Quantity-Insensitive Iambs in Osage
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QUANTITY-INSENSITIVE IAMBS IN OSAGE[1]

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This paper presents evidence for the quantity-insensitive iamb. Although many extant prosodic theories predict that QI iambs exist (e.g., Prince and Smolensky 2004, McCarthy and Prince 1993, and Halle and 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 is also quantity-sensitive.

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

[KEYWORDS: Osage, stress/tone, iamb, foot typology, Optimality Theory]

1. Introduction. Hayes (1995) 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" (1995:268).

An example of a language described by Hayes that has the syllabic trochees is Gooniyandi (McGregor 1990; 1993, Kager 1992, and Elías-Ulloa 2006), where trochees are parsed left-to-right with stress surfacing on every

[1] First and foremost, I would like to thank Alan Prince for his encouragement and shared wisdom throughout my research on stress in Osage. Moreover, I thank Paul de Lacy and Akin Akinlabi for their guidance and insight. Special thanks to Carolyn Quintero—to whom this modest contribution is dedicated (you will be missed; thank you for everything)—and Bob Rankin for help with the Osage data and very enlightening discussions; without their help this paper would not have been possible. Many thanks to José Elías Ulloa, Carlos Fasola, Jeffrey Heinz, Paula Houghton, Brett Hyde, René Kager, Colin Wilson, and three anonymous *IJAL* reviewers for their comments on previous drafts. Finally, thanks to John Koontz, Nazarré Merchant, Sarah Murray, Michael O'Keefe, Vieri Samek-Lodovici, Marc van Oostendorp, Willem de Reuse, Curt Rice, Lisa Selkirk, Donca Steriade, Bruce Tesar, and the audiences at HUMDRUM 2006, RORG, RULing 1, and SCLC 25 for insightful discussions and questions that led to various revisions. I take full responsibility for any errors.

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odd-numbered syllable regardless of the moraic makeup 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*a*)	/LH/	→	(ˈ**L**H)	ˈ***nga****bo:*	'father'
(1*b*)	/LL/	→	(ˈ**L**L)	ˈ***ba****ga*	'burr'
(1*c*)	/HL/	→	(ˈ**H**L)	ˈ***bo:l****ga*	'owl'
(1*d*)	/HH/	→	(ˈ**H**H)	ˈ***do****:mbo:*	'old man'
(1*e*)	/LLLH/	→	(ˈ**L**L)(ˌ**L**H)	ˈ***ja****mbin*ˌ***ba****ro:*	'a type of fish'
(1*f*)	/LHHH/	→	(ˈ**L**H)(ˌ**H**H)	ˈ***ba****bo:*ˌ***ddo****:nggo:*	'to the bottom'
(1*g*)	/LLLL/	→	(ˈ**L**L)(ˌ**L**L)	ˈ***ngi****ddi*ˌ***warn****di*	'across'

Much of the literature[2] on metrical theory over the past three decades has attempted to address the question of whether the lack of QUANTITY-INSENSITIVE (QI) iambs—the iambic counterparts to trochees in (1)—reflects a fundamental property of grammar. It is difficult to rule out the iambs in (2*a*), while at the same time predicting that a language can have the trochees in (2*b*).

(2*a*) *(Hˈ**L**), *(Hˈ**H**)

(2*b*) (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. From this viewpoint, language x differs from language y in its selection of foot types from this inventory (see, e.g., Hayes 1985; 1987; 1995 and McCarthy and Prince 1986). If this inventory does not include the iambs in (2*a*), then it is predicted that no natural language has feet of this type (see Hayes's 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 results from the interaction of Optimality Theorietic constraints (see Prince and Smolensky 2004 and McCarthy and Prince 1993*a*; 1993*b*; 1995). From this viewpoint, 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 (2*a*), the set of constraints must be defined in such a way that these foot types are HARMONICALLY BOUNDED by an optimal parse in every language (see Prince and Smolensky 2004 and Prince and Samek-Lodovici 2002). To the best of my knowledge, no Optimality Theoretic account of feet has been

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

	LEFT-TO-RIGHT 32 languages	RIGHT-TO-LEFT 13 languages
STRICTLY BINARY 29 languages	(*a*) ('σσ)(ˌσσ) (*b*) ('σσ)(ˌσσ)σ 14 languages (e.g., Pintupi)	(*c*) (ˌσσ)('σσ) (*d*) σ(ˌσσ)('σσ) 12 languages (e.g., Warao)
BINARY & UNARY 25 languages	(*e*) ('σσ)(ˌσσ) (*f*) ('σσ)(ˌσσ)(ˌσ) 18 languages (e.g., Murinbata)	(*g*) (ˌσσ)('σσ) (*h*) (ˌσ)(ˌσσ)('σσ) 1 language (Biangai)

FIG. 1.—Quantity-insensitive trochees (languages from Gordon 2002).

	LEFT-TO-RIGHT 4 languages	RIGHT-TO-LEFT 5 languages
STRICTLY BINARY 3 languages	(*i*) (σ'σ)(σˌσ) (*j*) (σ'σ)(σˌσ)σ 3 languages (e.g., Araucanian)	(*k*) (σˌσ)(σ'σ) (*l*) σ(σˌσ)(σ'σ) unattested
BINARY & UNARY 6 languages	(*m*) (σ'σ)(σˌσ) (*n*) (σ'σ)(σˌσ)(ˌσ) 1 language (e.g., Ojibwa)	(*o*) (σˌσ)(σ'σ) (*p*) (ˌσ)(σˌσ)(σ'σ) 5 languages (e.g., Weri)

FIG. 2.—Quantity-insensitive iambs (languages from Gordon 2002).

successful in this regard (however, see Eisner 1997 for a different competition-based theory of feet). For example, Kager (2007) argues that the eight unidirectional quantity-insensitive systems in figures 1 and 2 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 (see also Gordon 2002).

The major problem with a theory that derives the typology above is that none of the attested languages in figure 2 have the iambs in (2*a*), i.e., (H'**L**) and (H'**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 (Kager 1989, Hayes 1995, and Alber 2005).[3] Finally, the existence of QI iambs in the languages above has not been phonetically verified (Gordon 2002). Therefore, a theory that derives

[3] Brett Hyde (personal communication) notes that of the QI iamb parses in figure 2, (*j*) and (*p*) are the most convincing, partly because they also show up in QS systems in forms whose syllables are all underlyingly light. On the other hand, parses such as (*n*) are more questionable. Ojibwa (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

the typology above lacks an empirical basis, and it remains an open question whether it overgenerates (see de Lacy 2007 for more discussion).

The aim of this paper is to argue that any typological theory of feet should predict the QI iambs in (2*a*). The argument rests on data from Osage (Quintero 1997; 1994*a*; 1994*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; I show that Osage fills the empirical gap that is inherent in a typology that results from the interaction of prosodic constraints in Prince and Smolensky (2004) and McCarthy and Prince (1993*a*; 1993*b*; 1995).

The default stress pattern in Osage has primary stress on the peninitial syllable, followed by secondary stress on every other syllable:[5]

(3*a*) /pa:xo/ → [pa:ˈ**xo**]
mountain
'mountain' (MOJ; Quintero 1977)

(3*b*) /hi:ða:/ → [hi:ˈ**ða:**]
bathe
'bathe' (Quintero, personal communication)

(3*c*) /nã:lõxa/ → [nã:ˈ**lõ**xa]
undercover
'undercover, sneak' (MOJ; Quintero 1977)

(3*d*) /ka:sa:ki/ → [ka:ˈ**sa:**ki]
knock.someone.out
'knock someone out' (MOJ; Quintero 1977)

final syllable of odd-parity forms—there are also a number of very plausible alternative analyses (Alber 2005). This pattern has also been claimed for Central Alaskan Yupik, but there the final stress in odd-parity forms is limited to non-phrase-final position and is described as much weaker than the others.

[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).

[5] Following Quintero (2004), I represent the Osage orthography in terms of the IPA. Moreover, I use the following abbreviations in the glosses: PREV = preverb; LOC = locative; VAL = valence; REFL = reflexive; SUUS = reflexive possessive; IMPER = imperative; A1S = agent first-person singular; A2S = agent second-person singular; A1P = agent first-person plural; P1S = patient first-person singular; P2S = patient second-person singular; P3P = patient third-person plural.

(3*e*) /xõ:t͡se-o-ði:-brã/ → [xõ:ˈ**t͡so**ði:ˌ**brã**]
cedar-LOC-by.hand-smell
'smoke cedar' (Quintero 2004)

(3*f*) [a-wa-kik-ða:xuɣe] → [aˈ**wa**la:ˌ**xy**ɣe]
A1S-P3P-SUUS-crunch
'I crunch up my own (e.g., prey) with teeth' (Quintero 2005)

An alternative hypothesis is 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 4); primary stress never surfaces on a syllable other than the first two (i.e., the "window" for primary stress is the first two syllables).

(4*a*) /ˈ**ʃta**ke/ → [ˈ**ʃta**ke]
warm
'warm' (MOJ; Quintero 1977)

(4*b*) /ˈ**za**:ni/ → [ˈ**za**:ni]
all
'all' (MREI; Quintero 2000)

(4*c*) /ˈ**a**:lĩ:/ → [ˈ**a**:lĩ:]
chair, seat
'chair, seat' (MREI; Quintero 2000)

(4*d*) /ˈ**o**we:nã/ → [ˈ**o**we:ˌ**nã**]
grateful
'grateful' (MREI; Quintero 1994*a*)

(4*e*) /ˈ**ʰka**wa-a-lĩ:/ → [ˈ**ʰka**wa-a:ˌ**lĩ:**]
horse-upon-sit
'horseback riding' (FH; Quintero 1994*a*)

(4*f*) /ˈ**o**nãlĩpi/ → [ˈ**o**nãˌ**lĩ**pi]
hurry up
'hurry up' (FH; Quintero 1994*a*)

(4*g*) /ˈ**o**ðy:tsake/ → [ˈ**o**ðy:ˌ**t͡sa**ke]
lazy
'lazy' (MOJ; Quintero 1997)

However, upon a closer inspection, it is clear that this alternative hypothesis is inconsistent with the Osage data: a default position can host a distinction between underlyingly stressed and underlyingly unstressed syllables, whereas a nondefault position cannot, since it can only host lexically stressed syllables. 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., (3), are parsed as iambs from left-to-right (see 5). And, crucially, the vowel length distinction in these forms is not a factor in the placement of stress.

(5*a*)	*pa:*ˈ***xo***	(Hˈ**L**)	'mountain'
(5*b*)	*hi:*ˈ***ða****:*	(Hˈ**H**)	'bathe'
(5*c*)	*nã:*ˈ***lõ****xa*	(Hˈ**L**)L	'undercover, sneak'
(5*d*)	*ka:*ˈ***sa****:ki*	(Hˈ**H**)L	'knock someone out'
(5*e*)	*xõ:*ˈ***t͡so****ði:*ˌ***brã***	(Hˈ**L**)(Hˌ**L**)	'smoke cedar'
(5*f*)	*a*ˈ***wa****la:*ˌ***xy****ɣe*	(Lˈ**L**)(Hˌ**L**)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).

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 (5) are parsed in 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 noninitial stress constraint that makes bizarre typological predictions.

The main contribution of this paper can be summarized as follows: it explores the phonetic structures of stress in Osage and provides the first 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 is 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.

	Labial	Dental	Alveolar	Post-Alveolar	Velar	Glottal
Plosives	*p*, *ʰp*, *p'*, *b*	*t̪*, *ʰt̪*			*k*, *ʰk*, *k'*	
Nasals	*m*	*n*				
Fricatives		*ð̪*	*s*, *z*	*ʃ*, *ʒ*	*x*, *ɣ*	*h*
Affricates			*t͡s*, *ʰt͡s*, *t͡sʰ*, *t͡s'*			
Approximants	*w*	*l*				

FIG. 3.—Osage consonants.

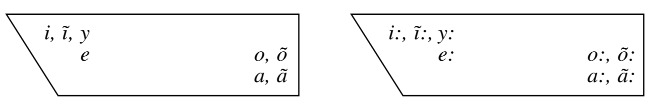

FIG. 4.—Osage vowels.

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; 1994*a*; 1994*b*; 2001) and a grammar of Osage (Quintero 2004). Moreover, an Osage story (Quintero 2005) is used to supplement the data where needed.

2.2. Consonants and vowels. Figure 3 illustrates Osage consonants (Quintero 2004:16–37) and figure 4 illustrates Osage vowels (Quintero 2004:16–37). 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 I argue in **4** that the vowel length distinction is not a factor in placement of stress.

oʰka	‘help’	***ãk****-oʰka*	‘we help him/her’
aðe:	‘go’	***ãk****-aðe:*	‘we go’
ða:t͡sʰe	‘eat’	***ã****-ða:t͡sʰe*	‘we eat’
tõpe	‘look’	***ã****-tõpe*	‘we look’

FIG. 5.—Phonological process of *k*-deletion before a consonant.

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*
	χ		*p, t*	*xp, xt*
	s		*p, t, k*	*sp, st, sk*

FIG. 6.—Obstruent clusters in Osage.

2.3. Syllable structure and obstruent clusters. According to Quintero (2004), the syllabic template for Osage is: ((C)C)V(:). Evidence for this view comes from the fact that there are no word-final consonants in Osage and no known phonological processes indicate syllabification of medial consonants as coda instead of onset. Figure 5 provides further evidence: Osage has a phonological process of *k*-deletion before a consonant.

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

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). 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, is not discussed here. Moreover, while duration may be a cue for stress, it is not discussed here either (see

Altshuler 2006 for preliminary measurements) because 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.

The argument presented in this section 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 (6), 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 even-numbered syllable carries secondary stress. In sum, stress always alternates; there is neither clash nor lapse.[6]

(6*a*) [ˈ**σ**σˌ**σ**σ . . .]

(6*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, (7) illustrates that as a word becomes more morphologically complex, the iambic pattern is preserved (see **4.2** for more discussion):[7]

(7*a*) /a-t͡sʰi/ → [aˈ**t͡sʰi**]
PREV-arrive.here
'arrive here' (Quintero 2004)

(7*b*) /a-ðĩ-a-t͡sʰi/ → [aˈ**brĩ**aˌ**t͡sʰi**]
PREV-have-PREV-arrive.here
'I bring/brought it' (Quintero 2004)

(7*c*) /a-wi-ðĩ-a-t͡sʰi/ → [aˈ**wi**brĩˌ**a**t͡sʰi]
PREV-I.to.you-have-PREV-arrive.here
'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 (8), or peninitial stress, as in (9):

[6] 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 Appendix A). Therefore, the hypothesis that stress alternates is based on words with no more than two stressed syllables (i.e., first and third and second and fourth).

[7] According to Quintero (2004), the forms in (7*b*) and (7*c*) are syncopating verbs. They exhibit a pattern of inflection that is common in the ð-stem verbs. The contrast of syncopating verbs with regular verbs occurs only in the first person, as in the data above, or in the second person (see Quintero 2004:107–8 for more discussion).

(8) *ˈ**i:**xa* ‘laugh’ (FH; Quintero 1994*b*)
(9) *pa:ˈ**xo*** ‘mountain’ (MOJ; Quintero 1977)

The phonetic measurements also reveal that Osage distinguishes high tones (*ℋ*) from low tones (*ℒ*). More specifically, *ℋ* falls on stressed syllables and on unstressed initial syllables, while *ℒ* falls on all other unstressed syllables. The generalization in (10) summarizes the correlation between stress and tone in Osage.

(10) CORRELATION BETWEEN STRESS AND TONE
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; 1994*a*; 1994*b*; 2001); the tapes were digitized by Paul de Lacy at mono 16-bit 44100k Hz 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). Note that all of the words produced by MOJ are in isolation; the words produced by the other two speakers vary in their 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 Appendix A, where the context of each measured word is provided).

Acoustic analysis was completed using Praat (Boersma and Weenink 2007). The analysis consisted in measuring the f0 of each peak and trough by using Praat’s MAX and MIN functions over the duration of each vowel, which was measured from the offset of the prevocalic consonant to the vowel offset (Peterson and 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. The results of the experiment are discussed below.

Figure 7 illustrates that f0 values for every syllable in words with initial stress are provided. These values suggest that Osage uses f0 to distinguish alternating stressed syllables. Note that words with vowels of different length and different number of syllables have been collapsed into the same table since their f0 values do not reliably differ.

Figure 8 illustrates statistical pair-wise comparison results of the f0 values; these results apply for all three speakers. More specifically, figure 8 illustrates that f_0 is significantly greater in the first syllable compared to the second; likewise when the third syllable is compared to the second.

Figure 9 illustrates f0 values for every syllable in words with peninitial stress. Although these values suggest that Osage uses f0 to distinguish unstressed

Speaker	1ST σ	2ND σ	3RD σ
MOJ (31 words)	206.2 Hz	126.9 Hz	157.35 Hz
FH (14 words)	202.43 Hz	128 Hz	152.96 Hz
MREI (17 words)	167.13 Hz	121.66 Hz	137.72 Hz

FIG. 7.—Average f_0 values for each syllable in words with initial stress.

	1ST σ	2ND σ	3RD σ
1ST σ		$p < .05$	n.s.
2ND σ			$p < .05$
3RD σ			

FIG. 8.—Statistical pairwise comparison results for each speaker.

Speaker	1ST σ	2ND σ	3RD σ	4TH σ
MOJ (39 words)	201.98 Hz	204.04 Hz	127.39 Hz	155.03 Hz
FH (19 words)	197.69 Hz	201.24 Hz	130.64 Hz	147.53 Hz
MREI (34 words)	157.23 Hz	156.09 Hz	113.64 Hz	130.01 Hz

FIG. 9.—Average f_0 values for each syllable in words with peninitial stress.

	1ST σ	2ND σ	3RD σ	4TH σ
1ST σ		n.s.	n.s.	n.s.
2ND σ			$p < .05$	n.s.
3RD σ				$p < .05$
4TH σ				

FIG. 10.—Statistical pairwise comparison results for each speaker.

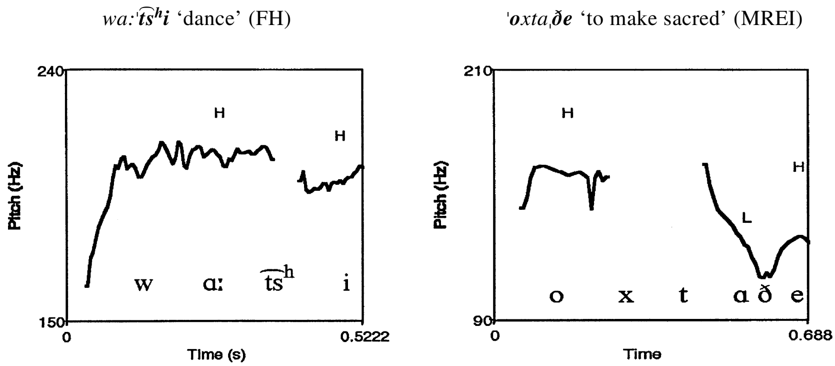

FIG. 11

noninitial syllables from secondary stressed syllables (compare the values for the third and fourth syllables) as well as stressed peninitial syllables from unstressed noninitial syllables (compare the values for the second and third syllables), the same cannot be said for unstressed initial syllables and stressed peninitial syllables. When the f_0 values for the first syllable are compared to the f_0 values for the second syllable, the results are not significant for all three speakers; see figure 10.

However, it is important to note that for all three speakers the f0 values in the first syllable of words with initial stress are higher than the f0 values in the first syllable of words with peninitial stress (cf. shaded cells in figures 8 and 10). This difference is statistically significant for MREI ($p < .05$) and is quite plausibly attributed to stress on the initial syllable of words in figure 8 and the lack thereof in figure 10. Moreover, the seeming discrepancy in f0 values between unstressed initial syllables and stressed peninitial syllables in figure 9 can be explained by the fact that there appears to be tonal downdrift (or declination) in Osage.[8] For example, figure 11 shows declination both in a disyllabic word where the syllables have $\mathcal{H}$ tones and in a three-syllable word where the first and third syllables have $\mathcal{H}$ tones.

In general, 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. Con-

[8] As noted by an anonymous reviewer, one can also assume that the lower f0 on secondary stressed syllables is attributed to the lower degree of stress as opposed to declination; the tone system assigns high tone to the initial syllable and the raised f0 values on stressed syllables are imposed by the stress system. Moreover, the steep drop in f0 on secondary stressed syllables could plausibly be analyzed as downstep attributed to a HL tone associated with the primary stress. Therefore, we do not really know whether the absence of higher f0 on the peninitial syllable relative to the first one in words with peninitial stress is really due to declination. In any case, it is not crucial here which analysis is adopted, since the main point of this subsection is to demonstrate that stress falls on alternating syllables.

sequently, if we increase the f_0 values for the peninitial syllable by 20 Hz, the resulting values become significantly greater than the f_0 values for the initial syllable, for all three speakers ($p < .05$).

In sum, the phonetic experiment presented in this section reveals that Osage uses f0 to distinguish alternating stressed syllables. More specifically, Osage has the following 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. Moreover, the experiment reveals that 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 nonheads); 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 nonhead. 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 will be argued to exemplify a QI iambic pattern. These facts should be predicted by either analysis.

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 make a difference. Therefore, there are two possible underlying forms of monosyllabic roots and prefixes, and four possible underlying forms for disyllabic roots (see 11).[9]

[9] Without any evidence to the contrary, I assume that Osage does not have lexical secondary stress, which is extremely rare cross-linguistically (however, see Liberman and Prince 1977 and Kager 1989 for discussion of secondary stress in English; also see Hayes 1995 for a discussion of Fijian).

(11) POSSIBLE UNDERLYING FORMS
Monosyllabic roots and prefixes: /σ/ or /'**σ**/
Disyllabic roots: /σσ/, /'**σ**σ/, /σ'**σ**/, /'**σ**'**σ**/

In this section, an argument is presented which shows 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. Initial stress is not the default. The hypothesis defended in this paper states that surface forms with primary stress on the initial syllable are lexically specified for stress (default-defying), whereas surface forms with primary stress on the peninitial syllable (default-obeying) are not. This hypothesis is consistent with the data below: the stress on the odd-numbered syllables in (12*a*) is due to the lexical stress on the P3P suffix.

(12*a*) /'**wa**-ða:wa/ → ['**wa**ða:ˌ**wa**]
P3P-count
'to count them' (Quintero 2004)

(12*b*) /wa-ða:wa/ → [wa'**ða:**ðwa]
VAL-count
'to count things/stuff' (Quintero 2004)

Another hypothesis would be to say 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. In this subsection, this hypothesis is refuted based on the affixal alternation patterns in Osage. For example, consider (13) and (14), where the P3P and the VAL prefixes must be lexically stressed according to this hypothesis, since the second syllable is stressed on the surface in both cases. The same is true in (15), where the second syllable of the verb *ða:wa* ('to count') must be lexically stressed given the surface representation.

(13) /ða-'**wa**-k'y/ → [ða'**wa**k'y]
A2S-P3P-give
'you are giving it to them' (Quintero 2004)

(14) /ãk-'**wa**-mã:ðõ/ → [ã'**wa**mã:ˌ**ðõ**]
A1P-VAL-steal
'we (two) stole things/stuff' (Quintero, p.c.)

(15) /ða:'**wa**/ → [ða:'**wa**]
count
'to count' (Quintero 2004)

Given the underlying forms in (13)–(15), the different surface representations in (16) must have the same underlying forms. Therefore, an inconsistent grammar is predicted.[10] This would be true even if the verb in (13) had lexical stress on both syllables; the forms in (16) would still have identical underlying forms.

(16*a*) */ˈ**wa**-ða**:**ˈ**wa**/ → [ˈ**wa**ða:ˌ**wa**]
P3P-count
'to count them' (Quintero 2004)

(16*b*) */ˈ**wa**-ða**:**ˈ**wa**/ → [waˈ**ða:**wa]
VAL-count
'to count things/stuff' (Quintero 2004)

With no evidence to the contrary (e.g., from long monomorphemic words, loanwords, nonce words, or other morphophonology), I conclude that the default pattern in Osage cannot be initial stress.[11] Instead, the default is peninitial stress; the difference between (16*a*) and (16*b*) is that the P3P prefix is lexically stressed and the VAL prefix is not. In the next section, I show that this hypothesis is consistent with other Osage data, which is predicted by the

[10] 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. Therefore, an inconsistent grammar is predicated.

(*ii*) /ˈ**wa**-ða:ˈ**wa**/ → [waˈ**ða:**wa]
VAL-count
'to count things/stuff' (Quintero 2004)

(*iii*) /ˈʰ**ki**k-ða:ˈ**wa**/ → [ˈʰ**ki**la:ˌ**wa**]
REFL-count
'to count yourself' (Quintero 2004)

[11] In light of this view, an anonymous reviewer asked 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 phonology of Osage treats the iambic stress pattern as default; this claim is distinguished from lexical frequency (see Pinker et al. 1992, Pinker 2006, and de Lacy 2008 for more discussion).

interaction between faithfulness constraints preserving lexical stress and markedness constraints that require a certain prosodic structure.

4. 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 (17)–(20), which illustrate that Osage has every possible arrangement of heavy and light syllables within a foot (for a complete list of data, see Appendix A). Here we see LHL, HHL, HLL, and LLL sequences, but stress differs in its location, showing that a weight distinction among the syllables is not a factor in placement of stress.

(17) LHL SEQUENCES

(17*a*) *o*ˈ***ʰta:****za* (Lˈ**H**)L ‘good-looking’ (MOJ; Quintero 1977)
(17*b*) *a*ˈ***wa:****ta* (Lˈ**H**)L ‘I plea/pray’ (MOJ; Quintero 1977)
(17*c*) ˈ***o****we:*ˌ***nã*** (ˈ**L**)(H,**L**) ‘grateful’ (MREI; Quintero 1994*a*)
(17*d*) ˈ***a****nã:*ˌ***ʒĩ*** (ˈ**L**)(Hˌ**L**) ‘step on it’ (MOJ; Quintero 1977)

(18) HHL SEQUENCES

(18*a*) *ka:*ˈ***sa:****ki* (Hˈ**H**)L ‘knock someone out’ (MOJ; Quintero 1977)
(18*b*) *ka:*ˈ***mã:****pe* (Hˈ**H**)L ‘it rings’ (Quintero 2004)
(18*c*) ˈ***ho:****sa:*ˌ***ki*** (ˈ**H**)(HˌL) ‘he yells’ (Quintero 2004)

(19) HLL SEQUENCES

(19*a*) *ðy:*ˈ***le****ke* (Hˈ**L**)L ‘break into’ (MOJ; Quintero 1977)
(19*b*) *hy:*ˈ***wa****lĩ* (Hˈ**L**)L ‘many, a lot’ (MOJ; Quintero 1977)
(19*c*) ˈ***to:****t͡se*ˌ***hã*** (ˈ**H**)(LˌL) ‘a glutton’ (MOJ; Quintero 1977)
(19*d*) ˈ***ha:****kxã*ˌ***ta*** (ˈ**H**)(LˌL) ‘when’ (MOJ; Quintero 1977)

(20) LLL SEQUENCES

(20*a*) *wa*ˈ***ʰkõ****ta* (Lˈ**L**)L ‘good-looking’ (MOJ; Quintero 1977)
(20*b*) *ʒɪ*ˈ***kã****ʒi* (Lˈ**L**)L ‘child’ (FH; Quintero 1994*a*)
(20*c*) ˈ***a****mã*ˌ***ʃi*** (ˈ**L**)(LˌL) ‘up’ (MOJ; Quintero 1977)
(20*d*) ˈ***o****xta*ˌ***ðẽ*** (ˈ**L**)(LˌL) ‘make sacred’ (MREI; Quintero 1994*a*)

In the next section, iambs of the form (Hˈ**L**) and (Hˈ**H**) are produced 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 (21), which are crucial in restricting the typology of foot types (see Prince 1983, Hayes 1987, and Selkirk 1995).[12]

(21*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).

(21*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).

(21*c*) Feet are maximally binary, e.g., [(σˈ**σ**σ)] 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 (22), are predicted by the interaction of the constraints in (23).

(22) /opawĩɣe/ → (oˈ**pa**)(wĩˌɣ**e**) 'joy-ride' (FH; Quintero 1994*a*)

(23*a*) IAMB
Incur a violation if a foot's head is not at its right edge (after Prince and Smolensky 2004).

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

(23*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 and Prince 1993*b*).

(23*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 and Prince 1993*b*).

Figure 12 illustrates that the head foot is at the left edge as opposed to the right edge given the ranking HFL >> HFR. Moreover, feet are right-headed as opposed to left-headed given the ranking IAMB >> TROCHEE.[13]

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

[13] 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).

	/opawĩγe/	HFL	Iamb	HFR	Trochee	Remarks
☞	(*o*ˈ***pa***)(*wĩ*ˌ***γe***)			1	2	iambic parse; head foot at left edge
a.	~ (*o*ˌ***pa***)(*wĩ*ˈ***γe***)	1 **W**		0 **L**	2	head foot at right edge
b.	~ (ˈ***o****pa*)(ˌ***wĩ****γe*)		2 **W**	1	0 **L**	trochaic parse

Fig. 12

Finally, I assume that default-obeying forms in Osage that have an odd number of syllables, as in (24), are predicted by the interaction of the constraints in (25); (25*c*) and (25*d*) 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.

(24) /a-wa-kik-ða:xuγe/ → (aˈ**wa**)(la:ˌ**xy**)γe
A1S-P3P-SUUS-crunch

'I crunch up my own (e.g., prey) with teeth'

(25) Markedness constraints

(25*a*) Parse-σ
Incur a violation for every syllable that is not parsed into a foot (after Prince and Smolensky 2004).

(25*b*) FtBin-σ
Incur a violation for every foot that is less than two syllables (after Prince and Smolensky 2004 and Elías-Ulloa 2006).

(25*c*) AFL
Aligh (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 and Prince 1993*b*).

(25*d*) AFR
Aligh (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 and Prince 1993*b*).

Figure 13 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.

In sum, the default-obeying forms in Osage are predicted by the rankings in figure 14.

	/a-wa-kik-ða:xuɣe/	FTBIN-σ	PARSE-σ	AFL	AFR	REMARKS
☞	(*a*ˈ***wa***)(*la:*ˌ***xy***)*ɣe*		1	2	4	stray syllable
a.	~ (*a*ˈ**wa**)*la:*(*xy*ˌ*ɣe*)		1	3 **W**	3 **L**	left edge
b.	~ (*a*ˈ**wa**)*la:xyɣe*		3 **W**	0 **L**	3 **L**	three stray syllables
c.	~ (*a*ˈ**wa**)(*la:*ˌ**xy**)(ˌ**ɣe**)	1 **W**	0 **L**	6 **W**	4	monosyllabic foot

FIG. 13

IAMB	HFL	FTBIN-σ
|	|	|
TROCHEE	HFR	PARSE-σ
		|
		AFL
		|
		AFR

FIG. 14

4.1. The quantity-insensitive iamb. As was illustrated in the previous section and repeated below in (26) and (27), Osage has iambs of the form (Hˈ**L**) and (Hˈ**H**).

(26) /wa:t͡sʰi/ → [wa:ˈ**t͡sʰi**] (Hˈ**L**)
dance

‘dance’ (FH; Quintero 1994*a*)

(27) /hi:ða:/ → [hi:ˈ**ða:**] (Hˈ**H**)
bathe

‘bathe’ (Quintero, p.c.)

The parses above are predicted by ranking a faithfulness constraint that prohibits quantity adjustments of syllable weight (see 28) over markedness constraints that induce quantity adjustments of syllable weight (see 29).

(28) FAITHFULNESS CONSTRAINT
IDENT(LENGTH)
Incur a violation if, for a vowel’s length, x in the input is not faithful to its output correspondent (after McCarthy and Prince 1993*b*).

	/wa:t͡sʰi/	IDENT(L)	WTS	STW	REMARKS
☞	(*wa:*ˈ***t͡sʰĩ***)		1	1	heavy σ unstressed; stress on light σ
a.	~ (*wa*ˈ***t͡sʰi:***)	2 **W**	0 **L**	0 **L**	F: length

FIG. 15

	/hi:ða:/	IDENT(L)	WTS	STW	REMARKS
☞	(*hi:*ˈ***ða:***)		1	0	heavy σ unstressed
a.	~ (*hi*ˈ***ða:***)	1 **W**	0 **L**	0	F: length

FIG. 16

	/wa:t͡sʰi/	IAMB	TROCHEE	WTS	STW	REMARKS
☞	(*wa:*ˈ***t͡sʰĩ***)		1	1	1	heavy σ unstressed; stress on light σ; iambic parse
a.	~ (ˈ***wa:****t͡sʰĩ*)	1 **W**	0 **L**	0 **L**	0 **L**	trochaic parse

FIG. 17

(29) MARKEDNESS CONSTRAINTS

(29*a*) WEIGHTTOSTRESS (WTS)
Incur a violation if a heavy syllable is unstressed (after Prince 1990).

(29*b*) STRESSTOWEIGHT (STW)
Incur a violation if a stressed syllable is light (after Halle and Vergnaud 1987), Prince and Smolensky 2004, and Kager 1999).

Figures 15 and 16 illustrate 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. Figure 17 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. In summary, feet of the form (Hˈ**L**) and (Hˈ**H**) are predicted by the rankings below:

(30) RANKINGS

(30*a*) IDENT(L) >> {WTS, STW}

(30*b*) IAMB >> {TROCHEE, WTS, STW}

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 (31) illustrates the WINDOW EFFECTS in Osage: when lexical stress is not within the first two syllables (i.e., the "window"), primary stress surfaces on the second syllable by default.

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

Note that the fourth syllable is lexically stressed in (31) given the surface form in (32), where primary stress surfaces on the initial syllable; the third syllable is not specified for stress in (31) given the surface form in (33), where the initial syllable is not stressed; the second syllable in (31) is not specified for stress given the surface form in (34), where the initial syllable is not stressed; the first syllable in (31) is not specified for stress given that it is not stressed on the surface.[14]

(32) /ˈ**xpa**ðe/ → [ˈ**xpa**ðe]
separate
'to separate' (Quintero 2004)

(33) /ði- ˈ**kˀy**/ → [ðiˈ**kˀy**]
P2S-give
'give to you' (Quintero 2004)

(34) /o-ˈ**xpa**ðe/ → [oˈ**xpa**ðe]
LOC-separate
'to lose' (Quintero 2004)

Figure 18 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.

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 (35).

[14] The 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).

	/ãk-o-ði-ˈ**xpa**ðe/	FtBin-σ	Iamb	Parse-σ	Trochee	Remarks
☞	(*ã*ˈ***ko***)(*ði*ˌ***xpa***)*i*			1	2	F: stress; stray σ
a.	~ (ˈ***ã***)(*ko*ˌ***ði***)(*xpa*ˌ***i***)	1 **W**		0 **L**	2	monosyllabic foot
b.	~ (ˈ***ã****ko*)(*ð*ˌ*i**xpa***)*i*		2 **W**	1	0 **L**	trochaic parse

Fig. 18

	/wa-py-ˈ**ʃta**ha/	HFL	Iamb	FtBin-σ	Parse-σ	Ident(ˈV)	Remarks
☞	(*wa*ˈ***py***)(*ʃta*ˌ***ha***)					1	default pattern; delete stress on V3
a.	~ (ˈ***wa***)(*py*ˌ***ʃta***)*ha*			1 **W**	1 **W**	0 **L**	monosyllabic foot
b.	~ (*wa*ˈ***py***)(ˌ***ʃta****ha*)		1 **W**			0 **L**	trochaic parse
c.	~ *wa*(*py*ˈ***ʃta***)*ha*	1 **W**			2 **W**	0 **L**	misaligned head foot

Fig. 19

(35) Ident(ˈV)
Incur a violation if a stressed vowel in the input does not correspond to a stressed vowel in the output (after McCarthy and Prince 1995).

Although (35) does not play an active role in predicting the optimal candidate in figure 18, things are different when forms like (36) are considered. Here we see that the third syllable carries lexical stress (cf. ˈ***ʃta****ha* 'smooth'), but only the even syllables are stressed on the surface.

(36) /wa-py-ˈ**ʃta**ha/ → (*wa*ˈ***py***)(*ʃta*ˌ***ha***)
val-by.pressing-smooth
'iron clothes' (MOJ; Quintero 1977)

Figure 19 illustrates various candidates which, unlike the optimal candidate, faithfully map lexical stress as either primary or secondary. These candidates 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.

The final issue concerning "window" effects that is addressed in this section involves five-syllable words like those in (37), where lexical stress is word-final.[15]

[15] 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; it needs the preverbal prefix *a*-). Therefore, this form should be seen as hypothetical—used for the purposes of illustrating that AFL >> Ident(ˈV).

	/a-wi-ðʰĩ-a-ˈ**t͡sʰi**/	AFL	IDENT(ˈV)	REMARKS
☞	*(aˈ**wi**)(brĩˌ**a**)t͡sʰi*	2	1	default pattern; delete stress on V5
a.	~ *(aˈ**wi**)brĩ(aˌ**t͡sʰi**)*	3 **W**	0 **L**	misaligned feet

FIG. 20

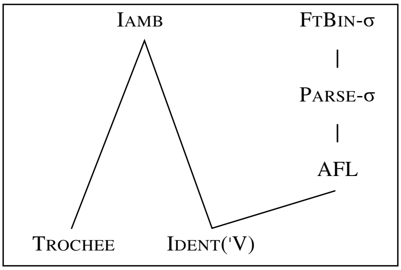

FIG. 21

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

Figure 20 illustrates a failed candidate that faithfully maps its lexical stress as secondary (see *a*). Although it avoids a violation of IDENT(ˈV), it has a disyllabic foot at the right edge of the prosodic word and thus violates AFL three times, motivating the ranking AFL >> IDENT(ˈV).

In summary, "window" effects result from the interaction between the faithfulness constraint IDENT(ˈV), which preserves lexical stress, and markedness constraints, which require a particular prosodic structure. In particular, "window" effects are predicted by the rankings in figure 21. Note that HFL is left out of the hierarchy below because there is no evidence in Osage about whether this constraint dominates IDENT(ˈV).

4.3. Competition within the "window." Consider the data in (38), where both the first and the second syllables are lexically specified for stress (cf. ˈ***nõ:**ʰpe* 'afraid').

(38) /ˈ**ĩ:**ˈ**nõ:**ʰpe-a/ → [ˈ**i:**nõ:ˌ**ʰpa**]
with-afraid-IMPER
'be careful!' (Quintero 2004)

	/ˈ**i:**-ˈ**nõ:**ʰpe-a/	IDENT(ˈV_1)	FTBIN-σ	IDENT(ˈV)	REMARKS
☞	(ˈ***i:***)(*nõ:*ˌʰ***pa***)		1	1	monosyllabic foot; delete stress
a.	~ (*i:*ˈ***nõ:***)ʰ*pa*	1 **W**	0 **L**	1	delete stress on V_1
b.	~ (ˈ***i:***)(ˈ***nõ:***)ʰ*pa*		2 **W**	0 **L**	two monosyllabic feet

FIG. 22

	/ˈ**nõ:**ʰpe/	IAMB	FTBIN-σ	REMARKS
☞	(ˈ***nõ:***)ʰ*pe*		1	monosyllabic foot
a.	~ (ˈ***nõ:***ʰ*pe*)	1 **W**	0 **L**	trochaic parse

FIG. 23

This lexical representation is reminiscent of vowel hiatus resolution involving deletion: in an environment such as V_1V_2, the grammar must choose which vowel to delete. 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 (39).

(39) 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).

Figure 22 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.

Interestingly, the initial foot must be monosyllabic in words with initial stress and an odd number of syllables, viz. the optimal candidate above; the only other available parse, namely (ˈ**σ**σ)(ˌ**σ**), is ruled out given that IAMB >> TROCHEE. This generalization is in accordance with Hayes's (1995) claim that monosyllabic feet must be in strong positions, i.e., at the head of a prosodic word. A question that arises, however, is how to parse words with an even number of syllables and initial stress. As illustrated in figure 23, 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.

However, figure 24 illustrates that even-numbered words with initial stress can also be parsed as trochees given the reverse ranking: FTBIN-σ >> IAMB.

	/ˈ**nõ:**^{h}pe/	IAMB	FTBIN-σ	REMARKS
☞	(ˈ***nõ:***^{h}*pe*)	1		trochaic parse
a.	~ (ˈ***nõ:***)^{h}*pe*	0 **L**	1 **W**	monosyllabic foot

FIG. 24

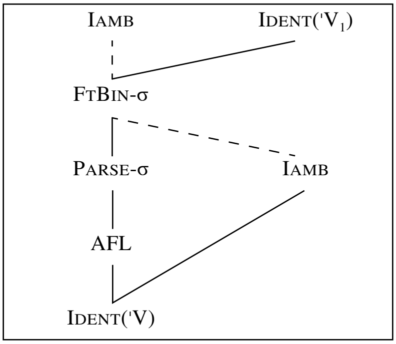

FIG. 25

Since IAMB dominates TROCHEE, the motivated ranking ensures that trochees are parsed only to avoid monosyllabic feet.

To the best of my knowledge, the Osage data do 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 are 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 figure 25. Note that IAMB appears in multiple places in the hierarchy (attached to a dashed line), reflecting the two possible rankings discussed above.

In the next section, an analysis of 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 (40) and (41) play the crucial role in predicting the distribution of tone and stress.

	/ˈ**i-nõ**hpe-a/	*NON-HD/𝓗	*HD/𝓛	REMARKS
☞	(ˈ***i***)(*nõ*ˌ***ʰpa***) 𝓗 𝓛 𝓗			perfect tonal grid
a.	~ (ˈ***i***)(*nõ*ˌ***ʰpa***) 𝓗	1 **W**		unstressed σ with an 𝓗
b.	~ (ˈ***i***)(*nõ*ˌ***ʰpa***) 𝓗 𝓛		1 **W**	stressed σ with an 𝓛

FIG. 26

(40) *NON-HD/𝓗
Nonhead syllables linked to an 𝓗 tone are prohibited (after de Lacy 2002).

(41) *HD/𝓛
Head syllables linked to an 𝓛 tone are prohibited (after de Lacy 2002).

Figure 26 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 to the stressed syllables and low tones are linked to unstressed syllables. The failed candidates in (*a*) and (*b*) are ruled out by the constraints in (40) and (41) respectively.

In order to predict the interaction between stress and tone in words with primary stress on the peninitial syllable, I propose the positional markedness constraint in (42):

(42) σ_1(𝓗)
Incur a violation if the first syllable in a prosodic word is not linked to an 𝓗 tone.

Figure 27 illustrates that the optimal candidate violates *NON-HD/𝓗 since the initial syllable is unstressed but bears a high tone. The failed candidate in (*a*) circumvents this violation by linking a low tone to the first syllable but, in doing so, incurs a violation of the constraint in (42). This motivates the ranking σ_1(𝓗) >> *NON-HD/𝓗.

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, I argue that a trochaic analysis is not feasible.

	/xõ:t͡se-o-ði:-brã/	σ1(𝓗)	*NON-HD/𝓗	REMARKS
☞	(*xõ:*'***t͡so***)(*ði:*ˌ***brã***) 𝓗 (xõ:t͡so) 𝓛 (ði:) 𝓗 (brã)		1	unstressed σ with 𝓗
a.	~ (*xõ:*'***t͡so***)(*ði:*ˌ***brã***) 𝓛 𝓗 𝓛 𝓗	1 **W**	0 **L**	initial σ with 𝓛

FIG. 27

5. Rejecting a trochaic analysis. 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 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. 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 43). Moreover, 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 44).

(43) /'**wa**-ða:wa/ → ('***wa****ða:*)(ˌ***wa***)
P3P-count

'to count them'

(44) /wa-ða:wa/ → *wa*('***ða:****wa*)
VAL-count

'to count things/stuff'

In order to predict the parses above, one could postulate the markedness constraint in (45), which requires the initial syllable to be stressed. Consequently, the stress in (43) surfaces on the initial syllable given that faithfulness to stress dominates the constraint in (45), while the stress in (44) surfaces on the second syllable in order to avoid a violation of (45), thereby invoking the initial extrametricality effect.

(45) *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 noninitial stress constraint, which unlike a nonfinal stress constraint (e.g., NonFinality in Prince and Smolensky 2004), 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, and Jacobs 1990) exemplifies final trochees but iambs elsewhere.

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., HLLˈHLH vs. ˈHLLL. 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).

Additionally, 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., (ˈH)(ˌLL) vs. L(ˈLL). 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 nonfinality, i.e., Latin-like stress with antepenultimate stress if the penult is light.

Finally, it is predicted that there should be 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 stress in Pintupi surfaces on odd-numbered syllables from the left, yet final syllables in odd-numbered words are never stressed (Hansen and Hansen 1969 and 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 nonquirky behavior of stress at the left edge has led many researches to doubt that the effect of initial extrametricality is best explained by a noninitial stress constraint. For example, van de Vijver (1998) argues that a noninitial stress constraint fails to make the correct predictions for extrametricality effects in Carib (see also Hyde 2001, where it is argued that a noninitial stress constraint does not exist and, therefore, any analysis that relies on it should be abandoned). Instead, van de Vijver proposes the constraint *Edgemost, which is violated by stressed syllables at either edge of the prosodic word.

To see the role that *Edgemost would play in the grammar of Osage, let us reconsider the forms in (43) and (44), repeated below in (46) and (47). One hypothesis would be to say that the stress in (46) surfaces on the initial syllable given that faithfulness to stress dominates *EDGEMOST, while the stress in (47) 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).

(46) /ˈ**wa**-ða:wa/ → (ˈ***wa****ða:*)(ˌ***wa***)
P3P-count
'to count them'

(47) /wa-ða:wa/ → *wa*(ˈ***ða:****wa*)
VAL-count
'to count things/stuff'

However, *EDGEMOST is unable to predict the Osage forms such as (48), where the final syllable carries secondary stress and thereby violates this constraint. That is, the parse in (48) is problematic since the undesired parse in (49) also violates *EDGEMOST once, but does not have stray syllables or monosyllabic feet.

(48) /xõ:t͡se-o-ði:-brã/ → *xõ:*(ˈ***t͡so****ði:*)(ˌ***brã***)
cedar-LOC-by.hand-smell
'smoke cedar'

(49) *(ˈ***xõ:****t͡so*)(ˌ***ði:****brã*)

To the best of my knowledge, the only way (48) could be predicted as being optimal over (49), given the Osage stress facts discussed in this paper, is if *INITIALSTRESS were invoked. However, as we have seen, this constraint makes odd typological predictions and ought to be avoided.

Finally, it is worth noting that Hayes (1995) analyzes Winnebago, a Siouan 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 cross-linguistically." Although Hayes's 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 noninitial stress constraint appears to be spurious even in the analysis of languages with initial extrametrical effects such as Winnebago.

In sum, a theory which adopts *INITIALSTRESS is not only far less predictive than the one advocated in this paper, it is an imposition on current stress theory. Moreover, it has been shown that an analysis that lacks such a constraint fails 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 can be predicted straightforwardly, using well-known constraints, with no burden to explain initial extrametricality effects. I therefore conclude that the trochaic analysis explored in this section should be rejected in favor of the iambic analysis.

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 have 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 and Smolensky (2004) and McCarthy and Prince (1993*a*; 1993*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 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 is also quantity-sensitive.

APPENDIX A

Corpus of Words Measured in Fundamental Frequency Study[16]

Myrtle Oberly Jones (all words produced in isolation)

(1)	*a*ˈ***wa:****ta*	‘I plea/pray’	(2)	ˈ***o****xta*	‘beloved, special, great’
(3)	*nã*ˈ***nu****hu*	‘tobacco’	(4)	*ʰpe:*ˈ***ʃta***	‘bald head’
(5)	*o*ˈ***ðo****pʃe*	‘Osage cradle’	(6)	*wa*ˈ***hy****ni*	‘arthritis’
(7)	*wa*ˈ***hy***	‘bone’	(8)	ˈ***wa:****t͡si* ˈ***ni****e*	‘venereal disease’
(9)	*o*ˈ***ʒã:****ke*	‘trail’	(10)	*pa:*ˈ***xo***	‘mountain’
(11)	*wa*ˈ***ʰle****ʰle*	‘flag’	(12)	*ka:*ˈ***sa:****ki*	‘knock someone out’
(13)	ˈ***wa:****la*ˌ***ke***	‘taboo’	(14)	*o*ˈ***ʒe****ʰt͡si*	‘outhouse, toilet room’
(15)	ˈ***ho****ni*	‘almost’	(16)	ˈ***wa:****spe*	‘to wait, stay’
(17)	ˈ***ni****ni*	‘cold, as food or drink’	(18)	ˈ***a****nã:*ˌ***ʒĩ***	‘step on it’
(19)	ˈ***za:****ni*	‘all’	(20)	ˈ***hĩ:****ke*	‘toothless’

[16] To describe the context of utterance, the following abbreviations are used: PI = Phrase-Initial, PM = Phrase-Medial, PF = Phrase-Final, IS = Isolation.

(21) *ðĩ*ˈ***ke*** 'none'
(22) *nãː*ˈ***lõ****xa* 'undercover, sneak'
(23) *o*ˈ***ʰtaː****za* 'good-looking'
(24) ˈ***ʃta****ke* 'warm'
(25) ˈ***kiː*** 'fly like a plane'
(26) ˈ***lã****ðe* 'big'
(27) *wa*ˈ***py****ʃka* 'beads'
(28) *wa*ˈ***ho****ʃt͡sa* 'little (diminutive)'
(29) *ã*ˈ***ka****t͡sʰi*ˌ***pe*** 'we come'
(30) ˈ***waː****li* 'really'
(31) ˈ***t͡so****ːpa* 'a little amount'
(32) *ði*ˈ***ʒo****ʒi* 'hurt somebody'
(33) *õ*ˈ***ki****ʰkãː* 'fan me off'
(34) ˈ***haː****kxã*ˌ***ta*** 'when'
(35) *sta*ˈ***ko*** 'neat'
(36) *ã*ˈ***ki****pʃe* 'they are combing my hair'
(37) ˈ***ni****wa*ˈ***ʰt͡se*** 'cold'
(38) *hyː*ˈ***ʃt͡seː*** 'tall'
(39) *mĩ*ˈ***t͡sʰo*** 'lion'
(40) *ðyː*ˈ***xta****ða*ˌ***pa͡ɪ*** 'they're tearing it down'
(41) ˈ***hã*** 'go ahead'
(42) ˈ***syʰ****ˌka*ˌ***ʰtaː*** 'turkey'
(43) ˈ***a****mã*ˌ***ʃi*** 'up'
(44) ˈ***we****t͡sʼa* 'snake'
(45) ˈ***heː*** 'lice'
(46) ˈ***ʰkeː*** 'turtle'
(47) ˈ***ʰtaː*** 'deer'
(48) ˈ***sĩ****ka* 'squirrel'
(49) *a*ˈ***ðĩ*** 'have; has it'
(50) *iʰ*ˈ***t͡sa****ʰtaː* 'rat'
(51) *ðyː*ˈ***le****ke* 'break into'
(52) *iː*ˈ***ða****ðe* 'I saw it'
(53) ˈ***toː****t͡se*ˌ***ha*** 'a glutton'
(54) *hĩː*ˈ***ʃa*** 'Caddo'
(55) *wi*ˈ***ki****sy*ˌ***ðe*** 'I remember you'
(56) ˈ***o****ðyː*ˌ***t͡sa****ke* 'lazy'
(57) *ðiː*ˈ***ʰtã*** 'grasp, handle, knead'
(58) *hyː*ˈ***wa****lĩ* 'many, a lot'
(59) ˈ***tãː****ska* 'whatchucallit'
(60) *wa*ˈ***py****ʃta*ˌ***ha*** 'iron clothes'
(61) *wa*ˈ***ʃi*** 'bacon'
(62) ˈ***he****xpa* 'bushy head'
(63) ˈ***ĩː****ʰtõ* 'earrings'
(64) *ã*ˈ***kʼy****mã*ˌ***ði*** 'go get it for me'
(65) *mãː*ˈ***ðõ*** 'steal'
(66) ˈ***ʰpe****ɣe* 'gourd'
(67) ˈ***o****wã*ˌ***laː****ka*ˌ***pe*** 'he told me'
(68) ˈ***taː****ʰka*ˌ***t͡se*** 'hot'
(69) ˈ***ʰpi****mõ* 'I know how'
(70) ˈ***o****ʃki*ˌ***ka*** 'ornery'
(71) *mĩ*ˈ***ʰkaː*** 'raccoon'
(72) ˈ***ðaː****ʰpa* 'short'

Francis Holding

(1) ˈ***to****e* 'some' (PM)
(2) *ðiː*ˈ***xõ*** 'break off' (PF)
(3) ˈ***o****nã*ˌ***lĩ****pi* 'hurry up' (IS)
(4) ˈ***ik****ʼy*ˌ***t͡sa*** 'to try' (PF)
(5) *wa*ˈ***ʰkõ****ta* 'God' (PI, PM)
(6) ˈ***hãː****t͡se* 'last night' (PI)
(7) *ʒĩ*ˈ***ka****ʒi* 'child' (PI, IS)
(8) ˈ***sĩː****t͡se* 'tail' (PI)
(9) ˈ***zaː****ni* 'all' (IS)
(10) *ha*ˈ***xĩ*** 'blanket' (PI)
(11) ˈ***hõː****pa* 'day' (PI, PM)
(12) ˈ***braː****t͡sʰe* 'I eat it' (PM)
(13) ˈ***oː****si*ˌ***pa͡i*** 'be getting out' (IS)
(14) ˈ***breː****ðe* 'I went' (IS)
(15) *waː*ˈ***t͡sʰi*** 'dance' (PI, PM)
(16) ˈ***waː****spe* 'to wait, stay' (IS)
(17) *ĩː*ˈ***ʃta*** 'eyes' (PI)
(18) ˈ***ʰkaː****wa*ˌ***lĩː*** 'horseback riding' (IS)
(19) *pa*ˈ***ʃõ****we* 'binding' (IS)
(20) *i*ˈ***ʒĩ****ke* 'son' (PF)
(21) *to*ˈ***ni****ðe* 'always' (IS)
(22) *paː*ˈ***ʃe*** 'we are binding' (IS)
(23) *wa*ˈ***nõ****bre* 'to dine' (PI)
(24) ˈ***paː****xa* 'cottonwood' (PI)
(25) *ðeː*ˈ***ka*** 'here' (PI)
(26) *ðiː*ˈ***ʃto*** 'remove by pulling' (IS)
(27) *o*ˈ***pa****ɣĩ*ˌ***ke*** 'joyride' (PI)
(28) *wa*ˈ***le****ze* 'paper with text on it' (PI)
(29) ˈ***ʰpa****ze* 'dark, darkness' (PI)
(30) *ã*ˈ***ðiː****xõ* 'we break it off' (PM)
(31) ˈ***iː****xa* 'laugh' (PI)

Margaret Red Iron Eagle

(1) *niː*ˈ***kaː****pxo*ˌ***ke*** 'pop' (PM)
(2) *ã*ˈ***kik****ʼy*ˌ***pe*** 'he gave it back to me' (PF)
(3) ˈ***bry****wĩ* 'I buy' (PI, IS)
(4) *laː*ˈ***ska****ʒĩ* 'little flower' (IS, PI)

(5)	*ãˈ**ðy**wĩ*	‘we buy it’ (PI, IS)	(6)	*leˈ**tã**mãˌ**ze***	‘Iron Hawk’ (PL, IS)
(7)	*waˈ**ho**ʃt͡se*	‘little’ (IS)	(8)	*ka:ˈ**ma***	‘the noise a bell makes’ (IS)
(9)	*ˈ**za:**ni*	‘all’ (PM, PI)	(10)	*ãˈ**ki**lyˌ**wi***	‘buy me (something)’ (PM)
(11)	*mãˈ**ðĩ***	‘walking’ (IS)	(12)	*ˈ**õ:**ðe*	‘throw away’ (PM)
(13)	*ˈ**a:**lĩ:*	‘chair, seat’ (IS)	(14)	*ˈ**kʃõ**ka*	‘second son’ (IS)
(15)	*ʒĩˈ**ka**ʒi*	‘child’ (PM)	(16)	*ʰpa:ˈ**xĩ***	‘hair’ (IS)
(17)	*ˈ**a**ʃi*	‘outside’ (PI)	(18)	*ka:ˈ**pʃe***	‘brush’ (IS)
(19)	*ðyˈ**wĩ***	‘buy’ (IS)	(20)	*ðyˈ**wĩ**paˌ**ʒĩ***	‘didn’t buy it’ (PF)
(21)	*ðy:ˈ**wa**sy*	‘clean’ (IS)	(22)	*ˈ**ðo**ha*	‘almost’ (PI, PM)
(23)	*ˈ**o**we:ˌ**nã***	‘grateful’ (PM)	(24)	*ˈ**ʰt͡si**ʰta*	‘inside, into the house’ (PI)
(25)	*iˈ**ʒĩ**ke*	‘son’ (PM)	(26)	*ðyˈ**wĩ:**ke*	‘he doesn’t usually buy anything’ (IS)
(27)	*ˈ**nõ:**ʒaˌ**ʒe***	‘adult name’ (IS)	(28)	*aˈ**kʃi***	‘they come/go back there’ (PM)
(29)	*la:ˈ**ska***	‘flower’ (IS, PI)	(31)	*ðaˈ**k’e**ðaˌ**pe***	‘he was kind to her’ (PM)
(31)	*ˈ**hõ:**pa*	‘day’ (PM)	(32)	*ãˈ**ka**kʃi*	‘we go back there’ (PI)
(33)	*haˈ**xĩ***	‘blanket’ (PI)	(34)	*ðy:ˈ**ʰka:**mã*	‘ring the doorbell’ (IS)
(35)	*waˈ**ʰkõ**ta*	‘God’ (PI)	(36)	*aˈ**lĩ***	‘arrive back here’ (PI)
(37)	*ˈ**ða:**lĩ*	‘good’ (PF)	(38)	*ãˈ**ka**ʰkiˌ**lã:**pi*	‘we carry ourselves’ (PI)
(39)	*ãˈ**nã**ðe*	‘we see’ (PM)	(40)	*ˈ**o**xtaˌ**ðe***	‘to make sacred’ (PM)
(41)	*ˈ**õ:**bre*	‘I throw away’ (PF)	(42)	*waˈ**sy**hy*	‘clean’ (IS)
(43)	*ˈ**o**xpaˌ**ðe***	‘somebody fell’ (IS)	(44)	*ãˈ**ki**k’y*	‘give it back to me’ (PF)
(45)	*aˈ**bry**wĩ*	‘buy something of you/one’s own back’ (IS)			

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