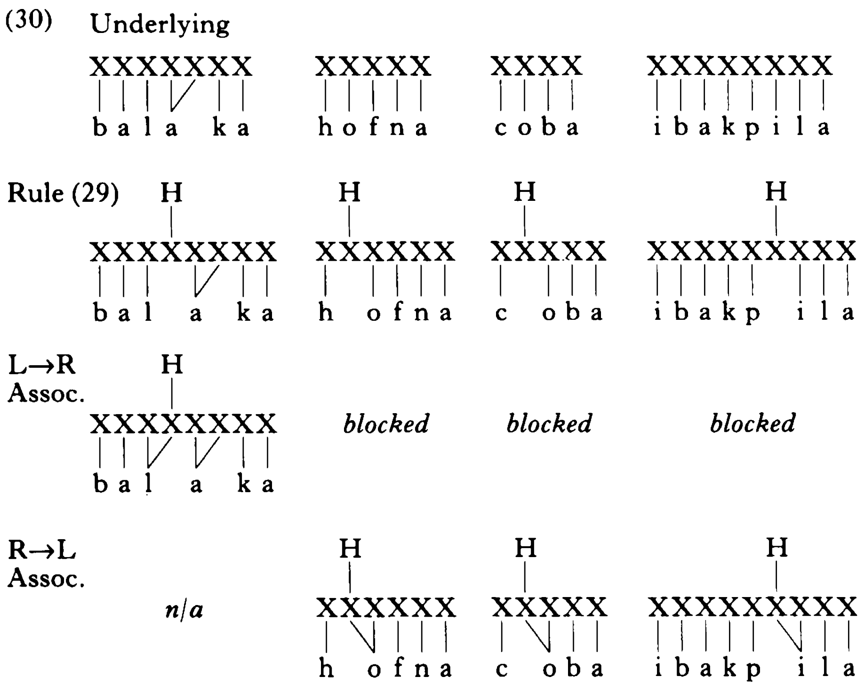
(28)


No stipulatory movement or reassociation of the accent is needed; the lack of contrast ensures that *coóba* and *cóoba* are indistinguishable.

The accentual treatment of the Alabama imperfective supplies an empirical argument against the conceptually quite different account of this phenomenon provided by Hardy & Montler (1988). Hardy & Montler's analysis is cast in terms of a theory with segment-sized skeletal units, specifically that of Levin (1985). Their rule for forming the imperfective is as follows (1988: 405):

(29) Insert an X [a segment-sized skeletal unit] linked to a high tone immediately before the nucleus of the penultimate syllable

Xs are filled obligatorily, preferentially from the left, but subject to general phonotactic conditions of Alabama. For the examples in (26b), we have these derivations:

(30)


Left-to-right association is incompatible with the phonotactics when it would yield an initial geminate (**hhofna*, **ccoba*) or a medial triconsonantal cluster (**ibakppila*). Right-to-left association therefore steps in as a default.

Apart from the obvious difference between this analysis and ours (rule (29) rather than prosodic base circumscription), of far greater importance is the prosodic incoherence of the inserted X. In cases like *ballaaka*, it functions as an onset, but in other cases it usurps the position of syllable nucleus. In a prosodic theory, committed to characterising skeletal behaviour in terms of prosodic units, this sort of account is impossible. As it happens, the duality of X leads to a significant problem in accounting for the accent.

Consider the output of (30) for inputs like *balaaka*, *ilkowatli* or *hocoba*. The *l* of *balaaka* is correctly geminated by an X inserted before the nucleus of the penult, but this X also incorrectly bears an accent. According to Hardy & Montler (1988: 406–407), 'tones link to syllable nuclei from right to left, and universally tones must link to vowels'. These specifications are taken to have the effect of moving the accent from the onset *l* of *ballaaka* to yield *bállaaka*. Although the desired result is obtained, the leftward movement of the accent from its uncongenial host to the preceding syllable is clearly a stipulation, with no organic connection to the rest of the analysis or the language as a whole. Indeed, this particular sort of accent movement is not required in any other language known to us. (General considerations of headedness like those in Poser 1988 would, if anything, lead us to expect the accent to be realised on the syllable containing the inserted X, yielding **balláaka*.) In the prosodic account described here, the accent remains within the syllable containing the inserted mora; its realisation reflects a general fact about the language.

The morphological process of medial gemination is needed independently because it is attested in languages outside the Muskogean family. In the Philippine Austronesian language Balangao (Shetler 1976: 45, 86, 105, 118), gemination of a medial consonant is used to mark various morphological distinctions, always in association with an affix on the geminated stem:

(31) a. Continuous aspect: CV reduplication, optionally repeated, and gemination

Stem	*Continuous*	
dakal	ʔe-pa-da-da-dakkal	'continuously make bigger'
matey	ma-mattey-ha	'that one will certainly die'
ʔayat-en	ʔa-ʔayyat-en	'to continuously climb'

b. Diminutive: CVC reduplication and gemination

Stem	*Diminutive*	
taba	t-en-abtabba	'poor quality fat'
ʔayat-en	ʔay-ʔayyat-en	'play at climbing'
ladaw-en	lad-laddaw-en	'jokingly make a little late'
bontok	b-in-onbontok	'poor imitation of Bontocs'

c. 'place of': CV reduplication and gemination

Stem	*Place of*	
basol-an	ba-bassol-an	'place of sinning'
gadang-an	ga-gaddang-an	'place of crossing'
soblak-an	so-soblak-an	'place of washing clothes'
hablot-an	ha-hablot-an	'place of hanging up'

As in Choctaw and Alabama, the gemination rule makes the first mora extraprosodic, prefixes a mora, and spreads from the right to fill the mora:

(32)	Root:	dakál
	Base:	(da)kál
	Prefix μ:	μ+kal
	Spread:	kkal
	Concatenate:	dakkál

Reduplication then applies to the result of gemination, prefixing a light syllable which is optionally repeated:

(33)	Reduplication:	dadadakkál	
	Prefixation:	ʔepadadadakkál	'continuously make bigger'

Since continuous aspect can apply to a stem, not only a root, prefixation can precede gemination/reduplication. The process is exactly the same, but because the base is different, the result is that a different consonant of the root is geminated, as well as a different syllable being reduplicated:

(34)	a.	*Stem*	*Continuous*	
		pa-dakal	ʔe-pa-pa-paddakal ʔe-pa-da-da-dakkal	'continuously make bigger'
		pa-baʔag	ʔe-pa-pa-pabbaʔag ʔe-pa-ba-ba-baʔʔag	'continuously cause to cut'
	b.	Root:	dakál	
		Prefixation:	padakál	
		Base:	(pa)dakál	
		Prefix μ:	μ+dakal	
		Spread:	ddakal	
		Concatenate:	paddakal	
		Reduplication:	papapaddakal	
		Prefixation:	ʔepapapaddakal	'continuously make bigger'

Examples like this one show that medial gemination is not 'templatic' in character; that is, it is not the result of mapping the stem onto a fixed canonical shape.

The geminating infix remains unrealised when conditions of syllabic well-formedness prevent it from being filled. This happens under two conditions. First, as examples like (31d) *soblak-an* show, gemination is impossible in closed syllables. Second, gemination is also impossible in stressed syllables:

(35) *Stem* *Continuous*

ʔáyat	ʔ-om-a-ʔa-ʔáyat	'continuously climb'
ʔánap	ʔe-pa-ʔa-ʔa-ʔánap	'cause to continuously look for'
	*ʔepaʔaʔaʔánnap	

Stress is said to be characterised by 'an added mora of vowel length on non-final CV syllables' (p. 33); this added mora is clearly stated to occur 'on non-final CV syllables and no others'. Therefore a stressed syllable is bimoraic *per se* and will not license the additional mora of gemination. (Or perhaps the lexical 'stress' of Balangao is in fact lexical vowel length.)

Another Austronesian language, Keley-i (Hohulin & Kenstowicz 1979; Archangeli 1987), also uses medial gemination in combination with particular affixes to mark morphological distinctions. In addition, certain affixes combine with initial gemination:

(36) *pili* 'to choose'

a. *Medial gemination*

fut:	sub. focus:	ʔum-pilli
	obj. focus:	pilli-ʔen
	ref. focus:	pilli-ʔan
pres:	sub. focus:	ka-ʔum-pilli
	obj. focus:	ke-pilli-ʔa
	ref. focus:	ke-pilli-ʔi

b. *Initial gemination*

fut:	acces. focus:	ʔi-ppili
	ben. focus:	ʔi-ppili-ʔan
pres:	acces. focus:	ke-ʔippili
	ben. focus:	ke-ʔi-ppili-ʔi

Medial gemination is blocked when the first syllable of the stem is heavy, as this would result in a violation of syllabic well-formedness. Since no stems begin with clusters, initial gemination is not so affected:[15]

(37) *duntuk* 'to punch'

a. *Medial gemination*

fut:	sub. focus:	ʔum-duntuk
	obj. focus:	duntuk-ʔen

b. *Initial gemination*

fut:	acces. focus:	ʔi-dduntuk
	ben. focus:	ʔi-dduntuk-ʔan

The conclusion is inescapable, then, that phonological theory must recognise an operation of mora prefixation which, under initial mora extraprosodicity, is responsible for the phenomenon of medial gemination. The Austronesian cases also show the independence of mora prefixation from mora extraprosodicity, since in these languages we meet with initial as well as medial gemination.

7 Final extraprosodicity

Final syllable extraprosodicity – technically, $\Phi(\sigma, \text{Right})$ under negative prosodic circumscription (2) – plays a role in several phenomena discussed thus far. Most significantly, the final syllable is outside the scope of mapping to the iambic base of the Choctaw *y*-grade. We have also related it to differences in the scope of the Onset Rule depending on word size.

Final syllable extraprosodicity appears in other aspects of Choctaw word formation as well. Nicklas (1974, 1975) describes several other grade alternations in the Choctaw verb, all of which share a predilection to affect the penultimate syllable. The following examples show the direct result of the grade alternation and the surface output derived by the rules discussed above in §3:

(38)	*base*	n-*grade*	h-*grade*	hn-*grade*	*lengthened grade*
	takči	/tankči/	/tahkči/	/tahnkči/	tákči
	'tie'	tã́kči	tahákči	tahã́kči	
	falama	/falanma/	faláhma	/falahnma/	faláama
	'return'	falã́ãma		falahã́ãma	
	waaya	/waanya/	/waahya/	/wahnya/	wáaya
	'grow'	wã́ãya	wáhya	wahã́ãya	
	pisa	/pínsa/	píhsa	/pihnsa/	píisa
	'arrive'	pĩ́ĩsa		pihĩ́ĩsa	

Nicklas (1975) glosses the *n*-grade as 'continuative', the *h*-grade as 'instantaneous' and the combined *hn*-grade as 'iterative'. The lengthened grade is used when the verb is negated or is followed by the conjunctions *ča* or *na*. All of these forms are accented on the surface penultimate.

We begin with the lengthened grade, which most closely resembles phenomena already discussed. With the final syllable extraprosodic, outside the scope of grade formation, the respective prosodically circumscribed bases are /tak/, /fala/, /waa/ and /pi/. Suffixation of an accented mora to these bases yields /faláa/ and /píi/ straightforwardly, by spreading of the only accessible melodic element. The bases /tak/ and /waa/ already end in a bimoraic syllable. The affixed mora is therefore unsyllabifiable, and we may assume that it is deleted by general conditions on prosodic licensing (Itô 1986, 1989).

The infixes *n* and *h* are located to the immediate left of the final consonant, if any, of the penultimate syllable. With final syllable extraprosodicity, the prosodic bases are /tak/, /fala/, /waa/ and /pi/; final consonant extraprosodicity reduces the first of these to /ta/. Suffixation of *h* and/or *n*, with restoration of the extraprosodic portions, completes the derivation of the remaining grade forms.

In a more speculative vein, we turn to some likely evidence for a more active role of final extraprosodicity in Muskogean languages. Kimball (1985) describes a subtractive morphological process in Koasati that forms the plurals of some (lexically distinguished) verbs. The Koasati phenomenon has received recent theoretical attention from Martin (1988), who considers examples like the following:

(39)	*Singular*	*Plural*	
	pitáf-fi-n /pitáf-li-n/	pít-li-n	'to slice up the middle'
	latáf-ka-n	lat-ka-n	'to kick something'
	tiwáp-li-n	tiw-wi-n /tiw-li-n/	'to open something'
	atakáa-li-n	aták-li-n	'to hang something'
	icoktakáa-li-n	icokták-li-n	'to open one's mouth'
	albitíi-li-n	albít-li-n	'to place on top of'
	ciɬíp-ka-n	cíɬ-ka-n	'to spear something'
	facóo-ka-n	fas-ka-n /fac-ka-n/	'to flake off'
	onasanáy-li-n	onasan-níici-n	'to twist something on'
	iyyakohóp-ka-n	iyyakóf-ka-n /iyyakóh-ka-n/	'to trip'
	koyóf-fi-n /koyóf-li-n/	kóy-li-n	'to cut something'

Underlying and surface forms differ in a few cases by virtue of various phonological rules.

The central observation is that the root of the plural is shorter by a final VV or VC than the root of the singular. The singular root must be taken as basic, since it cannot be predicted from the form of the plural root. Thus, we are dealing here with some sort of morphological truncation.

Martin (1988) proposes a rule of final rhyme deletion to account for these data, but an alternative conception of such truncation phenomena is possible within prosodic circumscription theory, as was first noted by Mester (1990). Mester begins with the observation that some kinds of truncation cannot be described by simple mapping-to-a-template. Evidence of this comes from the formation of truncated 'rustic girls' names' in Japanese, a phenomenon first analysed by Poser (1990). In rustic girls' names, truncation preserves exactly the first two moras of the base, as the following examples show:

(40)	*Base name*	*Rustic girl's name*
	Yuuko	o-Yuu
	Ranko	o-Ran
	Yukiko	o-Yuki
	Kinue	o-Kinu
	Midori	o-Mido

Bimoraic CVV, CVN and CVCV sequences are all possible rustic girls' names, conforming exactly to the first two moras of the base name. In addition, the truncated name has the honorific prefix *o*-.

The significance of the truncation strategy in (40) becomes apparent when it is compared with the productive hypocoristic-forming mechanism in Japanese. In this pattern, a bimoraic form is created (with the diminutive suffix *-čan*) in a variable way that only loosely conforms to the structure of the input:

(41) *Base name* *Hypocoristic*

Midori	Mii-čan, Mido-čan
Yooko	Yoko-čan, Yoo-čan
Mariko	Mako-čan, Mari-čan

Rather than scrupulous reproduction of the first two moras of the base, satisfaction of bimoraicity in hypocoristics is quite diverse, subject to idiosyncratic variation (on the part of either the user or the referent). On the grounds of this diversity, Mester singles out the hypocoristic case as authentic mapping to a bimoraic template (arguably the foot in Japanese; Poser 1990), with the idiosyncrasies residing in the association procedure. And indeed this appears to be correct – other systems of hypocoristics show similar variability in mapping. Some other mechanism must be at play in the invariant replication of the first two moras of the base in the rustic girls' names of (40).

Mester proposes that the rustic girls' names are derived by prosodic circumscription. The nickname is simply the prosodically circumscribed foot (a moraic trochee, $F_T = \mu\mu$) at the left edge of the base. How can we formalise this insight? The fundamental technical issue is that, in truncation via circumscription, one of the two portions of the Φ-parse is lost. That is, $\Phi(F_T$, Left) applied to *Midori* yields $B{:}\Phi$ = *Mido* and B/Φ = *ri*; only the $B{:}\Phi$ segment, *Mido*, is returned in truncation.

The most straightforward account of what is special about truncation is to use the definition (2) under a morphological operation of deletion, which we will call DEL. Then $\text{DEL}/\Phi(B) = B{:}\Phi * \text{DEL}(B/\Phi)$. Parsing according to $\Phi(F_T$, Left) and setting B = *Midori*, we obtain DEL/Φ(*Midori*) = *Mido* $*$ DEL(*ri*). The expression DEL(*ri*) reduces to the null string, and so we obtain the desired result *Mido*.

The rustic girls' nickname system, then, is sufficiently described by the usual parameters of prosodic circumscription theory: the parsing function Φ takes a foot at the left edge; the morphological operation is deletion; and the morphological operation is applied to the Φ-parse in the negative mode of (2), in which a constituent is parsed out and the residue is affected. We will soon modify one of these criteria, providing a more precise account of the deletion operation.

In the Japanese case, the morphological deletion operation is applied to the result of the Φ-parse under definition (2). The theory predicts that we should find cases of truncation where definition (3) is invoked instead, with the parsed-out segment being deleted. Such a case is Papago. In Papago (Hale 1965: 301; Pranka 1983: 114ff), the perfective verb is regularly derived by deleting the final CV of the (underlying) verb stem; the results are then subject to various regular phonological rules discussed by Hale:

(42)

Stem	*Perfective*	
huḍuni	huḍu	'descend'
kiḍiwa	kiḍi	'shell corn'
bidima	bidi	'turn around'
taapana	taapa	'split'
hiwaṣaana	hiwaṣaa	'scrape'
dagaṣapa	dagaṣa	'press with hand'
huhaaga	huhaa	'haul'

In Papago, the parsing function is $\Phi(\sigma$, Right) and the operation DEL is applied under definition (3). The DEL : $\Phi(\sigma$, Right) applied to, e.g. *bidima* yields *bidi* *DEL(*ma*), which correctly reduces to *bidi*. We can consider this truncation process in Papago a kind of aggressive extrametricality, hearkening back to a proposal about Lardil phonological truncation made by Wilkinson (1986).

We now return to the Koasati examples of (39). As Martin (1988) points out, template mapping is not a possible analysis of Koasati truncation. But prosodic circumscription is. Like Papago, Koasati truncates by exactly one syllable, but the two languages differ in the disposition of the final syllable's onset. In Papago, it is lost, but in Koasati it is retained; contrast Koasati *atakaa* → *atak* with Papago *huhaaga* → *huhaa*, **huhaag*. Since the truncating Koasati roots end in a heavy syllable, we could conceivably truncate the last two moras (that is, parse with $\Phi(\mu\mu$, Right)), leaving the onset of the final syllable intact.

This brute-force solution (which essentially recapitulates Martin's rhyme deletion rule) is unsatisfactory, though, since it stipulates something that in fact derives from independent phonotactic considerations. In Papago, syllable-final consonants are impossible at the stage of the derivation where truncation applies (Hale 1965: 297). But in Koasati, syllable-final consonants are possible. The onset of the final syllable cannot be preserved for phonotactic reasons in Papago; the opposite is true in Koasati. The correct solution, then, must be one in which Papago and Koasati invoke the same formal schema: positive prosodic circumscription via $\Phi(\sigma$, Right).

There is another way to think of the Koasati case, pursuing a suggestion attributed by Martin (1988: n.6) to Stephen Anderson (see also Martin 1989). If the effect of the morphological operation we have called DEL is to erase the prosody of its argument but leave melodic elements intact, then the onset of the former final syllable can be preserved by resyllabification, while the rest of that syllable will be deleted by Stray Erasure. (Perhaps, in fact, Stray Erasure is at the heart of all deletion phenomena.) Schematically, we have something like the following derivation for *pitaf* → *pit*:

(43) a. Prosodic Circumscription
DEL:$\Phi(\sigma$, Right)

σ σ
p i * DEL(t a f)

b. Definition of DEL as deprosodisation

σ

p i * (t a f)

c. Resyllabification

σ

p i t a f

d. Stray Erasure

σ

p i t

Since most languages do allow syllable (or word) final consonants, we expect the Koasati situation to be the typical one, and the Papago one to be unusual. The small literature on non-templatic truncation rules confirms this: in the Arabic jussive, the Danish imperative (Anderson 1987), the Icelandic deverbal action noun (Kiparsky 1984) and the Rotuman 'incomplete phase' (Besnier 1987), a final vowel is lost, but the preceding consonant is resyllabified onto the remainder of the stem. All of these cases can therefore be analysed as $\Phi(\sigma$, Right) under the definition of positive prosodic circumscription in (3), if we recognise the operation DEL of deprosodisation.

Technically, deprosodisation is the erasure of syllabic, moraic or other prosodic structure. Its function in truncation is to create stray melodic elements, which are then available for recruitment into other syllables by resyllabification. Failing that, their ultimate fate is Stray Erasure. But under quite similar conditions we can observe more modest consequences of deprosodisation. The prohibition on final long vowels in Choctaw noted in (6), a common phenomenon cross-linguistically, could be construed as deprosodisation of final vowels prior to initial syllabification. The effect of this then would be to neutralise the moraically encoded long/short distinction finally.

To sum up, prosodic circumscription theory provides a unified account of classic extraprosodicity phenomena, infixation, the special status of final syllables in the Choctaw *y*-grade and morphological truncation.

8 Summary: deriving the Choctaw *y*-grade

We have seen that the Choctaw *y*-grade is analysed by the following sequence of prosodic circumscriptions and morphological operations: (i) make the final syllable extraprosodic; (ii) parse out an iambic foot from the right of the resulting string; (iii) map the result onto an iambic template; (iv) make the first mora of the resulting string extraprosodic and prefix a mora. We will now show how these events are combined in the derivation.

- The function $\Phi(\sigma$, Right) parses out the final syllable of some base B. The residue of the parse (thus, B/$\Phi(\sigma$, Right)) is then passed on to the following operations.

- The function $\Phi(F_I, \text{Right})$ parses out a final maximally iambic foot, returning $B{:}\Phi$. This is mapped onto an iambic template by an operation we will call T, so the circumscribed operation is $T{:}\Phi(F_I, \text{Right})$.
- The function $\Phi(\mu, \text{Left})$ parses out the initial mora of the iambic template. We will write M for the operation of prefixing a mora, so the circumscribed operation is $M/\Phi(\mu, \text{Left})$.

The full expression appears in (44):

(44) $[M/\Phi(\mu, \text{Left}) \circ T{:}\Phi(F_I, \text{Right})]/\Phi(\sigma, \text{Right})$ (B)

For a base like *oktabli*, the definitions (2) and (3) give us the following:

(45) $[M/\Phi(\mu, \text{Left}) \circ T{:}\Phi(F_I, \text{Right})]/\Phi(\sigma, \text{Right})$ (*oktabli*)

a. $[M/\Phi(\mu, \text{Left}) \circ T{:}\Phi(F_I, \text{Right})]$ (*oktabli*/$\Phi(\sigma$, Right)) * *oktabli*:$\Phi(\sigma$, Right)
b. $[M/\Phi(\mu, \text{Left}) \circ T{:}\Phi(F_I, \text{Right})]$ (*oktab*) * *li*
c. $M/\Phi(\mu, \text{Left})$ ($T{:}\Phi(F_I$, Right) (*oktab*)) * *li*
d. [$M/\Phi(\mu$, Left) (T(*tab*)) * *ok*] * *li*
e. [$M/\Phi(\mu$, Left) (*tayab*) * *ok*] * *li*
f. [[M(*yab*) * *ta*] * *ok*] * *li*
g. [[*yyab* * *ta*] * *ok*] * *li*
h. [*táyyab* * *ok*] * *li*
i. [*oktáyyab*] * *li*
j. *oktáyyabli*

At steps (45a, b), we apply definition (2), circumscription via extraprosodicity. At step (45c), we rely on the identity $(g \circ f)(s) = g(f(s))$, where g and f are functions on s. Steps (45d, e) apply definition (3), positive prosodic circumscription, and the circumscribed domain is mapped to an iambic template. Steps (45f, g) apply definition (2), negative prosodic circumscription or extraprosodicity, and a mora is prefixed to the result. The rest of the progression in steps (45h–j) involves undoing prosodic circumscription by restoring material outside the focus of the operation.[16]

This completes the discussion. We have tried to show that the resources of prosodic circumscription theory provide a complete and revealing account of the complexities of the Choctaw *y*-grade. Along the way, we have explored a number of related phenomena – the elementary prosody of Choctaw, the nature of edge-in association, the rule of medial gemination and even the basis in extraprosodicity of truncation rules. In some respects we have departed from secure knowledge into more speculative domains, but on the whole we have sought to support our claims as securely as possible with arrays of independent evidence.

NOTES

* We are grateful to Morris Halle, Alan Prince, Elisabeth Selkirk and two anonymous reviewers for their assistance.

[1] The phonemic system of Choctaw is as follows:

(i)	p	t	č	k		i		
	b							o
	f	s	š		h		a	
		ł						
		l						
	m	n			w, y			

Vowel and consonant length are indicated by doubling, except that vowel length derived by the Alternate Lengthening rule (§3.2) is not written. The acute accent marks a high tone: low-toned syllables are unmarked. Only some Choctaw words have an accent.

[2] But Ulrich's (1986: 8) description notes that nasalised vowels are always 'phonetically long'. Perhaps this greater length, without phonological significance, is an implementational reflection of nasality.

[3] Ulrich (1987) shows that *bl* is the unique complex onset of Choctaw; thus, in examples like *haabli* 'to kick' the vowel does not shorten.

[4] An exception to this is the process resolving V+*i* sequences described by Nicklas (1974: 244).

[5] Enclitics are 'outside' the domain at which the prohibition on final long vowels is enforced. In a form like *pisa*+*tok* 'see+PAST', the enclitic *tok* renders the *a* word-final and so it will not lengthen.

[6] Nicklas (1975) characterises this condition somewhat differently, requiring that the tautomorphemic NC sequence be homorganic but not geminate. Since the nasal is deleted in every instance of a morpheme coming under this generalisation, we obviously cannot observe whether or not it is homorganic with the following consonant. The homorganicity condition therefore rests on exhibiting forms where the nasal is not homorganic with the following consonant and has not deleted. But this occurs in only one example, *łamko* 'strong', which is also transcribed as *łampko* (Nicklas 1974: 19).

[7] An apparently exhaustive list of medial CVNC syllables appears in Nicklas (1974: 19): /hayínhči/ 'kidney', /lonssa/ 'river bottom land', /biyónkko/ 'strawberry', /tínškila/ 'bluejay', /hayyonkpólo/ 'weed'. The word 'bluejay' may be onomatopoeic and is unique among nouns in having an antepenultimate accent (Nicklas 1974: 22). Just two words have final CVNC syllables (Nicklas 1974: 18), /hallons/ 'leech' and /okčank/ 'cucumber'.

[8] The form *píyyiisa* in (15) is subject to additional phonological transformation. According to Nicklas (1974: 94): 'in all but the most precise speech, *íyyi* changes to [*íì*]'. Booker (1980) attributes the existence of alternate *y*-grade forms like *toksáàli* and *táàkči* (cf. *toksáyyaali*, *táyyakči*) to this coalescence as well. This secondary phonological development explains why these are the only words in the language with falling tone and with long vowels in closed syllables.

Ulrich (1986: 213f) claims instead that *táàkči* and *táyyakči* are morphologically 'distinct, though synonymous, grades'. It is impossible to review his interesting analysis here beyond noting some difficulties. It cannot account for the locus of tone in trisyllables like *toksáàlih* (Ulrich 1986: 227). And it requires a rule lengthening vowels even in closed syllables under falling tone (Ulrich 1986: 214), a process that is otherwise unmotivated in this language and inconsistent with its phonological structure. Finally, it predicts that contracted and geminated forms will never cooccur, but in at least one case they do (*faláàya* and *fállaaya*; Nicklas 1974: 95).

[9] Notice that the prosodic base returned by circumscription of an iamb is not the same as the iambic foot assigned by the Alternate Lengthening rule. For an example like /atokoli/, Alternate Lengthening requires feet [ato][koli]. But prosodic circumscription parses out an iamb at the right, minus the final syllable. For this example, the prosodically circumscribed base is [toko], realised as *tókkoo* after template mapping. This shows, as do many other cases discussed

by McCarthy & Prince (1990a), that prosodic circumscription is part of a morphological operation, not a process that assigns phonological structure. The 'coherence' of the Choctaw system lies in the fact that both prosodic circumscription and the phonology are iambic, but the morphology does not assign iambic feet to words. Thus, it is inappropriate to suggest, as a reviewer has done, that circumscription and the phonology take place on different metrical planes (cf. Halle & Vergnaud 1987), which only makes sense for conflicting structures that coexist in the phonology.

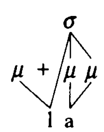
[10] Alan Prince has pointed out to us, however, that it might be possible to capture this result by noting that the edges of *syllables* in the input correspond to the edges of the *template* in the output.

[11] Ulrich (1986) cites additional examples from the speech of his consultant, but with a difference: the vowel of the penult in the *y*-grade is always short: *nokšoopah*, *nokšóyyopah* 'he's scared'; *bašah*, *báyyašah* 'he got cut'. With an iambic template in the *y*-grade, the penultimate vowel ought to be long. In fact, this vowel behaves as long in the rule of Alternate Lengthening, as Ulrich (1986: 219) notes. Perhaps the vowel is phonologically long but subject to a late, idiosyncratic shortening.

[12] Thanks to Timothy Montler for supplying this example, which is not reported in the article.

[13] An objection comes to mind that should be dealt with here. If consonant spreading is prohibited on phonotactic grounds in (25), then why is it permitted in the following configuration, which represents the result of prefixation on the prosodic base *laa* of (24a)?

(i)



A consonant linked to two moras – the result of spreading in (25) – is impermissible under all circumstances; the configuration never arises in the language. A consonant linked to a mora and a syllable – the result of spreading in (i) – is permitted whenever the sequence $\mu + \sigma$ is permitted. Only when μ cannot be syllabified ('licensed' is Itô's 1986 term), as in word-initial position, is this sequence excluded.

[14] In fact, Choctaw underlying syllables, heavy and light, are simply either accented or unaccented. The only exceptions are phonologically contracted syllables like *pi̋sa* (cf. n.8).

[15] The *pepet* roots, CVCV(C) roots with /e/ (the only native lax non-low vowel) in the first syllable, show various unexpected complications. With medial and initial gemination affixes, these roots have the following forms:

(i) *hepung* 'to break a stick'

a. Medial gemination

fut:	sub. focus:	ʔum-hehpung
	obj. focus:	hehpung-ʔen
	ref. focus:	hehpung-an
pres:	sub. focus:	ka-ʔum-hehpung
	ref. focus:	ka-hehpung-i

b. Initial gemination

fut:	acces. focus:	ʔi-hhehpung
	ben. focus:	ʔi-hhehpung-ʔan
pres:	acces. focus:	ke-ʔi-hhehpung
	ben. focus:	ke-ʔi-hhehpung-i

An even more curious property of the *pepet* roots is observed when they are subject to both initial and medial gemination. With normal roots like *bitu* 'to put', the stative future is marked by both geminations: *me-ʔi-bbittu-ʔan*. But the stative future of a *pepet* root like *deweng* 'to hunt' is *me-ʔi-dweng-an*, with no gemination at all. (We are indebted to Michael Kenstowicz for supplying this example from his unpublished notes.) Archangeli (1987) proposes an account of the facts in (i.a), but this does not generalise to (i.b) or the stative future.

[16] An anonymous reviewer has pointed out that by composing syllable extraprosodicity with itself it is possible to describe preantepenultimate stress systems, which do not occur. It is not clear how we might avoid the reviewer's objection yet still characterise the 'layered' structure of circumscription in Choctaw morphology. Nevertheless, it is worth pointing out two mitigating factors. First, preantepenultimate stress might be too difficult to learn rather than grammatically impossible. Crucially, it can be distinguished from initial stress only in words of at least five syllables, which are usually quite rare. Second, the only well-articulated alternative approach to extrametricality, that of Inkelas (1989: 202–206), entails exactly the same result. In fact, composed extrametricality is assumed in traditional metrical accounts of stress in *galaxy*-class words in English. Finally, it may be that this is an area of true difference between phonological extraprosodicity and morphological prosodic circumscription.

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