OSAGE FILLS THE GAP: THE QUANTITY INSENSITIVE IAMB & THE TYPOLOGY OF FEET*

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This paper presents evidence for the *quantity-insensitive* (QI) iamb. Although many extant prosodic theories predict that QI iambs exist (e.g. Prince & Smolensky 2004, McCarthy & Prince 1993, Halle & Vergnaud 1987), previously reported cases have not been verified by phonetic analysis. Some authors have even questioned the existence of QI iambs (e.g. Hayes 1995). The consequence of the existence of QI iambs is that foot headedness and quantity-sensitivity are independent: whether a foot is trochaic or iambic is unrelated to whether it also quantity-sensitive.

The lack of a solid case of QI iambs motivates close investigation of Osage, which has many characteristics that are directly relevant; it is the first QI-iambic system that has been subject to relevant phonetic examination.

[KEYWORDS: Siouan, Osage, stress, tone, iamb, quantity (in)sensitive, foot typology, Optimality Theory]

1. Introduction. Hayes (1995: 268) and others have observed an apparent link between quantity-sensitivity and foot headedness: if stress is not sensitive to the difference between heavy and light syllables, its feet seem to always be trochaic. Hayes writes: "…consider the mirror image of the even iamb, the syllabic trochee. Here, we find cases where a quantity distinction exists, but stress is nevertheless assigned to every other syllable, irrespective of quantity…In contrast, there appear to be no cases of this sort among iambic systems."

An example of a language that has the syllabic trochees described by Hayes is Gooniyandi (McGregor 1990, 1993; Kager 1992; Elías-Ulloa 2006), where trochees are parsed left-to-right with stress surfacing on every odd-numbered syllable irregardless of the moraic make-up of syllables (see (1)). Note that I make the standard assumption that a syllable is heavy ("H") if and only if it is at least bimoraic; a syllable is light ("L") if and only if it is monomoraic. For the purposes of this paper, what is crucial is that a syllable with a long vowel is necessarily heavy.

(1) <u>Gooniyandi</u>

a.	/LH/	→ (ˈ**L**H)	ˈ**nga**boː	'father'
b.	/LL/	→ (ˈ**L**L)	ˈ**ba**ga	'burr'
c.	/HL/	→ (ˈ**H**L)	ˈ**boːl**ga	'owl'
d.	/HH/	→ (ˈ**H**H)	ˈ**doː**mboː	'old man'
e.	/LLLH/	→ (ˈ**L**L)(ˌ**L**H)	ˈ**ja**mbinˌ**ba**roː	'a type of fish'
f.	/LHHH/	→ (ˈ**L**H)(ˌ**H**H)	ˈ**ba**boːˌ**ddoː**nggoː	'to the bottom'
g.	/LLLL/	→ (ˈ**L**L)(ˌ**L**L)	ˈ**ngi**ddiˌ**warn**di	'across'

Much of the literature on metrical theory over the past two decades has attempted to address the question of whether the lack of *quantity insensitive* (QI) iambs—the iambic counterparts to trochess in (1)—reflects a fundamental property of grammar.[1] This question is highly non-trivial as a heavy burden is placed on the analyst to rule out the iambs in (2a), while also predicting that a language can have the trochees in (2b).

(2a) IAMBS	*(Hˈ**L**)	*(Hˈ**H**)
(2b) TROCHEES	(ˈ**L**H)	(ˈ**H**H)

The traditional view in metrical theory has been that there is a *universal foot inventory*, which is a primitive in every grammar. On this view, language x differs from language y in its selection of foot types from this inventory (Hayes 1985, 1987, 1995; McCarthy & Prince 1986, etc.). If this inventory does not include the iambs in (2a) then it is predicted that no natural language has feet of this type (see Hayes' (1995) Iambic-Trochaic Law and the experiments in Rice (1992) for a performance-based argument as to why QI iambs are unattested).

More recently, it has been argued that the typology of feet result from the interaction of Optimality Theoretic constraints (Prince & Smolensky 2004, McCarthy & Prince 1993a,b, 1995). On this view, language x differs from language y given that x and y require a different ranking of constraints, which are part of every grammar. To rule out the iambs in (2a), the set of constraints have to be defined in such a way that these foot types are harmonically bounded (Prince & Smolensky 2004, Prince & Samek-Lodovici 2002) by an optimal parse in every language. To the best of my knowledge, no Optimality Theoretic account of feet has been successful in this regard (however, see Eisner 1997 for a different competition-based theory of feet). For example, as illustrated

[1] See Hyman (1977), Hayes (1981), (1985), (1987), (1995); McCarthy & Prince (1986); Halle & Vergnaud (1987); Prince (1990); Rice (1992), Kager (1993), (1995a,b), (2007); Alber (1997), (2005); Eisner (1997); Van de Vijver (1998); Dresher & van der Hulst (1998), van der Hulst (1999); Revithiadou (2004), etc.

in (3), Kager (2007) argues that eight unidirectional quantity insensitive systems are predicted by the interaction of Optimality Theoretic constraints that are violated based on whether a prosodic word has: (i) right-headed or left-headed feet, (ii) a rightward or a leftward parse, and (iii) monosyllabic feet or stray syllables.

(3) Foot systems (languages from Gordon 2002)

	QUANTITY INSENSITIVE TROCHEES 45 languages		**QUANTITY INSENSITIVE IAMBS 9 languages**	
	LEFT-TO-RIGHT 32 languages	RIGHT-TO-LEFT 13 languages	**LEFT-TO-RIGHT 4 languages**	**RIGHT-TO-LEFT 5 languages**
STRICTLY BINARY 29 languages	(a) (ˈσσ)(ˌσσ) (b) (ˈσσ)(ˌσσ)σ 14 languages (e.g. Pintupi)	(c) (ˌσσ)(ˈσσ) (d) σ(ˌσσ)(ˈσσ) 12 languages (e.g. Warao)	**(i) (σˈσ)(σˌσ)** **(j) (σˈσ)(σˌσ)σ** **3 languages (e.g. Araucanian)**	**(k) (σˌσ)(σˈσ)** **(l) σ(σˌσ)(σˈσ)** **unattested**
BINARY & UNARY 25 languages	(e) (ˈσσ)(ˌσσ) (f) (ˈσσ)(ˌσσ)(ˌσ) 18 languages (e.g. Murinbata)	(g) (ˌσσ)(ˈσσ) (h) (ˌσ)(ˌσσ)(ˈσσ) 1 language (Biangai)	**(m) (σˈσ)(σˌσ)** **(n) (σˈσ)(σˌσ)(ˌσ)** **1 language (Ojibwa)**	**(o) (σˌσ)(σˈσ)** **(p) (ˌσ)(σˌσ)(σˈσ)** **5 languages (e.g. Weri)**

The major problem with a theory that derives the typology in (3), is that none of the attested languages in (3) have the iambs in (2a), i.e. (Hˈ**L**) and (Hˈ**H**). Moreover, the nine attested languages that can potentially be analyzed as having QI iambs either do not have a contrast between short and long vowels, and/or are subject to a trochaic analysis (see Kager 1989, Hayes 1995, Alber 2005).[2] Finally, the existence of QI iambs in the

[2] As noted by Brett Hyde (p.c.), of the QI iamb parses in (3), left-to-right without degenerate feet and right-to-left with degenerate feet are the most convincing, partly because they also show up in QS systems in forms whose syllables are all underlyingly light. Left-to-right QI iambic parses with degenerate feet are more questionable. Ojibwa (actually QS according to Hayes 1995) is not a very convincing example because while it is true that such parsing could explain its reduction pattern—in particular the lack of reduction in the final syllable of odd-parity forms—there are also a number of very plausible alternative analyses (see e.g. Alber 2005). This pattern has also been claimed for Central Alaskan Yupik (also QS), but the final stress in odd-parity forms is limited to non-phrase-final position and is described as much weaker than the others.

languages above have not been phonetically verified.[3] Therefore, a theory that derives the typology in (3) lacks empirical basis and it remains an open question whether it over-generates.

The aim of this paper is to argue that any typological theory of feet *should* predict the QI iambs in (2a). The argument rests on data from Osage (Quintero 1977, 1994a,b, 2001, 2004, 2005), which is typologically remarkable because it has many characteristics—some phonetically verified in this paper—that point to a QI iambic system.[4] The analysis advocated in this paper is Optimality Theoretic; it is shown that Osage fills the empirical gap that is inherent in a typology that results from the interaction of prosodic constraints in Prince & Smolensky (2004) and McCarthy & Prince (1993a,b, 1995).

The default stress pattern in Osage has primary stress on the peninitial syllable, followed by secondary stress on every other syllable:

(4)	a.	/pɑːxo/ mountain	→	[pɑːˈ**xo**] ‘mountain'	(MOJ; Quintero 1977)
	b.	/hiːðɑː/ bathe	→	[hiːˈ**ðɑː**] ‘bathe’	(Quintero, p.c.)
	c.	/nɑ̃ːlõxɑ/ undercover	→	[nɑ̃ːˈ**lõ**xɑ] ‘undercover, sneak’	(MOJ; Quintero 1977)
	d.	/kɑːsɑːki/ knock.someone.out	→	[kɑːˈ**sɑː**ki] ‘knock someone out’	(MOJ; Quintero 1977)

[3] As noted in Hayes (1995), grammars in which many of these languages are documented do not provide phonological diagnostics to support their transcription and/or offer a limited set of relevant data. A prime example is Araucanian, which is claimed to have even iambs based on a very small sample of data from a single source (Echeverria and Contrreras 1965).

[4] The speaker and the source of the data are provided throughout the paper. In cases where the speaker is not specified, the particular data has not been phonetically verified. The speakers whose recordings were measured are: Myrtle Oberly Jones (‘MOJ’), Margaret Red Eagle Iron (‘MREI’) and Francis Holding (‘FH’). See §2.4 for more discussion.

e. /xõːt͡se-o-ðiː-brã/ → [xõːˈ**t͡so**ðiːˌ**brã**]
cedar-LOC-by.hand-smell 'smoke cedar' (Quintero 2004)

f. [ɑ-wɑ-kik-ðɑːxuɣe] → [ɑˈ**wɑ**lɑːˌ**xy**ɣe]
A1S-P3P-SUUS-crunch 'I crunch up my own (e.g. prey) with teeth' (Quintero 2005)

An alternative hypothesis is to say that the default pattern is initial stress and that peninitial stress is lexically marked. At first glance, there seems to be some support for this view since there are words with initial stress in Osage (see (5)); primary stress never surfaces on a syllable other than the first two (i.e. the 'window' for primary stress is the first two syllables).

(5) a. /ˈ**ʃtɑ**ke / → [ˈ**ʃtɑ**ke]
warm 'warm' (MOJ; Quintero 1977)

b. /ˈ**zɑ**ːni/ → [ˈ**zɑ**ːni]
all 'all' (MREI; Quintero 2000)

c. /ˈ**ɑː**ɫiː/ → [ˈ**ɑː**ɫiː]
chair, seat 'chair, seat' (MREI; Quintero 2000)

d. /ˈ**o**weːnã/ → [ˈ**o**weːˌ**nã**]
grateful 'grateful' (MREI; Quintero 1994a)

e. /ˈʰ**kɑ**wɑ-ɑ-ɫiː/ → [ˈʰ**kɑ**wɑːˌ**ɫiː**]
horse-upon-sit 'horseback riding' (FH; Quintero 1994a)

f. /ˈ**o**nãɫipi/ → [ˈ**o**nãˌ**ɫi**pi]
hurry up 'hurry up' (FH; Quintero 1994a)

g. /ˈ**o**ðyːt͡sɑke/ → [ˈ**o**ðyːˌ**t͡sɑ**ke]
lazy 'lazy' (MOJ; Quintero 1977)

However, upon a closer inspection, it is clear that this alternative hypothesis is inconsistent with the Osage data. The reason is that a default position can host a distinction between underlyingly stressed and underlyingly unstressed syllables, whereas a non-default position cannot, since it can only host lexically stressed ones. I argue that the affixal alternation patterns in Osage show that it is, in fact, the *second* syllable where this contrast must be admitted; forms with initial stress on the surface are lexically marked. I show that this hypothesis is consistent with the Osage data, predicted by the interaction between faithfulness constraints preserving lexical stress and markedness constraints that impose a certain prosodic structure.

Subsequently, I argue that the *default obeying* forms (with peninitial stress) in, e.g. (4), are parsed as iambs from left-to-right (see (6)). And crucially, the vowel length distinction in these forms is not a factor for the placement of stress.

(6)	a.	pɑːˈ**xo**	(Hˈ**L**)	'mountain'
	b.	hiːˈ**ðɑː**	(Hˈ**H**)	'bathe'
	c.	nɑ̃ːˈ**lõ**xɑ	(Hˈ**L**)L	'undercover, sneak'
	d.	kɑːˈ**sɑː**ki	(Hˈ**H**)L	'knock someone out'
	e.	xõːˈ**t͡so**ðiːˌ**brɑ̃**	(Hˈ**L**)(HˌL)	'smoke cedar'
	f.	ɑˈ**wɑ**lɑːˌ**xy**ɣe	(Lˈ**L**)(HˌL)L	'I crunch up my own (e.g. prey) with teeth'

Moreover, *default defying* forms (with initial stress) in, e.g. (5), are also parsed as iambs from left-to-right with a monosyllabic foot at the left edge of the prosodic word: (ˈ**σ**)(σˌ**σ**). Things are more complex, however, when default defying forms with an even number of syllables are considered; the proposed analysis is consistent with both an iambic and a trochaic parse, e.g. (ˈ**σ**)σ vs. (ˈ**σ**σ). This issue is addressed in §4.3.

In addition to showing that the iambic analysis makes the correct predictions straightforwardly, I also consider and ultimately reject an alternative analysis in which the forms in (6) are parsed as trochees, with a stray syllable at the left edge of the prosodic word: σ(ˈ**σ**), σ(ˈ**σ**σ), σ(ˈ**σ**σ)σ, etc. The inadequacy of this analysis is that it requires a non-initial stress constraint that makes bizarre typological predictions.

The major contribution of this paper can be summarized as follows: it explores the phonetic structures of stress in Osage and provides the first complete formal analysis of Osage stress. This analysis is important because it reveals that foot headedness and quantity-sensitivity are independent: whether a foot is trochaic or iambic is unrelated to whether it also quantity-sensitive.

2. An introduction to the Osage data.

2.1. Background. Osage is a Siouan language that is part of the Dhegiha subgroup, which also includes Omaha-Ponca, Kansa (Kaw) and Quapaw. As noted in Quintero (2004: 2), "Regional variation within Osage is limited. Some slight differences in lexical items are seen among speakers of different districts [in Oklahoma, United States]…but the number of these items is so small as not to constitute reason for positing a separate dialect." Moreover, "…by nearly everyone's estimates, there were approximately five to ten [fluent native] speakers of Osage alive in 1996, and these numbers had been reduced by half by the close of the century. Without extensive exploration, it is difficult to decide who is a [fluent] speaker and who is a semispeaker, as the language has lapsed into disuse. Some elders profess to understand Osage, but few claim to be able to speak it."

The data in this paper primarily comes from four tape recordings of native speakers of Osage (Quintero 1977, 1994a,b, 2001) and a grammar of Osage (Quintero 2004). Moreover, an Osage story (*The Raccoons and the Craw-fish*; Quintero 2005) is used to supplement the data where needed.

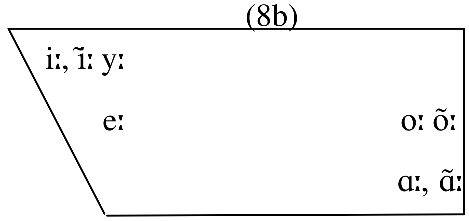
2.2 Consonants and vowels. The table in (7) illustrates Osage consonants (see Quintero 2004: 16-37).

(7)	Labial	Dental	Alveolar	Post-Alveolar	Velar	Glottal
Plosives	p, ^{h}p, pʔ, b	t̪, ^{h}t̪			k, ^{h}k, kʔ	
Nasals	m	n				
Fricatives		ð̞	s, z	ʃ, ʒ	x, ɣ	h
Affricates			t͡s, ^{h}t͡s, t͡s^{h}, t͡sʔ			
Approximants	w	l				

The tables in (8) illustrate Osage vowels (see Quintero 2004: 16-37).

(8a)

(8b)



It is important to note that vowel length is contrastive in Osage; long vowels differ from short vowels in terms of duration (see Quintero 2004 for (near-)minimal pairs). This fact is crucial because it argued in §4 that the vowel length distinction is not a factor in placement of stress.

2.3. Syllable structure and obstruent clusters. According to Quintero (2004), the syllabic template for Osage is: ((C)C)V(ː). Quintero provides the following evidence that there are no codas in the language[5]:

(9) a. No known phonological processes indicate syllabification of medial consonants as coda instead of onset.
b. There are no word-final consonants.

[5] More evidence that there are no codas in Osage is a phonological process of *k*-deletion, which is common in Siouan. As illustrated in (ia,b) 1st person plural agentive prefix *ɑ̃k* is faithfully mapped to the surface when it precedes a vowel. On the other hand, (iia,b) illustrate that if *ɑ̃k* precedes a consonant, then the final consonant in this prefix is deleted.

i.	a.	o^{h}kɑ	'help'	**ɑ̃k**-o^{h}kɑ	'we help him/her'
	b.	ɑðeː	'go'	**ɑ̃k**-ɑðeː	'we go'
ii.	a.	ðɑː t͡s^{h}e	'eat'	**ɑ̃**-ðɑːt͡s^{h}e	'we eat'
	b.	tõpe	'look'	**ɑ̃**-tõpe	'we look'

Moreover, Osage allows obstruent clusters in the onset both word-initially and word-medially.[6] Note that these clusters constitute two voiceless segments, which are either stop-fricative or fricative-stop. The table below summarizes the obstruent consonant clusters in Osage (see Quintero 2004: 26-36 for more discussion).

STOP	FRICATIVE	+ FRICATIVE	+ STOP	RESULTING CLUSTER
p		x, ʃ		px, pʃ
t		x		tx
k		x, s, ʃ		kx, ks, kʃ
	ʃ		p, t, k	ʃp, ʃt, ʃk
	x		p, t	xp, xt
	s		p, t, k	sp, st, sk

2.4. Fundamental frequency as a cue for stress. In this section I argue that Osage has feet and that foot heads are realized with a rise in fundamental frequency (f_0).[7] The argument is based on phonetic measurements that determined how primary and secondary stressed syllables are phonetically differentiated from each other and from unstressed syllables based on measurements of f_0. As illustrated in (10), two stress patterns were observed: (i) the first syllable is stressed and every other odd-numbered syllable carries secondary stress, and (ii) the second syllable is stressed and every other

[6] Note that various Osage forms violate Sonority Sequencing Principle. Following Morelli (1999), which characterizes Dakota (Mississippi Valley Siouan) as a language that allows fricative-stop, stop-fricative and stop-stop sequences, I assume that SSP is not a universal principle; see also Altshuler (2005a) where Biloxi (Ohio Valley Siouan) is also analyzed in this way.

[7] This generalization is in accordance with e.g. Laver (1994), where it is argued that a stressed syllable is one that is made more prominent than other (unstressed) syllables by an exaggeration of one or more of the acoustic parameters of f_0, amplitude and duration (see Gordon 2004 for more discussion). Measurements of amplitude indicate that it is not a cue for stress in Osage and for the sake of brevity will not be discussed. Moreover, while duration may be a cue for stress, it is not discussed here either. The reason is that duration is influenced by many factors such as sonority, nasality, the context in which the word is uttered, etc., and not enough (near-)minimal pairs were found to test for statistical significance.

even-numbered syllable carries secondary stress. In sum, stress always alternates; there is neither clash nor lapse.[8]

(10) <u>Distribution of stress in Osage</u>
a. [ˈ**σ**σˌ**σ**σ…] b. [σˈ**σ**σˌ**σ**…]

The domain for stress assignment is the prosodic word; the stress pattern is never interrupted within this domain. For example, (11) illustrates that as a word gets more morphologically complex, the iambic pattern is preserved (see §4.2 for more discussion):

(11)	a.	/ɑ-t͡sʰi/ PREV-arrive.here	→	[ɑˈ**t͡sʰi**] 'arrive here' (Quintero 2004)
	b.	/ɑ-ðĩ-ɑ-t͡sʰi/ PREV-have-PREV-arrive.here	→	[ɑˈ**brĩ**ɑˌ**t͡sʰi**] 'I bring/brought it' (Quintero 2004)
	c.	/ɑ-wi-ðĩ-ɑ-t͡sʰi/ PREV-I.to.you-have-PREV-arrive.here	→	[ɑˈ**wi**brĩˌ**ɑ**t͡sʰi] 'I brought it to you' (Quintero 2004)

Moreover, the (pen)initial syllable stress is not determined by morpheme boundaries. Evidence for this view comes from the fact that a root can have either initial stress as in (12) or peninitial stress as in (13):

(12) ˈ**iː**xɑ 'laugh' ('FH'; Quintero 1994b)
(13) pɑːˈ**xo** 'mountain' ('MOJ'; Quintero 1977)

The phonetic measurements also reveal that Osage has tone; it distinguishes high tones ('$\mathcal{H}$') from low tones ('$\mathcal{L}$'). More specifically, high tones ('$\mathcal{H}$') fall on stressed syllables and on unstressed initial syllables, while low tones ('$\mathcal{L}$') fall on all other unstressed syllables (see (14)). The generalization in (15) summarizes the correlation between stress and tone in Osage.

[8] Note that no words containing more than five syllables were measured (mainly due to the fact that such forms are rare) and the forms with five syllables had primary stress on the second syllable (see word list in the appendix). Therefore, the hypothesis that stress alternates is based on words with no more than two stressed syllables (i.e. first & third and second & fourth).

(14) MAIN STRESS	ODD # OF σ'S	EVEN # OF σ'S
Initial syllable	ˈσ σ ˌσ H L H	ˈσ σ ˌσ σ H L H L
Peninitial syllable	σ ˈσ σ H L	σˈσ σˌσ H L H

(15) <u>GENERALIZATION</u>
A stressed vowel initiates a fall in the pitch contour; word-final stress correlates with a word-final peak in the pitch contour.

The data used for analysis was recorded on analog tapes by Carolyn Quintero (1977, 1994a,b, 2001); the tapes were digitized by Paul de Lacy at mono 16-bit 44100kHz using a tape-deck attached to a Sound Blaster Audigy 2 ZS sound card into WAV format onto a Windows PC using Goldwave 5.06 (http://www.goldwave.com). Recordings of three female speakers were used for analysis: Myrtle Oberly Jones (1917-1986), Frances Holding (1917 – 2002) and Margaret Red Eagle Iron (1912 – 1996). The first speaker is recorded reciting a vocabulary list and various common expressions in Osage (Quintero 1977); the second speaker is recorded reciting various Osage words and expressions after listening to Lenora Hamilton (1912-1991) on tape (Quintero 1994a) and is recorded reciting various Osage words and expressions while discussing them with Carolyn Quintero (Quintero 1994b); the third speaker is recorded reading *Christmas and New Years Greeting* in Osage on one of the tapes (Quintero 1994a), and reciting various Osage words and expressions on the other (Quintero 2001). Note that all of the words produced by MOJ are in isolation; the words produced by the other two speakers vary in the context (i.e. isolation, phrase initial, phrase medial and phrase final). Since the context is not a factor in determining the f_0 values, it is not discussed below (however, see the appendix, where the context of each measured word in provided).[9]

Acoustic analysis was completed using Praat (Boersma & Weenink 2007). The analysis constituted measuring the f0 of each peak and trough by using Praat's *max* and *min* functions over the duration of each vowel (measured from the offset of the prevocalic consonant to the vowel offset (Peterson & Lehiste 1960)). Subsequently, a paired one-tail t-test was conducted to measure the variations in f_0 between each peak and its following trough. Below, I provide pairwise comparisons in f_0 that reached statistical significance for individual speakers.

The first measurements consisted of f_0 in disyllabic words with initial stress; the vowel in the first syllable was either short or long and the vowel in the second syllable was short. The hypothesis was that the f_0 would be greater in the first syllable compared to the second (regardless of vowel length). The results in (16) validate the hypothesis; they are statistically significant for all three speakers: $p < .05$ when the f_0 values for the first second syllables are compared. Since the f_0 was roughly the same for short and long vowels, the measurements below range over both types.

(16) *Average f_0 values for the first two syllables in words with initial stress*

SPEAKER	1ST SYLLABLE f_0	2ND SYLLABLE f_0	DIFFERENCE IN f_0 B/W 1ST AND 2ND SYLLABLES
MOJ (19 words)	203.41 Hz	125.78 Hz	+77.63 Hz
FH (11 words)	200.09 Hz	129.17 Hz	+70.92 Hz
MREI (12 words)	168.68 Hz	121.13 Hz	+47.55 Hz

9 Evidence that the context of utterance does not affect the f_0 comes from the fact that when a speaker would utter the same word in different contexts, the f_0 values were nearly identical.

The second measurements consisted of f_0 of the first two syllables in words with peninitial stress; the words that were measured had two to four syllables and the vowels were either short or long in the first two syllables. The hypothesis was that the f_0 would be greater in the second syllable compared to the first (regardless of whether the initial vowel is short or long). The results below, however, show that the f_0 of the peninitial syllable is only sometimes greater than the initial; for the three speakers $p > .05$ when the f_0 values for the first syllable are compared to the f_0 values for the second syllable. Once again, f_0 was roughly the same for short and long vowels and the measurements below range over both types.

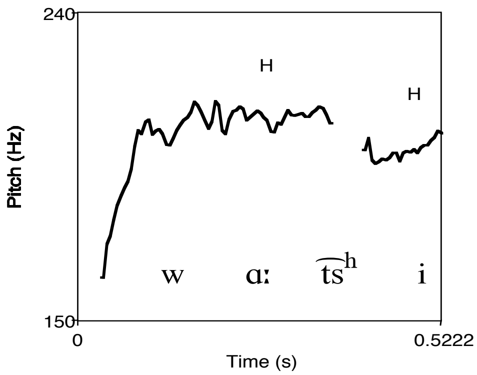
(17) *Average f_0 values for the first two syllables in words with peninitial stress*

SPEAKER	1ST SYLLABLE f_0	2ND SYLLABLE f_0	DIFFERENCE IN f_0 B/W 2ND AND 1ST SYLLABLES
MOJ (41 words)	202.23 Hz	204.21 Hz	+1.98 Hz
FH (16 words)	198.39 Hz	202.29 Hz	+3.91 Hz
MREI (33 words)	157.11 Hz	156.23 Hz	-0.88 Hz

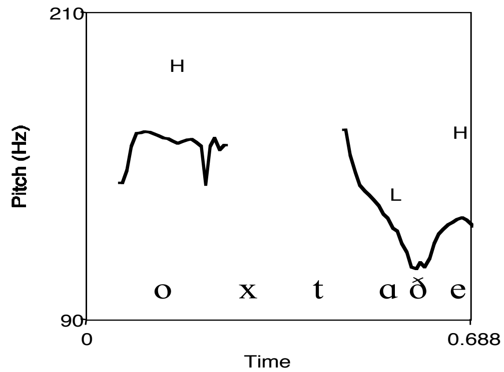
However, it is important to note that there is tonal down-drift (or declination) in Osage. For example, if we look at disyllabic words as in (18), where both syllables have high tones, as well as three syllable words as in (19), where the first and third syllables have high tones, the declination is evident[10]:

[10] The tonal down-drift is also observed in Winnebago, a related Siouan language (see Miner 1979, 1989; Hale & White Eagle 1980; Hayes 1995).

(18) wɑːˈ**t͡sʰi** (‘dance’; FH)



(19) ˈ**o**xtɑˌ**ðe** (‘to make sacred’; MREI)



When words with an $\mathcal{H}$-$\mathcal{L}$-$\mathcal{H}$ melody are considered, a conservative estimate is that the $\mathcal{H}$ tone drops (at least) 20-30 Hz. per syllable. Consequently, if we increase the f_0 values for the peninitial syllable by 20 Hz (see (20)), the resulting values become significantly greater than the f_0 values for the initial syllable; for all three speakers $p < .05$

(20) *Readjusted average f_0 values for 1st two syllables in words with peninitial stress*

Speaker	1st syllable f_0	2nd syllable f_0	Difference in f_0 b/w 2nd and 1st syllables
MOJ (41 words)	202.23 Hz	224.21 Hz	+21.98 Hz
FH (16 words)	198.39 Hz	222.29 Hz	+23.91 Hz
MREI (33 words)	157.11 Hz	176.23 Hz	+19.12 Hz

The final measurements consisted of f_0 of the second and third syllables in words with initial stress, and the third and fourth syllables in words with peninitial stress; the words that were measured had three or four syllables respectively and the vowels were short in these positions. The hypothesis was that the f_0 would be greater in the syllable with secondary stress when compared to its unstressed counterpart. The results below validate this hypothesis; they are statistically significant for all three speakers as $p < .05$ when the f_0 values are compared.

(21) *Average f_0 values for unstressed 2nd syllable and stressed 3rd syllable*

SPEAKER	2ND SYLLABLE f_0	3RD SYLLABLE f_0	DIFFERENCE IN f_0 B/W 3RD AND 2ND SYLLABLES
MOJ (11 words)	128.04 Hz	154.34 Hz	+26.3 Hz
FH (4 words)	125.09 Hz	161.56 Hz	+36.47 Hz
MREI (4 words)	115.79 Hz	137.72 Hz	+21.93 Hz

(22) *Average f_0 values for unstressed 3rd syllable and stressed 4th syllable*

SPEAKER	3RD SYLLABLE f_0	4TH SYLLABLE f_0	DIFFERENCE IN f_0 B/W 4TH AND 3RD SYLLABLES
MOJ (6 words)	136.4 Hz	155.03 Hz	+18.63 Hz
FH (2 words)	122.53 Hz	135.53 Hz	+13 Hz
MREI (7 words)	114.08 Hz	129.05 Hz	+12.97 Hz

In sum, Osage provides a good example of why a language cannot be simply categorized as *stress* or *tone*. Osage has stress; it has foot structure, and has a clear phonetic manifestation of foot heads. Measurements indicate Osage has two stress patterns: (i) the first syllable is stressed and every other odd-numbered syllable carries secondary stress, and (ii) the second syllable is stressed and every other even-numbered syllable carries secondary stress. Osage also has tone; it distinguishes $\mathcal{H}$ from $\mathcal{L}$ tone, and clearly realizes these. Osage could be called 'stress-dominant' in that foot heads determine the location of tone (i.e. $\mathcal{H}$ on heads, $\mathcal{L}$ on non-heads); however, feet do not completely determine the placement of tone since $\mathcal{H}$ must fall on the word-initial syllable, regardless of whether it is a head or non-head. Osage is therefore 'tone-dominant' in word-initial position, and 'stress-dominant' elsewhere, underscoring the artificiality of the tone-stress descriptive distinction.

At this point, the following question arises: how can we predict the distribution of stress and tone in Osage? In particular, is it the tone or the stress that is lexically specified? Prima facie, both possibilities are reasonable but only the latter is explored in this paper. Whether tone or stress is lexical is irrelevant for the purposes of this paper since the surface effect is what is crucial here: Osage has foot structure and has a clear phonetic manifestation of foot heads, which exemplify a QI iambic pattern. These facts should be predicted by either analysis.[11]

In the next section, I argue that the affixal alternation patterns in Osage show that the default stress pattern in Osage has primary stress on the peninitial syllable, followed by secondary stress on every other syllable; forms with initial stress on the surface are lexically marked. Subsequently, I show that this generalization is consistent with the Osage data, predicted by the interaction between faithfulness constraints preserving lexical stress and markedness constraints that impose a certain prosodic structure.

3. The default stress pattern. Since the 'window' for the placement of primary stress in Osage is the first two syllables, only in the first two syllables does lexical stress

[11] An anonymous reviewer notes that in many languages productions of pitch peaks for lexical $\mathcal{H}$ tone are delayed to a position approximately midway into the following syllable and that these peak delays are sometimes lexicalized as tone on a syllable following the syllable it was in, in a prior state of the language (see Myers 1998, 1999 for more discussion). If something like this happened in Osage, then one hypothesis would be that for only some of the lexical items, tone was shifted to the second syllable in the lexical representation. The anonymous reviewer notes that the advantage of this hypothesis is that it connects in a direct way to Hayes' (1995) analysis of Winnebago tone flop and potentially Siouan historical phonology.

At this point, it is not clear how this hypothesis would connect with all of the stress facts in Osage. However, given the Richness of the Base hypothesis in Prince & Smolensky (2004), it would incorrectly predict that an underlying $\mathcal{LH}$ word would faithfully surface as $\mathcal{LH}$ rather than the expected $\mathcal{HH}$.

make a difference. Therefore, there are two possible underlying forms of monosyllabic roots and prefixes and four possible underlying forms for disyllabic roots (see (23)).[12]

(23) <u>POSSIBLE UNDERLYING FORMS</u>

a. Monosyllabic roots and prefixes: /σ/ or /ˈ**σ**/

b. Disyllabic roots: /σσ/, /ˈ**σ**σ/, /σˈ**σ**/, /ˈ**σ**ˈ**σ**/

The hypothesis advocated in this paper says that the default stress pattern in Osage has primary stress on the peninitial syllable, followed by secondary stress on every other syllable. As mentioned in §1, an alternative hypothesis is to say that the default pattern is initial stress and that peninitial stress is lexically marked. At first glance, there seems to be some support for this view since there are words with initial stress in Osage. In this section, two arguments are presented which show that the initial syllable is not where the contrast is admitted. Subsequently, I show that a straightforward iambic analysis of the Osage data is feasible once default peninitial stress is assumed.

3.1. Argument #1: the default pattern is not initial stress. The hypothesis refuted in this section says that surface forms with primary stress on the peninitial syllable are lexically specified for stress (default defying), whereas surface forms with primary stress on the initial syllable (default obeying) are not. With this hypothesis in mind, consider the data in (24) and (25), where the patient 3rd person plural infix *wa* and the valence infix *wa* must be lexically stressed since the second syllable is stressed on the surface. The same is true in (26), where the second syllable of the verb *ðaːwa* ('to count') must be lexically stressed given the surface representation.

(24) /ðɑ-ˈ**wɑ**-kˀy / → [ðɑˈ**wɑ**kˀy]
A2S-P3P-give 'you are giving it to them' (Quintero 2004)

[12] Without any evidence to the contrary, I assume that Osage does not have lexical secondary stress, which is extremely rare cross linguistically (however, see e.g. Liberman & Prince (1979) and Kager (1989) for discussion of stress in English and Hayes (1995) for a discussion of Fijian).

(25) /ãk-ˈ**wɑ**-mãːðõ/ → [ãˈ**wɑ**mãːˌ**ðõ**]
A1P-VAL-steal ‘we (two) stole things/stuff’ (Quintero, p.c.)

(26) /ðɑːˈ**wɑ**/ → [ðɑ**ː**ˈ**wɑ**]
count ‘to count’ (Quintero 2004)

Given the underlying forms in (24)-(26), the different surface representations in (27) and (28) must have the same underlying forms. That is, (27) and (28) are minimal pairs differing solely in the placement of stress on the surface. However, since their underlying forms are identical, an inconsistent grammar is predicted.[13]

(27) /ˈ**wɑ**-ðɑ**ː**ˈ**wɑ**/ → [ˈ**wɑ**ðɑːˌ**wɑ**]
P3P-count ‘to count them’ (Quintero 2004)

(28) /ˈ**wɑ**-ðɑ**ː**ˈ**wɑ**/ → [wɑˈ**ðɑː**wɑ]
VAL-count ‘to count things/stuff’ (Quintero 2004)

In the next section, another argument is presented which shows that the default pattern cannot be initial stress.

3.2. Argument #2: the default pattern is not initial stress. As illustrated in (29), the second syllable of the verb *waːʃka* (‘to do one’s best’) and the agentive 2nd person singular infix *ða* must be lexically stressed given the surface representations.

(29) a. /wɑː-ˈ**ʃkɑ**/ → [wɑːˈ**ʃkɑ**]
PREV-do.one’s.best ‘to do one’s best’ (Quintero 2004)

b. /wɑː-ˈ**ðɑ**-ˈ**ʃkɑ**/ → [wɑːˈ**ðɑ**ʃkɑ]
PREV-A2S-do.one’s.best ‘you do your best’ (Quintero 2004)

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[13] The argument presented here applies to many other forms as well. For example, if initial stress were the default, then the form in (i) must have lexical stress on the second syllable given the surface representation.

(i) /o-ˈʰ**ki**k-õðe/ → [oˈʰ**ki**õˌðe]
LOC-REFL-toss ‘throw oneself into a place’ (Quintero 2004)

The surface representations in (ii) and (iii) have primary stress on different syllables, but the lexical stress is on the first and third syllable in both of the forms (given (i) and (25)-(26))). Therefore, an inconsistent grammar is predicated analogous to (27)-(28).

(ii) /ˈ**wɑ**-ðɑ**ː**ˈ**wɑ**/ → [wɑˈ**ðɑː**wɑ]
VAL-count ‘to count things/stuff’ (Quintero 2004)

(iii) /ˈʰ**ki**k-ðɑ**ː**ˈ**wɑ**/ → [ˈʰ**ki**lɑːˌ**wɑ**]
REFL-count ‘to count yourself’ (Quintero 2004)

As illustrated in (30a), the second syllable of *ɣa:ke* ('to cry') must also be lexically stressed. Given that the agentive 2nd person singular infix *ða* is lexically stressed in (29b), (30b) illustrates two lexical stresses in the input, but neither surfaces faithfully. Crucially, the lexical stress on the first syllable does not surface faithfully, thereby putting an insurmountable burden on the analyst to predict the surface forms in (30).

(30)	a.	/ɣɑː'**ke**/ cry	→	[ɣɑː'**ke]** 'to cry'	(Quintero 2004)
	b.	/'**ðɑ**-ɣɑː'**ke**/ A2S-cry	→	[ðɑ'**ɣɑ**ːke**]** 'you cry'	(Quintero 2004)

A possible alternative analysis is to say that the underlying forms in (30) are really those in (31), where the verbal stem has lexical stress on both syllables.

(31)	a.	**/'ɣɑː'ke/** cry	→	[ɣɑː'**ke]** 'to cry'
	b.	**/'ðɑ-'ɣɑː'ke/** A2S-cry	→	[ðɑ'**ɣɑ**ːke**]** 'you cry'

Given the underlying forms above, the generalization would have to be that given a choice between lexical stress surfacing on the first or second syllable, the latter option is always chosen.

The major flaw of this analysis is that problem presented in the previous sub-section does not go away. For example, consider the representation of the verb *ða:wa* ('to count') in (32). Even if it has lexical stress on both syllables, the forms in (33) and (34) still have identical underlying forms but differ in their surface representations.

(32) /ˈ**ðɑːˈwɑ**/ → [ðɑː**ˈwɑ**]
count ‘to count‘

(33) /ˈ**wɑ**-ˈ**ðɑːˈwɑ**/ → [ˈ**wɑ**ðɑːˌ**wɑ**]
P3P-count ‘to count them’

(34) /ˈ**wɑ**-ˈ**ðɑːˈwɑ**/ → [wɑˈ**ðɑː**wɑ]
VAL-count ‘to count things/stuff’

Given the two arguments presented in this section and with no evidence to the contrary (e.g. from long monomorphemic words, loan words, nonce words, or other morpho-phonology), I conclude that the default pattern in Osage cannot be initial stress.[14] Instead, the default is *peninitial* stress; all forms with initial stress on the surface are lexically marked. In the next section I show that this hypothesis is consistent with the Osage data, predicted by the interaction between faithfulness constraints preserving lexical stress and markedness constraints that require a certain prosodic structure.

4.0. Foot structure: Evidence for the QI iamb. In this section it is argued that the hypothesis under which the default is *peninitial* stress is consistent with the Osage data. In order to argue for this position, I assume that Osage forms with initial and peninitial stress have an iambic parse (for more discussion see §4.3). Subsequently, I show that the correct predictions are made given the interaction of Optimality Theoretic constraints. In §5, a trochaic analysis is considered and shown to entail typologically bizarre stress systems.

Consider the iambic parses in (35)-(40), which illustrate that Osage has every possible arrangement of heavy and light syllables (for a more complete list, see the

[14] In light of this view, an anonymous reviewer asks about simple frequency distribution facts, i.e. if it is the case that peninitial stress is statistically more common than initial stress. According to Quintero (2004), peninitial stress is more commonly found with verbs and initial stress is more commonly found with nouns. Arguing that peninitial stress is the phonological default, however, does not necessarily imply that it is the most frequent pattern, whether lexically or in a spoken corpus. The claim here is that the speaker's competence mechanisms use an iambic default; lexical frequency is another—performance—matter.

appendix). Crucially, note the contrast in stress placement in (37b,c) & (38e,f), (38g) & (39c,d,e,f) and (38c,d) & (39h,i). Here we see LHL, HHL and HLL sequences respectively, but stress differs in its location, showing that a weight distinction among the syllables is not a factor in placement of stress.

(35) Feet with a single light syllable

a.	ˈ**ʃi**	(ˈ**L**)	'you arrive there' (Quintero, p.c.)
b.	ˈ**hã**	(ˈ**L**)	'go ahead' (MOJ; Quintero 1977)
c.	ˈ**skɑ**	(ˈ**L**)	'white' (Quintero, p.c.)

(36) Feet with a single heavy syllable

a.	ˈʰ**keː**	(ˈ**H**)	'turtle' (MOJ; Quintero 1977)
b.	ˈ**heː**	(ˈ**H**)	'lice' (MOJ; Quintero 1977)
c.	ˈ**kiː**	(ˈ**H**)	'fly like a plane' (MOJ; Quintero 1977)

(37) Feet with light-heavy syllables

a.	mĩˈʰ**kɑː**	(Lˈ**H**)	'raccoon' (MOJ; Quintero 1977)
b.	oˈʰ**tɑː**zɑ	(Lˈ**H**)L	'good looking' (MOJ; Quintero 1977)
c.	ɑˈ**wɑː**tɑ	(Lˈ**H**)L	'I plea/pray' (MOJ; Quintero 1977)
d.	ˈ**sy**ʰkɑˌʰ**tãː**	(ˈ**L**)(Lˌ**H**)	'turkey' (MOJ; Quintero 1977)
e.	ˈ**t͡se**ɣeˌ**niː**	(ˈ**L**)(Lˌ**H**)	'drum' (MOJ; Quintero 1977)
f.	ãˈ**kɑː**ʃiˌ**t͡se**	(Lˈ**H**)(Lˌ**L**)	'we missed it' (Quintero 2004)
g.	wɑˈ**ðɑː**xtɑˌ**ke**	(Lˈ**H**)(Lˌ**L**)	'bite folks/people' (Quintero, p.c.)
h.	ãˈ**kɑ**ʰkiˌ**lãː**pi	(**L**ˈ**L**)(Lˌ**H**)L	'we carry ourselves' (MREI; Quintero 1994a)
i.	ʰt͡seˈ**xo**peˌ**hyː**st͡seː	(Lˈ**L**)(Lˌ**H**)H	'tarantula (spider with long legs)' (Quintero, p.c.)
j.	ˈ**o**wãˌ**lɑː**kɑˌ**pe**	(ˈ**L**)(Lˌ**H**)(Lˌ**L**)	'he told me' (MOJ; Quintero 1977)

(38) Feet with heavy-light syllables

a.	wɑːˈ**t͡sʰi**	(Hˈ**L**)	'dance' (FH; Quintero 1994a)
b.	kɑːˈ**mɑ**	(Hˈ**L**)	'the noise a bell makes' (MREI; Quintero 2000)
c.	ðyːˈ**le**ke	(Hˈ**L**)L	'break into' (MOJ; Quintero 1977)
d.	hyːˈ**wa**ɾi	(Hˈ**L**)L	'many, a lot' (MOJ; Quintero 1977)
e.	ˈ**o**weːˌ**nã**	(ˈ**L**)(Hˌ**L**)	'grateful' (MREI; Quintero 1994a)
f.	ˈ**ɑ**nãːˌ**ʒĩ**	(ˈ**L**)(Hˌ**L**)	'step on it' (MOJ; Quintero 1977)
g.	ˈ**hoː**sɑːˌ**ki**	(ˈ**H**)(Hˌ**L**)	'he yells' (Quintero 2004)
h.	xõːˈ**t͡so**ðiːˌ**brã**	(Hˈ**L**)(Hˌ**L**)	'smoke cedar'(Quintero 2004)
i.	ðyːˈ**xtɑ**ðɑˌ**p͡ɑɪ**	(Hˈ**L**)(Lˌ**L**)	'they're tearing it down' (MOJ; Quintero 1977)

j.	ˈ**o**ðyːˌ**t͡sʔɑ**ke	(ˈ**L**)(HˌL)L	‘lazy’ (MOJ; Quintero 1977)
k.	ɑˈ**wɑ**lɑːˌ**xy**ɣe	(LˈL)(HˌL)L	‘I crunch up my own (e.g. prey) with teeth’ (Quintero 2005)

(39) Feet with light-light syllables

a.	wɑˈ**hy**	(LˈL)	‘bone’ (MOJ; Quintero 1977)
b.	stɑˈ**ko**	(LˈL)	‘neat’ (MOJ; Quintero 1977)
c.	wɑˈ**ʰkõ**tɑ	(LˈL)L	‘God’ (MREI; Quintero 1994a)
d.	ʒĩˈ**kɑ**ʒi	(LˈL)L	‘child’ (FH; Quintero 1994a)
e.	õˈ**ki**ʰkɑ̃ː	(LˈL)H	‘fan me off’ (MOJ; Quintero 1977)
f.	iʰˈ**t͡sɑ**ʰtɑː	(LˈL)H	‘rat’ (MOJ; Quintero 1977)
g.	ˈ**ɑ**mɑ̃ˌ**ʃi**	(ˈ**L**)(LˌL)	‘up’ (MOJ; Quintero 1977)
h.	ˈ**o**xtɑˌ**ðe**	(ˈ**L**)(LˌL)	‘make sacred’ (MREI; Quintero 1994a)
i.	ˈ**toː**t͡seˌ**hɑ**	(ˈ**H**)(LˌL)	‘a glutton’ (MOJ; Quintero 1977)
j.	ˈ**hɑː**kxɑ̃ˌ**tɑ**	(ˈ**H**)(LˌL)	‘when’ (MOJ; Quintero 1977)
k.	leˈ**tɑ̃**mɑ̃ˌ**ze**	(LˈL)(LˌL)	‘Iron Hawk’ (MREI; Quintero 2000)
l.	oˈ**pɑ**wĩˌ**ɣe**	(LˈL)(LˌL)	‘joy-ride’ (FH; Quintero 1994a)
m.	ˈ**o**nɑ̃ˌ**l̃i**pi	(ˈ**L**)(LˌL)L	‘hurry up’ (FH; Quintero 1994a)
n.	ˈ**tɑː**ʰkɑˌ**tɑ**mɑˌ**ʒi**	(ˈ**H**)(LˌL)(LˌL)	‘I am not hot’ (Quintero 2004)
o.	ˈ**o**wɑ̃ˌ**lɑː**kɑˌ**pe**	(ˈ**L**)(LˌH)(LˌL)	‘he told me’ (MOJ; Quintero 1977)
p.	ɑ̃ˈ**kɑʰ**kiˌ**lɑ̃ː**pi	(**LˈL**)(LˌH)L	‘we carry ourselves’ (MREI; Quintero 1994a)
q.	ʰt͡seˈ**xo**peˌ**hyː**st͡seː	(LˈL)(LˌH)H	‘tarantula (spider with long legs)’ (Quintero, p.c.)

(40) Feet with heavy-heavy syllables

a.	hiːˈ**ðɑː**	(HˈH)	‘bathe’ (Quintero, p.c.)
b.	hyːˈ**ʃt͡seː**	(HˈH)	‘tall’ (MOJ; Quintero 1977)
c.	hõːˈ**xt͡sĩː**	(HˈH)	‘what kind?’ (MOJ; Quintero 1977)
c.	kɑːˈ**saː**ki	(HˈH)L	‘knock someone out’ (MOJ; Quintero 1977)
d.	kɑːˈ**mɑ̃ː**pe	(HˈH)L	‘it rings’ (Quintero 2004)
e.	hɑːˈ**žyː**t͡se	(HˈH)L	‘shroud’ (Quintero p.c.)
f.	ˈ**ʰkɑ**wɑːˌ**l̃iː**	(ˈ**L**)(HˌH)	‘horseback riding’ (FH; Quintero 1994a)
g.	ˈ**xi**ðɑːˌ**peː**	(ˈ**L**)(HˌH)	‘they died’ (MOJ; Quintero 1977)
h.	kɑːˈ**kšĩː**tɑˌ**pe**	(HˈH)(LˌL)	‘he missed’(Quintero 2004)
i.	ʰtɑːˈ**ðɑ̃ː**t͡sɑˌ**ʒi**	(HˈH)(LˌL)	‘not eating meat’(Quintero, p.c.)

In the next section, iambs of the form (HˈL) and (HˈH) are predicted by ranking a faithfulness constraint that prohibits quantity adjustments of syllable weight over markedness constraints that induce quantity adjustments of syllable weight. Before stating this analysis in detail, however, it is important to note that I assume the restrictions on GEN in (41), which are crucial in restricting the typology of foot types (see Hayes 1987, Selkirk 1995).[15]

(41) Assumptions about GEN

a. Every prosodic word has exactly one head foot, e.g. [σσ], [(ˈ**σ**)(ˈ**σ**)] are not possible candidates (GEN rules out culminativity disobedience).[16]

b. Every foot has exactly one stressed syllable, e.g. [(ˈ**σ**ˈ**σ**)], [(ˈ**σ**ˌ**σ**)] are not possible candidates (GEN rules out foot internal clash).

c. Feet are maximally binary, e.g. [(σˈ**σσ**)] is not a possible candidate (GEN rules out unbounded feet).

Moreover, I assume that default obeying forms in Osage that have an even number of syllables as in (42) are predicted by the interaction of the constraints in (443).

(42) /opɑw̃ĩɣe/ → (oˈ**pɑ**)(w̃ĩˌ**ɣe**) 'joy-ride' (FH; Quintero 1994a)

(43) a. IAMB
Incur a violation if a foot's head is not at its right edge (after Prince & Smolensky 1993).

b. TROCHEE
Incur a violation if a foot's head is not at its left edge (after Prince & Smolensky 2004).

c. HEADFTLEFT
ALIGN (PRWD, L, HEAD/PRWD, L): incur a violation if the head foot in a PrWd is not at the left edge (after McCarthy & Prince 1993b).

d. HEADFTRIGHT
ALIGN (PRWD, R, HEAD/PRWD, R): incur a violation if the head foot in a PrWd is not at the right edge (after McCarthy & Prince 1993b).

[15] GEN is a function that maps each lexical form into all possible output candidates.

[16] It has been documented in the literature that some Scandinavian languages as well as Guugu Ymidhirr (Haviland 1979, Kager 1995b, Bye 1996) have words with two main stresses (level stress). However, this phenomenon is controversial at best and for the purposes of this paper, will not be discussed.

The tableau in (44) illustrates that the head foot is at the left edge, as opposed to right given the ranking HFL >> HFR.[17] Moreover, feet are right-headed as opposed to left-headed given the ranking IAMB >> TROCHEE.

(44) /opɑwĩɣe/		HFL	IAMB	HFR	TROCHEE	REMARKS
☞	(oˈ**pɑ**)(wĩˌ**ɣe**)			1	2	iambic parse; head foot at left edge
a.	~ (oˌ**pɑ**)(wĩˈ**ɣe**)	1 **W**		0 **L**	2	head foot at right edge
b.	~ (ˈ**o**pɑ)(ˌ**wĩ**ɣe)		2 **W**	1	0 **L**	trochaic parse

Finally, I assume that default obeying forms in Osage that have an odd number of syllables as in (45) are predicted by the interaction of the constraints in (46) which are *gradient*: for every foot, these constraints calculate the distance, gradiently expressed in syllables, between its left (right) edge and the left (right) edge of the prosodic word.

(45) /ɑ-wɑ-kik-ðɑːxuɣe/ → (ɑˈ**wɑ**)(lɑːˌ**xy**)ɣe
A1S-P3P-SUUS-crunch 'I crunch up my own (e.g. prey) with teeth'

(46) Markedness constraints

a. PARSE-σ
Incur a violation for every syllable that is not parsed into a foot (after Prince & Smolensky 2004).

b. FTBIN-σ
Incur a violation for every foot that is less than two syllables (after Prince & Smolensky 2004, Elías-Ulloa 2006).

c. AFL
ALIGN (FT, L, PRWD, L): Every foot stands at the left edge of the PrWd. The total number of violation marks equals the sum of all individual violations by feet (after McCarthy & Prince 1993b).

d. AFR
ALIGN (FT, R, PRWD, R): Every foot stands at the right edge of the PrWd. The total number of violation marks equals the sum of all individual violations by feet (after McCarthy & Prince 1993b).

[17] The failed candidates are compared (denoted by "~") to the optimal candidate (denoted by "☞"). "W" denotes that the optimal candidate wins on a particular constraint, and "L" denotes that the optimal candidate loses; the numbers indicate the total number of violations incurred by the respective candidate. For more discussion, see Prince (2002).

The tableau in (47) illustrates that the ranking FtBin-σ >> Parse-σ >> AFL >> AFR ensures that syllables are parsed only into disyllabic feet such that stray syllables appear only at the right edge of the prosodic word.

(47) /ɑ-wɑ-kik-ðɑːxuɣe/	FtBin-σ	Parse-σ	AFL	AFR	Remarks
☞ (ɑˈ**wɑ**)(lɑːˌ**xy**)ɣe		1	2	4	stray syllable
a. ~ (ɑˈ**wɑ**)lɑː (xyˌɣe)		1	3 **W**	3 **L**	left edge
b. ~ (ɑˈ**wɑ**)lɑːxyɣe		3 **W**	0 **L**	3 **L**	three stray syllables
c. ~ (ɑˈ**wɑ**)(lɑːˌ**xy**)(ˌ**ɣe**)	1 **W**	0 **L**	6 **W**	4	monosyllabic foot

In sum, the default obeying forms in Osage are predicted by the rankings in (48).

(48)

Iamb | Trochee	HFL | HFR	FtBin-σ | Parse-σ | AFL | AFR

4.1. The quantity insensitive iamb. As was illustrated in the previous section and repeated below in (49)-(50), Osage has iambs of the form (Hˈ**L**) and (Hˈ**H**).

(49)	/wɑːt͡sʰi/ dance	→	[wɑːˈ**t͡sʰi**] 'dance'	(Hˈ**L**) (FH; Quintero 1994a)
(50)	/hiːðɑː/ bathe	→	[hiːˈ**ðɑː**] 'bathe'	(Hˈ**H**) (Quintero, p.c.)

The parses above are predicted by ranking a faithfulness constraint that prohibits quantity adjustments of syllable weight (see (51)) over markedness constraints that induce quantity adjustments of syllable weight (see (52)).

(51) <u>Faithfulness constraint</u>
Ident(Length)
Incur a violation if for a vowel's length is x in the input is not faithful to its output correspondent (after McCarthy & Prince 1993b).

(52) Markedness constraints

a. WeightToStress (WTS)
Incur a violation if a heavy syllable is unstressed (after Prince 1990).

b. StressToWeight (STW)
Incur a violation if a stressed syllable is light (after Halle & Vergnaud 1978, Prince & Smolensky 2004, Kager 1999).

The tableaus in (53) and (54) illustrates that markedness *pressure* to have stressed heavy syllables and unstressed light syllables does not cause the grammar to make quantity adjustments of syllable weight by lengthening and shortening vowels.

Ident(L) >> {WTS, STW}

(53) /wɑːt͡sʰi/	Ident(L)	WTS	STW	Remarks
☞ (wɑːˈ**t͡sʰi**)		1	1	heavy σ unstressed; stress on light σ
a. ~ (wɑˈ**t͡sʰiː**)	2 **W**	0 **L**	0 **L**	F: length

Ident(L) >> WTS

(54) /hiːðɑː/	Ident(L)	WTS	STW	Remarks
☞ (hiːˈ**ðɑː**)		1	0	heavy σ unstressed
a. ~ (hiˈ**ðɑː**)	1 **W**	0 **L**	0	F: length

The tableau in (55) illustrates that markedness *pressure* to have stressed heavy syllables and unstressed light syllables does not cause the grammar to parse the disyllabic words as a trochee.

Iamb >> {WTS, STW, Trochee}

(55) /wɑːt͡sʰi/	Iamb	Trochee	WTS	STW	Remarks
☞ (wɑːˈ**t͡sʰi**)		1	1	1	heavy σ unstressed; stress on light σ; iambic parse
a. ~ (ˈ**wɑː**t͡sʰi)	1 **W**	0 **L**	0 **L**	0 **L**	trochaic parse

In summary feet of the form (Hˈ**L**) and (Hˈ**H**) are predicted by the rankings below:

(56) Rankings

a. Ident (L) >> {WTS, STW} (see (53a), (54a))

b. Iamb >> {Trochee, WTS, STW} (see (55a))

In the next two sections, forms with lexical stress are predicted. First, an analysis of the so-called 'window' effects is proposed, and subsequently, this analysis is extended to predict forms with underlying stress on the first two syllables.

4.2. 'Window' effects. The form in (57) illustrates 'window' effects in Osage. These effects are evident in environments where lexical stress is not within the first-two-syllable-window, in which case primary stress surfaces on the second syllable by default.

(57)	/ãk-o-ði-ˈ**xpɑ**ðe/	→	[ãˈ**ko**ðiˌ**xpɑ**i]	(ãˈ**ko**)(ðiˌ**xpɑ**)i
	A1P-LOC-P2S-seprerate		'we lost you' (Quintero 2004)	

Note that the fourth syllable is lexically stressed in (57) given the surface form in (58), where primary stress surfaces on the initial syllable; the third syllable is not specified for stress in (57) given the surface form in (59), where the initial syllable is not stressed; the second syllable in (57) is not specified for stress given the surface form in (60), where the initial syllable is not stressed; the first syllable in (57) is not specified for stress given that is not stressed on the surface.[18]

(58)	/ˈ**xpɑ**ðe/	→	[ˈ**xpɑ**ðe]	
	separate		'to separate'	(Quintero 2004)
(59)	/ði-ˈ**kˀy**/	→	[ðiˈ**kˀy**]	
	P1S-give		'give to you'	(Quintero 2004)
(60)	/o-ˈ**xpɑ**ðe/	→	[oˈ**xpɑ**ðe]	
	LOC-separate		'to lose'	(Quintero 2004)

The tableau in (61) illustrates that given an option between the first or the second syllable carrying primary stress, the rankings FTBIN-σ >> PARSE-σ and IAMB >> TROCHEE ensure that the latter option is chosen.

[18] Even though (59) and (60) have lexical stress on the second syllable, the very fact that primary stress is not on the initial syllable on the surface provides evidence that the initial syllable is not lexically stressed. In other words, a syllable is lexically stressed if and only if primary stress falls on that syllable word-initially (see §4.3 for more discussion).

(61) /ãk-o-ði-ˈ**xpɑ**ðe/	FTBIN-σ	IAMB	PARSE-σ	TROCHEE	REMARKS
☞ (ãˈ**ko**)(ðiˌ**xpɑ**)i			1	2	F: stress; stray σ
a. ~ (ˈ**ã**)(koˌ**ði**)(xpɑˌ**i**)	1 **W**		0 **L**	2	monosyllabic foot
b. ~ (ˈ**ãk**o)(ðiˌ**xpɑ**)i		2 **W**	1	0 **L**	trochaic parse

Note that I assume that the lexical stress on the optimal candidate surfaces *faithfully* as secondary stress. In other words, I assume that faithfulness to stress is enforced regardless of its degree of prominence. This idea is captured in the definition of the constraint in (62).[19]

(62) IDENT (ˈV)
Incur a violation if a stressed vowel in the input does not correspond to a stressed vowel in the output (after McCarthy & Prince 1995).

Although (62) does not play an active role in predicting the optimal candidate in (61), things are different when forms like (63) are considered. Here we see that the third syllable carries lexical stress, but only the even syllables are stressed on the surface.

(63)	/wɑ-py-ˈ**ʃtɑ**hɑ/	→	(wɑˈ**py**)(ʃtɑˌ**hɑ**)
	VAL-by.pressing-smooth		'iron clothes' (MOJ; Quintero 1977)

The tableau in (64) illustrates various candidates, which unlike the optimal candidate faithfully map lexical stress as either primary of secondary.[20] These candidates

[19] Note that cyclic stress in English, in which primary and secondary stress are lexicalized, provides evidence for the constraint in (62). For example, in o'**ri**ginal → oˌ**ri**gi'**na**lity the primary stress in the base is subordinated and surfaces as a secondary. The crucial observation is that both the optimal candidate oˌ**ri**gi'**na**lity and the failed candidate ˌ**o**rigi'**na**lity exemplify an unfaithful mapping if faithfulness to lexical stress were enforced based on its degree of prominence. Therefore, without the constraint in (62), the failed candidate is incorrectly predicted to win since it has default initial secondary stress.

However, it is also important to note that trochee words like *Arizona*, *Oklahoma* vs. *Ladefoged*, *Aristotle*, *Studebaker*, etc. show that faithfulness to lexical stress may also be enforced based on its degree of prominence. Arguing for this position, however, would take us too far a field, especially since an analysis of the 'window' effects in Osage is possible (albeit different) whether or not faithfulness to lexical stress is enforced based on its degree of prominence. Therefore, I leave this issue open for further research.

[20] The third syllable is lexically stressed in the optimal candidate given the surface form in (i), where primary stress surfaces on the initial syllable; the second syllable is not specified for stress given the

illustrate that the grammar does not respond to an unfaithful parse by having a monosyllabic foot at the left edge, a trochee at the right edge, or a misaligned head foot surrounded by two stray syllables.

(64) /wɑ-py-ˈ**ʃtɑ**hɑ/	HFL	IAMB	FTBIN-σ	PARSE-σ	IDENT(ˈV)	REMARKS
☞ (wɑˈ**py**)(ʃtaˌ**hɑ**)					1	default pattern; delete stress on V3
a. ~ (ˈ**wɑ**)(pyˌ**ʃtɑ**)hɑ			1 **W**	1 **W**	0 **L**	degenerate foot
b. ~ (wɑˈ**py**)(ˌ**ʃtɑ**hɑ)		1 **W**			0 **L**	trochaic parse
c. ~ wɑ(pyˈ**ʃtɑ**)hɑ	1 **W**			2 **W**	0 **L**	misaligned head foot

The final issue concerning 'window' effects that is addressed in this section concerns five-syllable words like those in (65), where lexical stress is word-final.[21]

(65) /ɑ-wi-ðĩ-ɑ-ˈ**t͡sʰi**/ → (ɑˈ**wi**)(brĩˌ**ɑ**)t͡sʰi
PREV-I.to.you-have-PREV-arrive.here 'I brought it to you' (Quintero 2004)

The tableau in (66) illustrates a failed candidate that faithfully maps its lexical stress as secondary (see (66a)). Although it avoids a violation of IDENT('V), it has a disyllabic foot at the right edge of the prosodic word and thus violates AFL three times, motivating the ranking AFL >> IDENT ('V).

(66) /ɑ-wi-ðʰĩ-ɑ-ˈ**t͡sʰi**/	AFL	IDENT('V)	REMARKS
☞ (ɑˈ**wi**)(brĩˌ**ɑ**)t͡sʰi	2	1	default pattern; delete stress on V5
a. ~ (ɑˈ**wi**)brĩ(ɑˌ**t͡sʰi**)	3 **W**	0 **L**	misaligned feet

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surface form in (ii), where the initial syllable is not stressed; the first syllable is not specified for stress given that is not stressed on the surface.

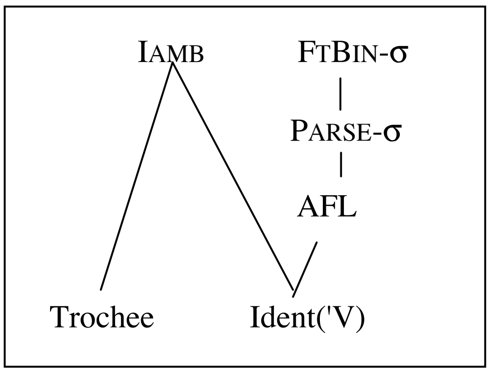
(i) /ˈ**ʃtɑ**hɑ/ → [ˈ**ʃtɑ**hɑ]
smooth 'smooth'

(ii) /py-ˈ**ʃtɑ**hɑ/ → [pyˈ**ʃtɑ**hɑ]
by.pressing-smooth 'iron'

[21] Evidence that the verbal stem *t͡sʰi* is lexically stressed would involve a form where it is stressed word initially on the surface, followed by at least one syllable. Unfortunately, I have not been able to locate such a form (perhaps because *t͡sʰi* does not occur in isolation, needing the preverbal prefix *a*). Therefore, (65) should be seen as a hypothetical form used for the purposes of illustrating the ranking in (66),

In summary, ‘window’ effects result from the interaction between the faithfulness constraint IDENT('V), which preserves lexical stress, and markedness constraints, which require a particular prosodic structure. In particular, ‘window’ effects are predicted by the rankings in (67). Note that to the best of my knowledge, there is no evidence in Osage as to whether HFL dominates IDENT ('V); see (64c). Consequently, this constraint is left out of the hierarchy below.

(67)



4.3. Competition within ‘the window’. As illustrated in (68), the second syllable is lexically specified for stress given the surface form in (69), in which primary stress surfaces on the initial syllable. Moreover, the first syllable in (68) must be lexically specified for stress given that it is stressed on the surface.[22]

(68)	/ˈ**iː**-ˈ**nõː**ʰpe-ɑ/	→	[ˈ**i**ːnõːˌʰ**pɑ**]
	with-afraid-IMPER		‘be careful!’ (Quintero 2004)
(69)	/ˈ**nõː**ʰpe/	→	[ˈ**nõː**ʰpe]
	afraid		‘to be afraid’ (Quintero 2004)

The placement of stress in (68) is reminiscent of vowel hiatus resolution involving deletion: in an environment such as V_1V_2, the grammar must choose which vowel to

[22] Since imperative suffix *a* never occurs word-initial, there is no evidence as to whether it is lexically specified for stress. The same is true of all other suffixes in Osage.

delete.[23] Analogous to vowel hiatus resolution, the grammar must choose which stress to delete in order to avoid clash. In Osage, stress on the second vowel is deleted. In order to predict this fact, the grammar requires the constraint in (70).[24]

(70) IDENT(ˈV_1)
Incur a violation if a stressed initial vowel in the input does not correspond to a stressed vowel in the output (after Casali 1996).

The tableau in (71) illustrates that given an option to delete stress on the first or second syllable, the ranking IDENT(ˈV_1) >> FTBIN-σ ensures that the former option is chosen. Moreover, both lexical stresses do not surface faithfully (i.e. clash is avoided) given the ranking FTBIN-σ >> IDENT (ˈV). Note that the constraint PARSE-σ does not play a role since FTBIN-σ dominates it (see (48)).

IDENT(ˈV_1) >> FTBIN-σ >> IDENT(ˈV)

(71) /ˈ**iː**-ˈ**nõː**ʰpe-ɑ/	IDENT (ˈV_1)	FTBIN-σ	IDENT (ˈV)	REMARKS
☞ (ˈ**iː**)(nõːˌʰ**pɑ**)		1	1	monosyllabic foot; delete stress
a. ~ (iːˈ**nõː**)ʰpɑ	1 **W**	0 **L**	1	delete stress on V_1
b. ~ (ˈ**iː**)(ˈ**nõː**)ʰpɑ		2 **W**	0 **L**	two monosyllabic feet

Interestingly, the initial foot must be monosyllabic in words with initial stress and an odd number of syllables viz. the optimal candidate above.[25] This generalization is in

[23] In the spirit of Prince & Smolensky (2004), Casali (1996: 19-24) proposes that constraints such as PARSE(F)-1SEG and PARSE(F)-LEX dominate the general PARSE(F) to predict vowel hiatus resolution involving deletion.

[24] Note that the constraint in (70) does not strictly speaking fall within Beckman's theory of positional faithfulness, which involve output-input correspondence as opposed to input-output a la Casali 1996. A constraint like OI-IDENT(ˈV_1), which refers to stressed peninitial vowels in the *output* rather than in the input, fails to make the correct predictions for (68); it does not rule out the failed candidate in which stress on the second (and not the first) vowel in the input is mapped onto the surface (i.e. OI-IDENT(ˈV_1) is vacuously satisfied). In order to maintain the Beckman-type analysis, one could treat stress as a binary feature [+/- stress], in which case this failed candidate would be ruled out by the OI-IDENT constraint. However, it is not immediately clear whether such a proposal is superior to positing the constraint in (70), which does not rely on a seemingly *ad hoc* stipulation of treating stress as a binary feature.

accordance with Hayes' (1995) claim that monosyllabic feet must be in strong positions, i.e. the head of a prosodic word. A question that arises, however, is how to parse even-numbered words with initial stress (see (69)). As illustrated in (72), such forms can be parsed with a monosyllabic foot and a stray syllable given that IAMB dominates FTBIN-σ (which in turn dominates PARSE-σ). This ranking ensures that no forms are parsed as trochees in Osage.

(72) /ˈ**nõː**ʰpe/	IAMB	FTBIN-σ	REMARKS
☞ (ˈ**nõː**)ʰpe		1	monosyllabic foot
a. ~ (ˈ**nõː**ʰpe)	1 **W**	0 **L**	trochaic parse

However, (73) illustrates that even-numbered words with initial stress can also be parsed as trochees given the reverse ranking: FTBIN-σ >> IAMB. Since IAMB dominates TROCHEE, the ranking motivated in (73) ensures that trochees are parsed only to avoid monosyllabic feet.

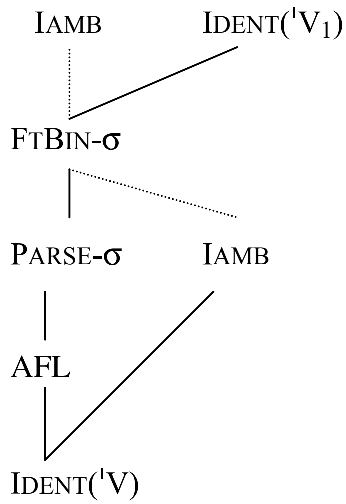
(73) /ˈ**nõː**ʰpe/	IAMB	FTBIN-σ	REMARKS
☞ (ˈ**nõː**ʰpe)	1		trochaic parse
a. ~ (ˈ**nõː**)ʰpe	0 **L**	1 **W**	monosyllabic foot

To the best of my knowledge, the Osage data does not provide evidence for how to parse even-numbered words with initial stress. However, this fact does not undermine the goal of this section, namely to argue the Osage data can be predicted straightforwardly under an iambic analysis in which peninitial stress is the default; whether there is one or two rankings that make the correct predictions (albeit with different structural assumptions), this goal is achieved. The required rankings to predict forms with initial stress are summarized in (74). Note that IAMB appears in multiple

[25] Note that the only other available parse, namely (ˈσσ)(ˌσ), is ruled out given that IAMB >> TROCHEE.

places in the hierarchy (attached to a dashed line), reflecting the two possible rankings discussed above.

(74)



In the next section, an analysis for the interaction between stress and tone is proposed. Subsequently, it is argued that a trochaic analysis of the data examined thus far ought to be rejected.

4.4. Interaction between stress and tone. In §2.4.3 it was shown that high tones fall on stressed syllables and on unstressed initial syllables, while low tones fall on all other unstressed syllables. Since it has been assumed that tone is predictable in Osage, faithfulness constraints that preserve underlying specification of tone do not play an active role in the grammar. Instead the constraints in (75) and (76) play the crucial role in predicting the distribution of tone and stress.

(75) *NON-HD/$\mathcal{H}$
Non-head syllables linked to an $\mathcal{H}$ tone.are prohibited (after de Lacy 2002).

(76) *HD/$\mathcal{L}$
Head syllables linked to an $\mathcal{L}$ tone are prohibited (after de Lacy 2002).

The tableau in (77) illustrates that the optimal candidate with primary stress on the initial syllable has a perfect "tonal grid": tones alternate in accordance with stress such that high tones are linked the stressed syllables and low tones are linked to unstressed syllables. The failed candidates in (77a) and (77b) are ruled out by the constraints in (75) and (76) respectively.

(77) /ˈ**i**-ˈ**nõ**hpe-ɑ/	*NON-HD/$\mathcal{H}$	*HD/$\mathcal{L}$	REMARKS
☞ (ˈ**i**)(nõˌʰ**pɑ**) $\mathcal{H}$ $\mathcal{L}$ $\mathcal{H}$			perfect tonal grid
a. ~ (ˈ**i**)(nõˌʰ**pɑ**) $\mathcal{H}$	1 **W**		unstressed σ with an $\mathcal{H}$
b. ~ (ˈ**i**)(nõˌʰ**pɑ**) $\mathcal{H}$ $\mathcal{L}$		1 **W**	stressed σ with an $\mathcal{L}$

The positional markedness constraint in (78) plays a crucial role in predicting the interaction between stress and tone in words with primary stress on the peninitial syllable.

(78) $\sigma_1(\mathcal{H})$[26]
Incur a violation if the first syllable in a prosodic word is not linked to an $\mathcal{H}$ tone.

The tableau in (79) illustrates that the optimal candidate violates *NON-HD/$\mathcal{H}$ since the initial syllable is unstressed but bears a high tone. The failed candidate in (79a) circumvents this violation by linking a low tone to the first syllable, but in doing so,

[26] Although this constraint is undominated in Osage, it is violable since many tone languages have forms in which a high tone is not linked to the first syllable. The role of this constraint in such languages, however, is left open for further research.

Moreover, as noted by Marc van Oostendorp (p.c.), an alternative constraint that rules out (79a) could require both syllables in the head foot to have a high tone. The main concern with such a constraint is that it requires a certain correlation between foot structure and tonal structure (contra the constraints in (75) & (76), which only require a certain correlation between stress and tone). Consequently, it will make many odd typological predictions when interacting with other prosodic constraints.

incurs a violation of the constraint in (78). This motivates the ranking $\sigma_1(\mathcal{H})$ >> *NON-HD/$\mathcal{H}$.[27]

(79) /xõːt͡se-o-ðiː-brã/	$\sigma_1(\mathcal{H})$	*NON-HD/$\mathcal{H}$	REMARKS
☞ (xõːˈ**t͡so**)(ðiːˌ**brã**) $\mathcal{H}$ $\mathcal{L}$ $\mathcal{H}$		1	unstressed σ with $\mathcal{H}$
a. ~ (xõːˈ**t͡so**)(ðiːˌ**brã**) $\mathcal{L}$ $\mathcal{H}$ $\mathcal{L}$ $\mathcal{H}$	1 **W**	0 **L**	initial σ with $\mathcal{L}$

In summary, it was shown in this section that the iambic analysis under which the default is *peninitial* stress is consistent with the Osage data. In the next section it is argued that a trochaic analysis is not feasible. Subsequently, the foot typology in §1 is derived and Osage is placed in this typology.

5. Rejecting a trochaic analysis: invoking an initial extrametricality effect. In the previous section it was shown that the hypothesis under which the default is *peninitial* stress is consistent with the Osage data. The crucial assumption made was that that Osage forms with initial and peninitial stress have an iambic parse. However, a trochaic analysis is also possible in which the second syllable is the default position for stress placement.[28] In this section, I argue that such an analysis ought to be rejected because it makes odd typological predictions.

Under the trochaic analysis explored in this section, forms with word initial stress are lexically specified and are parsed as trochees from left to right (see (80)). Moreover,

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[27] Note that I leave out the parse in which the first two syllables are each linked to different high tones, i.e. a candidate that violates the OCP. Note that Myers (1997) argues that candidates of this sort are possible and therefore, in principle, the optimal candidate could be represented in this way.

[28] Thanks to Colin Wilson for suggesting I consider the trochaic analysis explored in this section.

forms with default peninitial stress have a stray syllable at the left edge of the prosodic word and the rest of the syllables are parsed as trochees from left to right (see (81)).

(80) /ˈ**wɑ**-ðɑːwɑ/ → (ˈ**wɑ**ðɑː)(ˌ**wɑ**)
P3P-count ‘to count them’

(81) /wɑ-ðɑːwɑ/ → wɑ(ˈ**ðɑː**wɑ)
VAL-count ‘to count things/stuff’

In order to predict the parses above, one could postulate the markedness constraint in (82), which requires the initial syllable to be stressed. Consequently, the stress in (80) surfaces on the initial syllable given that faithfulness to stress dominates the constraint in (82), while the stress in (81) surfaces on the second syllable in order to avoid a violation of (82), thereby invoking the initial extrametricality effect.[29]

(82) *INITIALSTRESS
Incur a violation if the initial syllable is stressed (after Visch 1996).

While the analysis above makes the correct predictions for Osage, it crucially relies on a non-initial stress constraint, which unlike a non-final stress constraint (e.g. NONFINALITY in Prince and Smolensky 1993), yields odd typological predictions. For example, if *INITIALSTRESS were to interact with constraints that induce quantity adjustments of syllables (e.g. WEIGHT-TO-STRESS and STRESS-TO-WEIGHT), we would expect there to be a language in which there is foot reversal at the left edge of the prosodic word; *initial* iambs, but trochees elsewhere, e.g. (Lˈ**L**)(ˌ**L**L)(ˌ**L**L). To the best of my knowledge, no such language is attested. In contrast to this generalization, foot reversal has been attested at the opposite edge. For example, Southern Paiute (Sapir 1930, 1949; Hayes 1981, 1995; Jacobs 1990) exemplifies *final* trochees, but iambs elsewhere.

[29] Note that a related constraint that would achieve this effect is NONINITIALITY (Kennedy 1994, Kenstowicz 1994), which is violated by candidate with a foot at the left edge of the prosodic word. For the purposes of this paper, it is not crucial which constraint is used since the discussion of *INITIALSTRESS in this section also applies to NONINITIALITY.

Moreover, we would also expect there to be a language in which stress falls on the *leftmost* heavy syllable unless it is initial, e.g. HLL'HLH vs. 'HLLL. To the best of my knowledge, no such language is attested either. In contrast to this generalization, it is well known that in Classical Arabic, the *rightmost* nonfinal heavy syllable is stressed; otherwise the initial syllable is stressed (McCarthy 1979).

Additionaly, it is predicted that there should be a language in which stress alternates rightward (in a moraic trochee style), with pairs of light syllables to the right of a heavy syllable with clash; words that start with a sequence of light syllables have second syllable stress, i.e. ('H)(ˌLL) vs. L('LL). To the best of my knowledge, no such language is attested. On the other hand, a number of Arabic dialects (e.g. Damascene) have patterns with non-finality, i.e. Latin-like stress with antepenultimate stress if the penult is light.

Finally, it is predicted that there should a language in which stress surfaces on odd-numbered syllables from the *right*, minus the initial syllable. To the best of my knowledge, no such language is attested. On the other hand, it is well known that in Pintupi stress surfaces on odd-numbered syllables from the *left*, yet final syllables in odd-numbered words are never stressed (Hansen & Hansen 1969; Kager 1992).

In sum, there is a contrast in the behavior of stress at the right edge as opposed to the left. The quirky behavior of stress at the right edge motivated Prince and Smolensky to propose the constraint NONFINALITY. On the other hand, the non-quirky behavior of stress at the left edge has lead many researches to doubt that the effect of initial extrametricality is best explained by a non-initial stress constraint (see e.g. Hyde (2001), where it is argued that a non-initial stress constraint does not exist and therefore, any analysis that relies on it should be abandoned). One proposal relevant to the purposes here is found in Van de Vijver (1998), where it is argued that a non-initial stress constraint fails to make the correct predictions for extrametricality effects in Carib. Instead, Van de Vijver proposes the constraint *EDGEMOST, which is violated by stressed syllables at either edge of the prosodic word.

Too see the role that this contraint plays in the grammar of Osage, let us reconsider the forms in (80)-(81), repeated below in (83)-(84). One hypthesis would be to say that the stress in (83) surfaces on the initial syllable given that faithfulness to stress dominates *EDGEMOST, while the stress in (84) surfaces on the second syllable in order to avoid a violation of this constraint. In other words, at first blush, it appears that *EDGEMOST plays the same role as *INITIALSTRESS (without—perhaps—the bizarre typological predictions).

(83) /ˈ**wɑ**-ðɑːwɑ/ → (ˈ**wɑ**ðɑː)(ˌ**wɑ**)
P3P-count 'to count them'

(84) /wɑ-ðɑːwɑ/ → wɑ(ˈ**ðɑː**wɑ)
VAL-count 'to count things/stuff'

However, *EDGEMOST is unable to predict the Osage forms such as (85), where the final syllable carries secondary stress and thereby violates this constraint. That is, the parse in (85) is problematic since the undersired parse in (86) also violates *EDGEMOST once, but does not have stray syllables or monosyllabic feet.

(85) /xõːt͡se-o-ðiː-brɑ̃/ → xõː(ˈ**t͡so**ðiː)(ˌ**brɑ̃**)
cedar-LOC-by.hand-smell 'smoke cedar'

(86) *(ˈ**xõː**t͡so)(ˌ**ðiː**brɑ̃)

To the best of my knowledge, the only way (85) could be predicted as being optimal over (86), given the Osage stress facts discussed in this paper, is that if

*INITIALSTRESS is invoked. However, as we have seen, this constraints makes odd typological predictions and ought to be avoided.

Finally, it's worth noting that Hayes (1995) analyzes Winnebago, a language with default stress on the *third* syllable, without appealing to rules or constraints that explicitly prohibit stressed initial syllables (or word-initial feet); the extrametrical effect in Winnebago, according to Hayes, results from more general accentual and tonal rules such that "the metrical part of Winnebago phonology becomes typologically ordinary…the analysis does not invoke initial extrametricality, which is quite rare crosslinguistically." Although Hayes' analysis of Winnebago differs from my analysis of Osage—the initial weak-strong pattern in Osage is due to iambic constituency rather than a tonal flop from a stressed initial vowel to the subsequent one—the crucial point is that in addition to odd typological predictions, a non-initial stress constraint appears to be spurious even in the analysis of a language with initial extrametrical effects.

In sum, there is powerful evidence in favor of rejecting an initial-stress constraint.[30] However, without such a constraint, a very heavy burden is placed on the analyst to justify a trochaic parse of default obeying forms in Osage, especially since vowel length has no effect on foot structure. On the other hand, an iambic parse of these forms is predicted straightforwardly, with no burden to explain initial extrametricality

[30] As noted by Donca Steriade (p.c.), metrical analyses that are grid-only-based rather than foot-based often appeal to a non-initial stress constraint. Therefore, a rejection of such a constraint potentially weakens the grid-only-based approach. Whether or not such is the case, the crucial observation is that a non-initial stress constraint makes odd typological predictions within a grid-only-based theory in addition to foot-based ones: non-attested languages are predicted in which stress falls on the leftmost heavy syllable unless it is initial: HLL'HLH vs. 'HLLL. In sum, a non-initial stress constraint fails to capture the contrast in the behavior of stress at the two edges regardless of whether feet exist.

effects. I therefore conclude that the trochaic analysis explored in this section should be rejected in favor of the iambic analysis.[31]

6. The gap is filled: the typology of feet. As noted in Kager (2007), eight unidirectional quantity insensitive systems are predicted by the interaction of Optimality Theoretic constraints that are violated based on whether a prosodic word has: (i) right-headed or left-headed feet, (ii) a rightward or a leftward parse, and (iii) monosyllabic feet or stray syllables. The typology discussed in section 1 is repeated in (87). Note that Osage belongs to the shaded cell below, in which prosodic words have right-headed feet, a rightward parse and no monosyllabic feet (when there is no lexical stress).

(87)	QUANTITY INSENSITIVE TROCHEES 45 languages		QUANTITY INSENSITIVE IAMBS 10 languages	
	LEFT-TO-RIGHT 32 languages	RIGHT-TO-LEFT 13 languages	**LEFT-TO-RIGHT 4 languages**	RIGHT-TO-LEFT 5 languages
STRICTLY BINARY 30 languages	(a) (ˈσσ)(ˌσσ) (b) (ˈσσ)(ˌσσ)σ 14 languages (e.g. Pintupi)	(c) (ˌσσ)(ˈσσ) (d) σ(ˌσσ)(ˈσσ) 12 languages (e.g. Warao)	**(i) (σˈσ)(σˌσ)** **(j) (σˈσ)(σˌσ)σ** **4 languages** **(e.g. Osage, Araucanian)**	(k) (σˌσ)(σˈσ) (l) σ(σˌσ)(σˈσ) unattested
BINARY & UNARY 25 languages	(e) (ˈσσ)(ˌσσ) (f) (ˈσσ)(ˌσσ)(ˌσ) 18 languages (e.g. Murinbata)	(g) (ˌσσ)(ˈσσ) (h) (ˌσ)(ˌσσ)(ˈσσ) 1 language (Biangai)	(m) (σˈσ)(σˌσ) (n) (σˈσ)(σˌσ)(ˌσ) 1 language (Ojibwa)	(o) (σˌσ)(σˈσ) (p) (ˌσ)(σˌσ)(σˈσ) 5 languages (e.g. Weri)

Kager notes that four patterns exemplify perfect grids (38 languages, e.g. Murinbata, Warao, Araucanian and Weri): they allow neither clash nor lapse. Of the

[31] As noted by René Kager (p.c.), one of the major advantages of a foot-based, rather than a grid-only-based theory is that it has it has the formal tools necessary to address the iambic/trochaic asymmetry, which is meaningless without the existence of feet. Since the view advocated in this paper is that there is no such asymmetry, the burden is placed to provide other evidence for the existence of feet. Such evidence comes from well-known phenomena such as word minima, reduplicant shape, allomorphy, etc. (see Kager 2007 for an overview and references). More evidence comes from the observation that the head of an iamb lengthens, i.e. /σσ/→[(σˈσː)], but this usually does not happen with trochees, i.e. /σσ/ → [(ˈσσ)], not *[(ˈσːσ)].

remaining patterns (16 languages) that deviate from rhythmic perfection, Pintupi-type languages allow lapse in final position, while Biangai-type languages allow clash between two secondary stresses at the left edge, and Ojibwa at the right edge. The only unattested system that is predicted involves binary iambs going from right to left with a lapse on the initial syllables of odd-numbered forms (see (87l)).

The rankings in (88) predict the eight systems in (87). Note that the definitions of the eight constraints below were introduced throughout the analysis of Osage, and no new constraints are needed to predict the typology.[32]

(88) <u>RANKINGS THAT DERIVE THE TYPOLOGY IN (87)</u>

a.	FTBIN-σ >> PARSE-σ >> AFL >> AFR	(see 87a)
	HFL >> HFR; TROCHEE >> IAMB	(see 87b)
b.	FTBIN-σ >> PARSE-σ >> AFL >> AFR	(see 87c)
	HFR >> HFL; TROCHEE >> IAMB	(see 87d)
c.	FTBIN-σ >> PARSE-σ >> AFL >> AFR	(see 87i)
	HFL >> HFR; IAMB >> TROCHEE	(see 87j)
d.	FTBIN-σ >> PARSE-σ >> AFL >> AFR	(see 87k)
	HFR >> HFL; IAMB >> TROCHEE	(see 87l)
e.	PARSE-σ >> FTBIN-σ and PARSE-σ >> AFR >> AFL	(see 87e)
	HFL >> HFR; TROCHEE >> IAMB	(see 87f)
f.	PARSE-σ >> FTBIN-σ and PARSE-σ >> AFR >> AFL	(see 87g)
	HFR >> HFL; TROCHEE >> IAMB	(see 87h)
g.	PARSE-σ >> FTBIN-σ and PARSE-σ >> AFR >> AFL	(see 87m)
	HFL >> HFR; IAMB >> TROCHEE	(see 87n)
h.	PARSE-σ >> FTBIN-σ and PARSE-σ >> AFR >> AFL	(see 87o)
	HFR >> HFL; IAMB >> TROCHEE	(see 87p)

The tableau in (89) illustrates that left-to-right trochees (see (87a,e)) are predicted by ranking HFL >> HFR and TROCHEE >> IAMB.

[32] Since the cells in (87) exemplify systems with QI feet, I assume that faithfulness constraints that ban quantity adjustments of syllables are un-dominated in these systems.

(89) /σσσσ/	HFL	TROCHEE	HFR	IAMB	REMARKS
☞ (ˈ**σ**σ)(ˌ**σ**σ)			1	2	trochaic parse; head foot at left edge
a. ~ (ˌ**σ**σ)(ˈ**σ**σ)	1 **W**		0 **L**	2	head foot at right edge
b. ~ (σˈ**σ**)(σˌ**σ**)		2 **W**	1	0 **L**	iambic parse

The tableau in (90) illustrates that the difference between left-to-right trochees and right-to-left trochees (see (87c,g)) is predicted by the reverse ranking of HFR and HFL.

(90) /σσσσ/	HFR	TROCHEE	HFL	IAMB	REMARKS
☞ (ˌ**σ**σ)(ˈ**σ**σ)			1	2	trochaic parse; head foot at right edge
a. ~ (ˈ**σ**σ)(ˌ**σ**σ)	1 **W**		0 **L**	2	head foot at left edge
b. ~ (σˌ**σ**)(σˈ**σ**)		2 **W**	1	0 **L**	iambic parse

The tableau in (91) illustrates that left-to-right iambs (see (87i,k)) are predicted by ranking HFL >> HFR and IAMB >> TROCHEE.

(91) /σσσσ/	HFL	IAMB	HFR	TROCHEE	REMARKS
☞ (σˈ**σ**)(σˌ**σ**)			1	2	iambic parse; head foot at left edge
a. ~ (σˌ**σ**)(σˈ**σ**)	1 **W**		0 **L**	2	head foot at right edge
b. ~ (ˈ**σ**σ)(ˌ**σ**σ)		2 **W**	1	0 **L**	trochaic parse

The tableau in (92) illustrates that right-to-left iambs (see (87m,o)) are predicted by ranking HFR >> HFL and IAMB >> TROCHEE.

(92) /σσσσ/	HFR	IAMB	HFL	TROCHEE	REMARKS
☞ (σˌ**σ**)(σˈ**σ**)			1	2	iambic parse; head foot at right edge
a. ~ (σˈ**σ**)(σˌ**σ**)	1 **W**		0 **L**	2	head foot at left edge
b. ~ (ˌ**σ**σ)(ˈ**σ**σ)		2 **W**	1	0 **L**	trochaic parse

The tableau in (93) illustrates that left-to-right trochees with a stray syllable (see (87b)) are predicted by the ranking FTBIN-σ >> PARSE-σ >> AFL >> AFR.

(93) /σσσσσ/	FTBIN-σ	PARSE-σ	AFL	AFR	REMARKS
☞ (ˈ**σ**σ)(ˌ**σ**σ)σ		1	2	4	stray syllable
a. ~ (ˈ**σ**σ)σ(ˌ**σ**σ)		1	3 **W**	3 **L**	misaligned foot
b. ~ (ˈ**σ**σ)σσσ		3 **W**	0 **L**	3 **L**	three stray syllables
c. ~ (ˈ**σ**σ)(ˌ**σ**σ)(ˌ**σ**)	1 **W**	0 **L**	6 **W**	4	monosyllabic foot

The tableau in (94) illustrates that left-to-right trochees with monosyllabic feet (see (87f)) are predicted by the rankings PARSE-σ >> FTBIN-σ and PARSE-σ >> AFR >> AFL.

(94)	/σσσσσ/	PARSE-σ	FTBIN-σ	AFR	AFL	REMARKS
☞	(ˈ**σ**σ)(ˌ**σ**σ)(ˌ**σ**)		1	4	6	monosyllabic foot
a.	~ (ˈ**σ**)(ˌ**σ**σ)(ˌ**σ**σ)		1	6 **W**	4 **L**	misaligned foot
b.	~ (ˈ**σ**σ)σ(ˌ**σ**σ)	1 **W**	0 **L**	3 **L**	3 **L**	stray syllable

Note that in (93) and (94), the ranking HFL >> HFR ensures that the candidates are parsed from left-to-right; the reverse ranking predicts a right-to-left parse (see (87d, h)). Moreover, the ranking TROCHEE >> IAMB ensures that the feet in (93) and (94) are trochees; the reverse ranking predicts feet that are iambs (see (87j,l,n,p) as well as the analysis of default obeying forms in Osage in section 4). In sum, the interaction of the eight prosodic constraints considered in this section predicts the eight systems in the foot typology in (87).

6. Conclusion. Much of the literature on metrical theory over the past two decades has attempted to address the question of whether the lack of quantity insensitive iambs reflects a fundamental property of the grammar. This question presupposes that (Hˈ**L**), (Hˈ**H**) iambs do not exist. In this paper, I argued that such a presupposition is not warranted and that any typological theory of feet *should* predict QI iambs. The argument rested on data from Osage, which is typologically remarkable because it has many characteristics—some phonetically verified in this paper—that point to a QI iambic system. The analysis advocated in this paper is Optimality Theoretic; it was shown that Osage fills the empirical gap that is inherent in a typology that results from the interaction of Optimality Theoretic prosodic constraints in Prince & Smolensky (2004) and McCarthy & Prince (1993a,b, 1995).

The major contribution of this paper can be summarized as follows: it explores the phonetic structures of stress in Osage and provides the first complete formal analysis of Osage stress. This analysis is important because it reveals that foot headedness and quantity-sensitivity are independent: whether a foot is trochaic or iambic is unrelated to whether it also quantity-sensitive.

APPENDIX

CORPUS OF WORDS MEASURED IN FUNDAMENTAL FREQUENCY STUDY[33]

MYRTLE OBERLY JONES (ALL WORDS PRODUCED IN ISOLATION)

(1)	ɑˈ**wɑː**tɑ	‘I plea/pray’	(2)	ˈ**o**xtɑ	‘beloved, special, great’
(3)	nɑ̃ˈ**nu**hu	‘tobacco’	(4)	ʰpeːˈ**ʃtɑ**	‘bald head’
(5)	oˈ**ðo**pʃe	‘Osage cradle’	(6)	wɑˈ**hy**ni	‘arthritis’
(7)	wɑˈ**hy**	‘bone’	(8)	ˈ**wɑː**t͡si ˈ**ni**e	‘venereal disease’
(9)	oˈ**ʒɑ̃ː**ke	‘trail’	(10)	pɑːˈ**xo**	‘mountain’
(11)	wɑˈ**ʰleʰ**le	‘flag’	(12)	kɑːˈ**sɑː**ki	‘knock someone out’
(13)	ˈ**wɑ**ːlɑˌ**ke**	‘taboo’	(14)	oˈ**ʒe**ʰt͡si	‘outhouse, toilet room’
(15)	ˈ**ho**ni	‘almost’	(16)	ˈ**wɑ**ːspe	‘to wait, stay’
(17)	ˈ**ni**ni	‘cold, as food or drink’	(18)	ˈ**ɑ**nɑ̃ːˌ**ʒĩ**	‘step on it’
(19)	ˈ**zɑ**ːni	‘all’	(20)	ˈ**hĩː**ke	‘toothless’
(21)	ðĩˈ**ke**	‘none’	(22)	nɑ̃ːˈ**lõ**xɑ	‘undercover, sneak’
(23)	oˈ**ʰtɑː**zɑ	‘good looking’	(24)	ˈ**ʃtɑ**ke	‘warm’
(25)	ˈ**kiː**	‘fly like a plane’	(26)	ˈ**lɑ̃**ðe	‘big’
(27)	wɑˈ**py**ʃkɑ	‘beads’	(28)	wɑˈ**ho**ʃ͡tsɑ	‘little (diminutive)’
(29)	ɑ̃ˈ**kɑ**t͡sʰiˌ**pe**	‘we come’	(30)	ˈ**wɑː**li	‘really’
(31)	ˈ**t͡so**ːpɑ	‘a little amount’	(32)	ðiˈ**ʒo**ʒi	‘hurt somebody’
(33)	õˈ**ki**ʰkɑ̃ː	‘fan me off’	(34)	ˈ**hɑː**kxɑ̃ˌ**tɑ**	‘when’
(35)	stɑˈ**ko**	‘neat’(35)	(36)	ɑ̃ˈ**ki**pʃe	‘they are combing my hair’
(37)	ˈ**ni**wɑˈ**ʰt͡se**	‘cold’	(38)	hyːˈ**ʃt͡seː**	‘tall’
(39)	mĩˈ**t͡sʰo**	‘lion’	(40)	ðyːˈ**xtɑ**ðɑˌ**pɑ͡ɪ**	‘they’re tearing it down’
(41)	ˈ**hɑ̃**	‘go ahead’	(42)	ˈ**sy**ʰkɑˌ**ʰtɑː**	‘turkey’
(43)	ˈ**ɑ**mɑ̃ˌ**ʃi**	‘up’	(44)	ˈ**we**t͡sʔɑ	‘snake’
(45)	ˈ**heː**	‘lice’	(46)	ˈ**ʰkeː**	‘turtle’

[33] To describe the context of utterance the following notational conventions are used: ‘PI’ := Phrase Initial, ‘PM’ := Phrase Medial, ‘PF’ := Phrase Final, ‘IS’ := Isolation.

(47)	ˈʰ**tɑː**	‘deer’	(48)	ˈ**sĩ**kɑ	‘squirrel’
(49)	ɑˈ**ðĩ**	‘have; has it’	(50)	iʰˈ**t͡sɑ**ʰtɑː	‘rat’
(51)	ðyːˈ**le**ke	‘break into’	(52)	iːˈ**ðɑ**ðe	‘I saw it’
(53)	ˈ**toː**t͡seˌ**hɑ**	‘a glutton’	(54)	hĩːˈ**ʃɑ**	‘Caddo’
(55)	wiˈ**ki**syˌ**ðe**	‘I remember you’	(56)	ˈ**o**ðyːˌ**t͡sɑ**ke	‘lazy’
(57)	ðiːˈʰ**tã**	‘grasp, handle, knead’	(58)	hyːˈ**wɑ**lĩ	‘many, a lot’
(59)	ˈ**tãː**skɑ	‘whatchucallit’	(60)	wɑˈ**py**ʃtɑˌ**hɑ**	‘iron clothes’
(61)	wɑˈ**ʃĩ**	‘bacon’	(62)	ˈ**he**xpɑ	‘bushy head’
(63)	ˈ**ĩː**ʰtõ	‘earrings’	(64)	ãˈ**kʔy**mãˌ**ði**	‘go get it for me’
(65)	mãːˈ**ðõ**	‘steal’	(66)	ˈʰ**pe**ɣe	‘gourd’
(67)	ˈ**o**wãˌ**lɑː**kɑˌ**pe**	‘he told me’	(68)	ˈ**tɑː**ʰkɑˌ**t͡se**	‘hot’
(69)	ˈʰ**pi**mõ	‘I know how’	(70)	ˈ**o**ʃkiˌ**kɑ**	‘ornery’
(71)	mĩˈʰ**kɑː**	‘raccoon’	(72)	ˈ**ðɑ**ːʰpɑ	‘short’

<u>FRANCIS HOLDING</u>

(1)	ˈ**to**e	‘some’ (PM)	(2)	ðiːˈ**xõ**	‘break off’ (PF)
(3)	ˈ**o**nãˌ**lĩ**pi	‘hurry up’ (IS)	(4)	ˈ**i**kʔyˌ**t͡sɑ**	‘to try’ (PF)
(5)	wɑˈʰ**kõ**tɑ	‘God’ (PI, PM)	(6)	ˈ**hãː**t͡se	‘last night’ (PI)
(7)	ʒĩˈ**kɑ**ʒi	‘child’ (PI, IS)	(8)	ˈ**sĩː**t͡se	‘tail’ (PI)
(9)	ˈ**zɑ**ːni	‘all’ (IS)	(10)	hɑˈ**xĩ**	‘blanket’ (PI)
(11)	ˈ**hõ**ːpɑ	‘day’ (PI, PM)	(12)	ˈ**brɑ**ːt͡sʰe	‘I eat it’ (PM)
(13)	ˈ**oː**siˌ**pɑ͡i**	‘be getting out’ (IS)	(14)	ˈ**bre**ːðe	‘I went’ (IS)
(15)	wɑːˈ**t͡sʰi**	‘dance’ (PI, PM)	(16)	ˈ**wɑ**ːspe	‘to wait, stay’ (IS)
(17)	ĩːˈ**ʃtɑ**	‘eyes’ (PI)	(18)	ˈʰ**kɑː**wɑˌ**lĩː**	‘horseback riding’ (IS)
(19)	pɑˈ**ʃõ**we	‘binding’ (IS)	(20)	iˈ**ʒĩ**ke	‘son’ (PF)
(21)	toˈ**ni**ðe	‘always’ (IS)	(22)	pɑːˈ**ʃe**	‘we are binding’ (IS)
(23)	wɑˈ**nõ**bre	‘to dine’ (PI)	(24)	ˈ**pɑ**ːxɑ	‘cottonwood’ (PI)
(25)	ðeːˈ**kɑ**	‘here’ (PI)	(26)	ðiːˈ**ʃto**	‘remove by pulling’ (IS)
(27)	oˈ**pɑ**ɣĩˌ**ke**	‘joy-ride’ (PI)	(28)	wɑˈ**le**ze	‘paper with text on it’ (PI)
(29)	ˈʰ**pɑ**ze	‘dark, darkness’ (PI)	(30)	ãˈ**ðiː**xõ	‘we break it off’ (PM)
(31)	ˈ**iː**xɑ	‘laugh’ (PI)			

<u>MARGARET RED IRON EAGLE</u>

(1)	niːˈ**kɑː**pxoˌ**ke**	‘pop’ (PM)	(2)	ãˈ**ki**kʔyˌ**pe**	‘he gave it back to me’ (PF)
(3)	ˈ**bry**wĩ	‘I buy’ (PI, IS)	(4)	lɑːˈ**skɑ**ʒi	‘little flower’ (IS, PI)
(5)	ãˈ**ðy**wĩ	‘we buy it’ (PI, IS)	(6)	leˈ**tã**mãˌ**ze**	‘Iron Hawk’ (PI, IS)
(7)	wɑˈ**ho**ʃt͡se	‘little’ (IS)	(8)	kɑːˈ**mɑ**	‘the noise a bell makes’ (IS)

(9)	ˈ**zɑː**ni	‘all’ (PM, PI)	(10)	ɑ̃ˈ**ki**lyˌ**wi**	‘buy me (something)’ (PM)
(11)	mɑ̃ˈ**ðĩ**	‘walking’ (IS)	(12)	ˈ**õː**ðe	‘throw away’ (PM)
(13)	ˈ**ɑː**lĩː	‘chair, seat’ (IS)	(14)	ˈ**kʃõ**kɑ	‘second son’ (IS)
(15)	ʒĩˈ**kɑ**ʒi	‘child’ (PM)	(16)	ʰpɑːˈ**xĩ**	‘hair’ (IS)
(17)	ˈ**ɑ**ʃi	‘outside’ (PI)	(18)	kɑːˈ**pʃe**	‘brush’ (IS)
(19)	ðyˈ**wĩ**	‘buy’ (IS)	(20)	ðyˈ**wĩ**pɑˌ**ʒĩ**	‘didn’t buy it’ (PF)
(21)	ðyːˈ**wɑ**sy	‘clean’ (IS)	(22)	ˈ**ðo**hɑ	‘almost’ (PI, PM)
(23)	ˈ**o**weːˌ**nɑ̃**	‘grateful’ (PM)	(24)	ˈʰ**t͡si**ʰtɑ	‘inside, into the house’ (PI)
(25)	iˈ**ʒĩ**ke	‘son’ (PM)	(26)	ðyˈ**wĩː**ke	‘he doesn’t usually buy anything’ (IS)
(27)	ˈ**nõː**ʒaˌ**ʒe**	‘adult name’ (IS)	(28)	ɑˈ**kʃi**	‘they come/go back there’ (PM)
(29)	lɑːˈ**skɑ**	‘flower’ (IS, PI)	(31)	ðɑˈ**kˀe**ðɑˌ**pe**	‘he was kind to her’ (PM)
(31)	ˈ**hõː**pɑ	‘day’ (PM)	(32)	ɑ̃ˈ**kɑ**kʃi	‘we go back there’ (PI)
(33)	hɑˈ**xĩ**	‘blanket’ (PI)	(34)	ðyːˈʰ**kɑː**mɑ̃	‘ring the doorbell’ (IS)
(35)	wɑˈʰ**kõ**tɑ	‘God’ (PI)	(36)	ɑˈ**lĩ**	‘arrive back here’ (PI)
(37)	ˈ**ðɑː**lĩ	‘good’ (PF)	(38)	ɑ̃ˈ**kɑ**ʰkiˌ**lɑ̃ː**pi	‘we carry ourselves’ (PI)
(39)	ɑ̃ˈ**nɑ̃**ðe	‘we see’ (PM)	(40)	ˈ**o**xtɑˌ**ðe**	‘to make sacred’ (PM)
(41)	ˈ**õ**ːbre	‘I throw away’ (PF)	(42)	wɑˈ**sy**hy	‘clean’ (IS)
(43)	ˈ**o**xpɑˌ**ðe**	‘somebody fell’ (IS)	(44)	ɑ̃ˈ**ki**kˀy	‘give it back to me’ (PF)
(45)	ɑˈ**bry**wĩ	‘buy something of you/one’s own back’ (IS)			

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