INTRODUCTION

In this paper I argue that Blackfoot accent is the phonetic realization of primary stress within a prosodic word. “Accent” here refers to syllables with a higher pitch than surrounding syllables (Frantz 2009; Van Der Mark 2003). Studies of phrase-level characteristics conclude that accent is not metrical (Stacy 2004; Van Der Mark 2003). For instance, stress is culminating, exhibiting one primary stress per domain (Hayes 1995; Hyman 2006), but complex phrases can contain multiple accents, as shown in bold in (1) and (2):

(1) áíkihktáíisskipíiwa
    a-ikkhkt-á-isskip-[ópii]-wa
    IPFV-intermittent-IPFV-break-[sit.AI]-PRX
    ‘He rests intermittently (e.g., while climbing a hill).’ (Frantz and Russell 1995)

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2. Abbreviations not included in the Leipzig Glossing Rules are: AN = animate, NMLZ = event nominalization, PRX = proximate, UNREAL = unreal verbal order. Verb stems are categorized as AI = animate intransitive, II = inanimate intransitive, TA = transitive on animate object, and TI = transitive on inanimate object. Prosodic constituents are designated with $\varnothing$ = prosodic phrase, $\omega$ = prosodic word, $\sigma$ = syllable, and $\mu$ = mora. Stems are in square brackets.
Here, however, I restrict my attention to phonological properties of Blackfoot accent over smaller syntactic domains which include verbal stems and inflectional or derivational suffixes. Using data from fieldwork with a speaker of Káinaa Blackfoot, I show that accent in her speech over this domain exhibits typical metrical characteristics, including obligatoriness, culminativity, sensitivity to syllable weight, and orientation toward one edge (cf. Hayes 1995). I hypothesize that the domain where culminativity holds is the prosodic word, which may be smaller than a phrase. I advance a metrical analysis using Optimality Theory (Prince and Smolensky 1993), before concluding with implications for research on the morphosyntactic properties of accent.

PHONOLOGICAL OVERVIEW

Accent is sensitive to syllable weight, and cannot be expressed on voiceless syllable nuclei. This is because accent is signaled mainly by pitch modulation (Van Der Mark 2003), which requires vocal fold vibration (voicing). To orient my analysis, I first briefly describe the Blackfoot phoneme inventory and my transcriptions before turning to syllable structure,\(^3\) voiceless nuclei, and the phonetic realizations of accent.

Phoneme Inventory

I assume the phonemic inventory in Table 1. The vowels in parentheses usually result from coalescence across a morpheme boundary, such that [ɛ] arises from /ai/, and [ɔ] from /ao/. The sequence /oi/ becomes [y] only in closed syllables (Elfner 2006).

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\(^3\) See Denzer-King 2009; Elfner 2006; Frantz 2009; and Taylor 1969 for fuller phonological descriptions.
I also transcribe the three assibilants [tʰ], [t̚], and [k̚], and lax vowels, because their distribution is only partially predictable. The assibilant [tʰ] is a regular allophone of /t/ before /i/; [k̚] and [t̚] occur before and after, respectively, some instances of /i/. All vowels have an allophonic short, lax counterpart [ɨ ɐ ɔ ø] which occurs in closed syllables (Elfner 2006; Frantz 2009), but lax vowels also occur in some open syllables.

Phonemic representations in this paper are given in the orthography developed in Frantz (1978), which closely mirrors the IPA, except that geminates are written as doubled consonants, [ʃ] = [j], [ʃ̌] = [ɬ], [ʃh] represents pre-aspiration of the following obstruent, and coalesced vowels are written as digraphs mirroring their underlying forms.

**Table 1: Blackfoot Phonemic Inventory**

<table>
<thead>
<tr>
<th></th>
<th>Labial</th>
<th>Coronal</th>
<th>Dorsal</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plosives</td>
<td>p pʰ</td>
<td>t tʰ</td>
<td>k kʰ</td>
<td>?</td>
</tr>
<tr>
<td>Fricatives</td>
<td>s s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasals</td>
<td>m ṃ</td>
<td>n ṇ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glides</td>
<td>w j</td>
<td></td>
<td>(w)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Front</th>
<th>Central</th>
<th>Back</th>
</tr>
</thead>
<tbody>
<tr>
<td>i i̯ : (ɨ)</td>
<td>o o̯ :</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ɛ ɛ̚)</td>
<td>(ɔ ɔ̯)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a a̯ :</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plus moraic ṣ</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Phonemic representations in this paper are given in the orthography developed in Frantz (1978), which closely mirrors the IPA, except that geminates are written as doubled consonants, (y) = [j], (’) = [ʔ], (h) represents pre-aspiration of the following obstruent, and coalesced vowels are written as digraphs mirroring their underlying forms.

**Syllable Structure**

Blackfoot distinguishes light syllables, (C)V, from heavy syllables, (C)VV and (C)VC (Elfner 2006). Long consonants are parsed as ambisyllabic geminates, which create closed (C)VC syllables. The length of word-initial vowels is difficult to determine in my consultant’s speech, and I have transcribed what seems most accurate, even when it differs from the dictionary spelling.

Excluding pre- and post-consonantal /s/, Blackfoot has a highly restricted syllable structure. Coda consonants are limited to /ʔ/, /s/, geminate consonants, and sonorants (R) when they precede voiceless nuclei. Voiced segments are separated from voiceless nuclei by a facilitative /ʔ/ (see transcriptions in Taylor 1969); this is parsed as the onset to the voiceless nucleus, and the sonorant is parsed as the coda of the preceding syllable.

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4. The sequences [tʰ] and [k̚] are called “affricates” in Frantz 2009; Kaneko 1999; Taylor 1969. I follow Derrick’s (2006, 2007) term “assibilants” to emphasize that these sequences involve a non-moraic /s/.
I follow Elfner (2006) in using a moraic structure to distinguish syllable weight. Light syllables are monomoraic, while heavy syllables are bimoraic. Long intervocalic consonants are treated as ambisyllabic geminates (Hayes 1989).

Voiceless Syllable Nuclei

Blackfoot has two types of voiceless syllable nuclei: devoiced vowels and moraic /s/. Short vowels are allophonically devoiced word-internally when they precede a pre-aspirated consonant. Long vowels are only partially devoiced. This is demonstrated below with the near minimal pair /oohkooni ‘find.TI’ and /ooohko ‘wait.TA’. The short vowel in (5a) completely devoices before [k], and the long vowel in (6a) only partially devoiced. The difference is neutralized word-initially, (5b) and (6b), where both are partially voiced.

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5. Blackfoot pre-aspiration is often realized as a fricative which assimilates to the place of the preceding vowel ([iç], [aç], [ox]), especially following long vowels; this is a common characteristic of pre-aspiration (Silverman 2003). Other accounts of Blackfoot phonology treat the fricative as a separate coda segment (Denzer-King 2009; Elfner 2006; Kaneko 1999). I treat the frication as a secondary characteristic of pre-aspiration because it does not shorten preceding long vowels like other codas (Elfner 2006; Reis Silva 2011).
(5) **Short vowel before ʰC**

a. iː.ʊ.ʰkóː.nəm.ʔa
   iit-[ohkooni]-m-wa
   LOC-[find.TI]-DIR-PRX
   ‘S/he found it then.’

b. ʊʊ.ʰkóː.nɪ
   [ohkooni]-t
   [find.TI]-IMP.SG
   ‘Find it!’

(6) **Long vowel before ʰC**

a. iː.ʊ.ʰkóː.yi
   iit-[oohko]-yii-wa
   LOC-[wait.TA]-DIR-PRX
   ‘S/he waited for him/her then.’

b. ʊʊ.ʰkós
   [oohko]-s
   [wait.TA]-IMP.SG
   ‘Wait for him/her!’

Unlike the other consonants, the sibilant /s/ can occur before, after, or between consonants. The unusual clusters created with /s/ are resolved if /s/ is moraic in these contexts and can serve as the nucleus of a syllable (Denzer 2006, 2007; Denzer-King 2009; Goad and Shimada 2013). This analysis is supported by distinct phonetic durations for moraic and assibilant sibilants (Derrick 2006, 2007) and is also adopted in this paper.

(7) **Transcription**  **Example**  **Morphology**  **Gloss**

| VS.CV | i.ရs.kə | [i.pás.kaa]-wa | ‘S/he danced. (AI)’ |
| Cs.C  | i.ks.ki.mə | [i.ks.kimaa]-wa | ‘S/he hunted. (AI)’ |

**Realization of Accent**

Prominence in Blackfoot is signaled primarily with a higher $F_0$ (Van Der Mark 2003), but has different phonetic realizations depending on the location of the syllable in the word (Frantz 2009; Stacy 2004; Taylor 1969). Accent is a level high pitch on any syllable but the last, as in iihkiítaawa [i.ʔ.ʰkí.ʔa] ‘s/he baked (AI)’, and the pitch of the utterance as a whole gradually rises or falls to/from that peak. Accent is often realized as a falling pitch before glottal stops, as for isi’katsiwa [i.siʔ.kaʔi] ‘s/he kicked (TA)’. Accent on the final syllable can be realized in two ways: a sharply falling pitch, or greater intensity with no change in pitch, as for inihkiwa [inʔ.ʰkí] ~ [i.inʔ.ʰkí] ‘s/he sang (AI)’.

**METHODOLOGY**

This paper focuses on the phonological characteristics of accent. Accent is also affected by the morphological composition of the word (see, for
example, Dunham 2009 and Stacy 2004 for the interaction of accent and person proclitics). In order to minimize morphological factors, I only consider minimal words which include a verb stem plus necessary derivational or inflectional suffixes. A simplified morphological template is shown in (8).

Stems are preceded by person proclitics and prefixes, which include e.g., adverbs, aspect markers, relative roots, and negative operators. Transitive stems are followed by a direct/inverse theme. All stems are followed by agreement suffixes.

\[(8) \text{(PERS=)} \text{(prefixes-)} \text{[STEM(+final)]} \text{(-THM)} \text{-AGR}\]

I consider three environments which allow a verb stem to occur without prefixes or person proclitics: (1) independent order verbs for third person perfective (most other persons require proclitics; Déchaine and Wiltschko 2014), (2) imperatives, and (3) event nominalizations (Bliss et al. 2012; Frantz 2009), shown in (9), (10) and (11).

\[(9) \text{Independent order} \quad (10) \text{Imperative} \quad (11) \text{Event nominalization} \]
\[
\begin{align*}
\text{ij}^{.h}\text{kt.ta} & \quad \text{ij}^{.h}\text{kt.tat} & \quad \text{ij}^{.h}\text{kt.tam} \\
\text{[iikhiiitaa]-wa} & \quad \text{[iikhiiitaa]-t} & \quad \text{[iikhiiitaa]-n-wa} \\
\text{[bake.AI]-PRX} & \quad \text{[bake.AI]-IMP.SG} & \quad \text{[bake.AI]-NMLZ-AN.SG} \\
\text{‘S/he baked.’} & \quad \text{‘Bake!’} & \quad \text{‘baking’}
\end{align*}
\]

I define a verb stem as a minimal unit with non-compositional meaning which can immediately follow the imperfective prefix \(a\)-, and is bounded at the right by theme suffixes or agreement morphology. For example, the unit \text{ipststsoyi} in (12) is not a stem, even though it is delimited by \(a\)- and AGR, because it is not the most minimal unit which can appear in this position. Example (13) shows a minimal stem.

\[(12) \text{Non-minimal stem} \quad (13) \text{Minimal stem} \]
\[
\begin{align*}
\text{é.ps.t.o.ji} & \quad \text{é.o.ji} \\
\text{a-ipsst-[ooyi]-wa} & \quad \text{a-[ooyi]-wa} \\
\text{IPFV-inside-[eat.AI]-PRX} & \quad \text{IPFV-[eat.AI]-PRX} \\
\text{‘S/he eats inside.’} & \quad \text{‘S/he eats.’ OR ‘S/he is eating.’}
\end{align*}
\]

6. The subjunctive order is a fourth environment with no verbal proclitics, but is not considered here.
Stems include an abstract final which categorizes the stem as an AI, II, TA, or TI verb (Armoskaite 2011; Frantz 2009). Therefore, oowat in (14) and oowatoo in (15) are stems, in addition to ooyi. The stem type and morphology of each word are included in examples in this paper; glosses correspond to those in (9)–(15), which are given here for reference.

(14) əː.o.wa.ti  
    a-[oowat]-yii-wa  
    IPFV-[eat.TA]-DIR-PRX  
    ‘S/he eats it (anim).’

(15) əː.o.wa.t.oː.mə  
    a-[ooatoo]-m-wa  
    IPFV-[eat.TI]-DIR-PRX  
    ‘S/he eats it (inan).’

The data in this paper are from fieldwork by the author with a female speaker of the Káínaa (Blood) dialect in her late sixties. She was born in Alberta but has lived in various places in North America as an adult, and in Vancouver for many years. Tokens were prompted by an English translation. For most verb stems, I elicited at least two of the three types of words (independent, imperative, nominalization) across several elicitation sessions to confirm the location of accent across several tokens.

GENERALIZATIONS

Several generalizations emerge for minimal words which do not hold of the phrase as a whole. Accent is obligatory, culminative, and restricted to the first three syllables. First-syllable accent occurs only in restricted positions. Second- and third-syllable accents occur more generally, and the location is predictable from syllable weight. Like Kaneko (1999), I take these facts as evidence of the prosodic nature of Blackfoot accent.

Obligatoriness

All minimal words elicited had an accent, including monosyllables like piit! ‘enter!’, which are spoken with a high pitch. I take this as evidence that accent is obligatory, at least for forms containing verbal stems.

(16) Monosyllabic  piit  [pi]-t  ‘Enter! (AI)’
    Disyllabic  i.piː.mə  [ipi]-m-wa  ‘S/he entered. (AI)’
    Trisyllabic  i.pi.k’i  [ipiksi]-wa  ‘S/he hit. (AI)’
Culminativity

In the minimal syntactic words that are examined here, there is at most one accent per word (see examples throughout this paper). This suggests that there is some prosodic domain which instantiates culminativity of accent, and that the stem plus inflectional suffixes maps onto this domain. I hypothesize that this domain is the prosodic word (\( \omega \)).

\[
\begin{align*}
\phi & \quad \leftarrow \text{phonological phrase} \\
\omega & \quad \leftarrow \text{domain for accent culminativity} \\
[\text{STEM}]-(\text{THM})-\text{AGR}
\end{align*}
\]

Location

Accent is always on the first, second, or third syllable. Minimal words can be longer than three syllables, but accent never falls on the fourth or fifth syllable. Therefore, accent is oriented toward the left edge of the word (see also Kaneko 1999; Stacy 2004).

(18) No fourth syllable accent
\begin{align*}
i.k\text{a}.?\text{kja}.\text{ki} & \quad *i.\text{ka}.?\text{kja}.\text{ki} & \quad [\text{ika}.\text{kiaaki}-\text{wa}] \quad \text{‘S/he chopped wood. (AI)’} \\
i.\text{t}.\text{ni}.\text{ki} & \quad *i.\text{t}.\text{ni}.\text{ki} & \quad [\text{iitsiniiki}-\text{wa}] \quad \text{‘S/he told a story. (AI)’}
\end{align*}

(19) No fifth syllable accent
\begin{align*}
i.\text{ji}.\text{t}.\text{t}.\text{t}.\text{ma} & \quad *i.\text{ji}.\text{t}.\text{t}.\text{t}.\text{ma} & \quad [\text{iyiitsiitsimaa}-\text{wa}] \quad \text{‘S/he sliced meat thinly. (AI)’} \\
i.\text{s}.\text{t}.\text{mim}.?\text{qi} & \quad *i.\text{s}.\text{t}.\text{mim}.?\text{qi} & \quad [\text{isimimmohki}-\text{wa}] \quad \text{‘S/he gossiped. (AI)’}
\end{align*}

Prosodically (Un)Predictable Accent

Second and third syllable accent is predictable from prosodic structure. First syllable accent only occurs in a restricted set of allomorphs in certain clause types. These allomorphs are therefore lexically marked in some way. Later, I argue that they have lexical stress on the first syllable. I first discuss predictable accent, and then discuss lexical stress and the way it is incorporated into the prosodic structure of a phonological word.
PREDICTABLE ACCENT

If the stem has no lexical stress, accent is predictable based on the weight of the second syllable, as well as whether the third syllable has a voiced or voiceless nucleus.

(20) Predictable accent: Descriptive generalizations
   a. Monosyllabic words are accented on the one and only syllable.
   b. Disyllabic words are accented on the second syllable.
   c. For words with three or more syllables, the second syllable is accented if it is heavy and the third syllable otherwise,
   d. . . . unless the third syllable contains a voiceless nuclei, in which case the second syllable is accented.

I give examples of each of these patterns in turn (L = light (monomoraic) syllable; H = heavy (bimoraic) syllable).

Monosyllabic Words

(21) ‘Enter! (AI)’  pí:t [pii]-t  H

Disyllabic Words

Disyllables have second syllable accent, regardless of the weight of either syllable. Examples with a light initial syllable are shown in (22), and examples with a heavy initial syllable are in (23).

(22) Disyllables with light first syllable
   ‘S/he ate. (AI)’  i.yí [iiyi]-wa  L L
   ‘Drink! (AI)’  st.mít [simi]-t  L H
   ‘Rope! (AI)’  o.ká:t [okaa]-t  L H

(23) Disyllables with heavy first syllable
   ‘Take it! (TI)’  ma?.tít [ma’tsi]-t  H H
   ‘Sleep! (AI)’  o?.kát [o’kaa]-t  H H
   ‘Bark! (AI)’  oɡ.ˈkit [ohki]-t  H H
Three or More Syllables

Accent falls on the second syllable when it is heavy. The first syllable may be light, (24), or heavy, (25). Examples with a voiceless nucleus in the third syllable are shown in (26).

(24) Second syllable accented, light first syllable

<table>
<thead>
<tr>
<th>Example</th>
<th>Syllable</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘S/he baked. (AI)’</td>
<td>i̲.j̲.k̲i̲.t̲a</td>
<td>[i̲i̲h̲k̲i̲t̲a̲a̲]-wa</td>
</tr>
<tr>
<td>‘baking (AI)’</td>
<td>i̲.j̲.k̲i̲.t̲a̲n̲</td>
<td>[i̲i̲h̲k̲i̲t̲a̲a̲]-n-wa</td>
</tr>
<tr>
<td>‘S/he bought him/her. (TA)’</td>
<td>i̲.j̲.k̲.p̲.o̲.m̲.m̲.a̲.t̲.i̲</td>
<td>[i̲i̲h̲p̲o̲m̲m̲a̲t̲]-y̲i̲-wa</td>
</tr>
<tr>
<td>‘S/he chopped wood. (AI)’</td>
<td>i̲.k̲.k̲.a̲.k̲.j̲.a̲.k̲.i̲</td>
<td>[i̲k̲a̲’k̲i̲a̲a̲ki̲]-wa</td>
</tr>
<tr>
<td>‘S/he sliced meat thinly. (AI)’</td>
<td>i̲.j̲.i̲.t̲.t̲.t̲.i̲.m̲.a̲</td>
<td>[i̲y̲i̲i̲t̲s̲i̲t̲t̲s̲i̲m̲a̲a̲]-wa</td>
</tr>
</tbody>
</table>

(25) Second syllable accented, heavy first syllable

<table>
<thead>
<tr>
<th>Example</th>
<th>Syllable</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘S/he thirsted. (AI)’</td>
<td>i̲.n̲.k̲.a̲</td>
<td>[i̲’n̲a̲a̲k̲i̲]-wa</td>
</tr>
<tr>
<td>‘firewood (AI)’</td>
<td>k̲a̲.k̲.j̲.k̲.a̲.m̲</td>
<td>[k̲a̲’k̲i̲a̲a̲ki̲]-h̲i̲n̲</td>
</tr>
<tr>
<td>‘S/he helped out. (AI)’</td>
<td>i̲.s̲.p̲.o̲.m̲.m̲.h̲.t̲.a̲</td>
<td>[i̲s̲s̲p̲o̲m̲m̲i̲h̲t̲a̲]-wa</td>
</tr>
</tbody>
</table>

(26) Second syllable accented, voiceless third syllable

<table>
<thead>
<tr>
<th>Example</th>
<th>Syllable</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘S/he packed. (AI)’</td>
<td>i̲.j̲.a̲.k̲.t̲.a̲</td>
<td>[i̲y̲a̲a̲k̲i̲t̲a̲]-wa</td>
</tr>
<tr>
<td>‘S/he hit, contacted. (TA)’</td>
<td>i̲.k̲.n̲.i̲.k̲.o̲.y̲.i</td>
<td>[i̲k̲a̲n̲i̲h̲k̲o̲]-y̲i̲-wa</td>
</tr>
<tr>
<td>‘S/he helped out. (AI)’</td>
<td>i̲.s̲.p̲.ó̲.m̲.m̲.h̲.t̲.a</td>
<td>[i̲s̲s̲p̲o̲m̲m̲i̲h̲t̲a̲]-wa</td>
</tr>
<tr>
<td>‘S/he sniffed. (AI)’</td>
<td>i̲.s̲.s̲.i̲.m̲.h̲.k̲.a̲</td>
<td>[i̲s̲s̲i̲m̲i̲h̲k̲a̲]-wa</td>
</tr>
</tbody>
</table>

If the second syllable is light, then accent falls on the third syllable if it is voiced, regardless of its weight. Again, the first syllable may be light, (27), or heavy (28).

(27) Third syllable accented, light first syllable

<table>
<thead>
<tr>
<th>Example</th>
<th>Syllable</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘S/he hit. (AI)’</td>
<td>i̲.p̲.k̲.i̲</td>
<td>[i̲p̲i̲k̲s̲i̲]-wa</td>
</tr>
<tr>
<td>‘S/he got up. (AI)’</td>
<td>i̲.p̲.o̲.w̲.a̲</td>
<td>[i̲p̲o̲w̲a̲a̲]-wa</td>
</tr>
<tr>
<td>‘S/he hit him/her. (TA)’</td>
<td>a̲.w̲.a̲.j̲.á̲.k̲</td>
<td>[a̲w̲a̲y̲a̲k̲i̲]-y̲i̲-wa</td>
</tr>
<tr>
<td>‘S/he hunted. (AI)’</td>
<td>i̲.k̲.s̲.k̲.i̲.m̲ a̲.</td>
<td>[i̲k̲s̲k̲i̲m̲a̲a̲]-wa</td>
</tr>
<tr>
<td>‘story (AI)’</td>
<td>a̲.t̲.t̲.n̲.i̲.k̲.s̲ m̲</td>
<td>[a̲t̲s̲i̲n̲i̲k̲i̲]-h̲s̲i̲n̲</td>
</tr>
<tr>
<td>‘Boil it! (AI)’</td>
<td>a̲.k̲.ó̲.s̲.i̲.m̲.a̲t̲</td>
<td>[a̲k̲o̲h̲s̲i̲m̲a̲a̲]-t̲</td>
</tr>
<tr>
<td>‘S/he gossiped. (AI)’</td>
<td>i̲.s̲.m̲.m̲.m̲.i̲.m̲.h̲.k̲</td>
<td>[i̲s̲i̲m̲i̲m̲m̲o̲h̲h̲k̲]-wa</td>
</tr>
</tbody>
</table>

(28) Third syllable accented, heavy first syllable
(28) Third syllable accent, heavy first syllable

‘S/he dove. (AI)’  r’t.t.a.yí   [isttayi]-wa   H L Ł
‘Take it! (AI)’  maʔ.ta.kit   [ma’taki]-wa   H L Ł
‘playing (AI)’  awʔ.ʔ.kán   [awahkaa]-n   H L Ḥ
‘S/he wet it. (TI)’  iʔ.ʔ.pi.tó.tʔimʔ.ʔí   [i’pistotsi]-m-wa   H L Ł Ł Ł

However, if the third syllable is voiceless, then the second syllable is accented, as in (29):

(29) ‘S/he bit. (AI)’  i.si.ks.ta.ʔi   [isikstaki]-wa   Ł Ł Ł Ł Ł

ANALYSIS: PREDICTABLE ACCENT

Overview

The above patterns can be derived via a prosodic analysis which utilizes quantity-sensitive iambic feet. This analysis trivially holds for mono- and disyllabic words with a light first syllable, which conform to one of the possible iambic templates (Hayes 1995):

(30) ‘Enter! (AI)’  píʔt   [pii]-t   (Ĥ)
‘S/he ate. (AI)’  i.ʔi   [iïyi]-wa   (L Ł)
‘Drink! (AI)’  s.ʔi.ʔí   [simi]-t   (L Ĥ)

The accent of disyllables with a heavy initial syllable, as well as words with three or more syllables, also correspond to the head of an iambic foot if the first syllable is systematically unfooted. (I exclude interactions with voiceless syllable nuclei for the moment.) This is illustrated with examples in (31).

(31) ‘Take it! (TI)’  maʔ.ʔ.tʔí   [ma’tsi]-t   H (Ĥ)
‘S/he baked. (AI)’  ijʔ.ʔ.ki.ʔa   [iïhkiita]-wa   L (Ĥ) Ł
‘S/he thirsted. (AI)’  iʔ.ʔ.ná.ʔi   [iʔnaaki]-wa   H (Ĥ) Ł
‘S/he hit. (AI)’  i.ʔi.ʔi.ʔí   [ipiksi]-wa   L (L Ł)
‘S/he dove. (AI)’  r’t.t.a.yí   [isttayi]-wa   H (L Ł)

Under the assumption that as many syllables as possible are parsed into feet, accent is the phonetic manifestation of primary stress only. Words which are four or five syllables long often have a second or third foot, but only have one accent.
(32) ‘S/he gossiped. (AI)’ i.st.mim.?ə̌ki [isimimmohki]-waL (L Ê) (L Ł)

To sum, the Blackfoot prosodic word may have one of two structures. Small words contain a single iambic foot. Longer words contain an unfeetd initial syllable. In both cases, accent corresponds to primary stress, where the head foot is the leftmost foot.

(33) 1 or 2 syllables

\[
\begin{array}{c}
\omega \\
FT
\end{array}
\]

3+ syllables

\[
\begin{array}{c}
\omega \\
\sigma FT FT \ldots
\end{array}
\]

Unfooted Initial Syllables

The analysis laid out here assumes that phonological words and phrases have internal structure and are organized into a prosodic hierarchy, shown in (34).

(34) \(q\)

phonological phrase

\[
\begin{array}{c}
\omega \\
prosodic word
\end{array}
\]

foot

\[
\begin{array}{c}
\sigma \\
syllable
\end{array}
\]

mora

The Strict Layer Hypothesis (Nespor and Vogel 1986; Selkirk 1984) assumes prosodic constituents are contained within a constituent of the next highest level (i.e., no skipping of levels). Expressed as a violable OT constraint, PARSE SYLLABLES (PARSE-σ) requires syllables to be parsed into feet (Inkelas 1989; Itô and Mester 2003 [1992]; Selkirk 1996):

(35) Parse Syllables (PARSE-σ)

No \(\omega\) immediately dominates a \(\sigma\). (‘Syllables are parsed into feet.’)

Feet also represent the organization of syllables into rhythmic units (Hayes 1995), represented by the constraints *LAPSE and *CLASH, which require stressed syllables to be separated by no more and no less than one unstressed syllable, respectively (Gordon 2002; McCarthy 2003). When no
other constraints are involved, these together ensure a binary alternating rhythm. The definitions here are from McCarthy 2003.

(36) *LAPSE
*ð / ð, i.e., assign one violation-mark for each pair of adjacent unstressed syllables.

(37) *CLASH
*ð / ð, i.e., assign one violation-mark for each pair of adjacent stressed syllables.

The first syllable is unfooted in words which are three syllables or longer. The positional markedness constraint NONINITIALITY (NONINIT) prohibits word-initial feet and is modelled on McCarthy’s (2003) NONFINALITY constraint.

(38) NONINITIALITY (NONINIT)
*Ft / [ñ (‘Word-initial feet are prohibited.’)

By ranking NONINIT above PARSE-ð, the first syllable will be parsed directly to the prosodic word, ensuring that no feet are word-initial. This is illustrated in (39) with [i:t¹ni:ki] ‘s/he told a story (AI).’ NONINIT must also be ranked above *LAPSE, because forms with a light second syllable will have two adjacent unstressed syllables.

(39)

(40) NONINIT >> { PARSE-ð, *LAPSE }

The ranking in (40) is demonstrated in (41) and (42) with atsinikit ‘tell a story! (AI),’ which has a light second syllable, and a’po’taki-wa ‘s/he worked (AI),’ which has a heavy second syllable. Candidate (a) wins over candidate (b) in both tableaux because it incurs no violations of NONINIT, even though this creates an initial lapse and more violations of PARSE-ð.
Candidate (c) shows that no more than one syllable at the left edge will be left unfooted, because doing so incurs more violations of *LAPSE.

\[
\begin{array}{|c|c|c|}
\hline
\text{Candidate} & \text{NONINIT} & \text{PARSE} \rightarrow \sigma & \text{*LAPSE} \\
\hline
\text{a. } \text{\textipa{a.(t\textordmasculine}i\textordmasculine}.ni.(kit)} & \text{**} & \text{**} & \text{**} \\
\text{b. } \text{\textipa{a.t\textordmasculine}i\textordmasculine}.(ni.kit) & \text{!} & \text{!} & \text{!} \\
\text{c. } \text{\textipa{a.t\textordmasculine}i\textordmasculine}.(ni.kit) & \text{!} & \text{!} & \text{!} \\
\hline
\end{array}
\]

The head foot must be near the left edge of a word, or else accent would fall on the fourth or fifth syllables. The HEADLEFT constraint requires the head foot to be the leftmost foot. It is modelled on McCarthy’s (2003) ENDRULE-L constraint (itself a reformulation of the End Rule in Prince 1983).

\[
\text{HeadLeft} \quad \Rightarrow \quad \text{HeadRight} \\
\]

This ranking is demonstrated with \textit{asimimohki-hsin} ‘gossip(ing)’ (AI).’ The two candidates satisfy other parsing constraints equally, and differ only in which foot is head.

\[
\begin{array}{|c|c|}
\hline
\text{Candidate} & \text{HEADLEFT} \\
\hline
\text{a. } \text{\textipa{a.(si.mim)./(\textipa{h}ks\textordmasculine)n) \textordmasculine}i\textordmasculine}} & \text{*} \\
\text{b. } \text{\textipa{a.(si.mim)./(\textipa{h}ks\textordmasculine)n) \textordmasculine}i\textordmasculine}} & \text{!} \\
\hline
\end{array}
\]
Footed Initial Syllables

The initial syllable is parsed into a foot in order to avoid suboptimal parses. If the single syllable in a monosyllabic word like *pii-t ‘enter! (AI)*’ were unfooted, then the word would contain no feet. If the initial syllable of *iiyi-wa ‘s/he ate (AI)*’ were unfooted, a degenerate monomoraic foot would be created. The FOOT BINARITY (*FtBIN*) constraint in (47) ensures that feet are binary.\(^7\)

(47) **FOOT BINARITY (*FtBIN*)**

Feet are binary under a moraic or syllabic analysis.

\[\text{NONINIT} \text{ must be ranked below FtBIN, because NONINIT is violated in order to satisfy FtBIN in a word like } iiyi-wa \text{ ‘s/he ate (AI).'}\]

(48) **FtBin >> NonInit >> Parse-\(\sigma\)**

<table>
<thead>
<tr>
<th>/iiyi-wa/</th>
<th>FtBin</th>
<th>NonInit</th>
<th>Parse-(\sigma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (\varepsilon) (i.(y))</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b. i.((y))</td>
<td>*!</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

Voiceless Nucleus in the Third Syllable

The above rankings predict that accent should fall on the third syllable if the second syllable is light. This is the wrong prediction for forms which have a voiceless nucleus in the third syllable, like [i.si.ks.ta.\(k\)i] ‘s/he bit (AI)’, where accent falls on the second syllable. The constraint *VOICELESS NUCLEUS (*\(\mu\)) prohibits accent on voiceless morae and captures the phonetic fact that pitch cannot be realized on voiceless segments.

---

7. Minimal word templates (McCarthy and Prince 1993) provide additional evidence that degenerate feet are not allowed in Blackfoot, and that *FtBIN* is therefore undominated in the grammar. Minimal words include single heavy monosyllables (H) and two light monosyllables (L L) but no light monosyllables (*L). If a prosodic word must contain a foot, then (L) does not seem to constitute a foot in Blackfoot.
(50) *VOICELESS NUCLEUS (*˚)
Voiceless morae do not carry accent.

The foot type constraints in (51) and (52) create iambic and trochaic feet, respectively. Under normal circumstances, the ranking FtTYPE=I >> FtTYPE=T ensures that feet are preferably iambic.

(51) ALIGN(Ft, R; Hd, R) (FtTYPE=I)
For every foot, there is a head of the foot such that the right edge of the head aligns with the right edge of the foot. (Feet are iambic.)

(52) ALIGN(Ft, L; Hd, L) (FtTYPE=T)
For every foot, there is a head of the foot such that the left edge of the head aligns with the left edge of the foot. (Feet are trochaic.)

I propose *˚ dominates FtTYPE=I, allowing a trochaic foot when accent would otherwise fall on a voiceless mora. This is shown in (54) for isikstaki-wa ‘s/he bit (AI)’.

(53) *˚ >> FtType=I >> FtType=T

(54) 

<table>
<thead>
<tr>
<th>/isikstaki-wa/</th>
<th>*˚</th>
<th>FtTYPE=I</th>
<th>FtTYPE=T</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. i.(skš).(ta.kì)</td>
<td>*!</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>b. i.(škš).(ta.kì)</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

_Interim Summary_

Second or third syllable accent is phonologically predictable and corresponds to the primary stress of a prosodic word. The major points of the analysis are summarized by the partial OT rankings in (55).

---

8. Note that *˚ could also dominate FtBIN or NONINIT to create a second syllable accent. Minimal word templates suggest that FtBIN is undominated (fn. 7). Which of these three choices is the best analysis for Blackfoot can only be answered with data from other parts of the grammar.
The first syllable remains unfooted, unless leaving the first syllable unfooted would violate foot binarity, (55a). The head foot is leftmost in the word, (55b). Feet are iambs, unless this would cause a voiceless syllable nucleus to carry accent, (55c).

**Lexical Accent**

Some Blackfoot stems have two allomorphs: one with first syllable accent, and one with a prosodically predictable accent. These stems always begin with [a] in the independent order. The choice of allomorph is syntactically conditioned, shown in Table 2, where stems in independent order verbs have initial accent, but stems in imperatives and event nominalizations do not. The initial vowel is long when accented (unless it occurs in a closed syllable), and short otherwise.

<table>
<thead>
<tr>
<th>Gloss</th>
<th>Independent</th>
<th>Imperative</th>
<th>Nominalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘say (AI)’</td>
<td>[á:niː]</td>
<td>[a.niːt]</td>
<td>[a.nis.sin]</td>
</tr>
<tr>
<td>‘cry (AI)’</td>
<td>[á:seʔ.ni]</td>
<td>[a.seʔ.ni]</td>
<td>[a.sɛnʔ.sin]  (‘cry-baby’)</td>
</tr>
<tr>
<td>‘walk, play (AI)’</td>
<td>[á:ʔa.ka]</td>
<td>[a.ʔa.kat]</td>
<td>[a.ʔa.hkan]</td>
</tr>
<tr>
<td>‘boil (TI)’</td>
<td>[á:kɔʔ.sim]</td>
<td>[a.kɔʔ.sit]</td>
<td>—</td>
</tr>
<tr>
<td>‘hit (TA)’</td>
<td>[á:wa.ja.ki]</td>
<td>[a.wa.ja.kis]</td>
<td>—</td>
</tr>
</tbody>
</table>

Syntactic conditioning of left-edge stem allomorphy based on verbal order is pervasive in Blackfoot, although it usually involves differences in vowel quality, not accent (Frantz 2009; Taylor 1969). Some examples are shown in Table 3. First syllable accent is lexically specified in the same way that vowel quality is specified for each stem.
I have also found three stems, (56), which have idiosyncratic accent on a light second syllable, when normally the third syllable is accented.

(56) ‘S/he danced. (AI)’ iʁ.pi.ji (L L) L *iʁ.pi.ji *L (L L)
     ‘S/he spoke. (AI)’ iʔ.pó.ji (H L) L *iʔ.pó.ji *H (L L)
     ‘S/he told him/her. (TA)’ iʔ.pó.wá.ti (H L) (L L) *iʔ.pó.wá.ti *H (L L) L

ANALYSIS: LEXICAL STRESS

The following analysis rests on the separation of accent (the phonetic feature of high pitch) and stress (a property of the head syllable in a foot). So far in the analysis, I have assumed that accent is merely the phonetic manifestation of the primary stress. Therefore the cases of first syllable and idiosyncratic accent discussed above involve stems with a syllable which is lexically specified as the head of a foot. The phonology must then do two things: (1) incorporate the head into a well-formed prosodic structure, and (2) manifest the primary stress in the structure with higher pitch, as is usual.

First, stems with lexical heads preserve that head, or a prosodically predictable accent would have surfaced. Preservation of heads is expressed with the constraint Ident-Head(Ft), conceived of as a family of Ident-Head constraints.

(57) Ident-Head(Ft)-IO (IdHD(Ft))

The head of a foot in the input has a corresponding head of a foot in the output.
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(58) IDHd(Ft) >> NONINIT

IdHd(Ft) must be ranked above NONINIT, or else a light second syllable could not surface with accent for iihipi-yi-wa ‘s/he danced (AI)’ in (59). In the tableaux below, a stressed syllable in the input is underlined. Candidate (a) preserves stress from the input, even though it violates NONINIT. Candidate (b) has third-syllable stress because the first syllable is left unfooted, satisfying NONINIT, but does not preserve lexical stress.

<table>
<thead>
<tr>
<th>/iihipiyi-wa/</th>
<th>IDHd(Ft)</th>
<th>NONINIT</th>
<th>PARSE-α</th>
<th>&quot;LAPSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. i&gt;i.pi.ji</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. i.(^pi.ji)</td>
<td>*!</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

When an initial syllable is lexically stressed, it surfaces as a heavy syllable—either with a long vowel or a coda. The vowel lengthens in open syllables because the only way to form an iamb at the left edge of a word is to create a heavy syllable. Therefore the constraint FTBIN must be ranked above DEp-[μ]-IO, because a mora is epenthesized in order to create a binary iamb, satisfying FTBIN.

(60) DEp-[μ]-IO

A mora in the output must have a corresponding mora in the input. (No epenthesis of morae.)

(61) FTType=I, FTBin >> DEp-[μ]-IO

In the tableau for áwayaki-yii-wa ‘s/he hit (TA)’ in (62), all three candidates preserve the lexical head. Candidate (a) is optimal, because it creates a valid iamb, even though it epenthesizes a mora. Candidate (b) violates FTBIN and candidate (c) creates a trochee.

<table>
<thead>
<tr>
<th>/áwayaki-yii-wa/</th>
<th>FTType=I</th>
<th>FTBin</th>
<th>DEp-[μ]-IO</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. i&gt;á.(wa.já).ki</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. (á).(wa.já).ki</td>
<td></td>
<td>*!</td>
<td></td>
</tr>
<tr>
<td>c. (á.wa).(ja.ki)</td>
<td></td>
<td>*!</td>
<td></td>
</tr>
</tbody>
</table>
SUMMARY

Within the domain of the prosodic word, Blackfoot accent exhibits metrical properties. Stems may contain lexical stress, and this lexical stress is preserved and fit into the prosodic structure of the word. The OT analysis is summarized in (63). The first syllable is left unfooted, unless doing so would create a non-binary foot or shift stress from a lexically specified syllable, (63a). The head foot is leftmost, (63b). Trochaic flop is allowed in order to avoid accent on a voiceless nucleus, (63c). And finally, morae are epenthesized to create well-formed iambs at the left-edge of the word, (63d).

(63) a. \{ IDHd(Ft), FtBin \} >> NonInit >> \{ Parse-σ, *Lapse \}
   b. HeadLeft >> HeadRight
   c. *Their >> FtType=I >> FtType=T
   d. FtType=I, FtBin >> Dep-[μ]-IO

DISCUSSION

The above analysis makes certain predictions about the mapping between syntactic structure and prosodic domains. I argued that accent is culminative across a prosodic word, which requires that verbal complexes with multiple accents contain multiple prosodic words9 (as in 64). The accent of each prosodic word must arise either from lexical or predictable stress. It remains to be seen which syntactic domains map to new prosodic words, and which syntactic categories are incorporated into existing words.

(64) \( \varphi = [\sigma (\sigma \dot{\sigma}) \ldots]_{\text{a}} [(\sigma \dot{\sigma}) \ldots]_{\text{a}} [\sigma (\sigma \dot{\sigma}) \ldots]_{\text{a}} \ldots \)

This analysis also makes certain phonetic and phonological predictions related to prosody. Accent depends on a prosodic structure, and I predict that other areas of Blackfoot phonology will also evidence this structure. For example, I expect to find other evidence of secondary feet, such as vowel length or quality differences in stressed, unstressed, and unfooted

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9. See Riad 2012 for a similar treatment of stress in Swedish, where he argues that stress is culminative across a minimal prosodic word. This may be smaller than the maximal prosodic word, which is the domain for culminativity of tonal accent.
syllables. A good candidate is the “variable length” vowels discussed in Frantz (2009), which could arise from vowel-length neutralization in certain prosodic positions. Similarly, I suspect that underlying length contrasts may be neutralized in the unfooted positions, at least in my consultant’s speech, which would explain why the length of initial syllables (usually unfooted) was difficult to distinguish.

REFERENCES


Goad, Heather, and Akiko Shimada. 2013. /s/ is a voicoid in Blackfoot. Paper read at the Canadian Linguistics Association Annual Meeting, Victoria, BC.


