A metrical stress analysis of Mushuau Innu

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Abstract: This paper provides a metrical stress analysis of Mushuau Innu, a dialect of Innu-aimun spoken in Natuashish, Labrador. The majority of the data could be analyzed using two distinct analyses: a penultimate analysis (not quantity sensitive, stress falls on the penult at the underlying representation) and a right-most heavy analysis (quantity sensitive, final syllable extrametricality, stress falls on the right-most heavy syllable at the underlying representation). The right-most heavy analysis is preferred as it is quantity sensitive and allows for comparison to the related dialects of Northern East Cree and Southern East Cree. This is the first instrumental study of Mushuau Innu. Pitch differences between stressed and unstressed vowels were found to be statistically significant and the fact that the resulting metrical stress analysis found for Mushuau Innu patterns similarly to those described for other dialects indicates that the methodology of using pitch to determine stress placement is promising.

Keywords: metrical stress analysis, Innu-aimun, Algonquian language family, acoustic analysis, Mushuau Innu

1 Introduction

This paper provides a metrical stress analysis of Mushuau Innu, a dialect of Innu-aimun spoken in Natuashish, Labrador.[1] To date, the metrical stress parameters of Mushuau Innu, an Algonquian dialect of the Cree-Montagnais-Naskapi complex, have not been analyzed.

Descriptions of the Mushuau Innu phonological system are provided in MacKenzie (1980), Ford (1978, 1982), and Scott (2000), and it is acknowledged that Mushuau Innu is the most outlying of all of the dialects in terms of phonological behaviour and variability. Although a preliminary sketch of the stress system of Mushuau Innu is presented in Scott (2000), there is no detailed account of the metrical system. This is the first study focusing exclusively on the dialect's metrical stress parameters.

The current analysis is based on acoustic measurements from data collected for the purposes of undertaking a metrical stress analysis (see Section 3 on Methodology). The purpose of this research is to establish the metrical stress parameters (Hayes 1995) for Mushuau Innu and to support the analysis with empirical evidence of the stress pattern. This paper constitutes the first instrumental acoustic study of Mushuau Innu and will add new information to the literature and aid in comparison between dialects.

There are additional recordings and field notes from Mailhot (1971) which contain impressionistic stress markings. However, stress markings are provided on approximately one quarter of the data and due to the quality of the recordings (e.g., background noise, feedback), they are not suitable for an instrumental analysis.

1.1 Background: Metrical stress analysis (Hayes 1995)

Several theoretical assumptions are needed to describe stress placement in Mushuau Innu.

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[1] The community of Natuashish is formerly known as Davis Inlet.

This paper uses the metrical theory advanced by Hayes (1995). Metrical stress theory uses strong and weak syllable positions within a word, wherein the syllable is the stress-bearing unit and syllables are parsed into feet. The syllable that is stressed may be described as 'strong' and the syllable that is not stressed may be described as 'weak'. Additionally, syllables may be described as 'heavy' or 'light' based on whether or not the language is quantity sensitive (i.e., whether the internal structure of the syllable factors into stress placement).

Trochees and iambs are two types of binary foot constructions. A trochaic foot is made up of a stressed syllable followed by an unstressed syllable and an iambic foot is made up of an unstressed syllable followed by a stressed syllable. In addition, a language may not have bounded foot constructions, but instead have unbounded feet where a foot consists of one strong syllable and an unrestricted number of weak syllables.

Languages also differ in the direction in which footing occurs (i.e., whether the parsing of syllables into feet starts at the left or right edge), and may differ in whether or not it allows extrametricality. Extrametricality occurs when a constituent (e.g., syllable, foot) is excluded from the stress analysis: its presence does not affect stress assignment (Hayes 1981). Extrametricality most commonly affects the outer edges of word (i.e., occurs at the left-most or right-most edge).

Languages may also allow or disallow degenerate feet. A degenerate foot consists of a single weak syllable as there is no strong counterpart to make it a binary foot. The language may leave such syllables unfooted or foot them into degenerate feet. A language may also favour the left-most or right-most strong syllable to receive primary stress assignment and can hence be described as End Rule Left/Right.

Specific metrical stress parameters as they apply to Mushuau Innu are described in detail in Section 7 below.

1.2 Background: Related dialects

1.2.1 Southern East Cree (Brittain 2000)

Brittain (2000) conducted an impressionistic study of metrical stress assignment in Southern East Cree (SE Cree), a subdialect of Cree spoken on the Quebec-Labrador peninsula along the east coast of James Bay. She found that SE Cree is a quantity sensitive language, where heavy syllables attract stress and light syllables do not. Heavy syllables are defined in SE Cree as those containing a long vowel, or a short vowel closed by a glide or a nasal. All other syllables are light.

Stress placement was found to fit with two analyses: binary iambic feet and also unbounded feet. Under the iambic analysis, within a foot, a weak syllable must be followed by a strong syllable. Under the alternative unbounded analysis, feet could consist of an unlimited number of light syllables and a single heavy syllable which attracts stress.

The final foot in SE Cree is extrametrical, therefore not included in determining stress assignment, like Munsee and Unami Delaware, Malecite-Passamaquoddy, and Eastern Ojibwa, as cited in Brittain (2000). Excluding the extrametrical foot, the right-most heavy syllable is then stressed (End Rule Right).

1.2.2 Northern East Cree (Dyck, Brittain and MacKenzie 2006)

Dyck, Brittain and MacKenzie (2006) examined stress placement in Northern East Cree. The analysis of stress placement was impressionistic, although an acoustic analysis was also employed in certain cases to confirm transcriptions. They found that NE Cree is a quantity sensitive language at the level of the nucleus. Heavy syllables are defined in NE Cree as those containing a historically long vowel or rising diphthong (i.e., a diphthong where the second sound is more sonorous than the first; i.e., a glide followed by a vowel). Light syllables contain a historically short vowel. Coda consonants do not contribute to syllable weight.

Whereas SE Cree has final foot extrametricality (Brittain 2000), Dyck et al. (2006) found that the final syllable in NE Cree is extrametrical, and that excluding the final extrametrical syllable, the rightmost heavy syllable is stressed (End Rule Right). Feet are iambic and there are no degenerate (L) feet.

Words ending in a string of light syllables were problematic for stress assignment.[2] It was hypothesized, following MacKenzie (1980), that stress placement may be different in LL<L/H> words (and fall on the antepenultimate syllable) due to homophony: different stress patterns are needed to differentiate homophonous words (Dyck et al. 2006: 11).

2 Phonological description of Mushuau Innu

Mushuau Innu has the syllable template CV(:)C. The phonemic inventory as determined by Scott (2000) is listed below in Figures 1 and Figure 2.

p	t	k	
	tʷ	kʷ	
m	n		
mʷ			
	ʧ		
	s		h

Figure 1 Consonant phonemes

Scott (2000) details a variety of allophonic rules that can affect the consonants of Mushuau Innu (Mailhot 1971). However, few of the consonant allophonic rules Scott describes were present in the current data set. The consonant processes that were attested, for example, the voicing of voiceless obstruents intervocalically, did not influence or shift stress assignment.

i			u
i:			u:
	e:		
		a	
		a:	

Figure 2 Vowel phonemes

As illustrated in Figure 2 above, vowel length is phonemic in Mushuau Innu. Processes involving vowels include shortening, gliding, and deletion and these occur in a variety of environments. According to Scott (2000), long vowels have a more restricted set of allophones; long vowels only alternate with short vowels of the same quality (e.g., /i:/ will alternate with/ i/). However, short vowels are less restricted and alternate with vowels of differing qualities (e.g., /i/ will alternate with [ɨ], [ə] and [ʌ]). Scott (2000) determines that short vowels can centralize whereas long vowels can only shorten. This generalization is consistent with the present data.

Vowel hiatus is avoided in Mushuau Innu. To avoid hiatus, /i/ and /u/ become glides when they occur next to other vowels. This is a common occurrence in the data and affects both long and short

[2] That is, in the case of LL<H/L>, the final syllable could be heavy or light and not affect stress as it is extrametrical.

vowels. Syncope is also common and /i/ and /a/ are the only vowels that undergo syncope in Mushuau Innu (Scott 2000). Syncope occurs between homorganic consonants in positions of weak stress (MacKenzie 1980: 125).[3]

3 Methodology

3.1 Data collection

The present study is a preliminary acoustic analysis. New data were collected due to the need for a reliability and instrumental analysis.

The data were collected in November 2012 from a single Mushuau Innu speaker, Mary Jane Edmunds, by Marguerite MacKenzie, who also provided orthographic transcription and morpheme parsing and glossing. Marguerite said the utterance in English and Mary Jane said the sentence back in Mushuau Innu. Each utterance was repeated three times with a short pause between repetitions. I transcribed the utterances from the recordings using broad transcription conventions, and undertook the acoustic analysis using Praat and various Praat scripts. Cross-linguistically, there is no single phonetic property that corresponds to stress. However, pitch, duration, and intensity often show correlation with stressed vowels (e.g., higher pitch, longer duration, and greater intensity). A Praat script was used to measure each of these three possible stress correlates.

The data analyzed consisted of 83 distinct phrases with 169 words, consisting of three repetitions where available (i.e., the majority have three repetitions), for a total of 1294 vowel tokens.

3.2 Deriving the Underlying Representation

In order to determine whether stress assignment occurred at the level of the underlying representation or at the surface form, the underlying representation was established using the orthographic representation as a guide. The orthography was the best phonemic representation available, especially for distinguishing phonemically long vowels from phonemically short vowels (as both can surface as short vowels). Therefore, vowels marked with a circumflex accent [ˆ] were considered underlyingly long vowels (e.g., <â> was considered to be /a:/ in its underlying form). This is supported by evidence from phonological behavior: quality alternations are consistent with the orthography, as per Scott's (2000) description of the phonological behavior of Mushuau Innu vowels, since vowels marked in the orthography as short vowels centralize to other vowels, whereas orthographically marked long vowels only shorten. There is also new evidence from Dyck (2013) that suggests that the NE Cree orthography can be used as a phonemic guide for the underlying representation based on research by Knee (2012). For example, short vowels that are present in the orthography, but not heard in the perception, leave a measurable acoustic 'trace', such as [w] or lengthening of the preceding consonant, that supports the existence of such vowels.

Based on the orthographic and phonological patterning cues, syllables were coded as Heavy (H) or Light (L) syllables. Coda consonants did not contribute to syllable weight. All long vowels were coded as H in the underlying representation and all short vowels as L.

Additionally, the phonological processes of syncope and vowel hiatus occur in the surface representations of the data. The presence/absence of vowels in the underlying form (before syncope or vowel hiatus resolution occurred) was again aided by the orthography. For instance, in (1)

[3] However, the following penultimate analysis results in the deletion of presumably stressed vowels at the level of the underlying representation. The fact that this stressed vowel deletion occurs under the penultimate analysis may add additional information in favour of the right-most heavy analysis.

below, it was determined that the sequence [gw] in [nə**gw**ɑʃ**gw**ebɪnjun] results from vowel hiatus resolution in both cases as the orthography has two adjacent occurring vowels. Also the [j] occurs as a result of gliding to avoid vowel hiatus. It is of interest to note that it is a long vowel [i:] that undergoes gliding as it is the stress bearing vowel under both of the upcoming analyses.

(1)

Translation	Orthography	UR	SR
I jump	nikuâshkuêpanîun	nikua:ʃkue:pani:un	nəgwɑʃgwe:bɪnju

Further evidence for the presence of the /i:/ in the underlying representation can be seen in (2), where the /i:/ shown in the orthography (as <î>) appears in the surface form (where it does not in (1)). In most cases, in the current data, [i]-[u] vowel hiatus has been avoided by the [i:] surfacing as [j]. However, in (2), the [i] is preserved with a glide inserted between the two vowels (and [u] surfaces as [o]). The presence of both vowels and the epenthetic glide were verified by analyzing the structure of the formants and waveform using Praat.

(2)

Translation	Orthography	UR	SR
I jumped	nikuâshkuêpan**îu**nâpan	nikua:ʃkue:pan**i:u**na:pan	nəgwɑʃgwe:bɪn**ijo**nɑbɪn

3.3 Acoustic Analysis

Vowels were segmented and analyzed using Praat. Scripts were used to create gridlines and additional pitch, intensity, and duration scripts provided the measurements used in the analyses. Figure 3 shows the Praat workspace as used to investigate the vowel pitch, intensity, and duration measures.

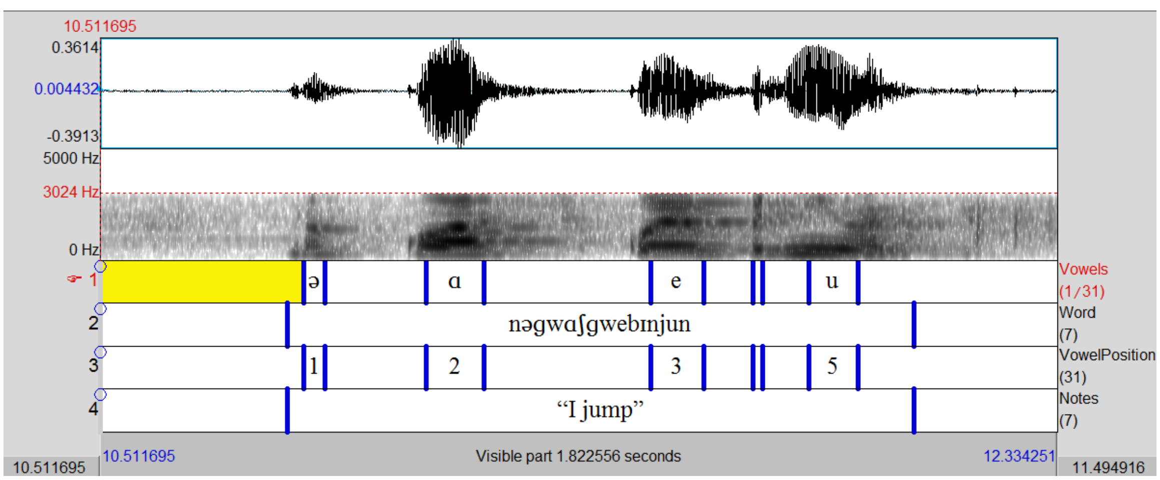

Figure 3

A combination of formant intensity/amplitude and waveform aperiodicity/periodicity was used to determine vowel boundaries. When marking vowel boundaries, the main cue was the periodicity of the waveform. The second cue used was formant intensity/shape with transitions included as part of the vowel. Ambiguous examples were checked by ear to confirm the boundaries of the vowel segment. The majority of the work in determining vowel boundaries was segmenting neighbouring glides from the vowels. The formant behavior of /j/ (F2 and F3 almost collide before moving in separate directions) and /w/ (starts as single F1 at 200–400Hz, gradually lower F2 and F3 components) proved the most useful in separating glides from vowels.

Vowel boundaries, specifically distinguishing vowels from neighbouring glides, followed guidelines suggested in Di Paolo and Yaeger-Dror (2010): the vowel boundaries were measured from vowel onset to vowel offset, in which case the transition was considered part of the vowel instead of part of the consonant.

The pitch and intensity scripts measured the maximum that occurred between the vowel boundaries. The duration script measured the time between vowel boundaries. All stress markings were determined by basing stress on the highest pitch point as it occurred between vowel boundaries. Vowel duration was also measured. However, due to the phonemic length distinction between vowels in Mushuau Innu, duration was not used to determine metrical stress assignment.

3.4 Statistical analysis

Previous literature suggests pitch is the relevant marker of stress, and the data did not show a consistent relationship between pitch and intensity or a consistent placement of peak intensity. No relationship between maximum intensity and maximum pitch was discovered, which provides support to the proposal that Mushuau Innu is a pitch accent language. To examine the relationship between peak pitch and intensity, I conducted a frequency analysis: how many times did the peak intensity correlate with the peak pitch within a word? Peak pitch and maximum intensity occurred on the same syllable only 36.9% of time as shown in a bar graph in Figure 4.

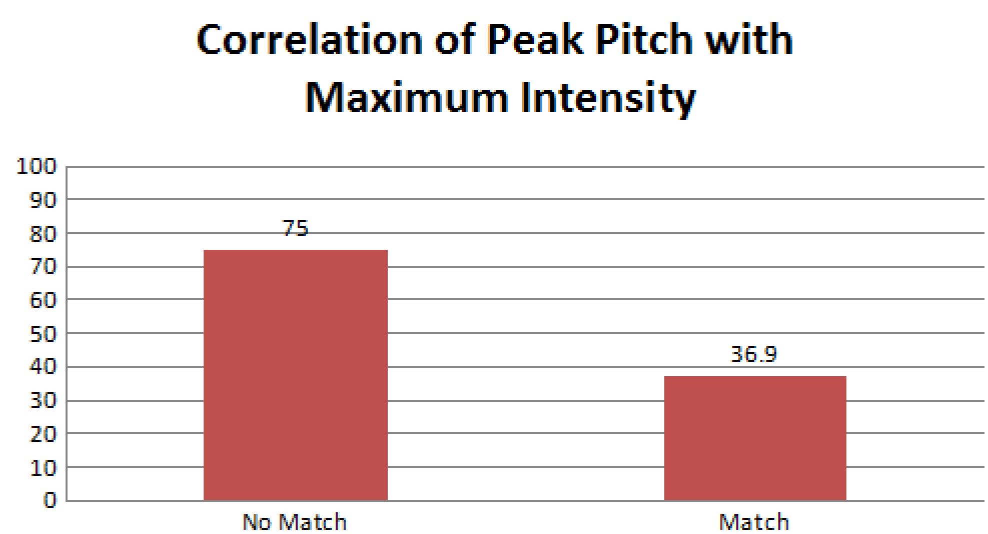

Figure 4

To determine if peak pitch was a suitable measure for marking stress, the pitch of all vowels that were marked as stressed (received peak pitch) were compared with all vowels that were marked as unstressed (did not received peak pitch).

There was a statistically significant difference between vowels marked as stressed and those marked as unstressed for all vowels (Figure 5). There was also a statistically significant difference between stressed and unstressed vowels that occurred in LLL sequences (Figure 6). LLL sequences were of special interest because they behave differently under the stress analyses discussed in Section 4.

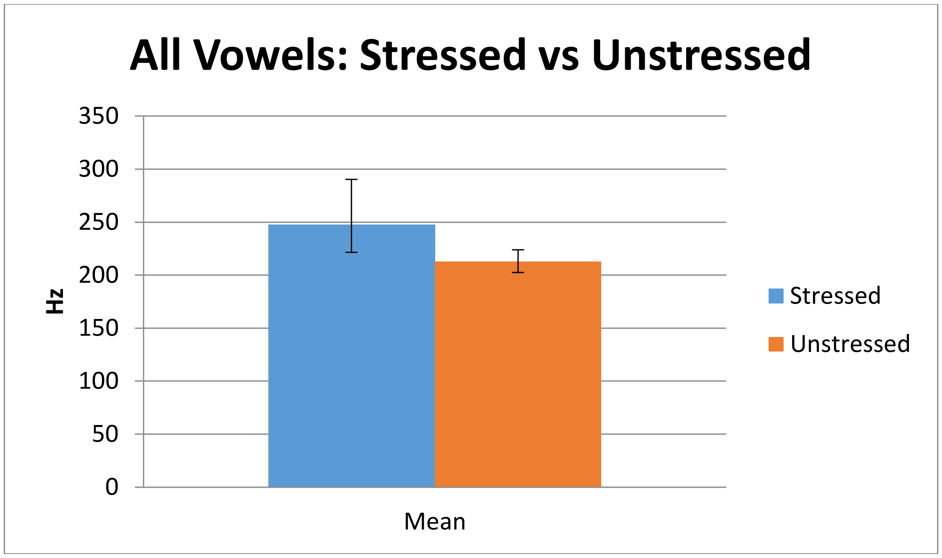

Figure 5

When comparing all unstressed vowels to all stressed vowels, the SEM (standard error of measurement) for unstressed vowels is 20.5, and for stressed vowels it is 6.3. The standard deviation for unstressed vowels is 20.5, and for stressed vowels is 68.2. The unpaired t-test two-tailed p value = 0.0001, showing a statistically significant difference. The confidence interval (the mean of stressed vowels minus unstressed vowels) equals 34.37 and the 95% confidence interval of this difference is from 26.10 to 42.83.

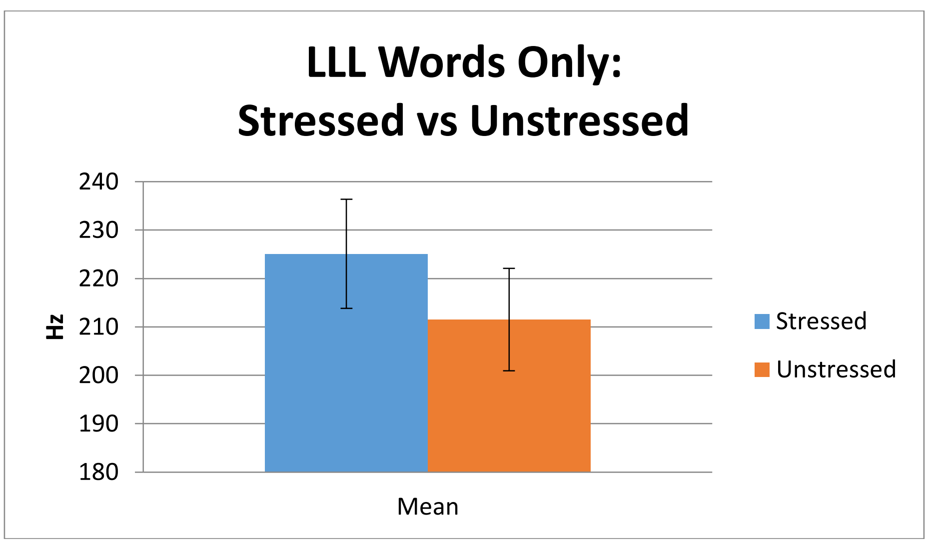

Figure 6

When comparing only the LLL unstressed vowels to LLL stressed vowels, the SEM for unstressed vowels is 2.2, and for stressed vowels it is 3.7. The standard deviation for unstressed vowels is 16.5, and for stressed vowels is 18.3. The unpaired t-test two-tailed p value = 0.0016, showing a statistically significant difference. The confidence interval (the mean of stressed vowels minus unstressed vowels) equals 13.56 and the 95% confidence interval of this difference is from 5.32 to 21.8

For the data set as a whole, the frequency range as measured on all vowels was 97 Hz – 572.3 Hz, with a standard deviation of 42.27, and an average pitch of 222.46 Hz.

4 Detailed analysis of metrical parameters

Multiple word utterances were excluded due to possible stress shift. Sequences of LLL are also excluded due their unpredictability, which will be discussed in Section 5.

In the surface form, stress most frequently falls on the ultimate syllable, followed by the penultimate syllable. The majority of the data could be analyzed using two distinct analyses: a penultimate analysis and a right-most heavy analysis. In both analyses stress is assigned at the level of the underlying representation with surface variations arising as a result of gliding, deletion, diphthongization, and syncope.

In the penultimate analysis, stress is assigned to the penultimate syllable at the level of the underlying representation. In the absence of gliding, deletion, syncope, or diphthongization, stress remains on the penultimate syllable in the surface representation. When a phonological process occurs that affects the number of syllables, a rightward adjustment is made resulting in stress on the ultimate syllable. In the right-most heavy analysis, stress is again assigned at the level of the underlying representation. The final syllable is extrametrical, and therefore does not count towards stress assignment, and stress is assigned to the right-most heavy syllable. If a phonological process occurs that alters the number of syllables at the end of the word, a rightward adjustment is made. Data that can be accounted for using both analyses is presented in Section 4.1., followed by data that works for only one of the analyses in Section 4.2. Exceptional data (that works for neither analysis) is described in Section 4.4.

Stress markings in the surface representation are based on acoustic analysis; maximum pitch determined stress assignment. Stress markings in the underlying representation are based on predicted stress assignment as determined by the right-most heavy and/or penultimate analysis. Vowels were coded as heavy (H) or (L) based on the guidelines described in Section 2.2 above. Data described in Section 4.1 did not have variable stress throughout repetitions: in all repetitions, stress occurred on the same syllable. In the other sections, all variability is described for each example.

4.1 Data that can be accounted for using both a penultimate and right-most heavy analysis

4.1.1 Stress on penultimate syllable

The following data were congruent with both analyses. In (3), there is no change in syllable structure from the underlying representation to the surface form. For the penultimate analysis, stress is assigned to the penult and remains on the penultimate heavy syllable in the surface form. For the right-most heavy analysis, the final syllable containing the short /a/ is extrametrical and stress is assigned to the right-most heavy vowel and remains there in the surface form. The /n/ surfaces as a /j/ as part of a complex [n]-[j] alternation that is a unique feature of the Mushuau Innu dialect.

This alternation can be variable for the same word depending on the speaker and did not affect the length or number of syllables in the current data set.

(3)

Translation	Orthography	UR	SR
our arm	nishpitunâna	niʃpituná:na L L L H L	nɛsbodʌnájɑ L L L H L

Example (4) is similar to example three above. No phonological processes affect the data so the penult (which also happens to be the right-most heavy syllable) receives primary stress.

(4)

Translation	Orthography	UR	SR
I jumped	nikuâshkuêpanîunâpan	nikua:ʃkue:pani:uná:pan L LH LH L HL H L	nəgwɑʃgwebɪnijonɑ́bɪn L H H LH L H L

In example (5), the two analyses have different underlying forms, but result in the same surface form. For the penultimate analysis, the penultimate vowel /u/ receives stress in the underlying form, and as no phonological processes affect it, retains primary stress in the surface form. For the right-most heavy analysis, the long vowel /i:/ receives stress in the underlying form (as the final heavy syllable /a:/ is extrametrical). However, to avoid vowel hiatus the long /i:/ is glided causing a rightward adjustment which results in penultimate stress. The process of the stress-bearing long vowel undergoing gliding (and resulting in a right-edge adjustment) is common in the current data set.

(5)

Translation	Orthography	UR	SR
We (incl.) are jumping	tshikuâshkuêpanîunân	ʧikua:ʃkue:pani:una:n L LH LH L HL H	ʤəgwɑsgwebɪnjúnaj L H H L L H

4.1.2 Stress on ultimate syllable

In example (6) and (7), the process of gliding affects the results of both analyses. For the penultimate analysis, the penultimate vowel /i:/ receives stress in the underlying form. However, to avoid vowel hiatus the /i:/ is glided causing a rightward adjustment which results in ultimate stress. For the right-most heavy analysis, the long vowel /i:/ receives stress in the underlying form as it is the right-most heavy vowel. However, to avoid vowel hiatus the long /i:/ is glided causing a rightward adjustment which results in ultimate stress.

(6)

Translation	Orthography	UR	SR
I jump	nikuâshkuêpanîun	nikua:ʃkue:paní:un L LH LH L HL	nəgwɑʃgwebɪnjún L H H L L

(7)

Translation	Orthography	UR	SR
He is jumping	kuâshkuêpanîu	kua:ʃkue:paní:u LH LH L HL	gwɑʃgwebɪnjú H H L L

In example (8), diphthongization affects both analyses. In the penultimate analysis, stress is assigned to the penultimate vowel /a:/ however due to the final two vowels becoming a diphthong to avoid vowel hiatus, a rightward adjustment is made to the ultimate syllable. Similarly, in the right-most heavy analysis, the long vowel /a:/ attracts stress at the underlying representation but becomes a diphthong at the surface form to avoid vowel hiatus. The rightward adjustment results in ultimate stress. This pattern is common throughout the current data set.

(8)

Translation	Orthography	UR	SR
I see him	nuâpamâu	nua:pamá:u LH L HL	nəwɑbma͡ú L H H

4.2 Data that can be accounted for using penultimate analysis only

All of the data that can be accounted for using only the penultimate analysis end in the syllable sequence HLL. In examples (9) and (10), only a penultimate analysis accounts for the stress assignment. For the penultimate analysis, the penultimate /i/ attracts stress. However, due to syllable deletion (it is unclear whether the final or penult /i/ is deleted) a rightward adjustment is made resulting in ultimate stress at the surface form. Under the right-most heavy analysis, stress should fall on the /ɑ/ in the surface form, which it does not.

(9)

Translation	Orthography	UR	SR
I'm falling	nipâtshishin	nipa:ʧíʃin L H L L	nəbɑʧín L H L

(10)

Translation	Orthography	UR	SR
You are falling	tshipâtshishin	ʧipa:ʧíʃin L H L L	ʤəbɑʧín L H L

Example (11) displayed variability in the stress placement throughout the repetitions. The first two repetitions fit with the penult analysis. Due to syncope of the penultimate /a/ vowel (vowel syncope between /p/ and /m/, i.e., homorganic segments, is common in Mushuau Innu; see Scott 2000), stress assignment is adjusted to the ultimate syllable. Under the right-most heavy analysis, the /ɑ/ should receive stress in the surface form, which it does not. The last repetition cannot be accounted for under either analysis.

(11)

Translation	Orthography	UR	SR Variations
You see me	tshuâpamin	ʧua:pamin LH L L	ʤəwɑbmín L H L
			ʤəwɑbmín
			ʤə́wɑbmɪn

Example (12) only fits with the penultimate analysis. Due to deletion of the penultimate /a/ vowel, stress assignment is adjusted to the ultimate syllable. Under the right-most heavy analysis, the /ɑ/ should receive stress in the surface form, which it does not.

(12)

Translation	Orthography	UR	SR
He sees you	tshuâpamik^{u}	ʧua:pámik^{w} LH L L	ʤəwɑbmʊ́k^{w} L H L

In example (13), the first repetition does not fit into either analysis. Under the penultimate analysis stress should fall on the penultimate syllable in the surface form (which it does in the last two repetitions). For the right-most heavy analysis, stress should fall on the antepenultimate syllable, which it does not.

(13)

Translation	Orthography	UR	SR Variations
You are nudging me	tshuêpishkun	ʧue:piʃkun LH L L	ʤəwebɪskún L H L L
			ʤəwebɪ́skun
			ʤəwebɪ́skun

4.3 Data that can be accounted for using right-most heavy analysis only

Example (14) fits with the right-most heavy analysis only. In the underlying form, stress is assigned to the antepenultimate /a:/ and due to the common process of vowel deletion between the /p/ and /m/, stress falls on the penultimate syllable at the surface representation. For the penultimate analysis to work, stress would have to fall on the ultimate syllable in the surface form (due to a rightward adjustment after the stress vowel /a/ underwent syncope), which it was not.

(14)

Translation	Orthography	UR	SR
He sees me	nuâpamik^{u}	nuá:pamik^{w} LH L L	nəwɑ́bmʊk^{w} L H L

Example (15) provides further evidence for the right-most heavy analysis. Under the penultimate analysis, stress should fall on the ultimate syllable in the surface form because the penult undergoes deletion. Stress placement follows the pattern of the right-most heavy analysis, where the right-most heavy /a/ receives stress underlyingly and due to deletion, a rightward adjustment is made to the penultimate syllable in the surface form.

(15)

Translation	Orthography	UR	SR
I'm nudging you	tshuêpishkâtin	ʧue:piʃkáwɛtin[4] LH L H L L	ʤəwebɪskάdən L H L H L

4.4 Exceptional data to both analyses

In example (16), using both the penultimate and right-most heavy analyses, stress should fall on the penultimate /ɑ/ syllable in the surface form, not the ultimate /e/. This example is more peculiar because the /t/ surfaces as /s/, which could be explained using the phonological rules in Scott (2000) if [ht]→ [θ]→[s], and the final /n/ is deleted.

(16)

Translation	Orthography	UR	SR
You see it	tshuâpâhtên	ʧua:pa:hte:n LH H H	ʤəwɑbɑsé L H H H

In example 17, the first repetition (with stress on final syllable) does not fit into either analysis. However, the last two repetitions can be analyzed using either pattern: for the penultimate analysis, the penult /u/ becomes part of a diphthong and ends up in stressed penultimate position. For the right-most heavy analysis, the long vowel /a:/ becomes part of a diphthong to avoid vowel hiatus causing stress to fall on the penultimate syllable at the SR.

(17)

Translation	Orthography	UR	SR Variations
I see them	nuâpamâuats	nua:pama:uaʧ LH L H LL	nəwɑbma͡uwíʧ L H H L
			nəwɑbma͡úwɪʧ
			nəwɑbma͡úwɪʧ

In example (18), the first two repetitions with ultimate stress cannot be accounted for using either analysis. The final repetition with stress falling on the penultimate syllable, which is also the right-most heavy syllable, is the form predicted by both analyses.

(18)

Translation	Orthography	UR	SR Variations
He sees it	uâpâ(h)tam^{u}	ua:pa:tam^{w} LH H L	wɑbɑtʌ́m H H L
			wɑbɑtʌ́m
			wɑbάtʌm

[4] Historically, this word contains the morpheme *awe*, where the *e* is historically short (resulting in a L /ɛ/ in the underlying representation).

4.5 Metrical Grids

To determine the foot type, various metrical grids were constructed, illustrated in Figure 7 and Figure 8 below. However, all four illustrated metrical parses make equivalent predictions for the data that can be accounted for using both the right-most heavy and the penultimate analysis. None of the illustrated structures work for example (16). However this example is already an exceptional piece of data to both proposed stress analyses.

The metrical grids are illustrated using the underlying representation shown in example (7), *kuâshkuepanîu* 'He is jumping', where the stress surfaces on the penultimate heavy syllable. For the right-most heavy analysis in Figure 7, both a moraic trochee grid and an iambic grid account for the data that fits with both analyses above (see Section 4.1). Moraic trochees are preferred to bisyllablic trochees as per Hayes (1985): in a quantity sensitive system, Hayes (1985) proposed not having bisyllabic trochees, but instead moraic trochees which have a single H syllable or two L syllables (Gussenhoven and Jacobs 2011:228).

```
Moraic Trochees          (X)  (X)
                         LH L H<L>
                      kua:ʃkue:pani:u


Iambs                   (. X) (. X)
                         LH  LH<L>
                      kua:ʃkue:pani:u
```

Figure 7 Foot construction for right-most heavy analysis

In the first structure shown in Figure 7, the final syllable is extrametrical, heavy syllables are parsed into moraic trochees, leaving the light syllables unparsed due to a ban on degenerate feet. In the second structure (i.e., the iambic parse) shown, the final syllable is extrametrical and the remaining syllables are exhaustively parsed into uneven LH iambs. If the strong syllable of the rightmost foot receives stress, the penultimate syllable is correctly stressed under both metrical analyses.

Unlike the right-most heavy analysis, the penultimate analysis does not make use of quantity sensitivity. For the penultimate analysis, shown in Figure 8, a trochaic analysis or an iambic analysis with final syllable extrametricality fits with the data that can be accounted for using either analysis. Similarly, Dyck (2013) found that the stress pattern of NE Cree is consistent with either an iambic or trochaic analysis.

```
Trochees
                          (X .) (X .)
                           σ σ  σσ
                      kua:ʃkue:pani:u

Iambs (with
extrametricality)        (. X) (. X)
                          σ σ  σ σ<σ>
                      kua:ʃkue:pani:u
```

Figure 8 Foot construction for penultimate analysis

5 LLL

In accordance with the research on NE Cree ((Dyck, Brittain and MacKenzie 2006), words ending in a LLL syllable structure pose a particular challenge. In the absence of a H syllable, foot construction is variable. Even with the presence of a H syllable (in the aforementioned data) there is not enough evidence to determine whether footing is iambic or trochaic, making the parsing of the LLL syllables even more difficult.

If the last three syllables are LLL at the level of the UR, footing is variable because there is no H syllable to attract stress. Twelve out of sixteen utterances ending in LLL have an alternating stress pattern within repetitions of the same word.

In (19), the penultimate vowel is glided to avoid vowel hiatus. Under the penultimate analysis the /u/ should receive stress at the UR and then shift to the ultimate /a/ due to gliding. This does not occur. The right-most heavy analysis cannot be applied due to the absence of a heavy vowel.

(19)

Translation	Orthography	UR	SR
Our shoes	tshimassinaua	ʧimasinaua L L L LLL	ʤəmɪsɪnówɑ L L L L

In (20), syncope occurs between the /p/ and the /m/. Stress falls on the penultimate syllable. This could be consisted with the penultimate analysis but not with the right-most heavy analysis.

(20)

Translation	Orthography	UR	SR
I see you	tshuâpamitin	ʧua:pamitin LH L L L	ʤəwɑbmítən L H L L

In (21), no phonological processes occur. In the first repetition peak pitch falls on the antepenultimate syllable, in the second repetition, two vowels have equal levels of pitch. This example does not fit with either analysis.

(21)

Translation	Orthography	UR	SR Variations
My arm	nishpitun	niʃpitun L L L	nɛ́sbodʌn L L L
			nɛ́sbódʌn

6 Summary of analyses

While the penultimate analysis accounts for more of the current data, the analysis does not take into account syllable weight. If Mushuau Innu is not quantity sensitive, there is no way to explain why three Light syllables in a row result in a variable stress pattern. Presumably, the combination LL<L/H> would behave the same as the final syllable is extrametrical, but there were no LLH utterances at the level of the UR in the current data set. The right-most heavy syllable analysis, which is sensitive to syllable weight, allows for an explanation of the unpredictability of LLL syllable combinations as there is no heavy syllable to attract stress assignment. The right-most heavy analysis also lends itself to comparison with other related dialects (e.g., NE Cree and SE Cree are both quantity sensitive).

The right-most heavy analysis offers an explanation as to why LLL patterns differently. The sequence of HL(L/H) without gliding or deletion would be ideal to show whether the penultimate or right-most heavy was the preferred analysis; under the penultimate analysis stress should fall on the penultimate L syllable, and under the right-most heavy stress should fall on the antepenultimate H. However, there is only one example of this in the data (cf. example (13)), and it alternates across repetitions. The first repetition does not fit into either analysis, and the last two repetitions only fit into a penultimate analysis.

(22) (previously described in (13))

Translation	Orthography	UR	SR Variations
You are nudging me	tshuêpishkun	ʧue:piʃkun LH L L	ʤəwebɪskún L H L L
			ʤəwebískun
			ʤəwebískun

The rightward adjustments in cases of deletion, gliding, diphthongization, and syncope suggests that footing is trochaic. As per Kager (1995), stress is anchored to its position within the foot and the shift of stress to the right, suggests a trochaic foot. However, other foot analyses, presented in Section 4.5, also work for the data set.

7 Overview of metrical parameters

Metrical stress can be predicted on the basis of a set of parameters (Hayes 1995). The following metrical parameters were determined for Mushuau Innu based on a pattern of maximum pitch. The use of maximum pitch to mark stress assignment was bolstered by the statistical analyses described in Section 3.4, which showed a statistically significant difference between vowels which were marked as stressed and those which were not.

7.1 Penult analysis parameters:

Quantity Sensitivity: Not quantity sensitive.

Extrametricality: None.

Foot type: Unable to determine; possibly trochaic due to rightward stress adjustments (Kager, 1995). It is also ambiguous as to unbounded or binary feet.

Degenerate Feet: Not enough evidence to determine.

Footing is from the right edge of the word.

Penultimate syllable receives stress at the level of the underlying representation. In the presence of deletion, gliding, diphthongization, or syncope of the penultimate or ultimate syllable, a rightward adjustment is made. This suggests a trochaic foot type, however further evidence is needed.

7.2 Right-most heavy analysis parameters:

Quantity Sensitivity: Mushuau Innu is quantity sensitive at the level of the nucleus. Historically long vowels result in a Heavy syllable, historically short vowels result in a Light syllable.

Weight-by-Position: Mushuau Innu does not have weight-by-position (i.e., the presence of a coda does not make a syllable heavy (Hayes 1989)).

Extrametricality: Final syllable is extrametrical.

Footing is from the right edge of the word.

Foot type: In general, the rightward adjustment of stress when deletion occurs is consistent with a trochaic analyses and stress remaining within the foot (as per Kager 1995). However, some examples require stress shift to move the stress beyond its original foot, including onto a syllable which is extrametrical at the UR. The pattern of stress shift therefore does not provide conclusive evidence with respect to foot type.

Degenerate Feet: No degenerate feet.

End Rule Right: Excluding the final extrametrical syllable, the right-most heavy syllable is stressed.

8 Summary and further research questions

The results of my acoustic analysis of Mushuau Innu show two analyses that can account for much of the current data. It appears that the right-most heavy analysis is preferred as it explains why LL<L/H> sequences pattern differently and it also aids in comparison between dialects; related dialects are quantity sensitive, have final syllable or foot extrametricality, and follow End Rule Right (e.g., NE Cree (Dyck, Brittain and MacKenzie 2006) and SE Cree (Brittain 2000) described above).

While the penultimate analysis accounts for more of the current data, it does not take into account syllable weight. The collection of additional data which exhibits the underlying form of HL(L/H) without gliding or deletion would be ideal to provide further insight into both analyses. In the absence of gliding or deletion, the syllable structure would not be altered from the underlying to the surface form. Under the penultimate analysis stress should fall on the penultimate L syllable, and under the right-most heavy stress should fall on the antepenultimate H. The difference in stress placement could highlight the preferred analysis.

This paper represents the first instrumental analysis of Mushuau Innu. In terms of acoustic analysis, stress was assigned based on a pattern of maximum pitch. Pitch differences between stressed and unstressed vowels were found to be statistically significant and the fact that the resulting metrical stress analysis found for Mushuau Innu patterns similarly to those described for other dialects indicates that the methodology of using pitch to determine stress placement is promising. Future research investigating correlations between maximum pitch and native speaker intuitions regarding stress placement has the potential to add further support to this method of investigating stress patterning.

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