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Phonetic and phonological evidence for a vowel merger in Southern East Cree*

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In this paper, we describe a partial merger of short /i/ and /a/ in Southern East Cree (SEC). We describe spelling difficulties which lead us to believe that I and A are merging into one phoneme in SEC. We then point out that there is little phonological evidence for a contrast between I and A in SEC. Our acoustic analysis provides evidence for a partial merger of I and A in the Coastal SEC communities but not in Inland SEC communities. Our data thus helps explain why Coastal SEC speakers have more difficulty deciding whether to use I or A than do Inland SEC speakers. However, our study does not help solve the problem of the standardization of the orthography of SEC. Identical spellings for each subdialect do not seem possible unless or until the merger of I and A spreads to the Inland subdialect of SEC.

1 Introduction

In this paper, we describe the phonetic and phonological merger of two short vowels in Southern East Cree (SEC), a subdialect of East Cree (EC). Specifically, we study to which extent the two short vowels /i/ and /a/ have merged in SEC. By doing so, we shed light on a problem for the standardization of the EC orthography.

In §2, we situate East Cree within the Algonquian language family, and describe the (sub)dialects of East Cree that form the basis of our study. In §3, we present our hypothesis that short /i/ and /a/ are merging into one phoneme in some (sub)dialects of EC. In §4 and §5, we present orthographic and phonological evidence which support the hypothesis of a merger of /i/ and /a/. In §6, we describe an acoustic study which supports a partial merger of /i/ and /a/ in some (sub)dialects of EC. In §7, we conclude that /i/ and /a/ remain distinct in Inland SEC, but are merging into one phoneme in Coastal SEC. We comment throughout the paper on the relationship between SEC and Northern East Cree (NEC).

2 Situating East Cree within Algonquian

East Cree is part of the Cree-Montagnais-Naskapi (also called Cree-Innu) dialect continuum (see www.atlas-ling.ca). This group of dialects stretches across Canada with a division between the Western and Eastern dialects. This division takes place at James Bay. The Western dialects include Moose Cree, Swampy Cree, Plains Cree and Woodland Cree. The Eastern dialects include East Cree, Naskapi, Innu and Attikamek^{w}. Figure 1 shows the general areas these dialects are spoken. A further division of these dialects distinguishes between non-palatalized and palatalized dialects. East Cree is a palatalized dialect.

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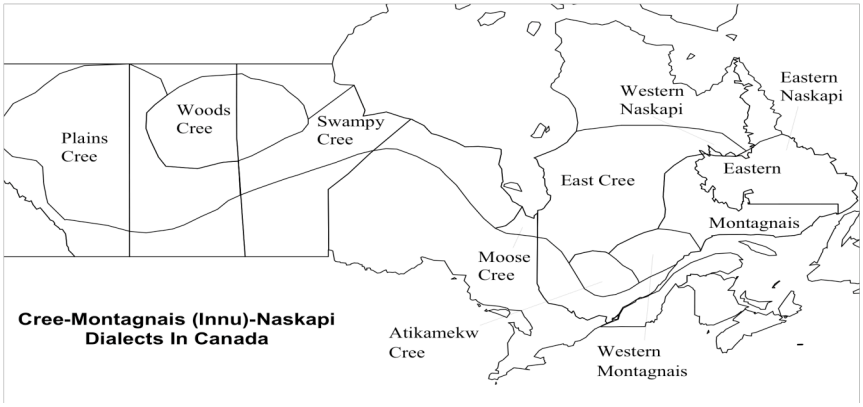
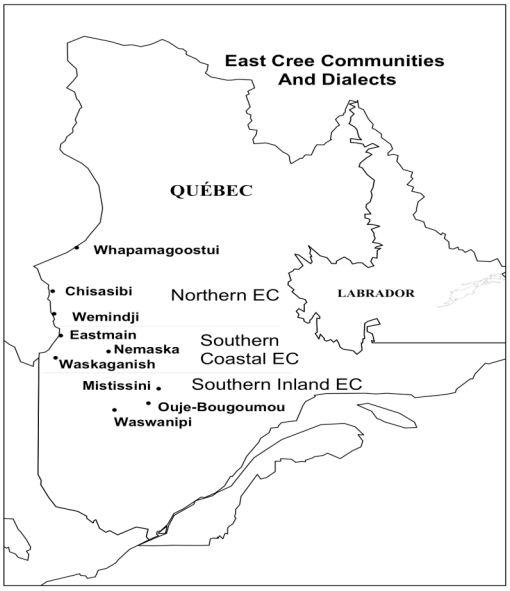
Figure 1 - Cree-Montagnais-Naskapi dialect continuum



There are two main dialects of East Cree; Northern (NEC) and Southern (SEC). The communities where each dialect is spoken are shown in Figure 2.

Figure 2 - Dialects of East Cree



What distinguishes NEC from SEC is the long vowel Ê.[1] In NEC, long Ê has merged with Â whereas in SEC these vowels have remained distinct. As shown in Figure 3, SEC can be further subdivided into the Coastal and Inland sub-dialects. In some ways, the Coastal sub-dialect is similar to NEC; for example, SEC Coastal speakers will often use [j] (spelled with the letter Y), like NEC speakers, where SEC Inland speakers use [n][2]. We will conclude in §7 that NEC and Coastal SEC also share another isogloss: the merger of /i/ and /a/.

[1] Because long *ê* does not contrast with a short *e*, the typical Algonquian practice is to write long *ê* simply as *e*. We depart from this practice to avoid confusion about vowel length.

[2] This reflex of the proto-Algonquian *l as [n] in the Inland dialect is limited to the word *înû* '(aboriginal) person' and compound words of this family, like *înûkamikw* 'friendship center'; otherwise the reflex is [j], for example *yûtin* 'it is windy' in all East Cree dialects.

Figure 3 - Divisions of East Cree

Northern East Cree (Â)	**Southern East Cree (Ê,Â)**	
	Coastal	**Inland**
Wemindji Chisasibi Whapmagoostui	Eastmain Waskaganish	Nemaska Waswanipi Ouje-Bougoumou Mistissini
[j] iyiyû 'Aboriginal person'		[n] înû 'Aboriginal person'

3 A phonemic vowel merger in East Cree

For the most part, the SEC roman orthography is phonemic. However, our evidence suggests that the orthography for short vowels no longer reflects phonemic reality. Example (1) shows how SEC vowels are spelled. (In this paper, we use capital letters for graphemes, slash brackets / / for phonemes, square brackets [ ] for allophones, and an asterisk for proto-Algonquian vowels.[3])

1. Southern East Cree Vowels

Long				**Short**		
Î	Ê	Â	Û	I	A	U
[iː]	[ɐː, ɛː]	[aː]	[ʊː]	[ɪ,ɨ, ə]	[ɪ, ɨ, ə, ʌ, ạ]	[ʊ]

In general, the phonetic realizations for each grapheme are distinct, suggesting that the orthography is phonemic. However, the phonetic realizations of short I and A overlap, and herein lies the problem: does SEC have two short unrounded vowel phonemes, /i/ and /a/, as the orthography implies, or does SEC have just one short unrounded vowel phoneme, as the phonetic overlap suggests?

The answer is more nuanced: our evidence suggests that Inland SEC speakers maintain a distinction between /i/ and /a/. In contrast, Coastal speakers are in the process of merging the short unrounded phonemes /i/ and /a/ (it resembles NEC in this respect). This merger in Coastal SEC is partly obscured by the orthographic practice of reflecting the Proto-Algonquian (PA) *i versus *a contrast (Pentland 1979) in the use of separate I versus A spellings. We show that in this case, the spelling system departs from the Phonemic Principle in maintaining an historical distinction that is disappearing in Coastal SEC.

4 Orthographic Evidence

In this section, we show that speakers of Coastal SEC cannot reliably spell the historically separate short unrounded vowel phonemes, *i /i/ and *a /a/. These observations suggest that /i/ and /a/ are merging in Coastal SEC. In contrast, Inland SEC speakers tend to be more accurate in using I for *i /i/ and A for *a /a/.

Coastal SEC is like NEC in this respect: in NEC, *i and *a have merged, at least in unaccented position (MacKenzie 1980:140; see §6 for further discussion). Reflecting this merger, in the NEC standard orthography most of the reflexes of *i and *a are spelled as I (Junker et al. 2002).

Coastal speakers of SEC (from Waskaganish) cannot reliably spell the reflexes of *i and *a. In contrast, older Inland SEC speakers (from Mistissini) can usually spell the reflexes of *i and *a reliably. For example, the plural ending /-Vtʃ/ (PA *-aki; Bloomfield 1946) is spelled -ICH by both Coastal SEC and NEC speakers (2a) but spelled -ACH by Inland SEC speakers (2b).

2. a. shiship-<u>ich</u>
'ducks' (SEC Coastal; NEC)

[3] For example, the grapheme Ê stands for the phoneme /ê/, which sounds like [ɐː, ɛː], and which arose from PA *ê.

b. shiship-ach
'ducks' (SEC Inland)

As shown in (3), the old spelling of the final, meaning 'bag' or 'container', alternated between -WIT and -WAT, and sometimes -ÛT (indicating vowel coalescence). Historically this final contained an *a, which Inland SEC speakers consistently spelled as A. During a dictionary workshop in June 2009, facilitated by one of the authors, a new pan-EC spelling was adopted. All the words ending in -WIT, -WAT, and -ÛT were changed into -WIT for consistency. This spelling follows the old NEC dialect spelling, although it is historically inaccurate.

3. *-w[*a]t* (final for 'bag', 'container')

Old Spelling	**New Spelling**	**Gloss**
shûlîyâwat	shûlîyâwit	'purse, wallet'
âpahîkanuwat	âpahîkanuwit	'tool box'
mishtikuwat	mishtikuwit	'wooden box, trunk'
mûhkumânuwit	mûhkumânuwit	'knife case, box'
nîmâunût	nîmâunuwit	'lunch bag'

As another example, the words in (4) all share the complex final for a vii verb meaning 'morning'.[4] Despite the semantic cues, SEC speakers spelled it with either -IN or -AN. Upon realizing that the meaning was the same, the SEC speakers agreed to spell the final with -AN. This was chosen over -IN because in other related languages in the Cree-Innu family, the same final contains a long -ÂN.

4. *-(w)âp-[*a]n* (+vii final for 'morning')

Old spelling	**New Spelling**	**Gloss**
îchikwâhtikâpan	îchikwâhtikâpan	'there is frost on the trees in the morning'
îchikwâpin	îchikwâpan	'it is a frosty morning'
petâpin	petâpan	'it is daybreak, sunrise'
miywâpin	miywâpan	'it is a nice, pretty dawn, a nice, clear morning'

A similar (ad-hoc) decision process was used in the same workshop for the initial TASHU- in (5).

5. *- t[*a]shu-* (initial for 'straight, back to normal')

Old spelling	**New Spelling**	**Gloss**
tishupayû	tashupayû	'it unfolds, smoothes out again, returns to original position'
tashuneu	tashuneu	's/he spreads it (anim.) out straight by hand from being bent'

In summary, the following was observed during Cree language documentation workshops: all speakers of SEC spell PA *i as I. PA *a, on the other hand, is spelled inconsistently as I or A. Coastal speakers from Waskaganish tend to spell both *i and *a as I (as is done in NEC). Inland speakers from Mistissini tend to spell and maintain the historical *i/I vs. *a/A distinction. The above examples of uncertainty surrounding the spelling of /i/ and /a/ suggest that the difference between /i/ and /a/ is no longer clear-cut in Coastal SEC (as in NEC).

[4] Abbreviations include: vii = verb, inanimate, intransitive; anim(ate); *initial*, *medial*, and *final* refer to morphemes that occur in initial, medial, and final positions in the Algonquian verb complex.

The spelling data for Coastal SEC listeners is reminiscent of other findings about what happens when listeners are asked to classify (or in this case, spell) a vowel distinction that they do not make. For example, in their classic study of American English vowels, Peterson and Barney (1952:179) conclude that "…if a speaker does not differentiate clearly between a pair of sounds in speaking them, he is unlikely to classify them properly when he hears others speak them. His language experience, as would be expected, influences both his speaking and his hearing of sounds."

It is therefore possible that PA *a and *i have merged in Coastal SEC but not in Inland SEC. Such a pattern of merger would be consistent with the [j] vs. [n] difference in certain lexical items discussed earlier with reference to Figure 3. Both patterns are summarized in Figure 4.

Figure 4 - Northern vs. Southern orthography and pronunciation tendencies

Northern	**Southern**	
	Coastal	**Inland**
*a/*i spelled as I		*a spelled as A *i spelled as I
[j] iyiyû 'Aboriginal person'		[n] înû 'Aboriginal person'

We hypothesize, then, that coastal SEC speakers (like NEC speakers) are merging short /i/ and /a/, while Inland SEC speakers are not. In the next part of our paper, we show that a merger would in fact be facilitated by the lack of phonological evidence for a distinction between short /i/ and /a/ in the Cree grammar.

5 Phonological Evidence

The Cree grammar provides little, if any, phonological evidence for a distinction between short /i/ and /a/. The main sources of evidence would come from syncope (optional deletion of unstressed short Vs) and Initial Change (morphologically-conditioned ablaut of the initial vowel in verbs).

5.1 Syncope

The outcomes of syncope are illustrated in (6) and (7). As shown in (6), paying attention to the underlined syllables, both I and A leave aspiration as a trace when they delete after plosives.[5]

6. Syncope of I and A → [ʰ]

Orthography	**Phonetic**	**Gloss**
â - pih - tûn	[aː - pʰ - ˈtun]	'wednesday'
a - hî - pih - chê - sû	[a̰ - hiː - pʰ - tʃɛː - ˈsuʔ]	'spider'
âh - ta - hî	[aːh - tʰ - ˈhiʔ]	'change'
â - ku - yê - ka - hî - kan	[aː - ku - jɛː - kʰ - ˈhi - kɪn]	'curtain'

In contrast, as shown in (7), when short U deletes, it leaves either a [ʷ] sound or aspiration after plosives. In other words, I and A pattern alike, and differently from U.

[5] Examples of SEC sound files can be found at http://www.ucs.mun.ca/~cdyck/eastcree.htm/SEC_sound_files_1.htm

7. Syncope of U → [ʷ, ʰ]

Orthography	Phonetic	Gloss
âh - ku - sî - u - ka - mikw	[aː - kʷ - ˈsi - ˈuː - ˈkə - mʊkʷ]	‘hospital’
âh - ku - sû - tâ - pân	[aː - kʰ - ˈsuː - taː - ˈban]	‘ambulance’

5.2 Initial Change

Similarly, short I and A pattern alike with respect to Initial Change (8-10). As shown in (8), short I becomes long Ê.

8. Initial Change: I → Ê

Dictionary Form	Changed form	Gloss
iskwâsam	awên êskwâsahk	‘s/he burns it’
tipâpâtam	awên têpâpâtahk	‘s/he measures it with a tape measure’
chipaham	awên chêpahahk	‘s/he closes it’
miskam	awên mêskahk	‘s/he finds it’
michisimû	awên mêchisimut	‘it (anim) barks’
sichû	awên sêchit	‘s/he/it (anim) urinates’
niskû	awên nêskût	‘s/he resists’
shimitapû	awên shêmitapit	‘s/he is sitting up’
shikuham	awên shêkuhakw	‘s/he crushes it’
wiyâskunichêu	awên wêyâskunichêt	‘s/he is judging’

Short A also becomes long Ê for the most part, although there are alternative outcomes, shown in (9b).

9. Initial Change: A → Ê; SHA → other

a. Canonical pattern

Dictionary form	Changed form	Gloss
akutâu	awên êkutât	‘s/he hangs it up, sets snares’
ashuwêputâu	awên êshuwêputât	‘s/he is putting out a fire with liquid’
tahkunam	awên têhkunahk	‘s/he holds it together’
kanawâpû	awên kênawâpit	‘s/he is watching’
machinam	awên mêchinahk	‘s/he dislikes the looks of it’
nakatam	awên nêkatahk	‘s/he abandons it, leaves it behind, forsakes it’
saskatapû	awên sêskatapit	‘s/he is bored from sitting’
wanishin	awên wênishihk	‘s/he goes astray, gets lost’
yahchinam	awên yêhchinahk	‘s/he pushes it forward’

b. Non-canonical pattern

Dictionary form	Changed form	Gloss
shawêyimêu	awên shâwêyimât	's/he blesses him/her/it (anim)'

In contrast to short I and A, Initial Change of short U creates a distinct outcome, WÊ (along with other patterns, shown in 10b).[6]

10. Initial Change: U → WÊ (and other patterns)

a. Canonical pattern

Dictionary form	Changed form	Gloss
utinam	awên wêtinahk	's/he takes it'
kutuwêu	awên kwêtuwêt	's/he makes a fire'
mushtênam	awên mwêshtênahk	's/he is attracted to it'

b. Non-canonical patterns

Dictionary form	Changed form	Gloss
nuwachîu	awên nêwâchit	's/he stops for a meal while travelling'
suskaschinam	awên suskaschinahk	's/he attaches the beaver, otter trap to a forked stick and lowers it into the water'

The historical patterning of IC is similar to the synchronic pattern: historically PA *i and *a became *ê, and proto *o (/u/) became *wê as a result of Initial Change (Pentland 1979:402-3; MacKenzie 1980:187). In other words, Initial Change has never provided good evidence for a distinction between short /i/ and /a/.

In summary, the evidence from phonological patterning should actually facilitate a merger between short /i/ and /a/ instead of working to prevent it. If there is any evidence for a distinction between /i/ and /a/, it is going to be in the pronunciation. In the final section of our paper, we describe the pronunciation of short I and A in Coastal and Inland SEC.

6 Phonetic Evidence

Our phonetic evidence reveals a partial merger of /i/ and /a/ in the Coastal dialect of SEC. The Inland dialect of SEC, however, has maintained a distinction between these two phonemes. The evidence is from an analysis done on the short vowels from a list of words recorded by two speakers of SEC, one Inland speaker and one Coastal speaker. The data from the Coastal speaker shows that I and A have a similar range of pronunciations in non-prominent positions of the word; whereas, the Inland speaker shows no evidence of this merger.

[6] One could argue that I and A do pattern differently, since I displays only canonical Initial Change outcomes while A displays both canonical and non-canonical outcomes. However, a more extensive survey of a wider array of forms would likely show that I and A are truly non-distinct. To illustrate, Burgess (2009) provides an extensive description of Initial Change in Sheshatshiu Innu-aimun (a Naskapi dialect related to SEC). Her study shows no substantive differences between the outcomes for I and A, whereas U is different. Burgess observes both canonical and non-canonical outcomes for Initial Change of I, A, and U in Sheshatshiu Innu-aimun. Her overall conclusion is that the choice of Initial Change outcome is both phonologically and lexically conditioned. This conclusion is consistent with the SEC data and does not detract from our overall point.

6.1 Methodology

Two female native speakers of SEC participated in this study. Each is fluently bilingual in SEC and English with SEC as their first language. The first speaker is a 40 year old woman from Waskaganish who speaks the Coastal dialect of SEC. The second speaker is a 50 year old woman from Mistissini who speaks the Inland dialect.

Data was collected in June 2009 for a pedagogical application of the Eastcree.org website. A list of approximately 200 words was recorded for each speaker. Each word in the list was recorded twice. Where possible, the first word in each word pair was analyzed.

Words spelled with short I, A, and U were measured in PRAAT (http://praat.org) and plotted in MapInfo. The length of the word, the pitch (F0), and first and second formants (F1, F2) were measured. F0 was measured over the full length of the vowel. Measurements for F1 and F2 were taken over 20 milliseconds of the steady-state portion of the vowel to control for the potential influence of surrounding consonants.

The vowels analyzed were initially separated into accented and unaccented categories to see if accent affected vowel production. However, statistical analysis was only possible when the accented and non-accented groups of vowels were combined, due to the small number of pitch-accented short vowels in SEC: in SEC, only one vowel per word is accented (Brittain, 2000).[7] Words that did not contain any syllable with a pitch at least 4 Hz higher than all other syllables were not analyzed.

Some limitations of this study include the fact that tokens were taken from recordings of reading lists, rather than spontaneous speech. We were also not able to control for non-metrical (i.e., segmental) conditioning due to the relatively small number of tokens available for analysis.[8]

[7] Brittain (2000) includes secondary accents in her transcriptions; these, however, do not have phonetic prominence, but instead reflect Brittain's claim that NEC has abstract metrical structure.

[8] However, in our analysis, we observed that for three related words — pahkunahcheshuweu 's/he skins a fox', wîskunahcheshû 'silver fox', and mahcheshû 'fox' — the tokens corresponding to the underlined A were relatively high in the vowel space in the first two words and low in the last word. This observation suggests that there is either free variation, or variation that is not conditioned by the immediately adjacent segments, which are similar in all three words.

6.2 Results

6.2.1. Coastal SEC

In the approximately 200 words analyzed for the Coastal SEC speaker, 100 unstressed and 52 stressed short vowels were measured. Figure 5 shows the formant chart for the stressed short vowels for Coastal SEC. The I shows a nice cluster in the high front quadrant. The U shows a nice cluster in the high back quadrant. In contrast, A is interspersed with these two short vowels.

Figure 5

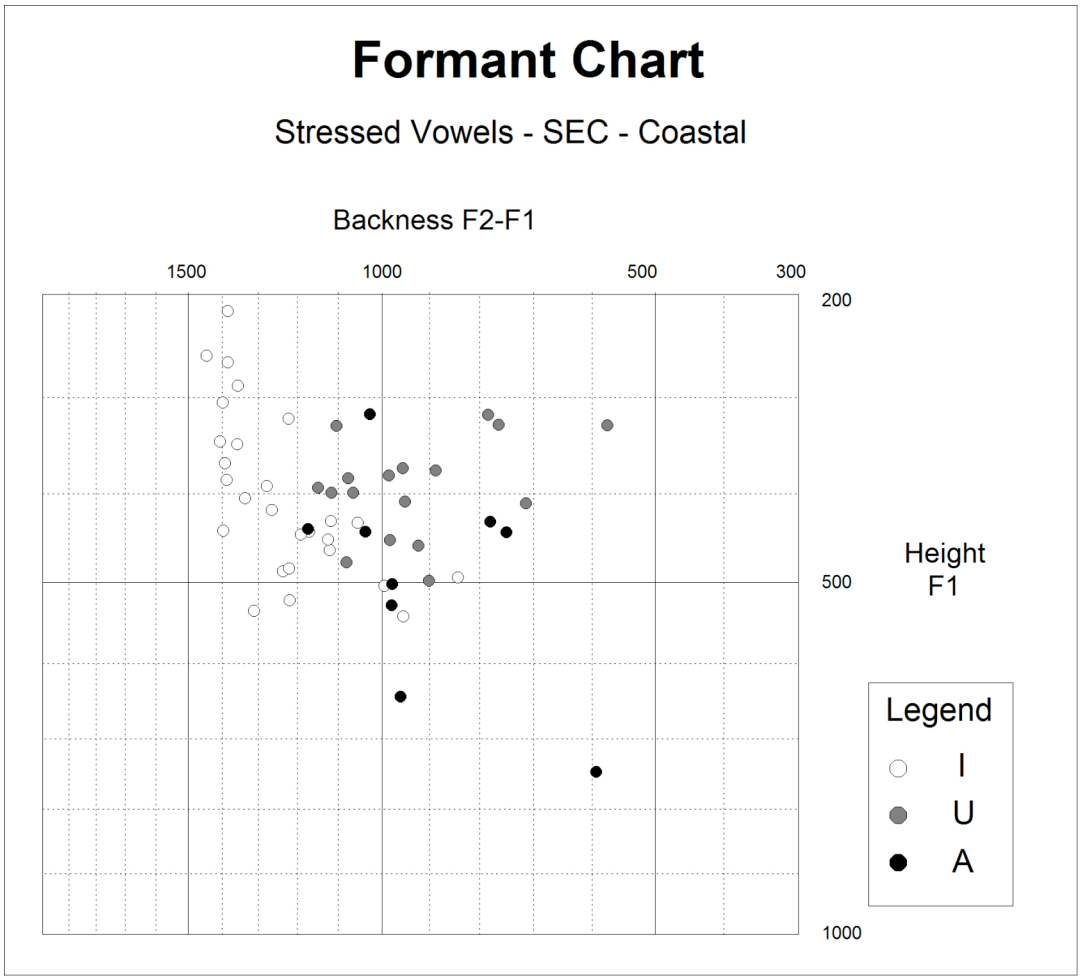
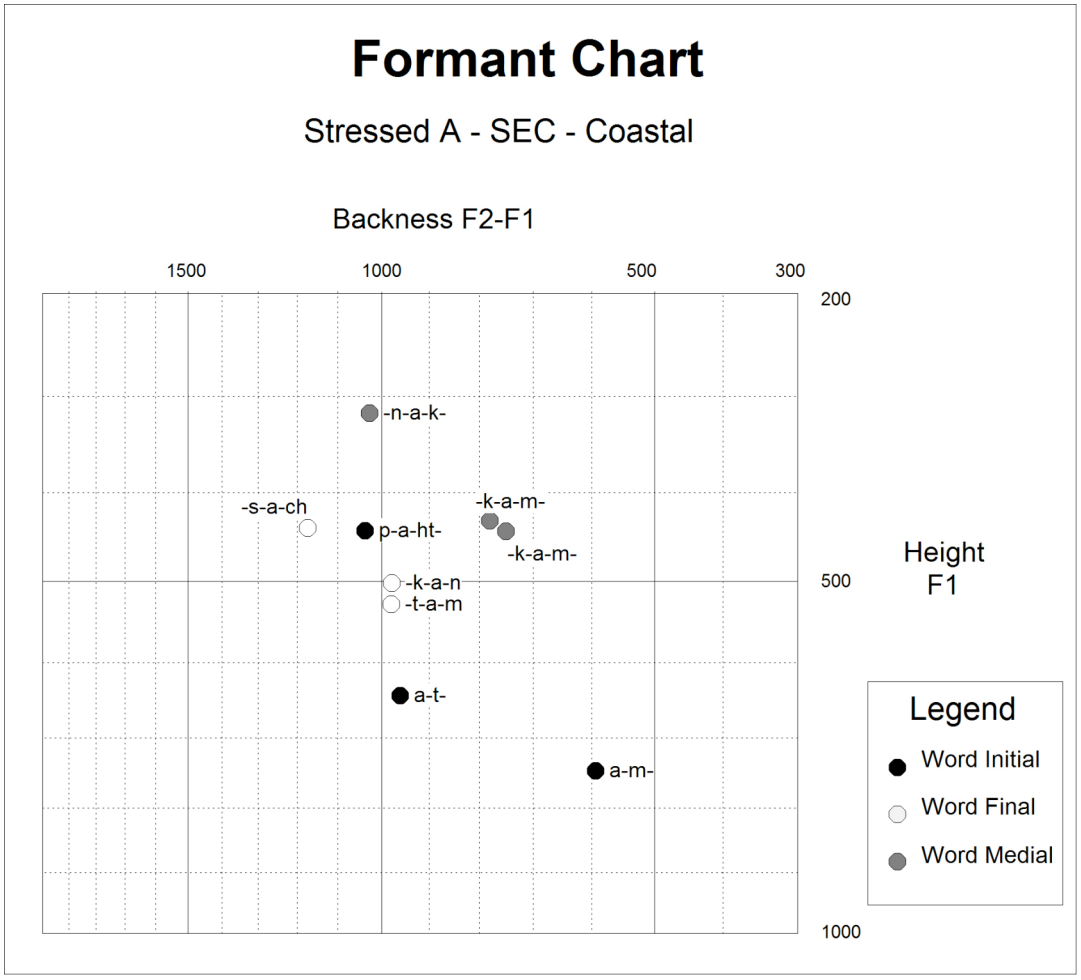


Figure 6 takes a closer look at just the stressed A tokens. The two tokens in the lower quadrant of the chart are the initial vowels in the words: *amiskw* and *atihkw*. The third word-initial A token contains an onset. All other tokens occur in non-word-initial syllables.

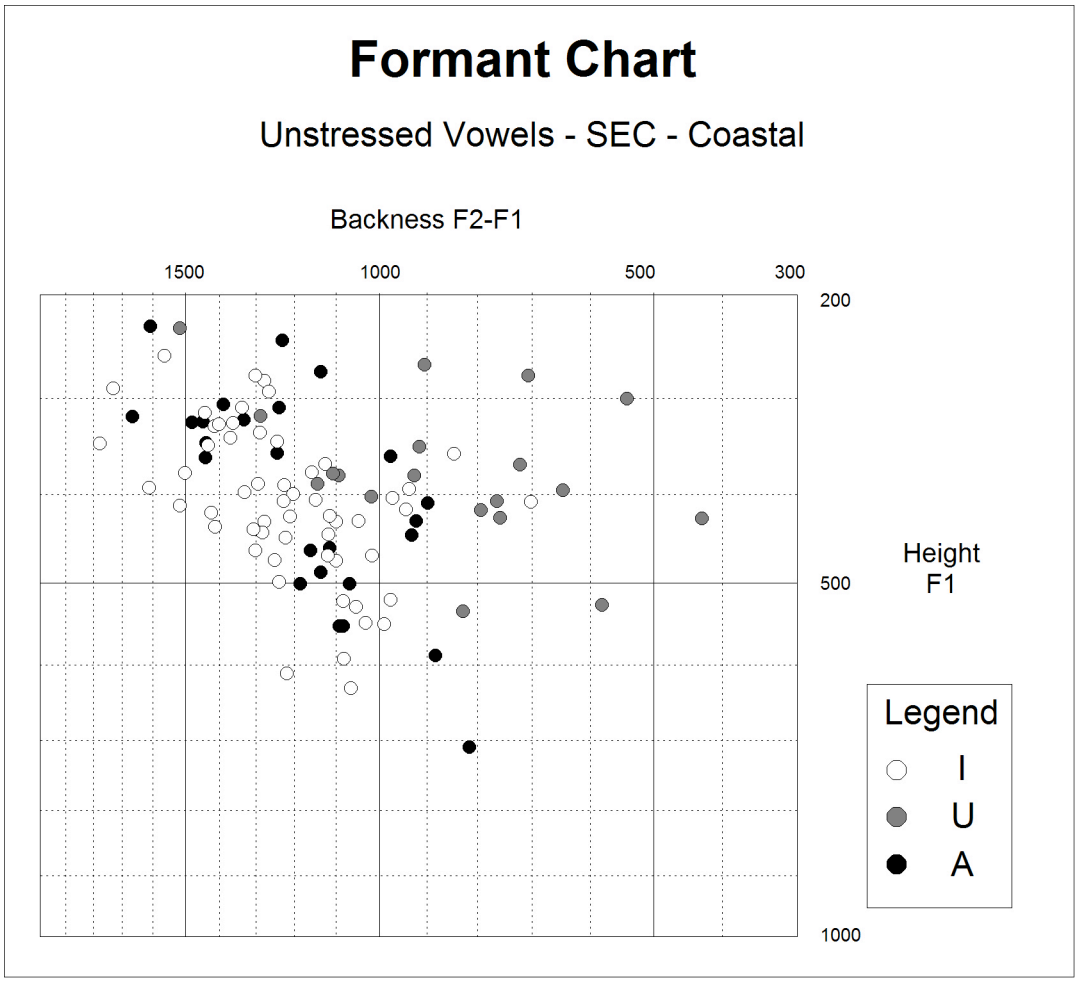
Figure 6



There is precedence for this pattern of maintaining a contrast in word- or morpheme- initial position: Pentland (1979: 401-2) claims that PA *i and *e merged to /i/ in Cree-Montagnais-Naskapi, except in morpheme-initial position, where the contrast between /i/ and /e/ is maintained in various forms.

Figure 7 shows the distribution of all the unstressed short vowels. In this case, word position did not play a role in the distribution of the unstressed tokens of A.

Figure 7



The data in Figure 5 - Figure 7 suggests that prominence plays some role in preserving the historical contrast between I and A. Similarly, MacKenzie (1980:140) observes that prominence plays a role in preserving the I vs. A contrast in NEC; short A is raised under stress but is otherwise neutralized with I to [ɪ]:

11. I vs. A contrast and neutralization in NEC (MacKenzie 1980:140)
    a. citakuhp > [stɛ́kuhp] 'your coat'
    b. nakata:w > [nikitá:w] 'he abandons him'

Moreover, a statistical analysis of all tokens of I and A (both stressed and unstressed) shows that I and A have partly merged in Coastal SEC: there was no significant difference in the values for F1 for A (M= 430.82, SD= 125.52) and I (M= 410.61, SD= 85.10); $t(46)= 0.86$, $p= 0.20$. There was, however, a significant difference in the values for F2 for A (M= 1554.56, SD= 185.66) and I (M= 1646.62, SD= 163.51); $t(55)= -2.52$, $p<0.01$. (Table I and Table II in Appendix I show the details of the statistics, calculated in Excel). This suggests that A and I have merged on the height dimension, but not on the backness dimension.

A sample of the analyzed words is shown in (12). The words are spelled with A in SEC but phonetically, they pattern like I. The same words in NEC are spelled with I because in NEC, the merger of I and A has already been implemented in the orthography (Junker et al. 2002).

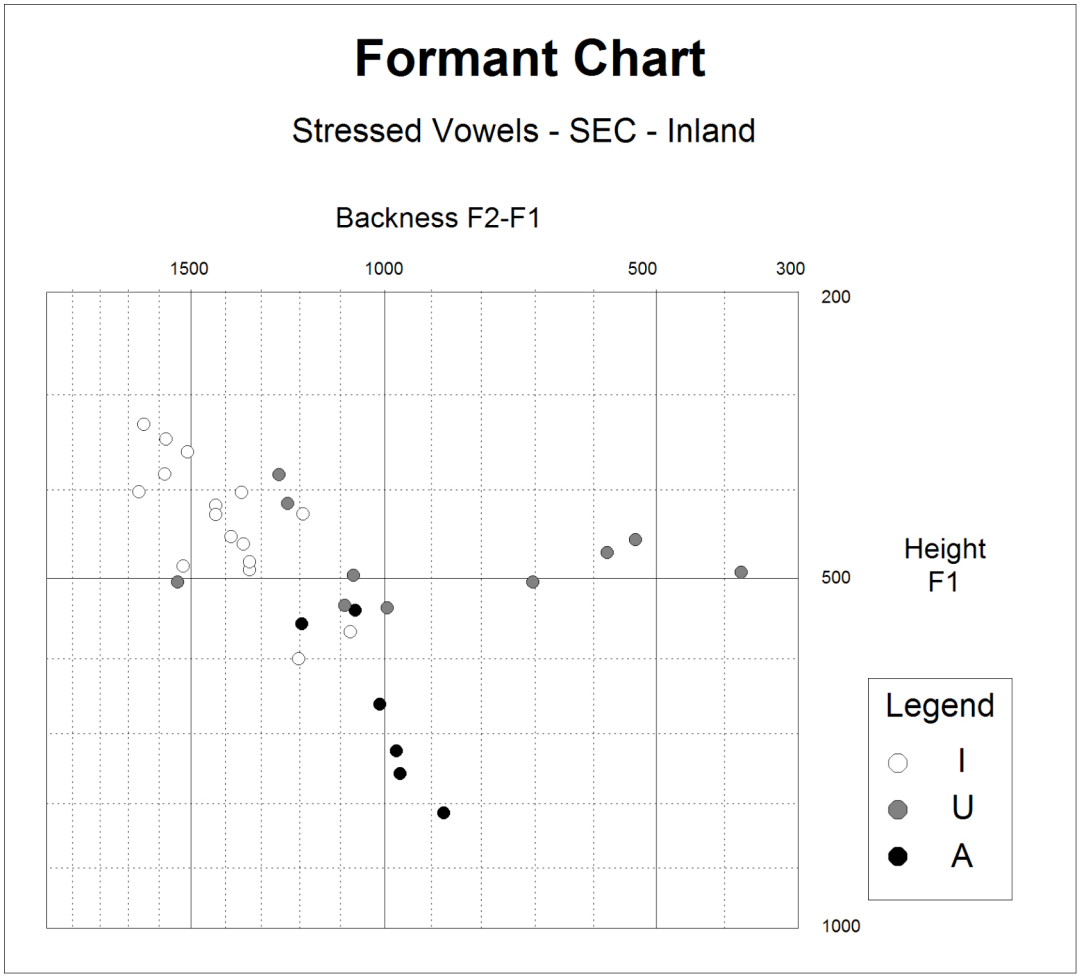
12. Southern and Northern spellings compared

Southern Spelling	**Northern Spelling**	**Gloss**
atihkukan	atihkukin	‘caribou bone’
atihkamekw	atihkimâkw	‘whitefish’
kûkamekw	-kimâkw	‘salmon’
pahtâwâpush	pihtâwâpush	‘rabbit with the fur singed off’
wâpushunakwân	wâpushunikwân	‘rabbit snare’
tipisitâhtam	tipisitâhtim	‘measure, feet’
namesach	nimâsich	‘many fishes’

6.2.2. Inland SEC

In the approximately 200 words analyzed for the Inland SEC speaker, 151 unstressed and 32 stressed short vowels were measured. Figure 8 shows the formant chart for the stressed short vowels of the Inland dialect of SEC. The A and I occur in fairly distinct vowel spaces. The back U, however, has tokens that stretch into the front vowel space.[9]

Figure 8



[9] Similarly, /u/ is fronted in many English dialects; see, for example, the Southern Vowel Shift described in Labov (1998). U fronting will not be discussed further as it does not bear on the topic of this paper.

Figure 9 shows the distribution of stressed A. The patterning is similar to the Coastal dialect (above; see Figure 6) in that the lowest tokens of stressed A are present in onsetless word-initial syllables.

Figure 9

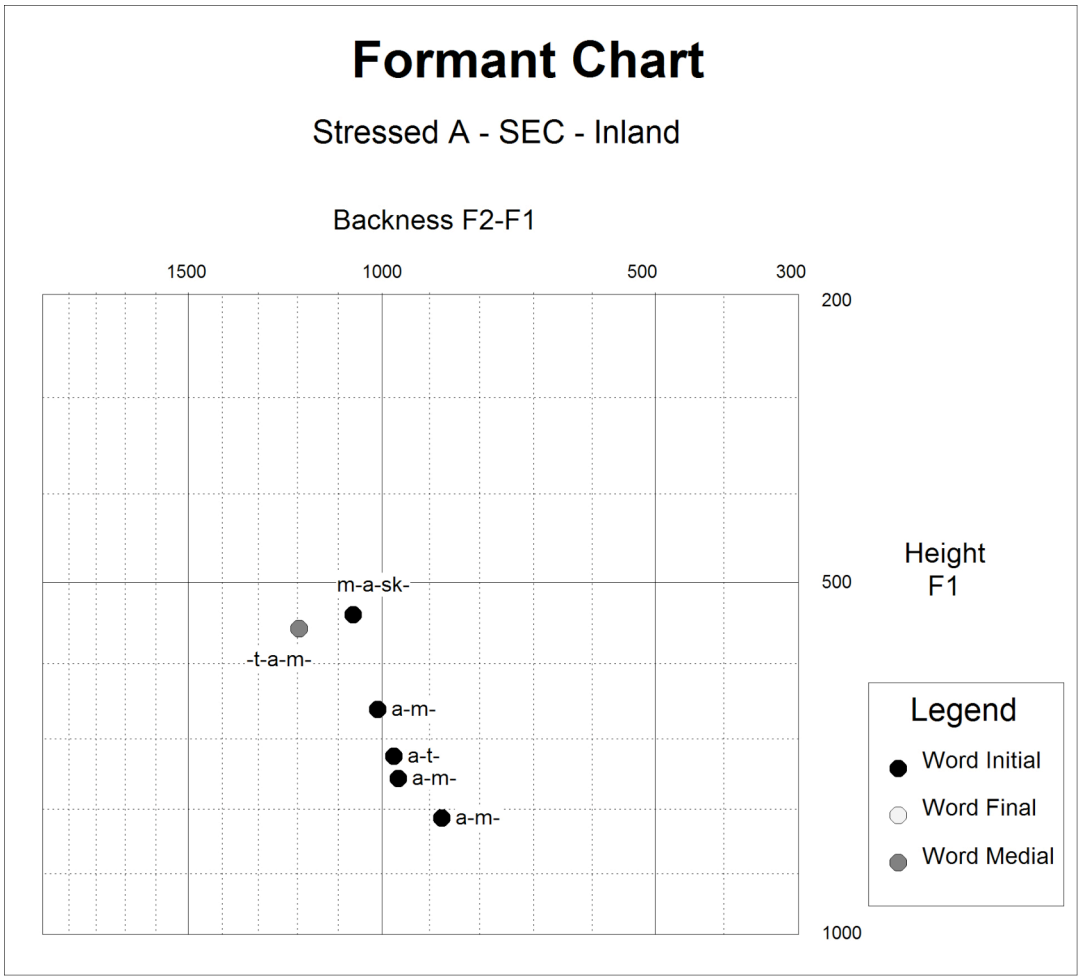
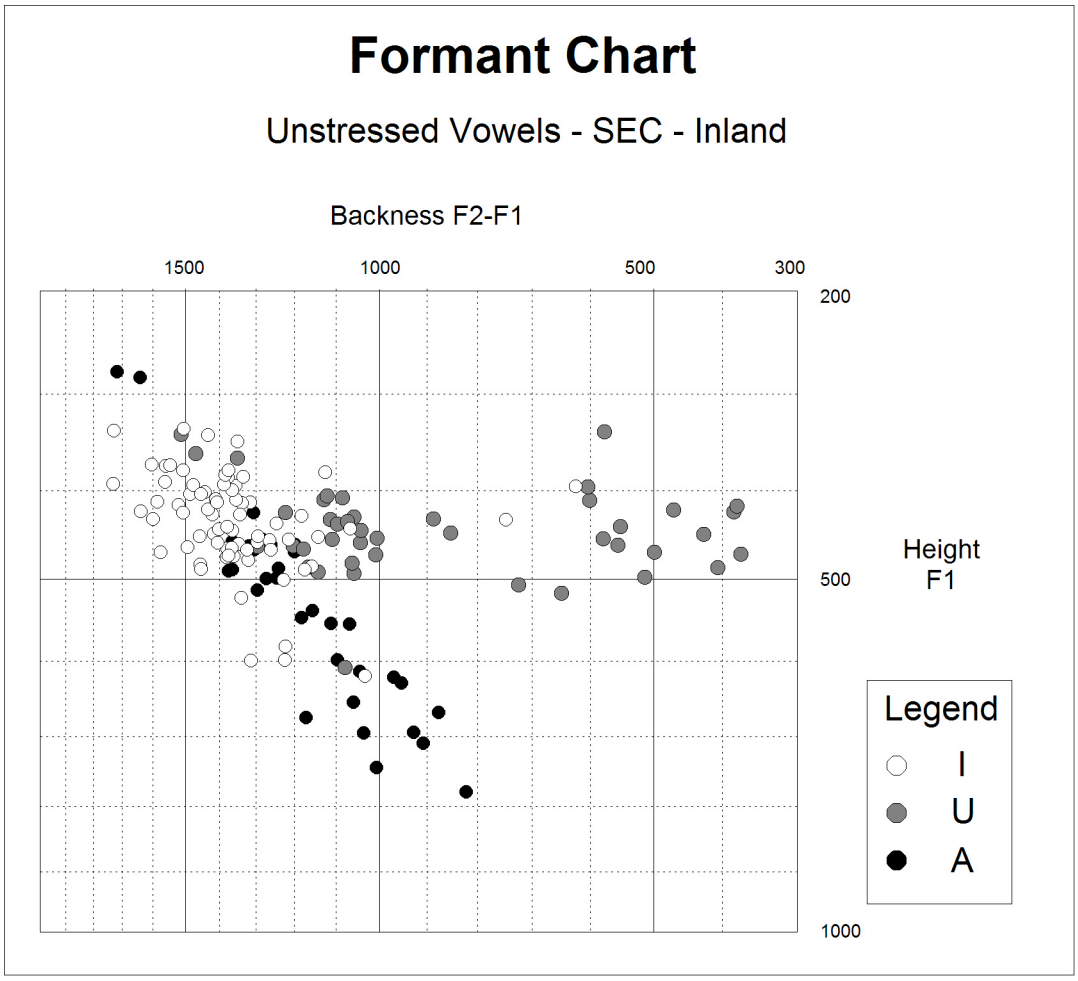


Figure 10 shows all of the unstressed short vowels. The unstressed vowels have a similar distribution to the stressed vowels except that there are more A tokens in the high vowel space.

Figure 10



The data in Figure 8 - Figure 10 suggests that, as in Coastal SEC, prominence plays some role in preserving the historical contrast between I and A in Inland SEC. A statistical analysis of all tokens of I and A (both stressed and unstressed) shows that I and A have not merged in Coastal SEC: there was a significant difference in the values for F1 for A (M= 565.76, SD= 126.77) and I (M= 436.23, SD= 60.04); $t(44)=6.01$, $p<0.01$).There was also a significant difference in the values for F2 for A (M= 1720.40, SD= 96.61) and I (M= 1809.64, SD= 163.20); $t(112)= -3.81$, $p<0.01$. (Table III and Table IV in Appendix I show the details of the statistics, calculated in Excel). This suggests that A and I have not merged on either the height or backness dimensions in Inland SEC.

6.3 Phonetic evidence for a merger of I and A in SEC

The data in §6 has shown that there is more phonetic evidence for a distinction between I and A in Inland SEC than in Coastal SEC. It also suggests that in both subdialects, the contrast between I and A was more likely to be preserved in prominent positions (word-initial or accented) than in non-prominent positions (non-word initial or unaccented).

7 Conclusions

Our study has revealed an interesting relationship between NEC and the subdialects of SEC. As shown in Figure 11, there are two types of isoglosses, ones separating NEC from SEC, and ones grouping NEC with Coastal SEC. The isogloss separating NEC from SEC is the merger of long Â and Ê, which occurred in NEC but not in SEC. The isoglosses grouping NEC with Coastal SEC are the partial merger of short I and A, and the [j] pronunciation of PA *l for the word i(y)iyû. In contrast, Inland SEC has not merged short I and A, and uses the [n] pronunciation of PA *l for that word.

Figure 11

Northern	Southern	
	Coastal	Inland
merger of Ê and Â	no merger of Ê and Â	
[j] iyiyû 'Aboriginal person'		[n] înû 'Aboriginal person'
merger of I and A		No merger of I and A

We initially undertook the present study in order to address a practical problem: when to use I and A in East Cree orthography. The spelling difficulties described in §4 lead us to believe that I and A were merging into one phoneme in SEC. We pointed out in §5 that there was little phonological evidence for a contrast between I and A in SEC, leaving only phonetic evidence as a potential cue for this contrast. The acoustic analysis in §6 provided evidence for a partial merger of I and A in the Coastal dialect of SEC but not in Inland SEC.

Our data thus helps explain why Coastal SEC speakers have more difficulty deciding whether to use I or A than do Inland SEC speakers. However, our study does not help solve the problem of the standardization of the orthography of SEC. If the distinction between I and A is maintained in the orthography, the spelling is more ad-hoc for Coastal SEC speakers. In contrast, if the orthography were to use one grapheme to represent a merged phoneme, then the spelling system would seem more ad-hoc to Inland SEC speakers. A compromise does not seem possible unless or until the merger of I and A spreads to the Inland subdialect of SEC.

Appendix I

Table I - Formant 1 - t-Test: Two Sample Assuming Unequal Variances

	F1-A	*F1-I*
Mean	430.82	410.61
Variance	15755.29	7241.74
Observations	34	83
Hypothesized Mean Difference	0	
df	46	
t Stat	0.86	
P(T<=t) one-tail	0.20	
t Critical one-tail	1.68	
P(T<=t) two-tail	0.39	
t Critical two-tail	2.01	

Table II - Formant 2 - t-Test: Two Sample Assuming Unequal Variances

	F2-A	*F2-I*
Mean	1554.56	1646.62
Variance	34471.41	26735.81
Observations	34	83
Hypothesized Mean Difference	0	
df	55	
t Stat	-2.52	
P(T<=t) one-tail	0.01	
t Critical one-tail	1.67	
P(T<=t) two-tail	0.01	
t Critical two-tail	2.00	

Table III - Formant 1 - t-Test: Two Sample Assuming Unequal Variances

	F1-A	F1-I
Mean	565.76	436.23
Variance	16069.85	3604.84
Observations	38	88
Hypothesized Mean Difference	0	
df	44	
t Stat	6.01	
P(T<=t) one-tail	0.00	
t Critical one-tail	1.68	
P(T<=t) two-tail	0.00	
t Critical two-tail	2.02	

Table IV - Formant 2 - t-Test: Two Sample Assuming Unequal Variances

	Variable 1	Variable 2
Mean	1720.40	1809.64
Variance	9334.44	26634.74
Observations	38	88
Hypothesized Mean Difference	0	
df	112	
t Stat	-3.81	
P(T<=t) one-tail	0.00	
t Critical one-tail	1.66	
P(T<=t) two-tail	0.00	
t Critical two-tail	1.98	

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