

# VOWELS SPACES AND REDUCTION IN PLAINS CREE

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## 1 Introduction

Plains Cree is an Algonquian language [1] spoken by approximately 35,000 individuals [2]. Plains Cree can be divided into a series of areal dialects that exhibit grammatical and phonetic differences. The present work focuses on the community of Maskwacis, Alberta and investigates the acoustic characteristics of vowels and phonetic reduction in the community.

## 2 Background

According to Thunder [3], Plains Cree vowels come in pairs of short and long, orthographically distinguished by a circumflex to mark length: a â, i î, o ô. The mid-high front vowel <ê>, which is written with or without a circumflex, is always considered long. Despite indicating that the vowels sound different, Thunder [3] differentiates vowels in a pair primarily through duration.

Muehlbauer [4] phonetically documents the vowel space of three speakers from various Cree communities using archival recordings. He reports that short and long vowels differ in both duration and quality. Muehlbauer [4] measures the F1 and F2 of vowels occurring between /k/ and /t/. This acoustic vowel plot indicates that, while front vowels overlap some, the vowel pairs are qualitatively different.

Relatively little research has also been conducted on Plains Cree reduction. Russel [5] focused on the reduction of a vowel when preceding another across a word boundary. Russell uses the orthographic form as an indication of the pre-reduced form. Investigating instances of various sandhi (in the form of  $(v_1\#v_2)$ ) and comparing the F1 and F2 of  $v_2$ , vowel averages, Russell determines the effect reduced  $v_1$  has on the remaining  $v_2$ . Indeed, most remaining vowels show diphthongization in their onset when compared to the average vowel, indicating that “reduced” vowels are present.

## 3 Methodology

We first investigate the acoustic characteristics of the vowels in Maskwacis Cree. This will provide a baseline for determining what sort of reduction is occurring elsewhere for the vowels. Syllables with a glide onset (/j/ and /w/) were selected for the study of reduction. This restriction was based on a pilot study, which identified these syllables as the most likely candidates for reduction.

### 3.1 Speakers

Three fluent female speakers from Maskwacis, ages 50-75, participated in the recordings. The speakers all work as language educators.

### 3.2 Vowel Acoustics Items

Following Muehlbauer [4], we created a list of words containing vowels in various positions. Target words contained vowels in word initial (before either /t/ or /s/) stressed and unstressed positions, as well as interconsonantly (between two /s/ phonemes) in a stressed position. English translations of targets were used for elicitations.

### 3.3 Reduction Items

Focusing on the reduction of words with glide onsets, syllables were selected from word initial, medial, and final positions (where possible). Elicitations followed the vowel acoustics items and we used the English translation of the word for elicitation. Similar to Russell [3], we used the Standard Roman Orthographic representation of a word as a pre-reduced/canonical form.

### 3.4 Recordings

Recordings were conducted in Maskwacis, AB in a quiet room using a portable recorder (Korg MR2000) and a head mounted omnidirectional microphone (Countryman E6). Mark-up, transcription and measurement were performed using Praat [6].

## 4 Results and Discussion

### 4.1 Vowel space

We find the vowel space of Maskwacis Plains Cree shows some overlap for the front vowels, in accord with Muehlbauer [4]. However, there are qualitative differences distinguishing the front vowels. We find substantial overlap for the back and low vowel pairs, illustrated in Figure 1. Orthographically low vowels are indicated with a double vowel in all figures.

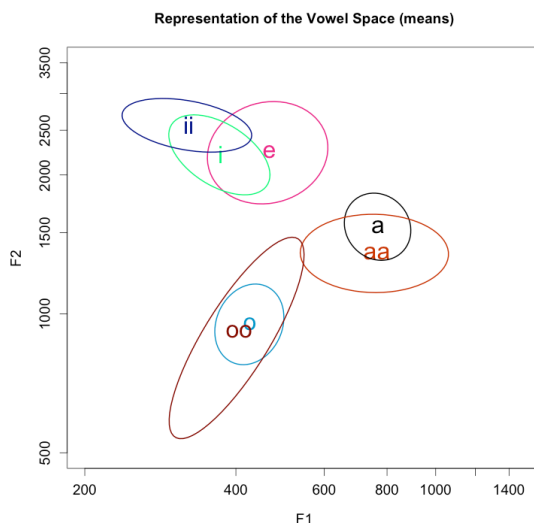


Figure 1: Vowel Space of Maskwacis Cree for three female speakers (log Hz).

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The short low vowel generally has a higher F2 than the long vowel. We also note the overlap of <o> and <oo>, with the long vowel's standard deviation almost entirely encompassing the short vowel's. In fact, each long/short vowel pairing indicates some overlap. This may explain the expected duration distinction between long and short vowels, seen in Table 1.

Vowel	a	aa	i	Ii	o	oo	e
Duration (ms)	83	157	97	122	122	157	203

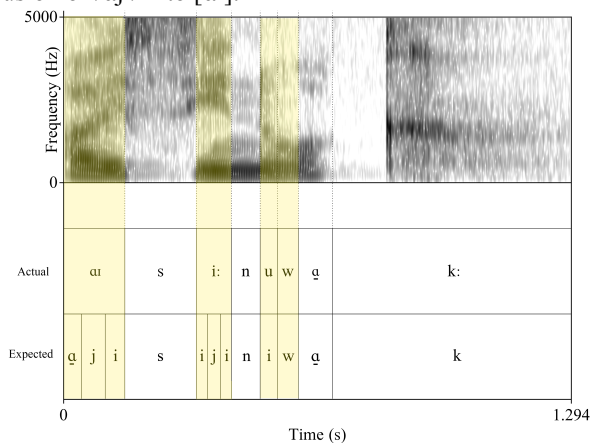
**Table 1:** Mean duration of vowels across participants.

As in Muehlbauer [7], stress seemed to have no effect on vowel space or duration.

## 4.2 Reduction

Looking towards reduction, we identify three main types: fusion of /j/ near high front vowels, assimilation of /i/ to [u] when preceding a /w/, and the fusion of /w/ when near high back vowels.

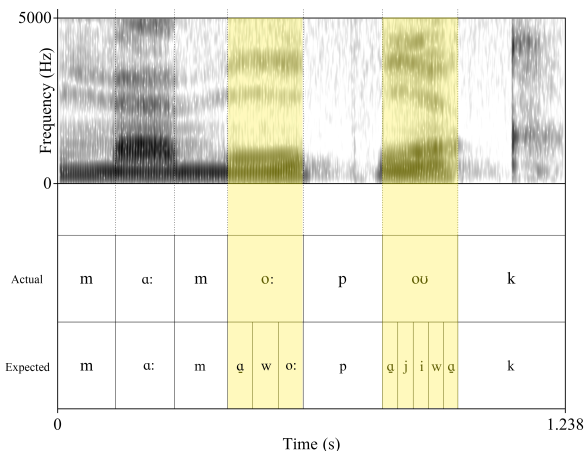
Dealing first with /j/ reduction near high vowels, we look to Figure 3. Because they're phonetically similar, the reduction of /j/ and /i/ is not surprising. In Figure 3 we see an example of this reduction, leading the /iji/ cluster to surface as [i:]. Interestingly, the resulting [i:] is longer (102 ms) than the speaker's average /i/ (83 ms), indicating an instance of sound fusion, rather than deletion. Similarly, we see the fusion of /aji/ into [a:].



**Figure 3:** Reduction of /iji/ to [i:] and /iw/ to [uw] in the word <ayisiyiniwak> (meaning 'People').

Figure 3 also illustrates the second form of reduction, where we find the change of /iw/ to /uw/. This can be seen as an assimilation of the high front /i/ to the back-round /u/. Although this sort of assimilation is mentioned by Thunder [3], the /w/ is generally lost, rather than left intact as in Figure 3.

The last reduction form concerns /w/ near mid and back vowels. We find two instances of this reduction illustrated in Figure 4. First is the reduction of /qwo:/ to [o:]. The resulting /o:/ has a duration of 184 ms, just slightly less than the average /o:/ of 187 ms. Because of this slight difference, this reduction might be one of sound deletion rather than fusion.



**Figure 4:** Reduction of /qwo:/ to [o:] and /qjiwq/ to [oo] in the word <maamawoo piwak> (meaning 'They come together').

Finally is the complex reduction of /qjiwq/ to [oo]. Because of the multiple forms of reduction happening, it's difficult to determine the order of reduction. It seems likely that /qji/ reduced into something resembling /i:/, which was assimilated by the /w/ into a /o/. Then, /w/ may have fused with the /q/ to create a lower, unrounded /o/.

## 5 Conclusion

We find that the Maskwacis Plains Cree vowel space exhibits some overlap in the vowel space but we also find indication of qualitative and quantitative differences between long and short vowels. Reduction of /j/ and /w/ onset syllables is prevalent in the speech examined. More research is needed to determine further instances of reduction and help identify more possible causes of reduction.

## Acknowledgments

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## References

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