Modelling Plains Cree Negation with Constraint Grammar

Katherine Schmirler
University of Alberta
Department of Linguistics
schmirle@ualberta.ca

Antti Arppe
University of Alberta
Department of Linguistics
arppe@ualberta.ca

Abstract

This paper explores negation in a Plains Cree corpus, using Constraint Grammar to model various aspects of negation (verbal, nominal, particle). Plains Cree, an Algonquian language of North America, displays rich morphological marking on nouns and verbs, but also makes use of a large class of indeclinable particles, including negative markers. Combined with non-configurational syntax and few strict word order patterns, modelling syntactic relationships involving particles is far from straightforward. Using previous grammatical descriptions and corpus observations, we describe the process of modelling relationships involving negative particles in Plains Cree, present the patterns that emerge, and identify issues for further modelling.

1 Introduction

Previous work on Plains Cree syntactic modelling has aimed to identify basic syntactic relationships between verbs and core arguments (e.g. Schmirler et al., 2018), which can, for the most part, be identified on the basis of previously marked lexical features (i.e. noun class or verb class) and morphological features output by a morphological model (cf. Snoek et al., 2014; Harrigan et al., 2017). For further development, considerations beyond simple morphological features need to be made. In the present work, we detail the ongoing process of modelling relationships involving Plains Cree negative particles.

2 Background

2.1 Plains Cree

Plains Cree is a member of the Algonquian language family, which ranges across much of North America, from the Blackfoot and Cree languages spoken as far west as Alberta, Canada and Montana, USA, to a number of languages spoken on the eastern coast of the continent. Plains Cree is the westernmost member of the Cree language continuum, which includes Cree dialects across Alberta, Saskatchewan, northern Montana, northern Manitoba, and northern Ontario, as well as the closely related Montagnais-Naskapi dialects, spoken in Quebec and Labrador (Wolvengrey, 2011).

Algonquian languages are known for their rich morphology and non-configurational syntax, such that syntactic roles are determined by morphological agreement rather than word order. Of their various typological features, the noun classification system of animacy and the hierarchical alignment system are of particular interest for syntactic modelling. *Animacy* refers to the noun classification or gender system in Plains Cree, which divides nouns into two classes: *animate* and *inanimate*. Though this system corresponds closely to conceptual animacy (i.e., all humans, animals, and trees are animate, while most other objects are inanimate), many nouns demonstrate that it is a grammatical classification: for example, *asikan* ‘sock’ and *ayôskan* ‘raspberry’ are animate, while *maskisin* ‘shoe’ and *otêhimin* ‘strawberry’ are inanimate.

The animacy of nouns also bears on the types of verbs with which they can occur. The verbal system of Plains Cree includes four classes of verbs, determined by their transitivity and the animacy of the nouns they license. Thus, intransitive and transitive verbs each have two subclasses for each animate and inanimate nouns. Inanimate intransitive verbs (VII) take one inanimate participant and include attributive verbs for describing inanimate

nouns and zero-place predicates such as weather terms. Animate intransitive verbs (VAI) take one animate participant and include intransitive actions and attributive verbs for animate nouns. The terminology for transitive verbs differs slightly; it is assumed that the actor[1] is animate, and so the classification refers to the animacy of the goal. Transitive inanimate verbs (VTI) take an animate actor and an inanimate goal. Transitive animate verbs (VTA) take two animate participants. Examples of different classes are given in (1) and (2); note the pairs of verbs for nouns of differing animacy. Detailed morphological breakdowns are presented in these examples to demonstrate the rich morphology of Plains Cree, but are not included in later examples, as morphology is not the focus of the present work.[2]

(1) Intransitive clauses

a. VII
otêhimin mîhkwâw
otêhimin mîhkwâ- -w
strawberry.N.IN be.red.VII 0SG
'the strawberry is red'

b. VAI
ayôskan mîhkosiw
ayôskan mîhkosi- -w
raspberry.N.AN be.red.VAI 3SG
'the raspberry is red'

(2) Transitive clauses

a. VTI
wâpahtam maskisin
wâpaht- -am maskisin
see.VTI 3SG shoe.N.IN
'she/he/it (animate) sees a shoe'

b. VTA
niwâpamâw asikan
ni- wâpam- -âw asikan
1 see.VTA 1/2SG>3SG sock.N.AN
'I see a sock'

Alongside the transitivity/animacy classes of verbs, we also briefly introduce verbal orders, or inflectional patterns with different semantic and syntactic functions. Wolfart (1973) describes three orders for Plains Cree: independent, conjunct, and imperative. As is frequent in other descriptions of Plains Cree, our morphological model also identifies a subclass of the conjunct order, the future conditional, so we include this as a fourth order herein. The functions of the orders are summarised briefly here. The independent order is generally used for matrix clauses while the conjunct order can be used for either matrix or subordinate clauses. Cook (2014) identifies these as indexical and non-indexical clauses respectively: in very simple terms, independent clauses require no prior knowledge or context, while conjunct clauses, if they occur as matrix clauses, are not syntactically embedded but instead pragmatically "embedded" in an established context (in the real world or established within a discourse). Future conditional verbs are generally subordinate clauses, as they occur with meanings such as 'if, when, whenever'. Finally, imperative verbs may be either immediate ("do action now") or delayed ("do action later") and are not considered subordinate clauses. With the exception of imperatives, which do not occur for VIIs, all verb classes can occur in all verbal orders.

The rich agreement morphology allows for straightforward modelling of core argument relationships while particles, the most frequent word class evidenced in texts, bear essentially no inflectional morphology, and include words with a variety of different functions, which have not yet been given a detailed classification for Plains Cree. Without such a classification, development of particle constraints in the Plains Cree parser is an ongoing process, such as that described for negative particles in section 3.

2.2 A Plains Cree corpus

The texts to which the Plains Cree CG parser is applied are referred to herein as the Ahenakew-Wolfart (A-W) corpus (Arppe et al., in press). The A-W corpus consists of several texts (totalling ∼73,000 words of Plains Cree) collected in the 1980s and 1990s, which have been transcribed, edited, and in some cases translated, then published in several volumes (Ahenakew, 2000; Bear et al., 1998; Kâ-Nîpitêhtêw, 1998; Masuskapoe, 2010; Minde, 1997; Vandall and Douquette, 1987; Whitecalf et al., 1993). Digital versions, which

[1] In accordance with Algonquianist tradition, we use actor and goal to label syntactic roles in place of the more common subject and object (Bloomfield, 1946).

[2] Grammatical abbreviations: N = noun, IN = inanimate, AN = animate, VII = inanimate intransitive verb, VAI = animate intransitive verb, VTI = transitive inanimate verb, VTA = transitive animate verb, 0SG = singular inanimate agreement, 3SG = third person singular animate, 1 = first person prefix, 1/2SG>3SG = first or second person singular acting on third person singular animate.

display less editing than the published texts (e.g. more fragments, commas representing pauses, etc.), have been supplied for the digital corpus by H.C. Wolfart. This corpus has been morphosyntactially analysed using a finite-state parser (Snoek et al., 2014; Harrigan et al., 2017), the results of which have been hand-verified by two researchers, and subsequently tentatively disambiguated and parsed for core arguments (Schmirler et al., 2018) using CG-3 (Bick and Didriksen, 2015). The corpus is available upon request at URL: http://altlab.ualberta.ca/korp. The corpus contains a variety of genres, including historical narratives, personal narratives, funny stories, speeches/lectures, and dialogues; future research is planned to explore the ways in which genre affects morphosyntactic patterns in Plains Cree.

3 Considering negation in the Plains Cree CG parser

3.1 Negative particles

The initial implementation of negative particles in the CG parser was straightforward. First, a LIST of negative particles was created, and negative particle phrases were similarly identified; examples of particles are given in (3) and examples of phrases are given in (4).[3] These were assigned a morphological tag `Neg` for reference in later constraints and in corpus searches. The same morphemes appear repeatedly in these particles: *namôy*, *môya*, and *môy* are reduced forms of *namôya*; *kâwiya*, *êkâya*, *êkây*, *kâya*, and *êkâ* of *êkâwiya*; and *mwâc* of *namwâc*.[4] The other form in this list, *nama*, occurs only particle phrases in the A-W corpus, though older texts demonstrate that it was once a common negative particle; additionally, *namôya* is historically derived from *nama* plus a focus or emphatic particle *wiya*. Similarly, though only a subset of the negative particle phrases are given in (4), the same phrases also occur with the reduced forms of *namôya*.[5]

(3) Negative particles

```
LIST NEG = "namôya" "namôy"
"môya" "môy" "êkâwiya"
"kâwiya" "êkâya" "êkây" "kâya"
"êkâ" "nama" "namwâc" "mwâc" ;
```

(4) Negative particle phrases

`"namôya_wîhkâc" Iph Neg` ‘never’
`"namôya_ahpô" Iph Neg` ‘not even’
`"namôya_cî" Iph Neg` ‘it is not so?’

Though not relevant to the initial implementation of negation relationships in the present parser, the distribution of these different negative particle types (*namôya*-type, *êkâwiya*-type, *namwâc*-type) is referenced throughout section 4 below. Two main accounts are given for the distribution of *namôya*-type and *êkâwiya*-type negative particles.[6] The most common of these is a syntactic explanation: *namôya*-types (generally) occur with matrix clauses and *êkâwiya*-types (generally) occur with subordinate clauses. Additionally, imperatives are always negated with *êkâwiya*-type particles (e.g. Dahlstrom, 1991; Wolfart, 1996).

Further investigations have noted that this description, while an excellent starting point, does not fully capture the distribution of *namôya*-types and *êkâwiya*-types. Instead, this distribution can be explained in terms of realis and irrealis contexts. However, conveniently, we can use the morphosyntactic features of verbal order to approximate this distinction in the present work. Thus, independent verbs, as matrix clauses, are most likely realis; conjunct verbs, just as they can be either matrix or subordinate clauses, they can represent situations with either realis or irrealis semantics; future conditional verbs are subordinate clauses, but can be either realis or irrealis; and finally imperative verbs are considered always irrealis (and thus the only verbal order that is negated only by *êkâwiya*-types) (e.g. Cook, 2014).

3.2 Constraint development

After a LIST of negative particles was created, an initial constraint then assigned the function tag `@Neg>` when any of these words or phrases appeared immediately before a verb. While this does produce adequate results, it does not by any means fully capture negation in Plains Cree. First, there can be some intervening material between the negative particle or particle phrase and the verb, some

[3] The LIST approach was implemented for the initial development stage described herein; in future development, tags for particle functions can be added in the morphological model.

[4] All of these are glossed as ‘no, not’.

[5] Parser abbreviations: `Neg` = negative, `Ipc` = particle, `Iph` = particle phrase, `@Neg` = any negative tag, `@Neg-V>` = negative dependent on a verb to the right, `@Neg-N>` = negative dependent on a noun to the right, `@Neg-Ipc>` = negative dependent on a particle to the right.

[6] Little is said for Plains Cree on the *namwâc*-type particles.

of these negative particles can modify nouns or other particles as well as verbs, and some of these particles modify only particular elements. For example, variations of *êkâwiya* modify particular conjugation patterns, and *nama* only occurs in particle phrases in the A-W corpus.

A cursory exploration of the A-W corpus begins to demonstrate the complexities of negation: of the ∼1510 negative particles (excluding particle phrases), ∼580 occur immediately before verbs, which are identified by the original simple constraint. Of the remaining particles, ∼25 occur immediately before nouns, ∼100 before pronouns, ∼550 before particles, ∼160 before punctuation, and the remainder before as-yet-unlabelled elements. While an exploration of how negatives interact with all of these categories is beyond the scope of this paper, those before nouns can be explored readily. Several occur before a noun (or noun phrase) which is followed by punctuation, and so the negative particle does appear to modify the noun. In other cases, however, the noun is followed by a verb, without intervening punctuation, suggesting that the verb is negated. One sentence displays a series of negated elements, including nouns and a verb; a portion is given in (5).

(5) *...namôya nipiy,*
not water
namôya sâkahikana k-âtâmitân,
not lakes I buy from you
namôya kinosêw; ...
not fish
'...I do not buy the water, nor the lakes, from you, nor the fish...' (Kâ-Nîpitêhtêw, 1998, pp. 110-13)

In example (5), where *namôya* occurs before *nipiy* 'water' or *kinosêw* 'fish', it is straightforward to analyse each negative as dependent on the following noun. Before *sâkahikana* 'lakes', however, the verb is negated (cf. the English translation, where the verb is negated once and the remaining nouns are preceded by 'nor'). With this observation in mind, a constraint was written for nouns that makes use of clause boundaries, and the verbal constraint was modified to allow for intervening nominals.

A similar constraint was also written for particles, and the verbal constraint modified once again to allow for any intervening material, excluding clause boundaries. The current three negation constraints are given in (6). While these three constraints allow for many of the negative particles to receive a dependency tag, further examination of the corpus is required to determine their accuracy.[7]

(6) Negation constraints for Plains Cree
```
MAP:NegV @Neg-V> TARGET Neg
IF (*1 V BARRIER CLB) ;
MAP:NegN @Neg-N> TARGET Neg
IF (1 N) ;
MAP:NegIpc @Neg-Ipc> TARGET
Neg IF (1 Ipc) ;
```

This empirical approach quickly reveals issues of scope: often, a negative particle appears to negate a verb later in a sentence, rather than the immediately following noun or particle, regardless of punctuation. While these constraints can begin to give some idea of how negation works in Plains Cree, and can be used to further develop more accurate constraints, additional research into the scope of negation is also required.

4 Negation in a Plains Cree corpus

4.1 Negative particles and other word classes

The parser identifies 1732 negative particles, of which 1480 receive an `@Neg` tag (of any type, V, N, or Ipc). Of those that receive a syntactic function tag, 1249 are identified as modifying a verb, 25 as modifying a noun, and 206 as modifying a particle. Details for each type of negative particle (*namôya*-type, *êkâwiya*-type, and *namwâc*-type) are given in Table 1 (with a significant co-occurrence distribution (χ^2 (4, N = 1470) = 33.76, $p < .001$)). In Table 2,[8] the posthoc analysis of this significant distribution is presented, demonstrating the likelihood of each negative particle type to modify verbs, nouns, or particles.[9] Verbs are more likely to be modified by *êkâwiya*-types, while particles are more likely to be modified by *namôya*-types or *namwâc*-types.

For these negative particles, we can also explore how they modify different subclasses. In Table 3,

[7] As negation in Plains Cree is *symmetric* (negation does not strictly occur with other clausal changes from positive utterances, such as the addition of an auxiliary verb in English) (Miestamo, 2013), we cannot use clues from other morphosyntactic features when modelling negation.

[8] Here, '+' indicates a positive association (signficant over-co-occurrence), '-' a negative association (significant under-co-occurrence), and '0' a non-significant co-occurrence. See also Table 6.

[9] See Arppe (2008, p. 82-4), based on standardised Pearson residuals as described in e.g. Agresti (2002, p. 81).

	namôya	*êkâwiya*	*namwâc*
Total	1347	331	54
@Neg	1150	305	25
@Neg-V	945	290	14
@Neg-N	21	4	0
@Neg-Ipc	184	11	11

Table 1: Negative particles and negative syntactic tags for all word classes.

	namôya	*êkâwiya*	*namwâc*
@Neg-V	-	+	-
@Neg-N	0	0	0
@Neg-Ipc	+	-	+

Table 2: Posthoc analysis of the co-occurrences of negative particle types with verbs, nouns and particles.

the frequency of each verbal transitivity/animacy class with each negative particle type is presented. There was no significant preference for a particular negative type for any verb class (χ^2 (6, N = 1280) = 11.09, p = .086). However, as seen in Table 4, VTIs are negated nearly twice as often as other verb classes (significantly so, (χ^2 (3, N = 21332) = 112.59, $p < .001$): a pattern worth exploring in future research.

	namôya	*êkâwiya*	*namwâc*
VII	84	21	0
VAI	342	128	8
VTI	313	75	3
VTA	229	73	4

Table 3: Negative particle types and verbal transitivity classes.

Verbal order, which we use here as a (very rough) approximation of realis and irrealis, presents more readily interpretable results, as given in Table 5 (with a significant co-occurrence distribution (χ^2 (6, N = 1249) = 374.33, $p <$ .001)). We see, not surprisingly, the majority of independent verbs (matrix clause verbs, roughly equivalent to realis) are negated with *namôya*-types far more often than *êkâwiya*-types. For conjunct verbs, which may be either matrix or subordinate clauses (and either realis or irrealis), are negated $\sim$60% of the time by *namôya*-types and $\sim$39% of the time by *êkâwiya*-types. Conditional forms, which are always considered subordinate and often irrealis are most often negated by *êkâwiya*-types ($\sim$76%), though *namôya*-types are not infrequent at $\sim$24%. Finally, as described in the literature, we see that all of the negated imperative verbs in the corpus occur with *êkâwiya*-type negative particles. The posthoc analysis is presented in Table 6, confirming the above observations. As seen for verb classes, we can also explore the percentage of each order that is negated. In Table 7, independent verbs are seen to be the most frequently negated, while conjunct verbs are the least frequently negated. These patterns may suggest that matrix clauses are more likely to be negated than subordinate clauses, though further investigation into conjunct subtypes is required.

	Negated	**In corpus**	%
VII	105	1989	5.28
VAI	478	9269	5.16
VTI	391	4100	9.54
VTA	306	5974	5.12

Table 4: Negative particle types and verbal transitivity classes.

	namôya	*êkâwiya*	*namwâc*
Independent	561	4	5
Conjunct	377	244	9
Conditional	5	16	0
Imperative	0	28	0

Table 5: Negative particle types negating verbs by order.

	namôya	*êkâwiya*	*namwâc*
Independent	+	-	0
Conjunct	-	+	0
Conditional	-	+	0
Imperative	-	+	0

Table 6: Posthoc analysis of the co-occurrences of negative particle types with verbal orders.

Nominal features (both class, animate or inanimate, and number, singular or plural) are presented with respect to negative particles in Table 8. Inanimate nouns are negated more often than animate nouns, though animate nouns are more frequent in the A-W corpus. An explanation for this pattern is not immediately evident and as such further investigation is required. However, when it

	Negated	**In corpus**	%
Independent	570	6181	9.22
Conjunct	630	13995	4.50
Conditional	21	331	6.34
Imperative	28	374	7.50

Table 7: Negative particle types and verbal transitivity classes.

comes to number, singular nouns are more common than plural (though animate plural are far more common than inanimate plural), and so these results align well with overall corpus results. Still, future examination would not be amiss.

	namôya	*êkâwiya*	*namwâc*
Inanimate	12	2	0
Animate	7	1	0
Singular	17	2	0
Plural	3	1	0

Table 8: Negative particle types negating nouns by feature.

Finally, results for negated particles are given in Table 9. As these particle classifications are only rudimentary, little can be said at this time. Temporals and quantifiers are more likely to be negated than locatives; one can readily imagine phrases such as "not long ago" and "not much", which might arise from negating these subclasses. It is perhaps also worth noting that *namôya*-type particles are considerably more common for negating other particles, though the proportion of *namôya* -types compared to all particles with an `@Neg` tag in the overall corpus (∼80%) is not dissimilar to the proportion of *namôya*-types compared to all particles with an `@Neg-Ipc` tag (∼90%).

	namôya	*êkâwiya*	*namwâc*
Locatives	5	1	0
Quantifiers	14	1	1
Temporals	21	0	5
Other	141	9	0

Table 9: Negative particle types negating particles by function.

4.2 Comments on *êkâwiya* and *namwâc*

In the above results, we see that for some curious patterns, there are but few cases that can easily be explored in more detail. Two of these patterns we briefly note here, though fuller investigations are beyond the scope of the present work.

The first of these is the occurrence of *êkâwiya*-type particles negating nouns, for which only three instances occur. Two of these occur in the context of conjunct verbs, which we can interpret as irrealis; due to the clause boundaries in the text, the negative particle was simply identified as dependent on the noun. In the third case, given in (7), however, there is no morphosyntactic means of identifying an irrealis context: instead, the semantics of the particle *tapiskôc* 'as if' and the negative *êkây* must be taken into account.

(7) *kiwayawîtisahokawin*
you (sg.) are sent away
tapiskôc *êkây* *âskîhkân*
as if not reserve
'you are sent away as if it were not a reserve'
(Bear et al., 1998, pp. 300-1)

The second question is the occurrence of *namwâc*, in particular where it modifies another word rather than occurring in isolation as 'no'. The *namwâc*-types are by far the least frequent negative particle type discussed here and, unlike *namôya*- and *êkâwiya*-types, over half occur in isolation. Additionally, no information on the use of *namwâc* can be found in the literature for Plains Cree. Of those 25 that do occur with an `@Neg` tag, over half occur in clauses the bear an interesting feature: some degree of uncertainty, conveyed either through evidential particles (*êsa*, *êtikwê* 'apparently') or the combination of the negative particle and the verbs *kiskêyihtam* 's/he knows (it)' or *kiskisiw* 's/he remembers (it)'. While an investigation of these features with other negative particle types has not yet been conducted, these patterns offer a number of questions for future investigation of Plains Cree syntax and semantics.

5 Discussion

5.1 Modelling process

The straightforward modelling process outlined in section 3.2 ignores key facts of negation in Plains Cree. First, in only looking at nouns, verbs, and particles, we exclude pronouns (e.g. *môy nîsta* 'me neither'), which has certainly led to other inaccuracies in our results. Our primary reason for excluding pronouns at this time is that the third person singular pronoun *wiya* also occurs as a focus

or emphatic particle and we have yet to determine the best course of action for handling this ambiguity in the parser. Currently, a crude technique is implemented that identifies *wiya* as a pronoun when a verb with third person features occurs in the same clause and as a particle otherwise, though this is known to be inaccurate. This ambiguity has likely led to over-generation of `@Neg-Ipc>` tags, as these have been applied to *wiya* even in cases where it behaves as a pronoun. While a solution for the disambiguation of *wiya* may not be immediately apparent, constraints to identify negated pronouns will be a priority in future modelling.

Second, recent research has noted discontinuous particle phrases in Plains Cree (Wolvengrey, 2019); for example, the phrase *namôya wîhkâc* 'never' may occur with intervening material, including the verb. While we have not explored phrases in the current paper, such discontinuous phrases will have resulted in the over-application of the negative tag constraints, applying to *namôya* as though it were a lone particle rather than a member of a phrase. Future model development must determine the best course of action for identifying such phrases automatically.

These are but two issues we have identified in the process of modelling negation in Plains Cree. These issues, among general scope issues as mentioned in section 3.2 are left to future research.

5.2 Morphosyntactic vs. semantic patterns

In the results presented above, we make reference to morphosyntactic features (i.e., those referred to in the morphological and syntactic models and overtly presented in the results), but also comment on broader syntactic features such as matrix and subordinate clauses, as well as semantic features, namely the realis/irrealis distinction. While the morphosyntactic features of verbal order can represent some of the distinctions between matrix and subordinate clauses and realis and irrealis semantics, much is not captured. At minimum, other morphosyntactic features can be used to further refine the distinction; Plains Cree makes use of a class of morphemes known as *preverbs*, which occur before the verb stem within a verb and bear a number of functions (e.g. tense, adverbial, modal). Among these preverbs we find those that mark different type of conjunct clauses: *ê-* marks basic clauses, *kâ-* marks relative clauses, others bear tense and aspect information. While not all of these are well-defined, their interactions with conjunct suffixes and the realis/irrealis distinction have been investigated to some degree (e.g. Déchaine et al., 2018). Using such research as a base, we can further identify syntactic and semantic functions of conjunct verbs and their relationships with negative particles and phrases.

5.3 Future considerations

Future research is planned to explore how negative particles interact with different verbal morphology patterns beyond those discussed herein, as well as more detailed looks at nouns, particles, and pronouns. This also requires a deeper investigation of particle phrases and their functions; of particular interest are negative particle phrases with *kîkway* 'thing', as these often function as nominals. Many phrases also seem to negate clauses, and thus verbs, rather than nouns or particles—an impressionistic observation that requires further consideration.

Beyond negative particles, overall improvements and further developments in the syntactic model will also be necessary. For example, to better understand negation and the interclausal relationships and semantic patterns discussed in section 5.2 above, we will need to undertake an important yet daunting step in the syntactic model: modelling interclausal relationships, including relative clauses. Thus far, we have limited ourselves to clauses as delineated by punctuation, though interclausal and text-level relationships will be instrumental in corpus investigations of Plains Cree.

6 Conclusions

Despite their morphological simplicity, negative particles in Plains Cree have presented an interesting exercise in modelling their relationships with nouns, verbs, and other particles. The combinatory freedom of particles and flexible word order of Plains Cree present an ongoing challenge for the development of a parser. However, the identification of broad functions within the particle class, such as negation, has revealed various avenues for further modelling, and has been an important step toward more detailed and accurate syntactic function tags for Plains Cree.

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References

Alan Agresti. 2002. *Categorical data analysis*, second edition. John Wiley & Sons, Hoboken.

Alice Ahenakew. 2000. *âh-âyîtaw isi ê-kî-kiskêyihtahkik maskihkiy / They Knew Both Sides of Medicine: Cree Tales of Curing and Cursing Told by Alice Ahenakew*. University of Manitoba Press, Winnipeg.

Antti Arppe. 2008. Univariate, bivariate, and multivariate methods in corpus-based lexicography: A study of synonymy. Publications of the Department of General Linguistics, University of Helsinki, No. 44. http://urn.fi/URN:ISBN:978-952-10-5175-3.

Antti Arppe, Katherine Schmirler, Atticus G. Harrigan, and Arok Wolvengrey. in press. A morphosyntactically tagged corpus for Plains Cree. In *Papers of the 49th Algonquian Conference*.

Glecia Bear, Minne Fraser, Mary Wells, Alpha Lafond, and Rosa Longneck. 1998. *Our Grandmothers' Lives: As Told in Their Own Words*, bilingual edition edition. University of Regina Press, Regina.

Eckhard Bick and Tino Didriksen. 2015. Cg-3—beyond classical constraint grammar. In *Proceedings of the 20th nordic conference of computational linguistics, NoDaLiDa 2015, May 11-13, 2015, Vilnius, Lithuania*, 109, pages 31–39. Linköping University Electronic Press.

Leonard Bloomfield. 1946. Algonquian. In *Linguistic structures of Native America*, volume 6, pages 85–129. Viking Fund Publications in Anthropology, New York.

Clare Cook. 2014. *The Clause-Typing System of Plains Cree: Indexicality, Anaphoricity, and Contrast*. Oxford University Press, Oxford ; New York.

Amy Dahlstrom. 1991. *Plains Cree morphosyntax*. Garland Pub.,, New York :.

Rose-Marie Déchaine, Monique Dufresne, and Charlotte Reinholtz. 2018. (In)variance in the Cree dialect continuum: evidence from (IR)REALIS syntax. Paper presented at the 50th Algonquian Conference, October 27, 2018, Edmonton, AB.

Atticus G. Harrigan, Katherine Schmirler, Antti Arppe, Lene Antonsen, Trond Trosterud, and Arok Wolvengrey. 2017. Learning from the computational modelling of Plains Cree verbs. *Morphology*, 27(4):565–598.

Jim Kâ-Nîpitêhtêw. 1998. *ana kâ-pimwêwêhahk okakêskihkêmowina / The Counselling Speeches of Jim Kâ-Nîpitêhtêw*. University of Manitoba Press, Winnipeg.

Cecilia Masuskapoe. 2010. *piko kîkway ê-nakacihtât: kêkêk otâcimowina ê-nêhiyawastêki*. Algonquian and Iroquoian Linguistics, Winnipeg.

Matti Miestamo. 2013. Symmetric and asymmetric standard negation. In Matthew S. Dryer and Martin Haspelmath, editors, *The World Atlas of Language Structures Online*. Max Planck Institute for Evolutionary Anthropology, Leipzig. https://wals.info/chapter/113.

Emma Minde. 1997. *kwayask ê-kî-pê-kiskinowâpatihicik / Their Example Showed Me the Way: A Cree Woman's Life Shaped by Two Cultures*. University of Alberta Press, Edmonton.

Katherine Schmirler, Antti Arppe, Trond Trosterud, and Lene Antonsen. 2018. Building a Constraint Grammar Parser for Plains Cree Verbs and Arguments. In *Proceedings of the Eleventh International Conference on Language Resources and Evaluation (LREC 2018)*, Miyazaki, Japan. European Language Resources Association (ELRA).

Conor Snoek, Dorothy Thunder, Kaidi Lõo, Antti Arppe, Jordan Lachler, Sjur Moshagen, and Trond Trosterud. 2014. Modeling the Noun Morphology of Plains Cree. In *Proceedings of the 2014 Workshop on the Use of Computational Methods in the Study of Endangered Languages*, pages 34–42, Baltimore, Maryland, USA. Association for Computational Linguistics.

Peter Vandall and Joe Douquette. 1987. *wâskahikaniwiyiniw-âcimowina / Stories of the House People, Told by Peter Vandall and Joe Douquette*. University of Manitoba Press, Winnipeg.

Sarah Whitecalf, H. C. Wolfart, and Freda Ahenakew. 1993. *kinêhiyawiwiniwaw nêhiyawêwin / The Cree Language is Our Identity: The La Ronge Lectures of Sarah Whitecalf*. University of Manitoba Press, Winnipeg.

H. Christoph Wolfart. 1973. *Plains Cree: A Grammatical Study*, volume 63.5 of *Transactions of the American Philosophical Society, New Series*. American Philosophical Society, Philadelphia.

H. Christoph Wolfart. 1996. Sketch of Cree, an Algonquian Language. In *Handbook of American Indians. Volume 17: Languages*, pages 390–439. Smithsonian Institute, Washington.

Arok Wolvengrey. 2019. *tānispīhk wīhkāc ōma kē-āpatahk!?*: *wīhkāc* as a Polarity Item In Plains Cree. Paper presented at the 51st Algonquian Conference, October 24-27, 2019, Montreal, QC.

Arok Elessar Wolvengrey. 2011. *Semantic and pragmatic functions in Plains Cree syntax*. Netherlands Graduate School of Linguistics.