Blackfoot Word Melody of Second Language Learners

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Oki nikso'kowaiks.
Nitsita'pao'takihpinnaan ki nitaokakio'satoohpinnaan nitsiipowahsini.
Annóóma, nitaakohtssinaakihpinnaan maanistaohtakoyihpi
aissksinima'tsaiksi aayaitsipoyissa.

Hello friends (relatives).
We are working together and studying about the Blackfoot language.
Here, we are going to write about how the language sounds
when learners speak Blackfoot.

We are a team consisting of an Indigenous student/scholar and a non-Indigenous linguist.[1] We have been collaborating on a project describing Blackfoot pitch in order to contribute to the findings of Blackfoot linguistics and to make use of the findings in application.

We are interested in how adult second language learners learn the sounds of Blackfoot within the context of Blackfoot language revitalization. We are investigating this through the ways learners' pronunciation differs from native speakers'. Building on previous work studying Blackfoot prosody (Fish and Miyashita 2017; Fish 2018; Miyashita and Weber 2020), we examined Blackfoot language learners' pronunciation, focusing on pitch movement. The results revealed that most learners we examined produced Blackfoot words differently from a native speaker and that there is a variety of pitch movements produced by learners. In addition, the research suggests that early exposure to Blackfoot and opportunity to hear the language may contribute to production of Blackfoot words with pitch movement that is closer to a native speakers.

Further, in attempting to conduct second language research in Blackfoot, we faced limitations that may also apply to studying other Indigenous languages as a second language. We hope that this study helps scholars and community language workers prepare for their own second language acquisition research in the context of Indigenous language revitalization.

While research in Indigenous language learning is an emerging field (e.g. Morcom 2017; Sabine et al. 2017), there is, to our knowledge, still little research done on second language acquisition specific to sound production in Indigenous languages (e.g. Crago 1992; Norris 2007; Ratima and May 2011). Our study addresses the pronunciation of Blackfoot produced specifically by adult learners; we therefore believe this study will contribute to an understanding of second language sound acquisition in the context of Indigenous language revitalization.

The rest of this paper is organized as follows. We first describe pitch movement or "word melody" in Blackfoot. Second, we outline our research methods, results, and findings on the pronunciation of Blackfoot words produced by second language learners with respect to pitch movement. Third, we describe the results in relation to the learners' demographic survey. Then we provide a distributional analysis of the learners' pronunciation in comparison with a native speaker of Blackfoot.

Blackfoot Word Melody

Blackfoot is spoken in Alberta, Canada, and Montana, US, and is considered endangered by UNESCO's *Atlas of the World's Languages in Danger* (UNESCO), though in Montana it should be considered critically endangered owing to the

speaker population. Speaker population estimates are 3,000-3,250 speakers in Canada (Statistics Canada 2011) and 50 or fewer in the US (Darrell Kipp, personal communication). On the Blackfeet Reservation in the US, it is rare for residents to hear Blackfoot in natural use. Recent activities among the Piegan Institute and public schools in the US and Canada have been conducted to reverse this language shift (Kipp 2000; 2007). However, the language remains extremely vulnerable, as it is very challenging for many adults to become proficient speakers.

Also, the language is very different from learners' first language, English. For example, while Blackfoot's basic sounds are relatively simple, Blackfoot consonant clusters can be more complex than in English and are pervasively observed. A few examples shown in (1) are words that contain six or seven consonants in a row, including geminates (the same consonants next to each other); it has not been extensively studied where the syllable boundary goes in these cases.

(1) Examples of complex consonant clusters[2]

a.	*omahksstooki*	'donkey'	[o**mxks:t**o:ki]
b.	*ikkstsskiómitaa*	'greyhound'	[i**k:sts:k**iómita:]
c.	*íímahkihkinaa*	'sheep'	[i:**mˀxkç**kinɑ:]

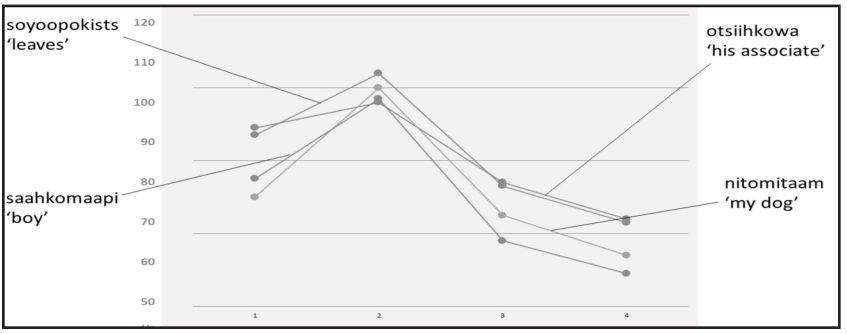
Blackfoot has been described as a "pitch accent language" (Frantz 2017).[3] Words have at least one accented vowel, which is pronounced with the highest pitch within the word. The accent location is idiosyncratic and, depending on the accent's location, words pronounced the same in terms of consonants and vowels will result in different meanings, as shown in (2).

(2) Lexical pitch accent: Pitch affects meaning

a.	*ápssiwa*	'It is an arrow.'	
b.	*apssíwa*	'It is a fig.'[4]	(Frantz 2017, 3)

In looking at two-, three-, and four-syllable words with various accent locations, we observed that words with the same number of syllables and the same accent position have strikingly similar overall word melodies (Fish and Miyashita 2017; Miyashita and Weber 2020). To show that there are patterns in pitch movements, we measured the pitch of every vowel in four different four-syllable words with accent on their second vowels, pronounced by the same native speaker, and created a graph in Microsoft Excel, which is shown in Figure 1. The relative pitch movement among the four samples is strikingly similar, both as measured and perceptually. Further pitch patterns observed among two-, three-, and four-syllable words are described by Miyashita and Weber (2020).

Figure 1. Word melodies of four different words that contain four vowels, with the second vowel accented.



Though this pitch movement is one of the salient phonetic characteristics in Blackfoot, native speakers produce Blackfoot words with "authentic" word melody while unaware of the patterns. Consequently, pitch movement is not usually (if ever) incorporated or taught in language classes. This situation is not unique to Blackfoot; it is generally true even in the teaching of dominant languages (see Shport 2016 for Japanese; De Bot and Mailfert 1982 for ESL).

We also believe that pitch movement or word melody contributes to native speakers' perception of whether words sound "native-like," and that word melody should be taught to second language learners. However, because pitch is not consciously perceived, the pronunciation of Blackfoot learners whose first language is English is predicted to significantly differ from that of native speakers. One of the contributing factors may be the phenomenon called "linguistic transfer." Linguistic or language transfer is a cause of production error owing to the linguistic differences between the first language and second language. It is widely understood that a learner's first language system influences his/her second language production (Ellis 1994; Saville-Troike 2006, and many others).

Our question with respect to second language learning is whether learners produce Blackfoot words with different pitch patterns than native speakers. Do learners successfully acquire lexical pitch and pitch movement? If not, how do learners pronounce Blackfoot words with respect to pitch accent and pitch movement? Finding answers to these questions will help us understand how Blackfoot pronunciation is learned and knowing such characteristics and pronunciation difficulties for learners will help develop effective language teaching curricula and learning strategies.

Methods

To answer the questions given in the previous section, we conducted recording sessions with L2 (second language) learners of Blackfoot who had taken or were taking a Blackfoot class. Before recording, the participants were given a survey asking about their language background and familiarity with Blackfoot, as well as demographic information (see Appendix).

Word List

We tasked participants with producing a series of two-, three-, and four-syllable Blackfoot words that were drawn from previous research (Fish and Miyashita 2017; Fish 2018; Miyashita and Weber 2020). These words were chosen because (i) we had access to recordings of native speakers pronouncing them and had permission to play these recordings, and (ii) the melodies of these words had already been determined through previous research. For each word length we chose two examples with the accent on each syllable position, with the exception of a four-syllable word with the accent on the third vowel, of which we found only one in the previous research. Also, we had no examples of four syllable words with the accent located on the last syllable. Therefore, a total of 15 words were used. Table 1 on the following page shows the words used in the recording.

Participants

We were able to work with nine people who speak English as their first language and had studied or taken a Blackfoot language class at the time of recruitment. Three of them were male and six were female. Their ages ranged from 20 to 56. Eight were undergraduate students; one was an employee at the University of Montana. Their experience prior to studying Blackfoot varied. Some grew up hearing the language, some had no background in Blackfoot before taking the

class, and some had studied it in elementary school. The group included members of the Blackfeet Nation and non-Indigenous individuals.

Table 1. Word list for recording.

Number of syllables	Accent location	Word	Gloss
2	1	*nínaa*	man
2	1	*ksááhkomm*	earth
2	2	*iiníí*	bison
2	2	*aohkíí*	water
3	1	*áípotta*	airplane
3	1	*áóttaki*	bartender
3	2	*makóyi*	wolf
3	2	*natáyo*	lynx
3	3	*ponoká*	elk
3	3	*imitáá*	dog
4	1	*níkso'kowaiksi*	my relatives
4	1	*áákiipasskaani*	women's dance
4	2	*nitómitaam*	my dog
4	2	*saahkómaapiw*	boy
4	3	*napayíni*	bread

Recording and Data Processing

We created a PowerPoint file with three sections, each with a different type of prompt for producing the 15 words. The participants' utterances were recorded as .wav files using a Zoom H4n with a lapel microphone. We used a small, quiet room for the recordings, with capabilities to display PowerPoint and play audio. Each recording session lasted about 30 minutes.

The first prompt for each word showed a picture depicting the target word; in case participants did not know the word, the written form was also shown (see Figure 2). The second round of prompts used the same pictures as the first, but words were given in random groups of four (or three). Additionally, the pictures were accompanied by a recording of a native speaker saying the words in the group one time. We asked participants to produce all the words after hearing the recording. We avoided playing the sample words one by one to control for mimicry. The third and final prompt for each word was given with a visual guide for pitch movement.

Figure 2. Sample PowerPoint slides for recording sessions: the left slide has a picture representing *iinii* 'buffalo'; the middle slide shows a group of three pictures for *aipotta* 'airplane,' *napayini* 'bread,' and *iinii* 'buffalo; and the right slide shows the Pitch Art of the word melody of *aipotta* 'airplane.'

This study only reports the learners' pronunciation based on the second round. The first round was run to make sure that the participants knew the words and was not intended to be examined for their pronunciation. The analysis of the third round is described in Fish (2018).[5]

Data Description with Speaker Background

The recordings were evaluated for pronunciation accuracy by a native speaker from Siksiká (in Alberta, Canada). Prior to the evaluation, we discussed the sound characteristics of Blackfoot, including pitch movement. When the native speaker was asked to evaluate the pronunciation with a focus on pitch movement, rather than other factors such as consonant/vowel quality, the evaluator, who is also a traditional singer, commented that he is confident with pitch movements in the language. The evaluator was given two evaluation sheets for each learner's production: one for evaluation of the accuracy of the sound for the entire word, and the other for evaluating the accuracy for the pitch movement only. The evaluator rated every word by listening to each learner's recordings per word (every word was uttered repeated three times) and rating each on a scale from 1 to 7, with 1 being the least native-like and 7 being the most native-like. This study used the evaluations given to the second sheets only. The highest possible score (7 for all 15 words) was 105 points. As shown in Table 2, the scores ranged from 35 to 77 (mean score per word: 2.3 - 5.1). It is not realistic to run any statistics, because of the size of the data set. Therefore, we will focus on describing our distributional analysis.

Table 2. Scores of the learners' pronunciation with respect to pitch movement.

	AF	CO	WK	ZW	GH	AG	KF	EJ	IM
Score	77	68	66	56	55	53	49	47	35
Mean	5.1	4.5	4.4	3.7	3.7	3.5	3.3	3.1	2.3

We looked at the data from three aspects: (i) learners' performance score compared to their demographic backgrounds, (ii) learners' accuracy by word types, and (iii) observations beyond pitch movements.

Gender and Age

Tables 3 and 4 show participants' mean scores based on their gender and age. We found that female learners produced more native-like pronunciation than male learners; participants in their 20s had higher scores than those who were older. However, given the small number of participants, any differences due to gender and age could be unreliable.

Table 3. Average scores of women versus men.

							n	**mean**
Women	5.1	4.5	4.4	3.7	3.5	4.1	6	4.1
Men	3.7	3.3	2.3				3	3.1

Table 4. Average scores by age groups: 20s and 30 or above.

						n	**mean**
20s	5.1	4.4	3.1	3.7	2.3	5	3.7
30 and up	4.5	3.3	2.3	3.5		4	3.4

Language learning experience

Table 5 below shows the participants' average scores divided by whether they had language learning experience other than Blackfoot. The average scores of those with and without such experience are very close (3.7 and 3.8). Note that our survey did not show the level of involvement or context of any language learning experience. We do not know whether participants were motivated to study these languages or did well in learning these languages, and we do not know whether they had constructed instruction or more extensive experience (e.g., study abroad). Although these data are inconclusive, we believe that further study into this topic would be valuable.

Table 5. Average scores of participants with and without other language learning experience.

						n	**mean**
Some experience	5.1	4.5	3.5	3.1	2.3	5	3.7
No experience	4.4	3.7	2.7	3.3		4	3.8

Community Upbringing and Exposure

Table 6 shows the average scores of the four participants who grew up on the Blackfeet Reservation versus the five other participants.[6] According to these results, growing up on the reservation is not predictive of acquiring more accurate word melody. Note that two participants who grew up on the Blackfeet Reservation represent the highest (5.1) and the lowest (2.3) average scores.

Table 6. Average scores of participants categorized who did or did not grow up in the Blackfoot speaking community.

						n	**mean**
Grown up in the community	5.1	3.7	3.3	2.3		4	3.7
Not grown up in the community	4.5	4.4	3.7	3.5	3.1	5	3.8

These results show that growing up in the community does not impact a learner's ability to produce native-like pitch. This is not surprising, given the fact that these participants are from the Blackfeet Reservation in Montana, as opposed to one of the reserves in Canada, where there are more Blackfoot speakers. Based on the personal experience of the first author, who is from the same reservation, the small number of native speakers on the Blackfeet Reservation are all elderly, and it is rare for most residents on the reservation to hear the language used in conversation.

Finally, the survey asked whether participants had opportunities to hear the language and, if so, who the users were and the frequency with which they heard spoken Blackfoot. The answers of the four participants who live or had lived on the Blackfeet Reservation are shown in Table 7, below, along with each

participant's age and average score. Another question, not shown in the Table, asked about the language in which they responded when they were spoken to in Blackfoot: All of them answered "yes (English)" (see appendix).

Participants AF, ZW, and KF had Blackfoot speakers around them while growing up, all of them cited (great-)grandparents, but two out of three also listed a younger generation family member, and one also included non-family members. Participant IM, who scored the lowest, did not have the opportunity to interact with speakers. The frequency of opportunity to hear spoken Blackfoot varied from rarely to almost every day. "Rarely" was the answer given by Participant IM, who scored the lowest. Interestingly, "almost every day" and "a lot" were not the answer given by the participant who scored the highest. That participant, AF, answered "not very often," but also gave more detailed description of occasions.

Pronunciation (pitch movement) scores are higher for learners who had more exposure (AF, ZW and KF) than the one that did not (IM). Still, we do not interpret these data to mean that the frequency of hearing Blackfoot is a crucial component to acquiring native-like pitch, because the data set is very small, and self-reporting of the frequency is highly subjective. In addition, there must be other factors that help learners pronounce Blackfoot words more accurately. In any case, this study included only four learners who are from the community.

Table 7. Answers to questions regarding exposure to Blackfoot from those who grew up in the community.

	Score	Age	Who around you spoke Blackfoot?	How frequently did you hear Blackfoot spoken around you?
AF	5.1	20	My Grandpa, my mom, and my Grandpa	Not very often aside from the NAS (Native American Studies) classes, at home it was rare. Only during special occasions, I would hear the Blackfoot prayer, my mom said a few words, or my grandpa would speak fluently with his doctor who would visit.
ZW	3.7	22	My sister who attended Cuts Wood, my grandparents, friends, and other family members	Almost everyday
KF	3.3	39	Great grandparents	A lot
IM	2.3	28	No	Rarely

Production Description

In this section, we describe learners' accuracy by word types, accent location, and second language word melody. We also offer further observations on learners' production.

Average accuracy by words

Table 8, below, shows the average score for all learners for each word. For example, the average score for all nine speakers for the word *aohkíí* 'water' is 4.9. The words *aohkíí* 'water' and *ponoká* 'elk' have the highest average scores, followed by *napayíni* 'bread,' *nínaa* 'man,' *iiníí* 'bison,' *saahkómaapi* 'boy,' and so on. The word *áóttaki* 'bartender' scored the lowest.

It is very difficult to make any generalizations about the characteristics of words that are scored higher or lower from this data. Therefore, we merely list possible accounts that can be tested in future research. First, learners' familiarity with the words may influence how well they can pronounce the words. The word *áóttaki* 'bartender,' which scored the lowest, is not usually used in language classes, and none of the participants could produce the word on their own during our recording sessions. On the other hand, the highest-scored words, *ponoká* 'elk' and *aohkíí* 'water,' are typical words that show up often in a beginning class. Thus, one way to analyze these scores would be to study learners' word familiarity and look at their pronunciation. Second, the syllable structure of the words could impact pronunciation. The two lowest-scored words include a long consonant [tt] which does not exist in English. Having an unfamiliar syllable structure in a word may interact with the learners' pitch movement production. However, this idea is not strongly supported by the results for the word *natáyo* 'lynx,' which has the third-lowest score but has a simple syllable structure of CVCVCV. Third, there may not be any pattern for words pronounced wrong in terms of pitch accent. While English tends to alternate strong-weak syllables in terms of stress, Blackfoot does not. If learners are not attuned to pitch movement in the language as they hear in class or in the sample audio played during the recording sessions, learners must guess or may not realize there is pitch movement in Blackfoot at all. Learners may just produce pitch randomly, or by using an English system of pitch and stress. In any case, careful research must be designed to find the patterns, if any, in learners' pronunciation accuracy based on the characteristics of words.

Table 8. Average score of each word, listed in order of highest to lowest.

Word	Gloss	Average score
aohkíí	water	4.9
ponoká	elk	4.9
napayín	bread	4.8
nínaa	man	4.6
iiníí	buffalo	4.3
saahkómaapi	boy	4.3
áákiipasskaani	women's dance	4.2
nitómitaam	my dog	4.2
makóyi	wolf	3.8
imitáá	dog	3.7
níkso'kowaiksi	my relatives	3.3
ksááhkomm	land	2.7
natáyo	lynx	2.7
áípotta	airplane	2.0
áóttaki	bartender	1.9

Accent Location

We measured the fundamental frequency (F0) of all vowels from the second round using Praat (Boersma and Weenink 2018). For each vowel, we highlighted the salient parts of the vowel and recorded each salient part's pitch average. We compiled the results electronically in an Excel spreadsheet. These measurements are the basis for the analysis and discussion in this section and the following sections.

We identified the vowel with the highest pitch within the word and compared this with the target samples produced by a native speaker. We observed that all

15 words were pronounced with the accent located in an inaccurate position by at least some of the participants. Table 9, below, shows the native speaker's accent location ("Target") and variations that were observed among the learners. This list only concerns the location of the pitch accent (the highest pitch). The samples are shown in the orthography; the actual pronunciation of consonants and vowels is ignored. Note that accuracy here is determined by the relative pitch as the result of measurements, and not based on the native speaker's judgment. The words *napayini* 'bread' and *áípotta* 'airplane' were produced with the correct accent location by the most participants (7 out of 9). It is interesting that *áípotta* 'airplane' ranks highly in this regard, because this word was judged by the native speaker as one of the least accurately produced words (see Table 1). This means that producing a word with correct pitch accent location is not enough for learners' word melody to sound authentic. More or less than half the participants produced two-syllable words with correct accent location except for *ksááhkomm* 'earth' which was produced with correct accent location by only three people. Also, we found that among three- and four-syllable words, the participants produced a variety of incorrect accent locations.

Table 9. Number of participants who produced pitch on the correct syllable.

Target	Number correct pitch location	Example(s) of learners' incorrect pitch location
áípotta	7	aipottá
napayíni	7	napáyini
aohkíí	6	áóhkii
áóttaki	6	aottáki aottakí
nínaa	5	ninää
iiníí	5	íínii
ponoká	5	pónoka
imitáá	4	ímitaa
ksááhkomm	3	ksaahkómm
nitómitaam	3	nitomitáám nítomitaam
makóyi	2	makoyí
saahkómaapiw	2	sááhkomaapiw saahkomaapí saahkómaapí
níkso'kowaiksi	1	niksóókowaiksi nikso'kowáíksi
natáyo	0	natayó
áákiipasskaani	0	aakiipásskaani aakíipasskaani áákiipasskaaní

Second Language Word Melody

Partly due to the incorrect accent location, we observed various non-native-like word melodies in the learners' production. Figures 3-5 below are samples showing word melodies differing from the native speaker. The x-axis shows (F0) in Hz, and the y-axis shows the points for each syllable. For example, Figure 3 shows the word melody of a two-syllable word produced by the native speaker (left) and selected learners (right). Note that the learners' melodies have been selected based on their divergence from the ideal to highlight the differences. Note also that while the pitch ranges differ depending on the speaker's physical characteristics (Ladefoged and Johnson 2014), we are focused on differences in the word melody rather than pitch.

Figure 3 shows the comparison between the native speaker's and learners' pronunciation of the word *nínaa* 'man,' which has a pitch accent on the

first syllable. When a two-syllable word has an accent on the first vowel, the word melody among native speakers is realized as a pitch drop from high to low (Miyashita and Weber 2020), and this is the melody observed in the native speaker's utterance. The learners who pronounced the word differently had a more or less flat melody, which is typical of a two-syllable word with the accent on the second vowel. It appears that learners are applying the word melody of a different word, such as *aohkíí* 'water,' to this word, similar to the phenomenon known as overgeneralization.

Figure 3. Word melody by native speaker (left) and learners (right): *nínaa.*

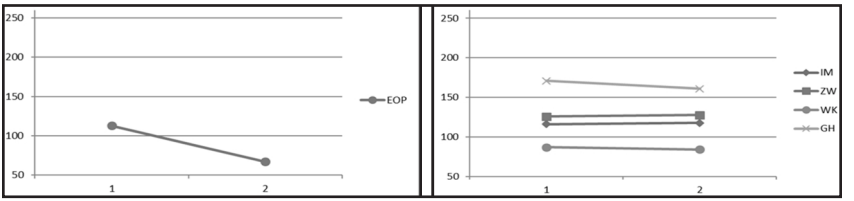


Figure 4 shows the word melody of *makóyi* 'wolf' produced by the native speaker (left) and those learners (right) whose pitch movements were different from the target. A three-syllable word with the second vowel accented typically has a word melody starting in the middle of the pitch range, going up high, and then dropping to the low boundary tone, as seen in the native speaker's production. The learners who produced an inaccurate word melody had a more or less flat melody (GH, AF), which is normally characteristic of a final-accent word such as *imitáá* 'dog.' Learners also raised their pitch at the second vowel but did not drop in the final vowel (RK, ZW), or stayed flat for the first two vowels and raised at the end (IM), which is characteristic of English nonfinal listed words (Beckman and Ayers 1997).[7]

Figure 4. Word melody by native speaker (left) and learners (right): *makóyi.*

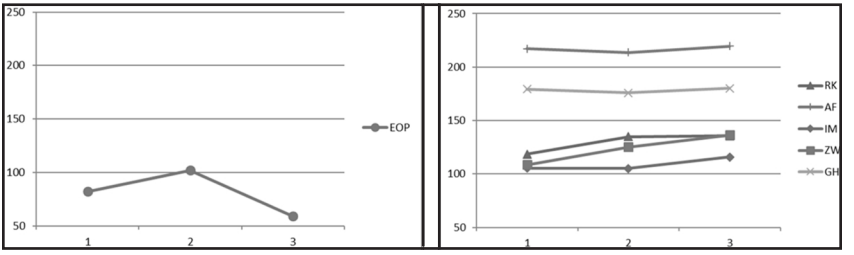
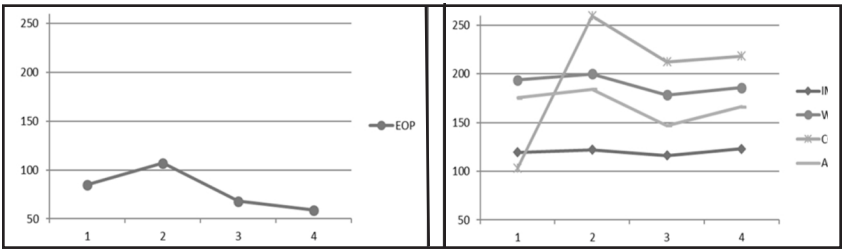


Figure 5 shows the word melody of *saahkómaapi* 'boy.' The typical word melody of a four-syllable word with the accent on the second vowel, such as this one, starts with a middle pitch, goes up high, and drops gradually till the lowest target, the low boundary tone. This is seen in the native speaker's word melody, on the left. The learners who produced the word with inaccurate word melody showed various pitch contours. Four of these are shown in the right-hand image. These learners' production is similar in that the accented or highest pitch location is on the second vowel. Their relative pitch movement alternates as low, high, low, and then high again. The pitch movement of learner CO has a drastic pitch rise from the beginning to the second vowel, but the alternation of low-high-low-high is still observed. This alternation is an unnatural form in both English and Blackfoot.

Figure 5. Word melody by native speaker (left) and learners (right): *saahkómaapi*.



Thus, this study shows that learning pitch movement or word melody does not necessarily coincide with learning a string of sounds. As suprasegmental elements (pitch, in this case) are not transparent in written form or overtly understood or taught, it is difficult for learners to be aware of them as part of what would help them produce words like native speakers do.

Further Observations

This project focused on the production of word melody. There are many factors that could contribute to learners' inaccurate production of word melodies.

One is linguistic transfer, where a speaker pronounces a word in a second language with linguistic features of the first, or native, language. The examples in (3) show production errors by the participants that are likely to be caused by linguistic transfer. The target samples are given in IPA transcriptions of a native speaker's pronunciation. The learner variations are also given in IPA, and each example is followed by the participant's identification. (3a) is a case where the target word begins with the [ks] consonant cluster, which does not occur word-initially in English. One learner, ZW, dropped the [k] to reduce the consonant cluster; EJ broke the consonant cluster by inserting a vowel; and WK metathesized the two consonants resulting in the [sk] sequence which is found word-initially in English. Also, there is another substitution found in all three learner variants in (3a): The mid back vowel is diphthongized, as in English, where it should be a monophthong. Example (3b) shows a case where what should be a geminate [tt], not found in English, is pronounced as a single consonant [t] by two learners. The difficulty English speakers have distinguishing between short and long consonants is reported in Han (1992) in her study of geminate acquisition in Japanese. In addition, the shortening of a long consonant in learners' production may be supported by the findings in Mah and Archibald (2003), Grenon and White (2008), and Hayes (2002), which report that the distinction between short and long consonants is perceptually challenging for English learners. In (3c), the voiceless stop [t] is pronounced with aspiration, as in English, while Blackfoot voiceless stops do not undergo aspiration.

(3) Transfer examples

	Target		**Learner variations**		
a.	[ksaxkom]	→	[**s**axk**ow**m] (ZW) [**kas**k**ow**m] (EJ) [**sk**axk**ow**m] (WK)	*ksáahkomm*	'earth/land'
b.	[æ:pot:a]	→	[apo**t**a] (IM) [æxpo**t**a] (WK)	*áipotta*	'airplane'
c.	[imita:]	→	[imit^{h}a:] (CO)	*imitáá*	'dog'

Hypercorrection can also contribute to inaccurate production; this occurs when a speaker produces an incorrect pronunciation based on a wrong comparison with a correct form. In this study, we found examples of the use of extra sounds or sound sequences that do not occur in English and were incorrect in the Blackfoot word in question, and these could be explained by hypercorrection. For example, as shown in (4), *áóttaki* [ɔttaki] 'bartender' has a geminate [t:], but learner CO instead inserted a velar fricative [x] after the first vowel and pronounced it [ɔxtaki]. Similarly, WK produced the velar fricative [x] after the initial long vowel followed by a consonant in *áípotta* 'airplane.' The sequence of a velar fricative preceded by a vowel and followed by another consonant, though not correctly found in these words, is pervasive in Blackfoot and does not occur in English. Use of this sound sequence may make learners feel that their production is native-like, even when the sequence is incorrect.

(4) Hypercorrection: dorsal fricative

	Target		**Learner variation**		
a.	[ɔ**t:**aki]	→	[ɔ**x**taki] (CO)	*áóttaki*	'bartender'
b.	[æ:pot:a]	→	[æ**x**pota] (WK)	*áípotta*	'airplane'

Another hypercorrection we observed is gemination. In (3), there was an example where learners did not successfully produce a geminate consonant when they should have. On the other hand, the examples in (5) show the opposite case. Some learners geminated a consonant when they should not, possibly because they had acquired gemination and started to use it incorrectly.

(5) Hypercorrection: consonant gemination

a.	[na**t**ajo]	→	[na**t:**ajo] (GH)	*natáyo*	'lynx'
b.	[na**p**ajini]	→	[na**p:**ajini] (EJ)	*napayín*	'bread'
c.	[ma**k**oji]	→	[ma**k:**oji] (AG)	*makóyi*	*'wolf'*

Discussion and Conclusion

In this study, we looked at Blackfoot words pronounced by second language learners, focusing on their pitch movement. By comparing them to sample recordings produced by a native speaker, we came to several conclusions. There is a wide range of learner pronunciation accuracy, based on the evaluation of a native speaker. Age, gender, and upbringing were not aspects about which conclusions could be drawn, since the participant group was so small and consisted of various ages and levels of previous Blackfoot experience. Still, one interesting finding, even though the data set is so small, was the amount of Blackfoot exposure during participants' upbringing. Three participants who scored relatively higher had exposure to the language at home and at school. The participant with the lowest score did not have exposure to the language, even though that participant was from the Blackfeet reservation. Therefore, even within this small set of data, it appeared that exposure to the language might be key to developing pronunciation skills, even as a second language.

This research also shows that there were different pitch patterns that were produced by learners. Some were very close to that of a native speaker, but others had variety of pitch movements. While vowels and consonants as well as pitch accent location are manifested with orthographic symbols, pitch movement is not visible. A visual guide may help learners acquire accurate word melody (Fish 2018).

During this research, we faced many challenges. One was not having a large number of participants who could contribute to recordings. The number of

students enrolled in the Blackfoot class was small, and the number of students willing to contribute to the study was even smaller. Even when we expanded the participant group by recruiting people who had Blackfoot learning experience beyond the classroom, we had only nine people who were willing and able to help us with the study.

Another limitation of second language research methodology is that only two semesters of Blackfoot are currently offered, and higher levels of language classes are unlikely to be offered in the future. This means that there is no opportunity for a cross-sectional method of studying the progress of language acquisition. If one plans to study the progress of second language acquisition, it must be done via longitudinal study: following the same learners for several years. However, it is extremely difficult to conduct longitudinal research, because there is no guarantee that individuals will continue learning the language after the two semesters are over.

This study also contributes to the field of second language acquisition. Most second language acquisition research relies on large data sets collected from a large pool of subjects who are learning dominant languages. While qualitative research is more widely accepted in education, there is a trend or common understanding that studies in second language acquisition must use statistics, and therefore that the data set must be large enough to run statistics. This field-specific requirement mitigates against development and growth of second language study among small language communities. As the majority of the world's languages are endangered (Crystal 2000; Harrison 2007), and second language acquisition in the context of language revitalization is emerging, the development and legitimization of research methods for languages with small speaker populations is overdue.

We hope that this study will help pave the way for future studies of second language acquisition in Blackfoot. Moreover, from casual conversations during the recording sessions, we found that many learners we encountered were interested in sounding more like native speakers. The research suggests that Blackfoot language learners need to work more on pronunciation to reach this goal. They may benefit from increased focus on pitch accent to be able to pronounce words with more accurate word melody. Finally, we believe this research represents an example of Community-Based Research (Czaykowska-Higgins 2009; Rice 2010). Revitalization is an activity which must be undertaken by community members. If linguistic research helps revitalization, it is significant for community members to be involved as stakeholders.

Notes

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[2] IPA transcription is based on recordings of these words pronounced by native speaker consultants.
[3] We are aware that this notion is controversial, as discussed in Hyman (2009).
[4] The translation given in Frantz (2017) for this sentence is 'it is a fig'; however, the dictionary (Frantz and Russell 2017) also gives 'white buffalo berry' versus 'fig.'
[5] The third session was included to see whether there is an immediate effect of the visual guide (called Pitch Art). Pitch Art is a visual representation of Blackfoot word melody modeled after Cherokee tone art (Hirata-Edds and Herrick 2017). The result of the study with the Pitch Art, reported in Fish (2018), was that some training in the use of the visual guide might help the learners, as there was no immediate effect of the use of pitch art in the present study.
[6] We are aware that residents may move back and forth between the reservation and off-reservation. The participants in this study spent the majority of their youth on the reservation.
[7] For example, in a listed phrase like "lemon, lime, and orange," English speakers tend to utter the first two (non-final) words with a rising intonation, and the last with falling.

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Appendix

Participant Survey

Thank you for your participation in this study. Please respond to the following questions. Your name and other identifying information will not be included in any presentation of the results of this study.

1. Please state the following:
   a. Name
   b. Age
   c. Gender
   d. Hometown/where you grew up
   e. Ethnicity
   f. What is your native language(s)? (The language(s) you grew up speaking and have the most control of)

2. Why did you choose to study Blackfoot?

3. Where and how long have you studied Blackfoot?

4. Did you hear Blackfoot spoken around you growing up? If so, please respond to the following questions. If not, skip to question 5.
   a. Who around you spoke Blackfoot?
   b. How frequently did you hear Blackfoot spoken around you?
   c. Was Blackfoot ever spoken to you growing up? If so, did you respond in English?

5. Have you studied any other languages? If so, please respond to the following questions. If not, skip to question 6.
   a. Which language(s) did you study?
   b. Where and how long did you study?

6. Can we contact [you] later with follow-up information about our study? If so, please provide your preferred email address.