TITLE

by

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Abstract

ABSTRACT HERE

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Chapter 1

Introduction

This dissertation explores the phenomenon of Nêhiywêwin, also known as Plains Cree, Order. Nêhiywêwin, like all Algonquian languages, is a polysynthetic language with rich verb morphology. The most striking system in Algonquian verbs morphology, apart from perhaps the language's hierarchical/direct-inverse alignment (Wolvengrey, 2011, 53), is the system of Order. Order is instantiated on verbs through a system of allomorphy of the polypersonal argument morphs. While other Algonquian languages differ in their number of Orders, Nêhiywêwin has three recognized Orders: the Imperative, the Independent, and the Conjunct. The function of Order has been discussed in the literature, most comprehensively by Wolfart (1973) and Cook (2014). The latter resource is most comprehensive, though it generally focuses only on the difference between the Independent and the Conjunct Orders, placing aside the Imperative Order. This is, in my opinion, valid, but unmotivated in (Cook, 2014, 11) who justifies their decision as 'There is a third paradigm: the imperative order. The imperative order cannot host most agreement, any of the elements on the far left edge, or most of the preverbs. I will not discuss it further.' Put simply, Cook (2014) proposes that the phenomenon of Order is one of clause typing, specifically in the difference between Indexical (not having a prior referrent) and Anaphoric (having a prior refferent) clauses. This conclusion was come to after careful hand-analysis of a Nêhiyawêwin corpus. Although I agree with many of the conclusions put forth by Cook (2014), the orientation of this research is decidedly theoretical.

This dissertation will approach the purpose and function on Nêhiyawêwin from a systematic and empirical perspective. Using a corpus (including, in part, all of the texts

used by Cook (2014)) and modern computational techniques, this dissertation attempts to uncover the motivations in the choice to use one Order over another. This research is undertaken through the lens of *alternation*. The primary method of analysis this dissertation relies on is mixed-effects logistic regression, based on the work of Arppe (2008). By framing Order as a system of alternation, mixed-effects logistic regression allows for the creation of a predictive model, where each of the predictor variables can be evaluated for their effect on the outcome of the alternation. Three types of alternations are investigated: Independent vs. Conjunct (the most straightforward alternation in terms of previous description of Order), Independent vs. ê-Conjunct (the most straightforward alternation in term of near-synonymy (Cruse, 2000, 157-159)), and the alternation of the various Conjunct types (a more straightforwardly semantic alternation).

Chapter 2 provides a background on Nêhiyawêwin, Order, and the use of alternation in linguistic investigation. This chapter also provides a detailed discussion regarding the nature of Order as an alternation, how this outlook can be used to study the phenomenon, and a detailed justification for the ignoring of the Imperative mood beyond methodological opportunism.

Next, Chapter 3 presents a study in semi-automatically clustering verbs together for the purposes of predictor generation for the logistic modelling at the centre of this dissertation. This chapture focuses on how one can use pre-existing majority language data to bootstrap the creation of an ontology for lemmas in a minority language, Nêhiyawêwin. The result of this research, a semantic class for every verb in a dictionary (Wolvengrey, 2001), was used as the main semantic effects in the main statistical modeling of this dissertation. Earlier versions of this research were published in Harrigan and Arppe (2021) and Harrigan and Arppe (ress).

Following the chapter of semantic classification, Chapter 4 describes and justifies the particular methodologies in statistical modelling. This chapter also details the morphosyntactically tagged corpus that is being used, and the ways in which this corpus has been construed as a data set. The main research questions driving this analysis are:

1. Can mixed effects modelling be used in investigating complex morphological phenomenon using a small but robust corpus?

2. Are the alternations between the Independent and Conjunct, the Independent and the ê-Conjunct, and the Conjunct types similarly able to be modelled, or are some of these alternations easier to model than others?

3. What are the variables that increase the likelihood that a lemma will occur in a particular Order/outcome?

Chapter presents the results the statistical modelling in three stages: univariate, bivariate, and multivariate. As the latter is of primary interest for this dissertation, it is discussed most in depth. The following chapter, Chapter , discusses in depth the multivariate results. This includes not only a discussion of what this means in the general sense of Order as well as how the results frame each outcome, but also how well the statistical modelling performed and what this overall success or failure can tell us about alternations and Order more generally.

Chapter 2

Background

Nêhiyawêwin (ᓀᐦᐃᔨᐧᐃᐣ ISO 639-3: CRK, also known as Plains Cree) is a member of the Algonquian language family, one of the major language families of North America, spoken across much of Canada and the eastern United States. Nêhiyawêwin is part of two major dialect continua: the Cree-Montagnais-Naskapi languages, which stretch mainly from Alberta to Quebec and Labrador, and the central Canadian Ojibwe-Cree continuum, which occur in central Canada and the Northern United States. [1]

Nêhiyawêwin is the westernmost member of the Cree-Naskapi-Montagnais continuum and is mostly spoken in Alberta, Saskatchewan, and northern Montana. There is said to be approximately 34,000 speakers of Nêhiyawêwin (Ethnologue, 2016), most over the age of 30. This number is likely overestimated, though a previous account by Ethnologue was dubious, with a number of roughly 150. Statistics Canada (2016) reports 3,655 native speakers of 'Plains Cree,' though this number may be higher if respondents reported their native language as 'Cree,' rather than 'Plains Cree.' Wolfart (1973) estimated 20,000 speakers, though the number has likely dropped since then. Although

[1]The languages/dialects of Cree-Montagnais-Naskapi continuum share many similarities, as can be seen in the following words for 'person', where the reflexes of Proto-Algonquian **l* are given in boldface. The dialects are given in roughly west to east geographical distribution:

(1) Plains: *i**y**iniw*
Woods: *i**th**iniw*
Swampy: *i**n**iniw*
Moose: *i**l**iliw*
Atikamekw: *i**r**iniw*
East: *i**y**iyiw/i**y**iyû/i**y**inû*
Naskapi: *i**y**iyû*
Innu: *i**l**nu/i**n**nu*

any of these numbers is dwarfed by the number of speakers of majority languages in Canada, Nêhiyawêwin retains a strong presence, particularly for an Indigenous North American language, holding a classification of 5 (Developing) on the Extended Graded Intergenerational Disruption Scale (EGIDS) (Ethnologue, 2016), a system for assessing language vitality based on domains of use, intergenerational transmission, and other sociolinguistic factors (Lewis and Simons, 2012). With its comparatively large speaker base, Nêhiyawêwin has garnered attention from a variety of Americanists, in the form of grammars (e.g. Wolfart 1973, Dahlstrom 2014, Wolvengrey 2011), textbooks (e.g. Okimāsis 2018; Ratt 2016) and an online electronic dictionary (itwêwina[2]).

2.1 Nouns

Nêhiyawêwin exhibits a number of morphosyntactic features that differ considerably from the well-known characteristics of often discussed Indo-European languages. Unlike sex-based gender systems such as those found in many contemporary romance languages, Algonquian languages have a two-way gender or noun classification system contrasting inanimate with Animate nouns; this grammatical animacy has some basis in semantic animacy: all humans, animals, and trees are animate. This distinction is not clear-cut though, as *êmihkwân*, 'spoon', *sîwinikan*, 'sugar', and *sêhkêpayîs*, 'automobile' are animate,[3] and thus the system is considered one of grammatical classification. Notably there are few-to-no examples of clearly alive animals that are grammatically inanimate. Animacy is relevant to nominal and verbal morphology in Nêhiyawêwin in various ways. Among nouns, this animacy distinction is manifested in two distinct plural markers, {-ak} for animate and {-a} for Inanimate nouns; archaic singular marking is seen for monosyllabic roots, for example *maskw-a* 'bear (ANIM)' and *wâw-i* 'egg (INANIM)'. Nêhiyawêwin has no grammatical case system, but it does have locative marking, generally *-ihk* for Inanimate nouns (Wolfart, 1973, 1996), with Animate nouns often not being locativized.

Nêhiyawêwin is a head-marking language, and so the person and number of the

[2]http:/itwewina.altlab.app

[3]It is worth noting that animacy is not always consistent across dialects of Cree, or even communities of Nêhiyawêwin. Some words, such as *sîwinikan* 'sugar', are animate in some dialects and inanimate in others.

possessor is marked on the possessum. Singular possessors are marked only with prefixes: {ni-} for first person, {ki-} for second person, and {o-} for third person. For plural possessors, circumfixes are used: the prefixes are the same as for singular persons, which are matched with a set of suffixes: {ni- -(i)nân} for first person plural exclusive ('ours but not yours'), {ki- -(i)naw} for first person plural inclusive ('mine/ours and yours'), {ki- -(i)wâw} for second person plural ('yours but not ours'), and {o- -(i)wâw} for third person plural. Nêhiyawêwin also distinguishes between alienable and inalienable nouns; the latter category must occur with possession and includes kinship terms and body parts as well as some other intimate possessions or relationships, such as *nôhkom* 'my grandmother' versus **ôhkom* 'grandmother' (Wolfart, 1973, 1996; Wolvengrey, 2011). Some nouns, particularly body parts, are inalienable and may be posessed by a general posessor, as in *mitas*, '(someone's) pants'.

Within Animate nouns, a pragmatic distinction is made regarding the topicality of a noun when used in the third person. All animate nouns can occur as either proximate third person (more topical entity in a discourse) and the obviative third person (less topical entity or entities in the discourse). This distinction occurs any time more than one animate third person occurs in a discourse, such as when one third person animate entity acts on another or when a third person animate entity possesses another, as in (1). An obviative animate noun is marked with the obviative suffix {-a} and no number distinction is made; this is conventionally marked with 3′ (or as the '4th person', with no number distinction). The further obviative, which occurs when two obviative entities occur in one discourse, necessitating the demotion of one of them, is by convention marked with 3′′ (or as the '5th person', also with no number distinction). As obviation is based in topicality rather than syntactic roles, it is generally not considered a marker of case. This is further exemplified with respect to verbal constructions below.

(1) atim nâpêw-a tahkwam-ê-w
dog.PROX man-OBV bite.TA-DIR.THM-3SG.3′
'the (proximate) dog bites the (obviative) man.'

2.2 Verbs

Cree verbs are traditionally classified according to both their transitivity and the animacy of their arguments/participants. There are two classes of intransitive verbs, which can occur with one inanimate participant (VII—verb inanimate intransitive) or one animate participant (VAI—verb animate intransitive). The former includes impersonal verbs such as weather terms and stative verbs used attributively to describe inanimate objects, and the latter includes intransitive actions and attributive verbs used to describe animate objects (Bloomfield, 1946; Okimāsis, 2018; Wolfart, 1973, 1996). The VII and VAI classes are exemplified in (2) and (3) respectively.

(2) VII

a. wâpiskâ-w
be.white.VII-3SG
'it is white'

b. astotin wâpiskâ-w
hat.NI be.white.VII-3SG
'the hat (inanimate) is white'

(3) VAI

a. wâpiskisi-w
be.white.VAI-3SG
's/he (animate) is white'

b. mîciso-w
eat.VAI-3SG
's/he eats, has a meal'

Similarly, there are two classes of transitive verbs, though these are distinguished by the animacy of their second participant, often considered the object: transitive inanimate verbs (VTI) with an animate subject and an inanimate object, and transitive animate verbs (VTA) with two animate arguments.[4] Examples are given in (4) and (5); note that

[4] *Subjects* and *objects* are conventionally called *actors* and *goals* in Algonquian literature (Bloomfield,

there are three different verbs for ‘eat’ depending on the transitivity and the animacy of participants.

(4) VTI

a. mîci-w
eat.VTI-3SG
‘s/he eats it (inanimate)’

(5) VTA

a. mow-ê-w
eat.VTA-DIR.THM-3SG.ACTOR.3′GOAL
‘s/he eats it/him (animate)’

As noted above, Nêhiyawêwin does not have a case system to determine syntactic roles. Nouns exhibit obviation, a system in which non-focal, animate, third persons are marked (Bloomfield, 1946, 94). Together with the directionality system, discussed below, semantic roles are determined through relationships between items rather than simple case marking.

Verbs agree with arguments according to animacy: inanimate actors for VII and animate actors for VAI, VTI, and VTA. The inanimate participant in a clause containing a VTI is the goal of the verb, or some other oblique argument, but not the actor. The person marking on VII, VAI, and VTI verbs corresponds to the person and number of the actor. However, in VTAs, both arguments are animate and realized in the verbal morphology, with their respective roles determined by obviation and direction morphology, discussed below. Essentially, verbs and their arguments can be thought of as constructions where certain verb stems license a certain number of arguments of particular animacy.

To determine the roles of participants in VTA clauses, Algonquian languages make use of a direct-inverse system (Jacques and Antonov, 2014; Wolfart, 1973). VTAs occur with two animate participants and there is no grammatical case or fixed word order by which to determine the semantic roles. Instead, direction is used as a method

1946; Wolvengrey, 2011). *Actors* here refer to the do-er of an action or subject of a description, despite the syntactic or semantic role. Similarly, *goals* are any entity that receives a transitive action, regardless of the semantic or syntactic role (e.g. patient, recipient, benefactive, etc.). For this dissertation, I make use of these terms.

of determining which argument is the actor and which is the goal. In Nêhiyawêwin, direction is determined by the relative topicality of participants, extended beyond the proximate-obviative distinction into a full hierarchy known as the Algonquian person hierarchy, given in (6) (Jolley, 1983). Direction is indicated by a theme morpheme, which indicates that the action is either *direct* or *inverse*. When a more topical participant acts on a less topical participant, the morphology or theme sign is direct (*-â-*, *-ê-*, *-i-*). When the opposite occurs, the morphology or theme sign is inverse (*-ik*(*w/o*)*-*, *-iti-*). As visualized in (6), second person is ranked topically above first person, and both of these speech act participants are ranked above all third or unspecified[5] persons, wherein obviation applies. Due to this hierarchy, first person acting on second necessarily always occurs with inverse morphology. In this way, these are not passive forms, but simply the only way of indicating first person acting on second. For this and a variety of other reasons not discussed herein, Nêhiyawêwin inverse forms are not considered equivalent to passive voice in languages such as English (Wolfart, 1973; Wolvengrey, 2011).

(6) $2 > 1 >$ Unspecified Actor $> 3 > 3' > 3''$

With obviation marked on both nouns and verbs, sentences such as those in (7)a. are possible in Nêhiyawêwin. Additionally, both obviative and further obviative marking may be needed, depending on the number of third persons lexically specified, as in (7)b. However, when a Nêhiyawêwin VTI is involved, and so there is an inanimate goal rather than an animate one, no goal or obviative marking occurs on either the verb, or the inanimate noun, as in (8) (Wolfart, 1973; Wolvengrey, 2011).

(7) VTA

a. cân pahkwêsikan-a mow-ê-w
John.3SG bread.NA-3′ eat.VTA-THM.DIR-3SG.3′
'John eats bread (animate).'

b. cân o-têm-a oskâtâskw-a mow-ê-yiwa
John.3SG 3.POSS-dog.NA-3′ carrot.NA-3′′ eat.VTA-THM.DIR-3′.3′′

[5]In Nêhiyawêwin, the Unspecified Actor is an actor on a verb where the exact person and number of the actor is not specified. It may be translated as a sort of agentless passive (Wolvengrey, 2011).

'John's (3SG) dog (3′) eats the carrot (animate, 3′′).'[6]

(8) VTI

a. cân wiyâs mîci-w
John.3SG meat.NI eat.VTI-3SG
'John eats meat (inanimate).'

The {-w} in (8) is one of two third person suffixes in the VTIs, the other being {-m}. This morph is homophonous with third person markers in other conjugation classes. Alongside extensive person and direction morphology, several other categories may also be expressed on verbs.[7] Preverbs attach to the verb between person and the verb stem and serve several purposes. There are two types of preverbs: grammatical and lexical. The outermost of grammatical preverbs include those such as {ê} and other Conjunct preverbs including {ka-}/{ta-}[8], and {kâ-}. While most preverbs are relatively freely combineable, these three are mutually exclusive. These morphs serve as complementizers and may have further functions, such as marking future or relative clauses. Closer to the verbal stem, one can observe another type of grammatical preverb for tense and aspect: {kî-} for past, {wî-} for prospective future, and {ka-/ta}- for definite future. Closer still to the verb are lexical preverbs, e.g., {kakwê-} 'try (to)', {nihtâ-} 'be good at', {nitawi-} 'go and (do something)', {âpihtâ-} 'half (of)/halfway', {kihci-} 'large', etc. (Wolfart, 1973, 1996; Wolvengrey, 2001), though even these show a gradience in lexicality/grammaticality.

2.3 Nêhiyawêwin Order

Algonquian languages are noted for their unique system of what is called Order, most easily recognized through allomorphy instantiated on the person-marking affixes of verbs. According to Bloomfield (1946, 97):

> The forms of the verb fall into five orders. Each order consists of one or more modes, each with a full set of forms. The independent order takes prefixes; its principal

[6]As the marking for obviative and further obviative is formally the same, they must instead be distinguished on the basis of semantics and pragmatics.

[7]For a large (though not yet complete) overview of Nêhiyawêwin morphemes (including common preverbs) see Cook and Muehlbauer (2010).

[8]This is a single morpheme that contains two allomorphs that are used in free variation. In central and southern Alberta, {ka-} is the more common form

> mode, however, the indicative, has zero instead of *we-* for the third person. The other orders take no prefixes. The imperative has forms for second person actor only, and only one mode. The prohibitive has two modes with the same restriction, but also a third mode, the potential, with a full set of forms. The conjunct and interrogative orders are used only in subordinate clauses and as participles. The languages differ widely in their stock of modal forms; all seem to have lost a few, and some languages have created new ones.

The Orders described by Bloomfield are mutually exclusive. One can not have the morphology for both the Independent and the Conjunct, for example. For this reason, it seems obvious to group the mutually exclusive orders as a cohesive unit. As alluded to by Bloomfield, some Algonquian languages have fewer than five orders. Nêhiyawêwin is one of these languages, usually regarded as having only three orders: the Imperative, the Independent and the Conjunct. Despite the centrality of Order to the use of verbs, descriptions of the system as a whole remain vague for Nêhiyawêwin. Sometimes, Order is treated as a semantic alternation: the Imperative Order marks the imperative mood, while the Independent and Conjunct do not correspond to any specific mood. However, there is no such distinction between the Independent and Conjunct Orders. Instead, these Orders are usually analyzed through their morphological difference.

I argue that Order, can be analyzed as an alternation. I suggest that Order as currently described is essentially two overlapping linguistic systems: one of mood/aspect and one of morphology that corresponds to an type of semantic alternation previously undescribed: a paradigmatic alternation. To support this proposal, I will detail the morphological, syntactic, and semantic/pragmatic ways in which Order is used and defined, and the ways in which these definitions are inadequate.

2.3.1 Morphology

Speaking strictly in terms of structural/morphological phenomena, the different Orders of Nêhiyawêwin can be divided into three main types: the Independent, the Conjunct, and the Imperative. The Independent is comprised of those forms which mark for any person argument and take a person prefix ({ni-} for first person, {ki-} for second, and no prefix for third person) and a set of suffixes (Bloomfield, 1946; Wolfart, 1973). The Conjunct is comprised of forms that also mark for any argument and which take no person prefix and one of a number of conjunct suffixes. The Imperative, on the other hand, marks for

only second person arguments, cannot be used without a second person argument, does not make use of person prefixes, and uses a unique set of suffixes as compared to the Independent or Conjunct. Treating these Orders as of the same type due to their mutual exclusivity, as done by Bloomfield (1946), results in a system depicted in Figure 2.1.

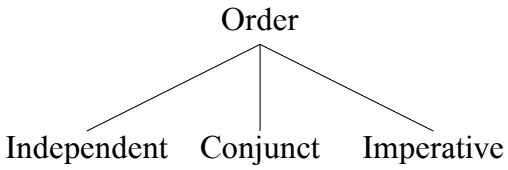

Figure 2.1: Order Ontology based on Morphology

This ontology, however, fails to capture clear distinction of the Imperative from the Independent and the Conjunct. In a strictly structural sense, the shape of the Independent and Conjunct paradigms are similar to each other, while the Imperative's diverges from this standard substantially. To demonstrate and describe these differences, the structural makeup of the three canonical orders will be described below.

The Independent Order

According to Wolfart, the Independent order comes in two main modes: the preterit and non-preterit (1973). Preterit forms can be thought of as past-perfect constructions; conversely, the non-preterit form is essentially equivalent to the traditionally described indicative (Wolfart, 1973). Wolfart spends much of his description discussing the preterit forms of the Independent order, explaining the three types of preterit Independents. Since Wolfart's publication these preterit forms have largely fallen out of use in Nêhiyawêwin (Wolvengrey, 2011, 74) and so will not be further discussed. As previously mentioned, the Independent is identified by Bloomfield (1946), Wolfart (1973), and Cook (2014) as the Order that marks for all possible persons with the person prefixes {ni-} and {ki-} for first and second persons, respectively, and the lack of an prefix for the third and obviative persons. Independent forms are unable to take the {ê-} preverb (discussed later) which has begun to function exclusively as a marker of Conjunct constructions.

Table 2.1 describes the Independent VII paradigm. Notice that only third person (and obviative) participants exist in this paradigm, and so no speech act participant prefix or suffixes are used. These along with the final column, the additional third person obviative

Table 2.1: VII Independent Paradigm. Based on Wolvengrey (*2011, 413*).

	Prefix	Stem	Theme	SAP Person	Obviative	3SG	3PL	3’
3SG		mihkwâ				w		
3PL		mihkwâ				w	a	
3’SG		mihkwâ			yi	w		
3’PL		mihkwâ			yi	w	a	

Table 2.2: VTA Independent Direct, Mixed Participant Paradigm Excerpt. Based on Wolvengrey (*2011, 418*).

	Prefix	Stem	Theme	SAP Person	Obviative	3SG	3PL	3’
1	ni	wâpam	â			w	ak	
2SG	ki	wâpam	â			w	ak	
1PL	ni	wâpam	â	nân			ak	
21PL	ki	wâpam	â	naw			ak	
2PL	ki	wâpam	â	wâw			ak	
3SG		wâpam	ê			w		
3PL		wâpam	ê			w	ak	
3’		wâpam	ê		yi	w		a

suffix, are unused but included to maintain consistency with the VAI, VTI, and VTA paradigms.

The VTA paradigms are further split. Here, a distinction is made between the *local* and *mixed* subsets. A *local* VTA subparadigm is one where the actor and the goal are both speech act participants (first or second persons), while the *mixed* subparadigm contains interactions between speech act participants and third or obviative persons. This subparadigm also contains third persons acting on obviative persons. This is presented in this way for the sake of convenience. In reality, one could place these non-speech act participant forms in their own sub-paradigm.

As seen in Tables 2.3 and 2.4, the paradigms of the VAI and VTI are extremely similar, differing in their inclusion of a theme sign.[9]

In fact, there are some VAIs, like *âsokâham*, ‘s/he swims across’ that follow

[9]Theme is used in the sense of traditional grammars, such as Goodwin (2002), where the theme sign is used to associate a stem with a particular paradigmatic shape.

[10]This represents the first person inclusive actor. In Algonquian linguistics, this is often considered as a second person form due to its morphology and its marking with the second person {ki-} prefix in the Independent.

Table 2.3: VAI Independent Paradigm. Based on Wolvengrey (2011, 415).

	Prefix	Stem	Theme	SAP Person	Obviative	3SG	3PL	3'
1SG	ni	nipâ		n				
2SG	ki	nipâ		n				
1PL	ni	nipâ		nân				
21PL[10]	ki	nipâ		(nâ)naw				
2PL	ki	nipâ		nâwâw				
3SG		nipâ				w		
3PL		nipâ				w	ak	
3'		nipâ			yi	w		a

Table 2.4: VTI Independent Paradigm. Based on Wolvengrey (2011, 417). Note the difference of theme sign for local and non-local participants.

	Prefix	Stem	Theme	SAP Person	Obviative	3SG	3PL	3'
1SG	ni	wâpaht	ê	n				
2SG	ki	wâpaht	ê	n				
1PL	ni	wâpaht	ê	nân				
21PL	ki	wâpaht	ê	naw				
2PL	ki	wâpaht	ê	wâw				
3SG		wâpaht	am			(w)		
3PL		wâpaht	am			w	ak	
3'		wâpaht	am		(i)yi	w		a

the general VTI paradigm and takes the {-m-} theme sign; conversely, some VTIs like *kâtâw*, 'S/he hides something,' take VAI morphology and follow the VAI paradigm. This has lead to an alternative interpretation of verb conjugation proposed by Wolvengrey (2011). Here, there is a three-way distinction between verbs, based solely on the number of animate participants: *V0* containing any verb forms with no animate participants (corresponding to VII), *V1* containing verbs with only one animate participant (corresponding to VAI and VTI), and *V2* containing verbs with two animate participants (corresponding to VTA).

Tables 2.2 through 2.7 gives a subset of an Independent VTA paradigm,[11] exemplifying direct and inverse forms for different pairs of participants for the VTA *wâpamêw* 's/he (animate) sees someone (animate)'. The person prefixes, and often the suffixes, remain the same while the direction morphology changes (note that some

[11]There are 36 person combinations in each of the Independent and Conjunct Orders.

Table 2.5: VTA Independent Direct, Local Paradigm Excerpt. Adapted from Wolvengrey (*2011, 418*).

	Prefix	Stem	Theme	1SG	1PL	2PL
2SG	ki	wâpam	i	n		
2SG/PL	ki	wâpam	i	n	ân	
2PL	ki	wâpam	i			nâwâw

Table 2.6: VTA Independent Inverse, Mixed Participant Paradigm Excerpt. Wolvengrey (*2011, 418*).

	Prefix	Stem	Theme	SAP Person	Obviative	3rd Person	3PL	3’
1	ni	wâpam	ik(w)			w	ak	
2	ki	wâpam	ik(w)			w	ak	
1pl	ni	wâpam	ikw	inân			ak	
21pl	ki	wâpam	ikw	inaw			ak	
2pl	ki	wâpam	ikw	iwâw			ak	
3		wâpam	ik(w)			w		
3pl		wâpam	ik(w)			w	ak	
3’		wâpam	ikw		yi	w		a

dialects allow for third person inverse forms with {-ikow} endings instead of {-ik}[12].). While the VTA Independent forms are decomposible, the Conjunct forms are not always so predictable.

Table 2.7: VTA Independent Inverse, Local Paradigm Excerpt. Based on Wolvengrey (*2011, 418*).

	Prefix	Stem	Theme	1SG/PL	2PL
2SG	ki	wâpam	iti	n	
2SG/PL	ki	wâpam	iti	nân	
2PL	ki	wâpam	iti		nâwâw

The Conjunct Order

Wolfart (1973) described four modes of the Conjunct, based on the presence or absence of the verb-final suffix {-ih} and the presence or absence of ‘initial change’ (an Algonquian process where the first vowel in the verb stem (or sometimes verbal prefixes) is

[12]Note that the{iko} morph derives from the {ikw} morpheme along with a an epenthetic /i/, the combination of which produces /iko/

Table 2.8: Wolfart's Conjunct modes. Adapted from Wolfart (*1973, 45*)

		Initial Change	
		+	-
/ih/	+	Iterative ('whenever it is')	Subjunctive ('if it be')
	-	Changed ('it being')	Simple ('that it is')

mutated—abbreviated IC) (Wolfart, 1973). According to Wolfart those Conjunct verbs with both {-ih} and Initial Change are iterative and are named by him as such. Those without Initial Change but with {-ih} impart conditionality and are what Wolfart terms the *subjunctive*. Verbs with Initial Change but without {-ih} are simply called *Changed* and are the most commonly used Conjunct form, though Wolfart notes that Initial Change is beginning to fall out of use, being replaced instead by the use of the {ê-} preverb (1973). This view is consistent with that of Wolvengrey's account of {ê-} being born out of a regularization of a particular type of change, /i/ > /ê/, where the changed vowel was extracted from the construction to be used as a preverb, the verb stem retaining its original form (e.g., *itwêt* > *êtwêt* > *ê-itwêt*) (A. Wolvengrey, Personal Communication). Finally, those verbs without Initial Change or {-ih} are referred to as *simple* (Wolfart, 1973). A summary of this four way distinction is found in Table 2.8. In more contemporary Nêhiyawêwin orthography, the -ih ending is realized simply as a suffixal {-i}.

Cook (2014) provides further detail on the morphosyntactic and semantic behaviour of the Conjunct order. Agreeing with Wolfart (1973), Cook explains the wide spread use of the order through several modes of the Conjunct. Unlike Wolfart's tetrachotamy, Cook gives a pentachotomy (2014). Under Cook's system, the Conjunct is split into the *Changed* and *Unchanged* modes (2014). The Changed Conjunct is further split into three subtypes: the *Changed Conjunct*$_1$, the *Changed Conjunct*$_2$, and the *Iterative Changed Conjunct*[13]. Although three subtypes are titled *Changed* due to being historically derived from changed forms, only the Iterative currently exhibits Initial Change. Changed$_1$ and Changed$_2$ on the other hand, are marked with the {ê-} and {kâ-}

[13]Where Wolfart (1973) identified an iterative/conditional morpheme as -ih, Cook (2014) follows the contemporary orthography.

Table 2.9: Cook's Conjunct modes. Adapted from Cook (*2014, 125*)

Submode	Subtype	Form	Gloss
Changed	Changed Conjunct$_1$	ê-apiyân	'I sleep'
	Changed Conjunct$_2$	kâ-apiyân	'When I sleep'
	Iterative	êpiyâni	'Whenever I sleep'
Unchanged	Simple	ka-apiyân	'for him to eat'
	Subjunctive	apiyâni	'whenever I eat'

preverbs respectively [14]. The unchanged Conjunct forms are split into the *Subjunctive Simple Conjunct*, which are marked with no preverb and no Initial Change (but instead with a -i suffix appended to the person endings), and the *Irrealis Simple Conjunct*, which is marked with the {ka-} preverb. These forms are represented in Table 2.9.[15]

The following paradigms demonstrate the general shape of the Conjunct paradigm and represent the ê-Conjunct forms for the VII, VAI, VTI, and VTA conjunct classes.

As with the Independent paradigm, the VII Conjunct paradigm marks only for the third and obviative persons, as in Table 2.10.

Table 2.10: VII Conjunct Paradigm for mihkwâ, 'to be red'. Based on (*Wolvengrey, 2011, 413*)

	Prefix	Stem	Theme	SAP Person	Obviative	3rd Person	3PL	3'
3SG	ê-	mihkwâ				k		
3PL	ê-	mihkwâ				k	i	
3'SG	ê-	mihkwâ			yi	k		
3'PL	ê-	mihkwâ			yi	k	i	

Similar to the Independent, the Conjunct's VAI and VTI paradigms are strikingly similar. The main difference is the inclusion of an epenthetic /y/ in the SAP Person endings for the VAI paradigm, as well as the /am/ theme element in the VTI. These differences are exemplified in the differences between Tables 2.11 and 2.12.

The paradigmatic breakdowns used in Tables 2.13 through 2.16 highlight the theme morphs for the direct and inverse. There are alternative ways to analyze

[14]Wolfart (1973) classifies these two types together as changed conjunct forms, deriving {kâ-} from {kî-})

[15]Terminology for these terms vary between researchers. The subjunctive is sometimes referred to as the *future conditional*, which helps avoid the the term subjunctive (Okimāsis, 2018; Ratt, 2016). Similarly, the term *timeless conditional* has been used in place of *iterative* (Harrigan et al., 2018).

Table 2.11: VAI Conjunct Paradigm for nipâ, 'to sleep'. Based on (*Wolvengrey, 2011, 415*).

	Prefix	Stem	Theme	SAP Person	Obviative	3rd Person	3PL	3'
1SG	ê	nipâ		yân				
2SG	ê	nipâ		yan				
1PL	ê	nipâ		yâhk				
21PL	ê	nipâ		yahk				
2PL	ê	nipâ		yêk				
3SG	ê	nipâ				t		
3PL	ê	nipâ				c	ik	
3'	ê	nipâ			yi	t		

Table 2.12: VTI Independent Paradigm for wâpaht, 'to see it'. Based on (*Wolvengrey, 2011, 417*).

	Prefix	Stem	Theme	SAP Person	Obviative	3rd Person	3PL	3'
1SG	ê	wâpaht	am	ân				
2SG	ê	wâpaht	am	an				
1PL	ê	wâpaht	am	âhk				
21PL	ê	wâpaht	am	ahk				
2PL	ê	wâpaht	am	êk				
3SG	ê	wâpaht	am			k		
3PL	ê	wâpaht	am			k	ik	
3'	ê	wâpaht	am		(i)yi	t		

the endings in VTA paradigms, perhaps more straightforwardly by chunking all the suffixes together as sorts of portmanteau morphemes, as in Harrigan et al. (2017). For consistency and compatibility with Wolvengrey (2011), this dissertation will continue to use the paradigmatic patterns as presented in the four-conjugation class appendices of Wolvengrey (2011).

The Imperative Order

Just as Bloomfield (1946) does, Wolfart (1973) describes two main Imperative modes: the Immediate and Delayed imperatives. The Immediate Imperative refers to a command to do something immediately, while the Delayed Imperative refers to a command to do something later. Because the Imperative only encodes command forms, both the immediate and the delayed mark only for second person forms. Resultingly, VII conjugation class of verbs, which only encodes third person and obviative actors, does not occur in the Imperative.

Across the remaining three conjugation classes, the Immediate Imperative describes

Table 2.13: VTA Conjunct Direct, Local Paradigm Excerpt for mow, 'to eat'. Based on Wolvengrey (*2011, 419*).

Actor → Goal	Prefix	Verb Stem	Theme	2SG/2PL	1PL
2SG → 1SG	ê-	mow	i	yan	
2SG/PL → 1PL	ê-	mow	i		yâhk
2PL → 1SG	ê-	mow	i	yêk	

Table 2.14: VTA Conjunct Inverse, Mixed Participant Paradigm Excerpt. Based on Wolvengrey (*2011, 419*).

Actor → Goal	Prefix	Verb Stem	Theme	Obviative	SAP	3SG	3PL
1SG → 3SG	ê-	mow			it		ik
2SG → 3SG	ê-	mow			isk		ik
3SG → 3'	ê-	mow	iko		yâhk		ik
1PL → 3SG	ê-	mow	iko		yahkw		ik
21PL → 3SG	ê-	mow	iko		yêkw		ik
2PL → 3SG	ê-	mow	iko			t	
3PL → 3'	ê-	mow	iko			t	ik
3' → 3"	ê-	mow	iko	yi		t	

an immediate command and is marked with no suffix, a {-tân} suffix, and a {-k} suffix for second person singular, first person inclusive, and second person plural, respectively. Again, the main differentiation between the VAI and VTI imperative paradigms is the latter containing a theme morph, as seen in Tables 2.17 and 2.18.

Additionally, the second person plural and all delayed forms contain an empenthetic /ɪ/. In each of these cases, the theme sign is realized as {-amw-} and the resulting /wɪ/ sequence coalesces to /o/, as in *wâpahtamok*, 'See it, y'all!'. Where the {-amw-} and epenthetic /ɪ/ occur before an /h/, the surfacing form contains a long /o/, as in *wâpahtamôhkan*, 'see it later!'

Table 2.15: VTA Conjunct Inverse, Local Paradigm Excerpt. Based on Wolvengrey (*2011, 419*).

Actor → Goal	Prefix	Verb Stem	Theme	2SG/2PL	1PL
2SG → 1SG	ê-	mow	i	yan	
2SG/PL → 1PL	ê-	mow	i		yâhk
2PL → 1SG	ê-	mow	i	yêk	

Table 2.16: VTA Conjunct Direct, Mixed Participant Paradigm Excerpt. Based on Wolvengrey (2011, 419).

Actor → Goal	Prefix	Verb Stem	Theme	Obviative	SAP	3SG	3PL
1SG → 3SG	ê-	mow			ak		ik
2SG → 3SG	ê-	mow			at		ik
3SG → 3'	ê-	mow	â		yâhk		ik
1PL → 3SG	ê-	mow	â		yahkw		ik
21PL → 3SG	ê-	mow	â		yêkw		ik
2PL → 3SG	ê-	mow	â			t	
3PL → 3'	ê-	mow	â			t	ik
3' → 3"	ê-	mow	â	yi		t	

Table 2.17: VAI Imperative Paradigm. (*Wolvengrey, 2011, 395*)

	Verb Stem	Immediate	Delayed
2SG	nipâ		
21PL	nipâ	tân	
2PL	nipâ	k	
2SG	nipâ		hkan
21PL	nipâ		hkahk
2PL	nipâ		hkêk

The Imperative paradigms for the VTAs looks somewhat different than the VAI and VTI paradigms. Because the VTAs take two animate participants, the Imperative paradigm includes both first person and third person goals, as seen in Tables 2.19 and 2.20.

All forms except 2SG and 2PL acting on third persons in the Immediate imperative have a theme morph, {-â-} for the Mixed Participant Paradigm and {-i-} for the local. As in other cases, where one morpheme ends with /w/ and another begins with /i/, the surface form is realized as /o/, as in the Immediate second person acting on third singular for *wâpamihkok*, 'witness him, y'all!'

Morphology Summarized

Morphologically, and in particular from a structural point of view, it is obvious that the Independent and the Conjunct have similar paradigmatic shapes: they each mark for the same persons and make use of similar prefixes (though the Conjunct does so

Table 2.18: VTI Imperative Paradigm. (*Wolvengrey, 2011, 398*)

	Verb Stem	theme	Immediate	Delayed
2SG	wâpaht	a		
21PL	wâpaht	ê	tân	
2PL	wâpaht	amw	ik	
2SG	wâpaht	amw		ihkan
21PL	wâpaht	amw		ihkahk
2PL	wâpaht	amw		ihkêk

Table 2.19: VTA Imperative Mixed Participant Paradigm (*Wolvengrey, 2011, 403*).

			Immediate		Delayed	
	Stem	Theme	3SG	3PL	3SG	3PL
2SG	mow		(i)	ik		
21PL	mow	â	tân	ik		
2PL	mow		ihkw	ik		
2SG	mow	â			hkan	ik
21PL	mow	â			hkahkw	ik
2PL	mow	â			hkêkw	ik

more uniformly than the Independent) and suffixes to mark these persons. Conversely, the Imperative exhibits a far more restricted paradigm: among actors it marks only for second person and makes no use of person prefixes. Further, while the Independent and the Conjunct can occur in any verb class, the Imperative and VIIs are mutually exclusive. These factors, at least on their own, suggest an ontology that place the imperative separately from the Independent and Conjunct, which are more similar to each other. This is illustrated in Figure 2.2.

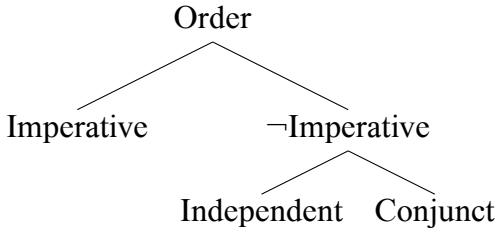

Figure 2.2: Morphological Ontology

As will be seen throughout the rest of this chapter, this pattern of two orders being similar while the remaining one stands apart is pervasive through various levels of

Table 2.20: VTA Imperative Local (*Wolvengrey, 2011, 403*).

			Immediate		Delayed	
	Stem	Theme	1SG	1PL	1SG	1PL
2SG	mow	i	n			
21PL	mow	i		nân		
2PL	mow	i	k			
2SG	mow	i			hkan	
21PL	mow	i				hkâhk
2PL	mow	i			hkêk	

representation. This poses difficulty for creating a description or analysis of Order as a unified tripartite system, as one order seems to act substantially different from the others.

2.3.2 Syntax

Progressing from Morphology, I will now discuss the syntax of the three canonical Nêhiyawêwin Orders. The syntactic differences between the Independent, Conjunct, and the Imperative orders are best described by Cook (2014). Although Wolfart (1973) touches on these differences, he does so without great detail. Wolfart (1973) mentions that while the Imperative and the Independent can stand alone (without a prior clause or referent), the Conjunct often represents some form of subordination (which requires another clause on which to depend). Further, he describes each of his four kinds of Conjunct forms as follows: the Simple Conjunct (without IC or a subjunctive suffix) generally follows future markers or conjunctions such as *nawac*, 'should', or *pitanê*, 'would that/may'; conversely, the Changed Conjunct (with IC but not a subjunctive suffix) indicates subordination with little other syntactic restrictions; The Iterative Conjunct (with both IC and the subjunctive suffix) generally occurs in narrative and participial clauses, and finally, the Subjunctive Conjunct (without IC but with a subjunctive suffix) represents some sort of conditionally and often futurity (Wolfart, 1973, 46). Similarly, Cook details the syntactic distribution of the Conjunct order, explaining like Wolvengrey (2011), that the Conjunct can occur in subordinate (i.e. dependent clauses) (2014). In particular, Cook describes the Conjunct as *mostly* occuring in these subordinate clauses, but with her Changed Conjunct_1 class as additionally being possible

in matrix clauses. A summary of Cook's Conjunct subtype distinction is found in Table 2.21 (2014, 125).

Table 2.21: Description of Conjunct Orders (*adapted from Cook* (*2014, 125*))

Submode	Subtype	Form	Matrix	Subordinate
Changed	Changed Conjunct$_1$	ê-apiyân	✓	✓
	Changed Conjunct$_2$	kâ-apiyân	✗	✓
	Iterative	êpiyâni	✗	✓
Unchanged	Simple	ka-apiyân	✗	✓
	Subjunctive	apiyâni	✗	✓

Although Cook explicitly does not discuss the Imperative, its syntactic distribution is like similar to that of the Independent. Cross linguistically, it has been reported that imperatives 'tend not to occur as dependent clauses' (Sadock and Zwicky, 1985, 174). Wolfart (1973) mentions that the imperative is often, but not exclusively, used along side a conditional clause, but in his examples, he gives only instances where the imperative verb is used in a matrix clause that contains a conditional subordinate clause. Alternatively, Lakoff (1984, 476) contends that Imperatives *can* occur in subordinate clauses provided the subordinate be introduced by *because* and the imperative actually convey a statement rather than an order. It is worth noting, however, that the evidence is provided for English, are not based in corpora or acceptability-judgement studies, and that the resulting 'grammatical' sentences (e.g. *I'm staying because consider the girl who pinched me*) are almost categorically ungrammatical to my ear. Takahashi (2008) presents a different approach, arguing that, at least in English, imperatives may be used as commands in certain concessive subordinate classes (e.g. *I am going to Toronto, although don't expect me to bring you anything back!*). Little has been written about this phenomenon in Nêhiywawêwin, and to do so would be beyond the scope of this dissertation. What can be said is that the Imperative is not *exclusively* used in embedded clauses. This results in two organizational structures. The first patterns the Imperative syntactically with the Independent and the Changed Conjunct$_1$ as all three are restricted to matrix clauses, as in Figure 2.3.

The second possibility is one where the Imperative occurs both in both Matrix and Embedded clauses, as in Figure 2.4. In either of these situations, the syntactic system

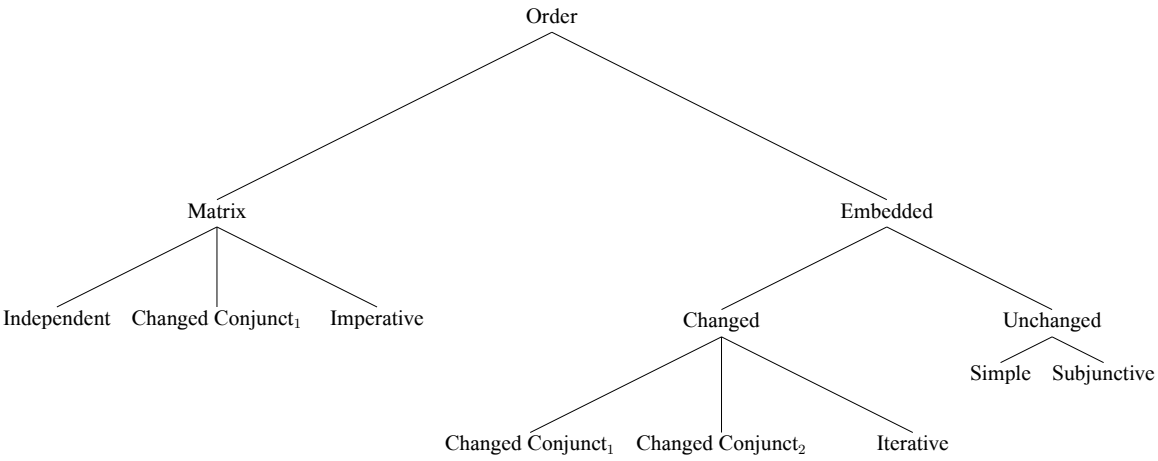

Figure 2.3: Syntactic Ontology 1

does not cleanly align with the morphological system of Order.

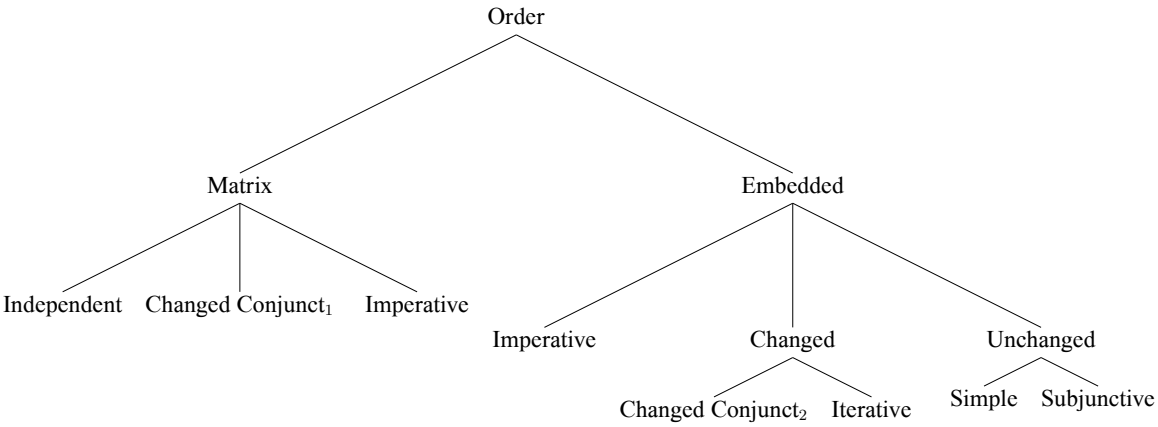

Figure 2.4: Syntactic Ontology 2

2.3.3 Semantics and Pragmatics

The semantics and pragmatics of Nêhiyawêwin Order can be broken down into two main theoretical constructs: (1) *sentence typing*, and (2) *clause typing*. Here, *sentence typing* refers to the three 'basic sentence types' as described by König and Siemund (2007), who identify the *declarative*, the *imperative*, and the *interrogative* as widespread typological phenomenon. These three Sentence Types are also represented in Nêhiyawêwin. While the Imperative order obviously corresponds to the imperative sentence type, the Independent and the Conjunct do not each represent one of the remaining sentence types. Instead, both the Independent and the Conjunct are able to be used as declarative

constructions (in an unmarked or elsewhere case) as well as interrogatives (by making use of the {cî} clitic). This produces an ontology similar to the morphological organization seen previously, demonstrated in Figure 2.5.

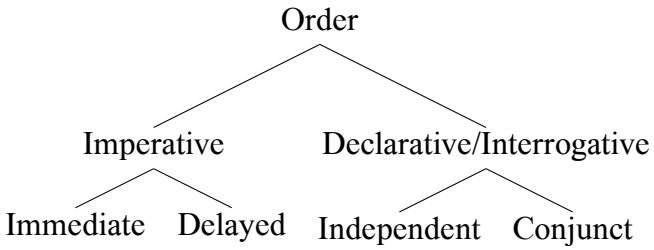

Figure 2.5: Semantic Ontology

For Cook (2014) the use of Order comes down to clause typing. Here, Cook (2014) distinguishes between indexical and anaphoric clauses. Indexical clauses are those that are grounded to the speech act, as in (**??**). Indexical clauses are evaluated according the speaker as well as the time and place of the speech act; on the other hand, anaphoric clauses are evaluated according some different anchor (Cook, 2014).

(9) mistahi **kî-miyohtwâ-wak** êkonik ôk âyisiyini-wak
extremely **pst-be.kind.vai-3pl** DIST.PL FOC.PL person-PL
kâ-kî-ohpikih-iko-yâhkik
CNJ-PST-raise.VTA-INV.THM-3PL.1PL
'The people who raised us (...) **they were extremely good people.** (Ahenakew, 2000, 38)'

This is perhaps most clearly instantiated in the use of the {kî-} morph, which is used with past events. According to (Cook, 2014, 125), this past morph is interpreted in an unspecified way in Conjunct clauses, which Cook identifies as inherently anaphoric, but is interpreted with a strictly modal (and non-tense) meaning in the independent. Cook (2014) describes these anaphoric clauses as being licensed by some antecedent, present in the discourse or in the real world knowledge of the interlocutors. Essentially, Cook (2014) describes anaphoric clauses as having *some* sort of semantic or syntactic relation with a licensor in another clause (as in (10)). She also contends that, in Nêhiyawêwin, anaphoric clauses are an elsewhere case that are defaulted to when an indexical clause is not present. The non-iteratve subjunctive form is not included by Cook, and its placement remains unclear

(10) mistahi kî-miyohtwâ-wak êkonik ôk âyisiyini-wak
extremely PST-be.kind.VAI-3PL DEM.PL FOC.PL person-PL
kâ-kî-ohpikih-iko-yâhkik
cnj-pst-raise.vta-inv.thm-3pl.1pl
'**The people who raised us** (...) they were extremely good people. (Ahenakew, 2000, 38)'

Focusing specifically on the Conjunct modes, (Cook, 2014) distinguishes these forms by the ways in which their pragmatic/semantic propositions are introduced: the Changed Conjunct$_2$ and Iterative presuppose propositions, while Changed Conjunct$_1$ do not. Like the Changed Conjunct$_1$ forms, simple Conjuncts were not presuppositions, but are distinguished from Changed Conjunct$_1$ forms in that the latter are veridical statements, while simple Conjuncts are averidical Cook (2014, 302).[16] An adaptation of Cook's Order ontology is found in Figure 2.6.

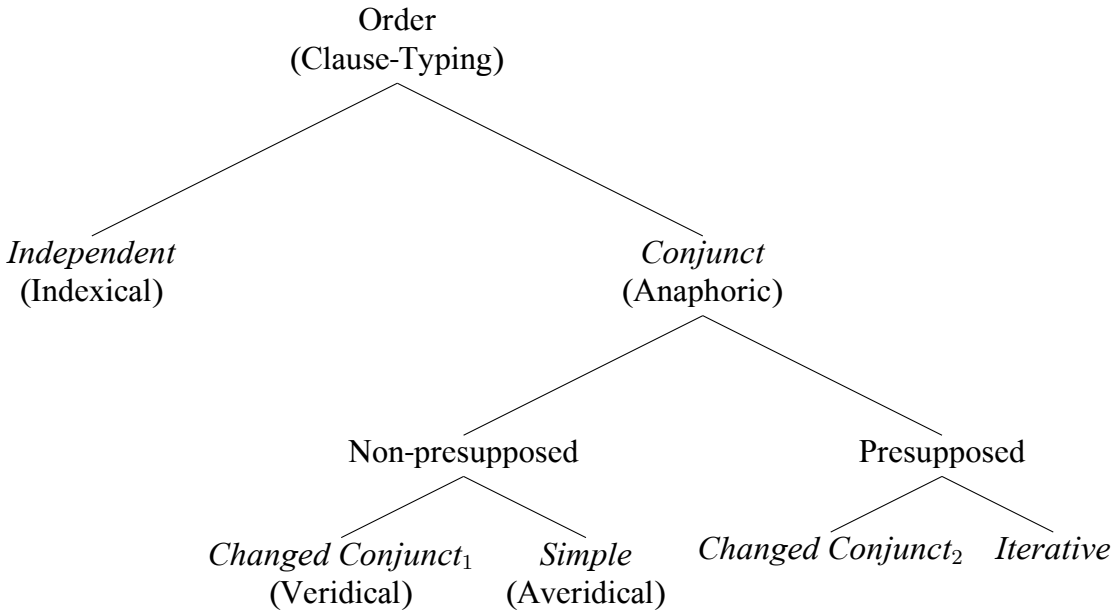

Figure 2.6: Order Ontology in Cook (2014)

Cook does not include the Imperative Order in her study, and it is difficult to determine where it would be placed in her ontology. Broadly, the imperative is clearly a clause type of its own: it represents an imperative clause as distinguished from declarative and interrogatives. If an indexical clauses is one that is rooted in the speech act. The

[16]It is unclear where Cook would place her subjunctive Conjunct in terms of veridicality, though given her placement of it as a type of 'simple conjunct', it seems possible that it would be an averidical form

definition of *indexical* provided could just as easily apply to the Imperative Order. Indeed, Alcázar and Saltarelli (2014, 111) describes the Imperative (independent of any specific language) as ”encoding the (indexical) parameters of the speech act, such as participant roles, temporality and locality”. Under this analysis, we find the ontology found in Figure 2.7.

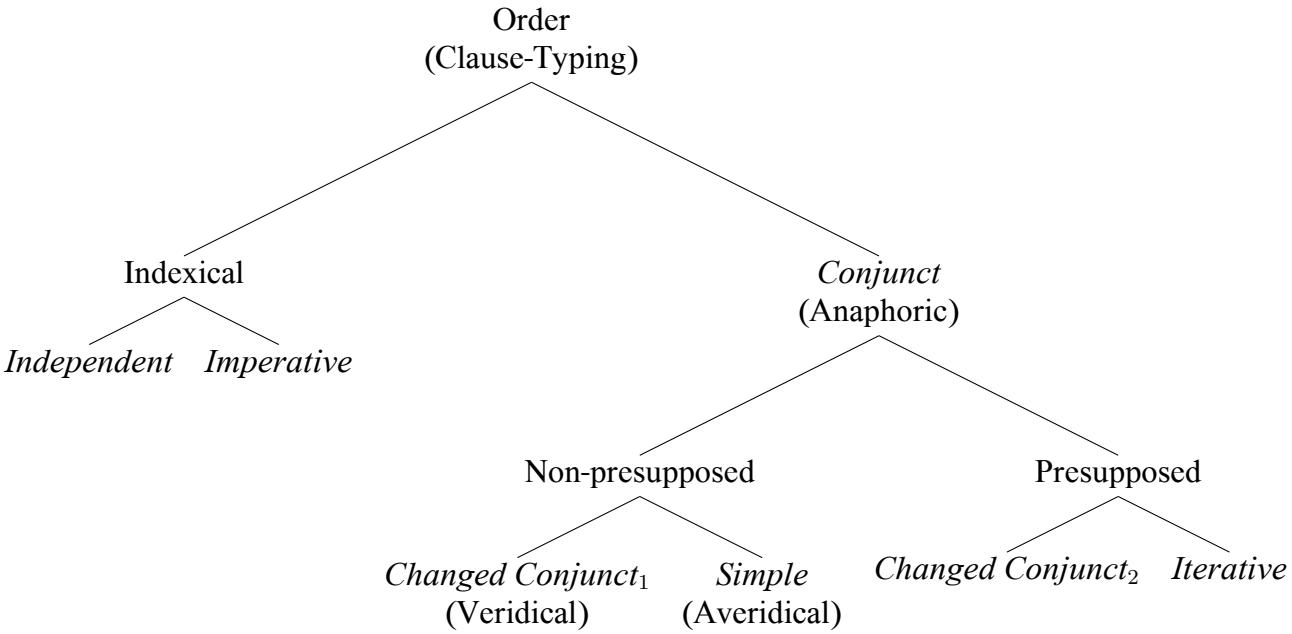

Figure 2.7: Order Ontology in Cook (2014)

Regardless of these interpretations, this sort of classification of Order, like others, necessarily treats the Independent, Conjunct, and Imperative not of the same kind (as is done in traditional descriptions of Algonquian grammar), but position Conjunct as opposed to an Independent-Imperative conglomerate (distinct from descriptions by Bloomfield (1930), Wolfart (1973), Wolvengrey (2011) and others, which group the Independent and Conjunct together as opposed to the Imperative).

Conjunct modes in This Dissertation

As shown, while both agree that modes of the Conjunct exist, Wolfart (1973) and Cook (2014) vary in their descriptions of them. In order to study Order, it is critical to operationalize what different modes exist. Rather than simply taking either the Wolfart (1973) or Cook (2014), I opt to use corpus evidence to define the Conjunct modes on a

structural basis. In the subset of the Ahenakew-Wolfart corpus (Arppe et al., 2020) used for this dissertation (see Chapter 4 for more detail), the following set of morphological patterns were found:

- ê- Initial (6373 tokens)
- ka-/ta- Initial (910 tokens)
- kâ- Initial (2458 tokens)
- Initial Change (54 tokens)
- Subjunctive {-i} (172 tokens)

Interestingly, there were no forms in the analyzed corpus that contained both a subjunctive suffix *and* IC (the *iterative* in Wolfart (1973) and Cook (2014)). While the corpus lacked an iterative, it did contain verbs with *only* IC,[17] a form seemingly missing in Cook (2014). Further, the naming conventions used by Cook (2014) and Wolfart (1973) will not be used for this dissertation. Instead, I will refer to the Conjunct modes by their prefixes. The only exceptions to this are those forms where there is only initial change and those forms suffixed with the subjunctive morph. Because they can not be identified by a single prefix, they will be called the *Initial Change Conjunct* and the *Subjunctive Conjunct*.

In considering types of Conjunct, there is a structural difference between those types that have a grammatical, Conjunct specific, preverb such as {ê-}, {ka-}/{ta-}, and {kâ-}. These forms can be thought of as being *prefixed*, while the Initial Change and Subjunctive forms can be considered *bare*, due to their lack of a Conjunct prefix. Both Initial Change and Subjunctive forms have only a small number of tokens. Bare tokens with Conjunct endings but lacking either the Subjunctive {-i} or IC were excluded as contemporary speakers considered them as 'incorrect,' and their frequency in the corpus was even smaller than that of the Initial Change Conjunct.

[17]This may be due, at least regarding IC, to the fact that {ê-} was historically nothing more than a vehicle to indicate Initial Change (Wolfart, 1973, 46). In this way, one could consider the {ê-} prefixed Conjuncts as inherently Changed, though synchronically this is non-obvious. As a result, the remainder of this dissertation will not consider the {ê-} prefixed Conjuncts as examples of Initial Change.

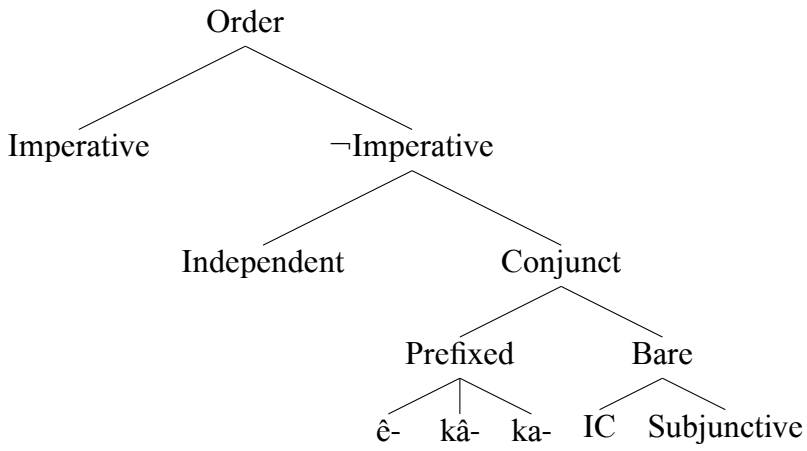

Figure 2.8: Morphological Ontology of Order

While morphologically the Imperative Order is similar to the Conjunct and Independent Orders, its inability to take all arguments as well as the conjunct or Independent person-marking preverbs sets the Imperative apart. In fact, the most salient similarity between the Imperative, the Independent, and the Conjunct orders is that all three are able to inflect for second person items, at least in the non-VII classes. Beyond this, the Independent and Conjunct Orders can take exactly the same persons, but differ in the exponents used. This results in a morphological system as visualised in Figure 2.8. Although the corpus used in this dissertation does not include Iterative Conjuncts, one could include them as a type of Subjunctive Conjunct (as both contain the Subjunctive suffix), resulting in the structure of Figure 2.9.

Alternatively, one could group the iterative with the Subjunctive, thus creating a Bare distinction between item with an {-i} suffix and those without, as in Figure 2.10.

There is no good theoretical reason to chose one of these options over the other. One could also choose to treat the Subjunctive, IC, and Iterative conjuncts as three separate nodes, grouping none together. While this seems as valid as the previous two ontologies, it ignores the similarities of these classes. In fact, because all bare forms are combine fore the sake of analysis in this dissertation, this distinction is not material for this dissertation.

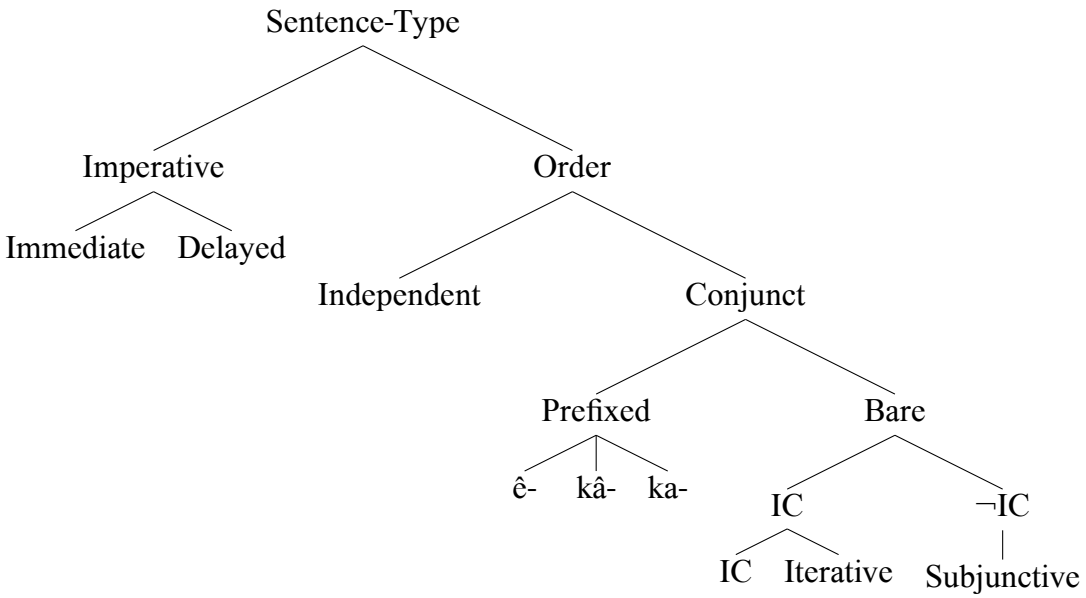

Figure 2.9: Morphological Ontology of Order 2

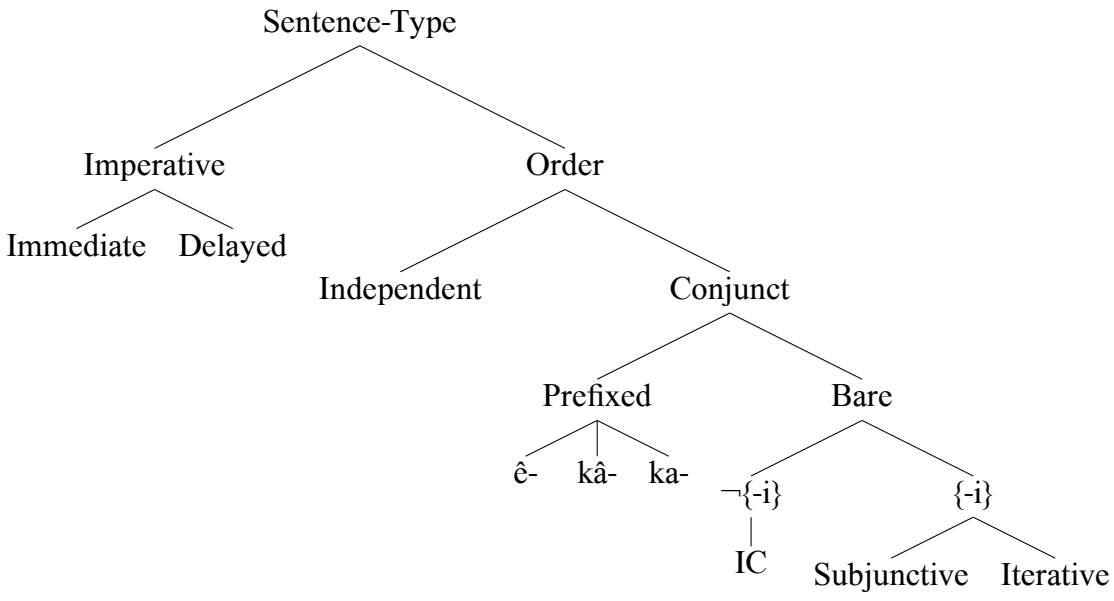

Figure 2.10: Morphological Ontology of Order 3

2.3.4 Summary of Order

Nêhiyawêwin Order has been described as a system of linguistic features cross cutting various levels of representation. Morphologically, Order is a structural phenomenon where Algonquian language use various exponents to mark person on verbs. Under this definition, we can identify three Orders:

1. Those where the VAI, VTI and VTA classes use circumfixes with {ni-} prefixes for first person and {ki-} prefixes for second person (the Independent)

2. Those with the prefixes {ê-}, {ka-}/{ta-}, {kâ-}, or Initial Change regardless of person (the Conjunct)

3. Those which use neither of these strategies (the Imperative)

This places the Independent and Conjunct together against the Imperative (which is essentially defined as not being Independent or Conjunct). Alternatively, we can identify two Orders:

1. Those that can mark for first, second, third, and obviative persons (the Independent and Conjunct)

2. Those that can mark only for the second person (the Imperative)

Again, in this situation the first of these proposed Orders would include what is traditionally called the Independent *and* what is traditionally called the Conjunct, with the second class making up the Imperative.

If we choose to define the phenomenon in terms of semantic, syntactic, and pragmatic behaviour, we can refer to Figure 2.7, wherein Independent and Imperative are indexical, while the Conjunct in anaphoric. Contrary to the previous descriptions, this places Conjunct apart from the other Orders.

Finally, if we consider Order purely in terms of semantics, we can define Order as system of distinguishing mood (the imperative vs. the declarative). In this classification, the Independent and Conjunct are not distinguished by mood in the same way that they can be contrasted against the Imperative (cf. 2.11).

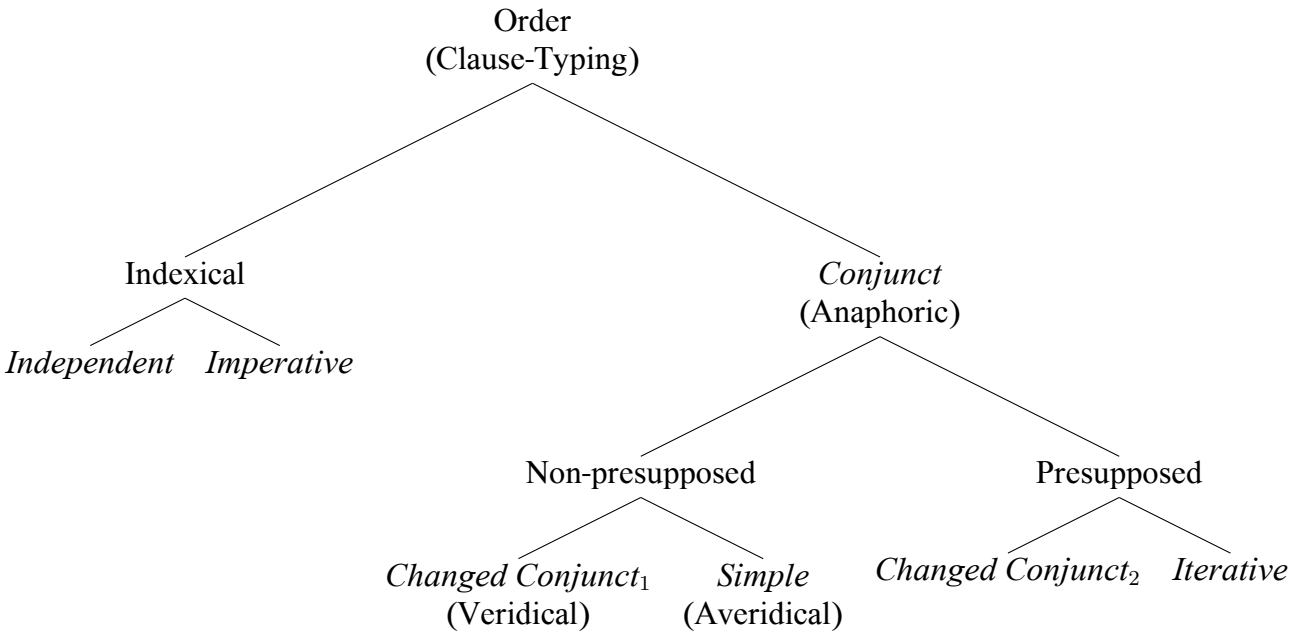

Figure 2.7: Order Ontology in Cook (*2014*) (*repeated from page 27*)

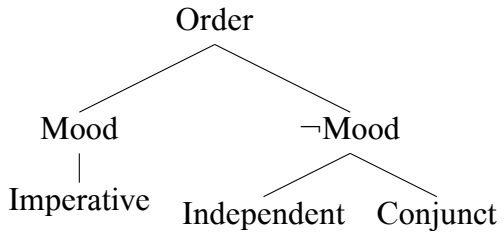

Figure 2.11: Semantic Order Ontology

Thus, we again have a situation where the Imperative is of a different kind than the Independent/Conjunct. Regardless of what scheme one uses to describe Order in Nêhiyawêwin, there is no way to divide the Independent, Imperative, and Conjunct such that they're all of the same kind or on the same level. The best argument for equating the Independent, Conjunct, and Imperative is that occurrence in one of these precludes occurrence in the other (i.e. there is no such thing as an Independent Imperative).[18] Under this definition, a tri-partite Order is essentially an operation that takes a verb stem, a linguistic person or persons, and a direction (if needed) and produces a surface form as in (11).[19]

[18]Unless, of course, one identifies the Delayed Imperative as a Conjunct form for the Imperative, as described above.

[19]I make no claim of psychological reality in this statement, it is purely metaphorical.

(11) Conjunct(wâpam,(1SG,3SG),inverse) = ê-wâpamit

In this way, one can think of Order as an operation that applies to verbs; however, the Imperative is incompatible with the VII class, while both the Independent and Conjunct can apply to any class. Even considering Order as this sort of formal function leads to a distinction between the Imperative and the Independent/Conjunct. In terms of structure, behaviour, and semantics, this difference persists. This conflict is problematic to the study of Nêhiyawêwin grammar, as any claim about Order needs to be relevant to all three of these categories. For these reasons, the use of the term *Order* will be redefined in this dissertation. Instead of creating a three way split between Independent, Conjunct, and Imperative, I will consider Order to be a grouping of allomorphic alternations in the paradigm. Therefore, in this dissertation will refer only to the Independent and Conjunct.

In terms of describing what the Imperative is, if not Order, I propose that the Imperative is a construction that acts as an illocutionary force indicating device (Searle and Vanderveken, 1985) marking a command. Under this system, we can understand the interrogative to be marked through the use of the {cî} morph, and the declarative to remain unmarked. Thus the concept of mood (which is mostly imparted by preverbs in Nêhiyawêwin) is made separate from the idea of Order entirely. Thus, while the Independent and Conjunct may still be referred to as Order, the Imperative is of the sentence-type or illocutionary force.

2.3.5 Alternation

By extricating the Imperative from the system of order, we are left with a binary distinction of Independent and Conjunct. This juxtaposition presents two ways of encoding person number with different morphemes. In other words, while the shape and grammatical content (e.g. both Orders mark exactly the same persons) of the *paradigms* are the same, the actual exponents that are realized in the cells are not. According to Cook (2014), these two alternatives correspond one-to-one to clause typings, the indexical and the anaphoric. This view of Order as two alternative constructions used to encode different meaning is essentially one of *alternation*.

In its broadest conception, the idea of an alternation is simply one in which some linguistic form—be it phonological, morphological, syntactic, or other—is contrasted

with another. Perhaps most popular are the alternation of allophony and allomorphy, wherein two or more forms are used interchangeably according to some context. Sociolinguistic studies, such as Labov's famous study of English retroflex consonants in New York City department stores (1986), often make use of the concept of the alternation by framing the realization of a phoneme as one of a set of allophones that change depending on some contextual criteria. In addition to this basic sociolinguistics-based approach, there exists a constructional/psycholinguistic based approach to alternations. Pijpops (2020) presents an overview of the concept covering the three traditional definitions (1-3) along with three more recently developed conceptions (4-6):

1. Alternations share the same meaning, are similarly processed in the mind, and vary according to some dialectal factor.

2. Alternations share the same meaning, do **not** vary according to dialect, but **are** differently processed in the mind.

3. Alternations have a difference in meaning that varies due to some lexical influence

4. Alternations represent any point where the speaker must make a choice in what is said

5. Alternations are a tool to analyze phenomenon that a linguist deems interesting

6. Alternations are items with special theoretical relations to one another

Collectively, these definitions privilege the sociolinguistic/psycholinguistic/processing aspects. While they consider the concept of meaning similarity, they define alternation primarily by factors such as dialect, psycholinguistic processing, or as some sort of linguistic tool of convenience. In fact, Pijpops (2020) suggests this latter definition when citing Arppe et al. (2010). However, the claim that Pijpops (2020) cites from Arppe et al. (2010) comes from only one of the five authors; others, such as Arppe and Gilquin, instead argue that alternations do, in fact, exist and can be valid areas of study in their own right. Additionally, the criticism of alternations by Glynn appears to be based upon: (1) the idea that alternation studies are an artifact of Cognitive and Construction Grammars responding to Generative Grammars, and (2) that alternations are inherently

non-binary and researchers lack the knowledge of multinomial statistics. The latter of these claims is something that may have been true in 2010[20], but is certainly not true today. The former of these claims, even if it were true, does not comment on the validity of the idea of an alternation as a subject of study. Being originally a response to generative grammar is not in and of itself a problem for alternation studies.

In addition to Pijpops (2020)'s definitions, there are other ways to approach alternations. Specifically, one can make use of a lexicographically grounded approach which considers the concept of synonymy and the way in which synonyms and near synonyms can be used in similar (but not identical) contexts. In this vein, (Cruse, 2000, 156) discusses the concept of synonymy, which he defines as not simply as words with the same meaning, but "words whose semantic similarities are more salient than their differences." In particular, Cruse identifies three types of synonyms: absolute synonyms (which are fully equivalent in all cases and occur rarely, if at all), propositional synonyms, (which may alternate without changing the truth condition of a statement, but which may differ in speaker attitude or register), and pleisonyms/near-synonyms (which can be said to share core semantic properties, even if they differ in 'minor' or 'background' ways) (Cruse, 2000, 157-159). Because any of these forms of synonymy necessarily concern the employment of one of many forms for the same referent, synonymy is a straightforward and clear case of alternation.

Following from this lexicographic approach, alternations can be construed on various levels: conceptual-semantic alternation, stylistic-semantic alternation, and a syntactic-semantic alternation (Arppe 2008, 8; cf. Edmonds and Hirst 2002 for an earlier discussion of a similar concept). According to Arppe (2008, 8), conceptual-semantic alternations concern words that mean generally the same thing and can be used (roughly) interchangeably (e.g. *dash* and *sprint*); Stylistic-semantic alternations occur between words or phrases that share similar meanings, but contain different connotations (*poop* and *shit*); and syntactic-semantic alternations deal with similar utterances which take different syntactic patterns (*comb* (*through*) and *inspect*). These levels of representation consider alternations as near-synonymous pairs that can make use of three latter definitions presented by Pijpops (2020), particularly as a point-of-choice. They also

[20]It wasn't.

roughly correspond to those of Hanks' lexical, semantic, and syntactic-type alternations (2013, 173). Arppe (2008, 10) also proposes a subset of syntactic-semantic alternations referred to as constructional alternations, which keep the same central meaning, though which may differ in more subtle, often pragmatic dimensions. Framing a phenomenon as an alternation creates a structured difference that researchers can investigate. The previous sections have demonstrated the ways in which Nêhiyawêwin Order, at least as conceived as a tripartite system can not be thought of as an alternation. The decision in which one would decided to use the Imperative (that is, the choice of sentence typing) is not the same decision as between the Independent and Conjunct. Thus, while alternation is not a useful tool for the study of the morphological difference between the Independent, Conjunct, and Imperative, it may be useful for the the difference between the Independent and Conjunct.

I argue that the phenomenon of binary Order, between Independent and Conjunct, is a form of nearly synonymous constructional alternation, but one that has remained, as of yet, undescribed. I propose that order represents a *paradigmatic alternation*. A paradigmatic alternation is here defined as one where *any* lexeme of a particular word class is able to take two or more different paradigms but where each of those paradigms is identical in shape but different in exponence. This differs from similar phenomena such as noun class. In such a phenomenon, there are indeed alternating paradigms, for example Latin's masculine, feminine and neuter, with similar or identical shapes with differing exponents. Here however, it is not the case that any noun can occur in any paradigm. Instead, the paradigm which a lexeme occurs in is functionally a an attribute of a lexeme.

Viewed as an analysis of an alternation, the primary research question of this dissertation is as follows: what morphosyntactic and semantic features affect a lemma's propensity to occur in a particular alternation of Order or mode. Adopting a usage-based approach based in the distributional hypothesis (Firth, 1957; Harris, 1954), this research will utilize quantitative methodologies in an effort to see to what extent empirical, corpus-based evidence can guide us in the understanding of Nêhiyawêwin order.

For the purposes of this dissertation, three main alternations will be considered. The first of these alternations is the **Independent vs. Conjunct** alternation. This is the highest

level alternation and is essentially that of the phenomenon of Order. This alternation thus represents the high level decision of what morphological paradigms is to be used. The second alternation is the **Independent vs. ê-Conjunct**. Although this alternation appears to cross multiple levels of representation (e.g. the decision to use an Independent vs. a Conjunct form appears to precede the decision to use an ê-Conjunct), the linguistic motivation for this alternation is found in the similar behaviour and functions as described by Wolfart (1973) and Cook (2014). The final alternation is the **Conjunct Type** alternation between the ê-Conjuncts, kâ-Conjuncts, and all other Conjunct types. This alternations is perhaps the most straightforward, and is motivated by the fact that one must choose what form of a Conjunct they use for a verb.

Chapter 3

Automatic Semantic Classification

Abstract

A previous versions of this paper were published Harrigan and Arppe (2021) and Harrigan and Arppe (ress). This paper details a semi-automatic method of word clustering for the Algonquian language, Nêhiyawêwin (Plains Cree). Although this method worked well, particularly for nouns, it required some amount of manual postprocessing. The main benefit of this approach over implementing an existing classification ontology is that this method approaches the language from an endogenous point of view, while performing classification quicker than in a fully manual context.

3.1 Introduction

Grouping words into semantic subclasses within a part of speech is a technique used widely throughout quantitative and predictive studies in the field of linguistics. Bresnan et al. (2007) use high level verb classes to predict the English dative alternation, Arppe (2008) uses verb class as one of the feature sets to help predict the alternation of Finnish *think* verbs, and Yu et al. (2017) use polarity classifications (*good* vs *bad*) from pre-defined lexica such as WordNet Miller (1998). In many cases, classifications within word classes allow researchers to group words into smaller cohesive groups to allow for use as predictors in modelling. Rather than using thousands individual lexemes as predictors, one can use a word's class to generalize over the semantic features of individual lexemes to allow for significantly more statistical power.

While extensive ontologies of word classifications exist for majority languages like English (Miller, 1998), German (Hamp and Feldweg, 1997), and Chinese (Wang and Bond, 2013), minority languages, especially lesser resourced languages in North America generally do not boast such resources.[1] Where such ontologies do exist, for example in Innu-aimun, also known as Eastern Cree (Visitor et al., 2013), they are often manually created, an expensive process in terms of time. Alternatively, they may be based upon English ontologies such as WordNet. This opens the window to near-automatic ontology creation by associating definitions in a target language and English through a variety of methods. This is especially important, given the amount of time and effort that goes into manually classifying a lexicon through either an existing ontology (be it something like Rapidwords[2] or even Levin's like classes (Levin, 1993)). Moreover, there is a motivation based in understanding a language and its lexicalization process on its own terms, though how to do this with a lesser resourced language remains unclear.

[1]There is one attempt at semantically classifying Nêhiyawêwin through automatic means found in Dacanay et al. (2021). This work makes use of similar techniques as described in this paper, differing mainly in its mapping of Nêhiyawêwin words onto Wordnet classes.

[2]See http://rapidwords.net/

3.2 Background

I began word classification in preparation for modelling a morpho-syntactic alternation in Nêhiyawêwin verbs. One hypothesis we developed for this alternation, based on Arppe (2008), is that the semantic classes of the verbs themselves as well as their nominal arguments would inform the verbal alternation. Due to constraints of time, we investigated methods to automatically classify both verbs and nouns in Nêhiyawêwin. Although statistical modelling remains the immediate motivator for the authors, semantic/thematic classifications have a wide range of benefits for language learners and revitalization, particularly in online lexicographic resources, where one may want to view all words to do with a theme, rather than simply finding translations of single English words.

In creating a framework for automatic semantic classification we make use of Word2vec (Mikolov et al., 2013a) word embeddings. Word embeddings are words represented by *n*-dimensional vectors. These vectors are ultimately derived from a word's context in some corpus through the Word2vec algorithm. Unfortunately, the Word2vec method is sensitive to corpus size. We initially attempted to create basic word and feature co-occurrence matrices based on a 140,000 token Nêhiyawêwin corpus Arppe et al. (2020) to create word vectors using Principal Components Analysis, but in the end found the results to be not practically useful. Similarly, an attempt at both tf-idf and Word2Vec using only the Nêhiyawêwin dictionary produces mostly ill-formed groupings, though in these cases preprocessing by splitting verbs and nouns was not performed. Regardless, the poor performance was most certainly due simply to the paucity of data. Although the available corpora are small, Nêhiyawêwin does have several English-to-Nêhiyawêwin dictionaries, the largest being Wolvengrey (2001). Although a bilingual Nêhiyawêwin-English dictionary, it is one formed from an Indigenous point of view, based on vocabulary from previous Nêhiyawêwin language resources, some of which have been compiled by Nêhiyawêwin communities from their own perspectives, or gleaned from a number of texts collections rather than attempting to find Nêhiyawêwin word matches for a pre-defined set of English words. This results in dictionary entries such as sakapwêw: it roasts over a fire (by hanging, with string on stick). Definitions such as this take

into account the nuanced cultural understanding reflected in the word's morphology.

3.3 Methodology

To address the issue of corpus size, we attempted to bootstrap our classification scheme with pre-trained English vectors in the form of the 3 million word Google News Corpus, which represents every word with a 300-dimensional vector.[3] We make use of the English definitions (sometimes also referred to as glosses) provided in Wolvengrey (2001) and fit to each word its respective Google News Corpus vector. This dictionary makes use of lemmas as headwords, and contains, at the time of writing, 21,717 entries. The presumption is that the real-world referents (at least in terms of denotation) of English and Nêhiyawêwin words are approximately comparable, in particular when taking the entire set of words in an English definition. Stop words (common words that supply little lexical or semantic information) were removed, and where content words were present in definitions in Wolvengrey (2001) but *not* available in the Google News Corpus, synonyms were used (one such example might be the word *mitêwin*, which is unavailable in the corpus and thus would replaced with something like *medicine lodge* or deleted if a synonym was given in the definition as well). Because the Google News Corpus is based in American spelling, while Wolvengrey (2001) is based in Canadian spelling, American forms (e.g. *color, gray*) were converted into Canadian forms (e.g. *colour, grey*). If such preprocessing is not performed, these words are simply unavailable for clustering, as they lack a matching vector.[4] Where a Nêhiyawêwin word had more than one word sense, each sense was given a separate entry and the second entry was marked with a unique identifier. Finally, where needed, words in the Nêhiyawêwin definitions were lemmatized.

Once every word in Wolvengrey (2001) definitions matched an entry in the Google News Corpus, we associated each word in a Nêhiyawêwin definition with its respective Google News Vector. That is, given a definition such as awâsisihkânis: small doll, the

[3]This corpus was trained on a large corpus of 100 billion words. Available at https://code.google.com/archive/p/word2vec/

[4]In reality, there were only a handful of cases where words occurred in the dictionary but not in the Google News Corpus. Because there are so few examples of this, even simply leaving these items out would not substantiqally change clustering results.

resulting structure would be:

$$\text{awâsisihkânis} = \begin{bmatrix} 0.159 \\ 0.096 \\ -0.125 \\ \vdots \end{bmatrix} \begin{bmatrix} 0.108 \\ 0.031 \\ -0.034 \\ \vdots \end{bmatrix}$$

Because all word-vectors in the Google News Corpus are of the same dimensionality, we then took the resulting definition and averaged, per dimension, the values of all its constituent word-vectors. This produced a single 300-dimensional vector that acts as a sort of naive sentence vector for each of the English glosses/definitions:

$$\text{awâsisihkânis} = \begin{bmatrix} 0.134 \\ 0.064 \\ -0.080 \\ \vdots \end{bmatrix}$$

Mikolov et al. (2013b) mention this sort of naive representation and suggests the use of phrase vectors instead of word vectors to address the representation of non-compositional idioms; however, given the way Wolvengrey (2001)'s definitions are written (e.g. with few idiomatic or metaphorical constructions), and for reasons of computational simplicity, we opted to use the above naive implementation in this paper.

After creating the sentence (or English definition) vectors, we proceeded to cluster definitions with similar vectors together. To achieve this, we created a Euclidean distance matrix from the sentence vectors and made use of the `hclust` package in R (R Core Team, 2017) to preform hierarchical agglomerative clustering using the Ward method (based on the experience of Arppe (2008) in using the method to produce multiple levels of smaller, spherical clusters). This form of clustering is essentially a bottom-up approach where groupings are made by starting with individual labels with the shortest distance, then iteratively at a higher level making use of the clusters that result from the previous step or remaining individual levels; this second step is repeated until there is a single cluster containing all labels. This method of clustering creates a cluster tree that can be cut at any specified level after the analysis has been completed to select different numbers of clusters, allowing researchers some degree of flexibility without needing to rerun the clustering. This method is very similar to what has been done by both Arppe (2008), Bresnan et al. (2007), and Divjak and Gries (2006). The choice of how many clusters were used was based on an impressionistic overview of effectiveness by myself.

For our purposes, we focused on the semantic classification of Nêhiyawêwin nouns and verbs. Nêhiyawêwin verbs are naturally morphosemantically divided into four separate classes: Intransitive verbs with a single inanimate argument (VII), Intransitive verbs with a single animate argument (VAI), transitive verbs with an animate actor[5] and an inanimate goal (VTI), and verbs with an animate actor and goal (VTA). For verbs, clustering took place within each of these proto-classes. Among the VIIs, 10 classes proved optimal, VAIs had 25 classes, VTIs with 15 classes, and VTAs with 20 classes. The choice to preprocess verbs into these four classes was chosen as not doing so resulted in a clustering pattern that focused mainly on the difference between transitivity and the animacy of arguments. Any more or fewer classes and HAC clusters were far less cohesive with obvious semantic units being dispersed among many classes or split into multiple classes with no obvious differentiation. Similarly, verbs were split from nouns in this process because definitions in Wolvengrey (2001) vary significantly between verbs and nouns.

Nouns are naturally divided into two main classes in Nêhiyawêwin: animate and inanimate.[6] For our purposes we divide these further within each class between independent (i.e. alienable) and dependent (i.e. inalienable) nouns to create four main classes: Independent Animate Nouns (NA), Dependent Animate Nouns (NDA), Independent Inanimate Nouns (NI), and Dependent Inanimate Nouns (NDI). The reason for this further division is due to the morphosemantic differences between independent and dependent nouns in Nêhiyawêwin. While independent nouns can stand on their own and represent a variety of entities, they are semantically and morphologically dependent on some possessor. We opted to pre-split NDIs and NDAs into their own classes, so as not to have the clustering focus on alienablity as the most major difference.[7]

[5]As discussed in Wolvengrey (2005), Nêhiyawêwin sentences are devoid subject and objects in the usual sense. Instead, syntactic roles are defined by verbal direction alignment. For this reason, we use the terms *actor* and *goal* instead of *subject* and *object*.

[6]Although this gender dichotomy is *mostly* semantically motivated (e.g. nouns that are semantically inanimate are part of the inanimate gender) this is not always the case as in the word *pahkwêsikan*, 'bread', a grammatically animate word.

[7]Preliminary results for words not seperated by their conjugation class or declension did, in fact, create clusters based around these obvious differences. This likely due to the way definitions were phrased (e.g. dependent nouns would have a possessive determiner or pronoun).

Table 3.1: HAC built cluster counts vs. counts after postprocessing

	HAC classes	Manually Adjusted Classes	Lexemes
VII	10	6	581
VAI	25	13	5254
VTI	15	6	1825
VTA	20	7	1781
NI	15	13	3650
NDI	3	2	245
NA	10	8	1676
NDA	3	3	191

3.4 Results

In all cases, clusters produced by this procedure needed some amount of post-processing. For nouns, this post-processing was minimal and mostly took the form of adjustments to the produced clusters: moving some items from one class to another, splitting a class that had clear semantic divisions, etc. For the verbs, this processing was often more complex, especially for the VAI and VTA classes. Although most clusters produced somewhat cohesive semantic units, the largest clusters for the VAI and VTA classes acted as, essentially, catch-all clusters. Although computationally they seemed to have similar vector semantics, the relationship between items was not obvious to the human eye. Postprocessing for these clusters took more time than other classes and essentially composed of using the more cohesive clusters as a scaffold into which one may fit words from these catch-all clusters. In most cases, this resulted in very slightly more clusters after postprocessing, though for VAIs this number was significantly higher, and for the NDIs it was slightly lower. Table 1 lists the number of clusters directly from HAC and from postprocessing. The actual quality of clustering varied form class to class. In general, nouns resulted in much more cohesive clusters out-of-the-box and required far less postprocessing. For example, nearly all $\mathrm{NI}_1 4$ items referred to parts of human bodies (and those that did not fit this description were terms clearly related to, or containing, body parts like aspatâskwahpisowin, 'back rest'), $\mathrm{NI}_1 3$ was made up of trapping/hunting words and words for nests/animals.

The NA classes produced through HAC were similarly straightforward: NA_9 was

made up of words for trees, poles, sticks, and plants; NA_8 was made up entirely of words relating to beasts of burden, carts, wheels, etc.; while much of NA_3 and NA_7, and nearly all of NA_2 referred to other animals. Once manually postprocessed, the NA lexemes settled into 8 classes: NA-persons, NA-beast-of-burden, NA-food, NA-celestial, NA-body-part, NA-religion, NA-money/count, and NA-shield.[8]

The NDI and NDA classes required almost no postprocessing: NDA_1 and NDA_3 were each made up of various family and non-family-based relationships, while NDA_2 was made up of words for body parts and clothing. The resulting classes for these were: NDA-Relations, NDA-Body, and NDA-Clothing.

The NDI lexemes took two classes: the vast majority of NDI forms referred to bodies and body parts while two lexemes referred to the concept of a house, resulting in only two classes: NDI-body, and NDI-house.

Verbs, on the other hand, required more postprocessing. VIIs showed the best clustering results without postprocessing. For example, VII_6 was entirely made up of taste/smell lexemes, VII_7 verbs were almost entirely weather-related, VII_8 contained verbs that only take plural subjects (the semantic nature of which is discussed below), VII_9 had only lexemes referring to sound and sight, and VII_10 had only nominal-like verbs (e.g. *mîsiyâpiskâw* '(it is) rust(y)').[9] Despite these well-formed clusters, VII_1 through VII_5 were less cohesive and required manual clustering. In the end, 6 distinct classes were identified: II-natural-land, II-weather[10], II-sensory, II-collective[11], II-move, II-named[12]. Although postprocessing was required, this was not too substantial in scope or time. The VAIs required significantly more work. Some classes were well defined, such as VAI_23 whose members all described some sort of flight, but VAI_12 contains verbs of expectoration, singing, dancing, and even painting. Rather than being able to consolidate some classes, most HAC-produced classes needed to be manually split further. Although here one could have cut the HAC tree at a lower level to create more classes. This did not

[8]This class refers to forms such as *nakahâskwân* and *pahpahâhkwân*, which both translate as 'shield', despite being grammatically animate.

[9]Although this form may be thought of as attributive, an identical form is used as an NI. Whether this is a separate lexeme, or a nominal use of a verb is debatable.

[10]This class includes terms of weather as well as terms of seasons or times of day such as sîkwan, 'it is spring'.

[11]The semantic status of this class is discussed below.

[12]This class contains terms of being named, such as *isiyihkâcikâtêw*, 'It is named thus'

produce better or cohesive classes. The resulting VAI classes were as follows: AI-state, AI-action, AI-reflexive, AI-cooking, AI-speech, AI-collective, AI-care, AI-heat/fire, AI-money/count, AI-pray, AI-childcare, AI-canine[13], and AI-cover. The VTIs similarly required manual postprocessing after HAC clustering. Although some classes such as $\mathrm{VTI}_1 1$ (entirely to do with cutting or breaking) or $\mathrm{VTI}_1 4$ (entirely to do with pulling) were very well formed, the majority of the classes needed further subdivision (though significantly less so than with the VAIs), resulting in the following 6 classes: TI-action, TI-nonaction, TI-speech, TI-money/count, TI-fit[14], and TI-food. Finally, the VTAs required a similar amount of postprocessing as the VAIs. Although a few classes were well formed (such as VTA_4 which was entirely made up of verbs for 'causing' something), the vast majority of HAC classes contained two or more clear semantic groupings. Through manual postprocessing, the following set of classes were defined: TA-action, TA-nonaction, TA-speech, TA-food, TA-money/count, TA-religion, and TA-allow.

3.4.1 Evaluation

In addition to the wualitative evaluation presented above, I present a preliminary quantitative evaluation of this technique. This evaluation allows us to judge how useful these classes are in practical terms, providing an indirect measure of the informational value of the clusters. We make use of the mixed effects modelling that initially motivated automatic semantic clustering, focusing on a morphological alternation called Nêhiyawêwin Order, wherein a verb may take the form *ninipân* (the *Independent*) or *ê-nipâyân* (the *ê-Conjunct*), both of which may be translated as 'I sleep.' The exact details of this alternation remain unclear, though there appears to be some syntactic and pragmatic motivation (Cook, 2014). Using R (R Core Team, 2017) and the lme4 package (Bates et al., 2015), we ran a logistic regression to predict alternation using verbal semantic classes as categorical variables. In order to isolate the effect of semantic class, no other effects were used. The semantic classes were included as random effects. To assess the effectiveness of semantic class in this context, we assess the pseudo-R^2

[13]This class refers to verbs that specifically describes behaviors specific to canines, e.g. nêmow, 's/he growls as a dog'.

[14]This class refers to verbs that specifically describes behaviors specific to canines, e.g. nêmow, 's/he growls as a dog'.

Table 3.2: pseudo-R^2 Values for Modelling Independent vs. ê-Conjunct Order Choice Based on Manual and Automatic Clustering Evaluation. Larger values represent better model fits.

	Manual	**HAC-Only**
VII	0.18	0.19
VAI	0.13	0.09
VTI	0.04	0.01
VTA	0.06	0.06

value, a measure of Goodness-of-Fit. Unlike a regular R^2 measure, the pseudo-R^2 can not be interpreted as a direct measure of how much a model explains variance, and generally ”good” pseudo-R^2 value are comparatively smaller (McFadden et al., 1973), though a higher value still represents a better fit. As a general rule, a pseudo-R^2 of 0.20 to 0.40 represents a well fit model. (McFadden, 1977)[15] Models were fit for each of the four conjugation classes for both classes produced directly from the Hierarchical Agglomerative Clustering as well those manually adjusted. We used a subset of the Ahenakew-Wolfart Corpus (Arppe et al., 2020), containing 10,764 verb tokens observed in either the Independent or ê-Conjunct forms. The resulting pseudo-R^2 scores represent the way in which automatic and semi-manual clusters can explain the Nêhiyawêwin Order alternation.

Table 3.2 presents the result of these analyses. the *Manual* column represents clusters that were manually adjusted, while the *HAC-Only* column represents the result of the logistic model that used only the fully automatic HAC-produced clusters. A larger value in the table represent a model that is better able to predict the Order a verb takes. While this prediction is not in and of itself of primary importance to the focus of this section, a better fitting model in this context suggests the efficacy of fully-manual vs semi-automatic verb classification. If, for example, the semi-automatic classification scheme produced a less explanatory model than the fully-automatic scheme, there would be no reason to spend the time and effort for the semi-manual classification task. Further, if either model neglected to show any significant explanatory power, one would have no reason to include semantic classes in future predictive models at all.

The manually adjusted and HAC-only classes performed similarly, especially for

[15]One can also compare the results in this paper with results from a similar alternation study in Arppe (2008).

VTAs, though manual adjustment had a slightly worse fit for the VIIs, and conversely the VAI and VTI has somewhat significantly better fits using the manually adjusted classes. Although it appears that manual adjustment produced classes that were somewhat better able to explain this alternation, both manually adjusted and HAC-only clusters appear to explain a non-negligible degree of this alternation phenomenon in the above models. This is significant, because it shows that the result of the clustering techniques presented in this paper produce a tangible and useful product for linguistic analysis. Further, it suggests that, although manual classification was sometimes more useful, automatic classes more or less performed as well, allowing for researchers to determine if the added effort is worth the small increase in informational value. Nevertheless, alternative methods of evaluation, such as evaluating clusters based on speaker input, particularly through visual means as described in Majewska et al. (2020) should be considered.[16]

3.5 Discussion

In general, the best clustering was seen in classes with fewer items. The VAI and NI lexemes required the most postprocessing, with each having roughly double the number of items as the next most numerous verb/noun class. Verb classes in general seemed to produce less cohesive classes through HAC. Although the exact cause of this discrepancy in unknown, it could perhaps be due to the way words are defined in Wolvengrey (2001). In this dictionary, verb definitions almost always contain more words than noun definitions. Almost every single verb definition will have at least two words, owing to the fact that Nêhiyawêwin verbs are defined by an inflected lexeme. This means that if one looks up a word like *walk*, it would appear as: pimohtêw: s/he walks, s/he walks along; s/he goes along. Meanwhile, nouns tend to have shorter definitions. The definition for the act of walking, a nominalized form of the verb for walk, is written as: pimohtêwin: walk, stroll; sidewalk. This difference is exacerbated by the fact that definitions are often translated fairly literally. Something like *pêyakwêyimisow* might be translated simply as 's/he is selfish,' but contains morphemes meaning *one*, *think*, *reflexive*, and *s/he*. A gloss of this word is seen in (12). Rather than simply defining the word as 's/he is selfish,'

[16]It is worth noting that previous attempts at such experimentation via Nêhiyawêwin communities with which we have good relationships have been poorly received by speakers.

Wolvengrey (2001) has opted to provide a more nuanced definition: pêyakwêyimisow: s/he thinks only of him/herself, s/he is selfish, s/he is self-centered.

(12) pêyakwêyimisow
pêyakw-êyi-m-iso-w
one-think-VTA-RFLX-3SG
's/he thinks only of him/herself'

The result of this complex form of defining is that words are defined more in line with how they are understood within the Nêhiyawêwin culture, which is indeed often manifested in the derivational morphological composition of these words. This is central to the motivation for this method of semi-automatic clustering, but produces verbs with relatively long definitions. An alternative explanation for why Nêhiyawêwin lexemes with English definitions consisting of more numerous parts of speech were more difficult to classify is that these divisions simply have significantly more variation in meaning for whatever reason. Further investigation into this is needed.

Table 3.3: Manually Adjusted Noun Classes

NI (N)	NDI (N)	NA (N)	NDA (N)
NI-nominal (1783)	NDI-body (243)	NA-persons (720)	NDA-relations (143)
NI-object (902)	NDI-house (2)	NA-beast-of-burden (512)	NDA-body (45)
NI-natural-Force (283)		NA-food (325)	NDA-clothing (4)
NI-place (228)		NA-celestial (45)	
NI-nature-plants (198)		NA-body-part (37)	
NI-body-part (78)		NA-religion (23)	
NI-hunt-trap (60)		NA-money/count (12)	
NI-animal-product (48)		NA-shield (2)	
NI-religion (36)			
NI-alteration (23)			
NI-scent (4)			
NI-days (4)			
NI-persons (3)			

Also worth noting is the relative distributions of each of the postprocessed classes mentioned above. Table 3.3 details each of the postprocessed noun classes sorted by their size.

Perhaps unsurprisingly, the distribution of lexemes into different classes followed a sort of Zipfian distribution. The NA-person and NA-beast-of-burden accounted for

Table 3.4: Manually Adjusted Verb Classes

VII (N)	VAI (N)	VTI (N)	VTA (N)
II-natural-land (275)	AI-state (2083)	TI-action (1409)	TA-action (1013)
II-weather (96)	AI-action (1982)	TI-nonaction (293)	TA-nonaction (574)
II-sensory (90)	AI-reflexive (542)	TI-speech (80)	TA-speech (103)
II-collective (79)	AI-cooking (172)	TI-money/count	TA-food (54)
II-move (38)	AI-speech (131)	TI-fit (10)	TA-money/count (23)
II-named (3)	AI-collective (97)	TI-food (8)	TA-religion (9)
	AI-care (81)		TA-allow (5)
	AI-heat/fire (55)		
	AI-money/count (34)		
	AI-pray (29)		
	AI-childcare (17)		
	AI-canine (16)		
	AI-cover (15)		

the vast majority of noun lexemes for animate nouns. Just under half of all NI lexemes were nominalized verbs, and roughly a quarter were smaller object-like items (e.g. tools, dishes, etc.). The NDAs were almost entirely dominated by words for family, while all but three NDIs were body part lexemes. Some categories such as NI-scent, NI-days, and NA-shield have extremely low membership counts, but were substantially different from other categories that they were not grouped into another class. Most interestingly, there appeared to be three NI lexemes that referred to persons, something usually reserved for NAs only. These lexemes were *okitahamâkêw* 'one who forbids,' *owiyasiwêwikimâw* 'magistrate,' and *mihkokwayawêw* 'red neck.' In all three cases, the lexemes seem to be deverbal nouns (from *kitahamâkêw* 's/he forbids,' *wiyasiwêw* 's/he makes laws,' and *mihkokwayawêw* 's/he has a red neck.'

Verbs showed a similar distribution. Table 3.4 details the distribution of words within each of semantic classes for verbs. With the exception of VII and VAIs, verbs were dominated by classes for action, which subsumes most volitional actions (e.g. *kîskihkwêpisiwêw* 's/he rips the face off of people,' *kâsîpayiw* 's/he deletes'), and nonaction which includes most verbs of thought, emotion, judgment, or sensory action (e.g *koskowihêw*, 's/he startles someone,' *nôcîhkawêw* 's/he seduces someone'). Other classes may include action verbs, such as AI-cooking and TI-speech. Although these verbs could be classified in one of the two previously mentioned systems, their automatic

classification and semantics unify them in a way that is unique to other items in these larger classes.

Verbs in AI-action have little in common with each other except that they are a form of volitional action, while AI-care verbs (which may include actions related to giving care such as *kanawastimwêw* 's/he looks after/guards horses') have a distinct and unifying characteristic relating to giving care. Similarly, although AI-childcare could be subsumed under AI-care, the former includes items like *kimotôsêw* 's/he bears an illegitimate child'. This is even more obvious in categories such as AI-collective or AI-reflexive, which refer to lexemes that are plural only or reflexive in nature/morphology, respectively. These may not seem as semantically defined as other classes for VAIs, though one could argue that verbs that occur only in the plural are inherently collective in action, and thus semantically defined; similarly, reflexive forms are necessarily actions that are done to one's self. Although there may be action or nonaction verbs in this category, the automatic classification divided and grouped most reflexive and plural only lexemes into their own respective classes. Resultantly, these clusters were kept as separate classes. For this classification scheme, reflexives were deemed to be more reflexive than they were to be action or nonaction.

Additionally, VAIs contained a sort of stative class, AI-state. This classification, being inherently non-transitive, is not present in the VTI or VTA classes. Stative verbs are present in the VII class, but given how many VII lexemes are essentially stative, we opted not to have a single stative class, but instead defined classes describing natural-land (including general landscape features such as *kinohtakâw* 'it has a long floor'), sensory information (e.g. *kihcinâkwan* 'it looks impressive'), or weather terms (*mispon* 'it is snowing').

Overall, verb forms, especially the most numerous classes of VAI and VTA, required a large degree of manual postprocessing. Because this approach assumes no underlying ontology, but rather attempts to work bottom-up (cf. Hanks 1996), the time taken to postprocess VAI and VTA classes is likely not too far from what it would take to manually classify these words based off a prebuilt ontology; however, the appeal of a bottom-up classification should not be overlooked.

3.6 Conclusion

This paper describes an attempt at semi-automatically classifying Nêhiyawêwin verbs and nouns. Resulting clusters of Nêhiyawêwin words are freely available online. Although the technique worked quite well with nouns, which required very little manual adjustment, verbs required more directed attention. Despite this, the technique presented in this paper offers a bottom-up, data-driven approach that takes the language on its own terms, without resorting to ontologies created primarily for other languages. If, however, one wishes to use a pre-defined ontology, the basis for this work (representing word definitions using pre-trained English word vectors) could be used in conjunction with existing ontologies to expedite the classification process. For example, Dacanay et al. (2021) compare the naive definition vectors for Wolvengrey (2001) with the same for the English WordNet word senses; word senses whose vectors bear a strong correlation with the Nêhiyawêwin definitions can then be assumed to be synonymous with a Nêhiyawêwin word, and the latter can take the WordNet classification of the former. Because this technique leverages resources from a majority language, it is not sensitive to the issue of paucity of data for minority languages. It should be applicable to any context where a minority language has a majority-language-bilingual-dictionary and where the majority language is well resourced. Applications for this research extend not only to the creation of semantic classes, but also to the association of words based on semantic similarity. The results of the quantitative evaluation suggest that, at least in the Independent vs. ê-Conjunct alternation, semantic class plays some role in predicting the alternation, though its use varied by conjugation class. In addition to the use of these results to bolster modelling of Nêhiyawêwin Order, the word similarity scores on which clustering was based can be used to identify words that are similar to one another, a task that is ideal for word discovery, for example in the presentation of synonymous (or at least semantically related) terms when searching through an online dictionary.

Future research should investigate how these classes compare to raw HAC clusters and manual classification of various sorts (should these become available in Nêhiyawêwin). Different methods of calculating item distance in clustering techniques (e.g. through cosine distance (Dacanay et al., 2021)) should be considered. More

sophisticated sentence/definition embeddings, such as those returned by BERT (Devlin et al., 2018) or other state of the art models would also likely increase the efficacy of this technique. Further, as one reviewer suggested, one could use a weighted average for words in the dictionary definitions along with word relevance measures (such as tf-idf scores) to more accurately represent the semantics of an English sentence. Although fully Nêhiyawêwin-trained vectors are ideal, as with most Indigenous languages of North America, there is simply nowhere close to enough data to build robust word embeddings as seen in the Google News Corpus. The technique described in this paper presents a compromise of taking the language on its own terms, while leveraging the massive data sets that exist for majority languages.

Chapter 4

Methodology

This chapter details the methods used in the analysis of Nêhiyawêwin Order. The primary research question investigated in this dissertation is: how, and in what way, can Nêhiyawêwin order be understood as an alternation that can be predicted through morphosyntactic, surface-syntactic, and lexical-semantic features. This chapter describes the corpus used, the univariate analysis, and the multivariate analysis. The methodologies used in this analysis are based off those bivariate and multivariate statistics described in Bresnan et al. (2007); Divjak and Gries (2006); Gries (2003) and Arppe (2008), in particular the combination of univariate and multivariate techniques. This chapter does not detail the methods used for creating the underlying corpus (information detailed at length in Arppe et al. (2020)) or the process by which verbs and nouns were semantically clustered for inclusion as predictors (described in Chapter 3).

4.1 The Corpus

The underlying corpus from which the data set used in this dissertation is the Ahenakew-Wolfart corpus (Arppe et al., 2020). The Ahenakew-Wolfart corpus is likely the largest morphosyntactically tagged corpus of all Canadian Indigenous languages, let alone Nêhiyawêwin. Although there has been attemtps in the last few decades to increase the amount of texts in Nêhiyawêwin, there is still a paucal amount of texts written in Nêhiyawêwin, and many of those texts that are publicly available, are written in a nonstandard Roman orthography. The Ahenakew-Wolfart corpus is unique in that it is meticulously standardized. The texts that make up the corpus were collected

by Freda Ahenakew and H. C. Wolfart between the 1970s and 1990s. These texts have previously been published in Ahenakew (2000); Bear et al. (1992); Kâ-Nîpitêhtêw (1998); Masuskapoe (2010); Minde (1997); Vandall and Douquette (1987); Whitecalf (1993). These texts are mainly dialectic or narrative discussions between two or more native Nêhiyawêwin speakers. Together, these texts contain 142,192 tokens (20,503 types), though some of these tokens are English, French, or Michif words; fragments; or other items. Focusing only on Nêhiyawêwin items, there are 80,221 tokens (16,532 types). Each of these tokens has been morphosyntactically tagged by automatic and hand-parsed means (Arppe et al., 2020). Tokens were tagged for their lemma as well as both verbal and nominal features. For verbs: preverbs, tense, word class, Order, commitative morphemes, and conjugation class; For nouns: person/number marking, possession, declension, and diminutive morphemes; Both nouns and verbs were marked for the feature of semantic class. An example token with its relevant tags is found in (13).

(13) ê-ohci-pimâtisit
pimâtisiw PV/e PV/ohci V AI Cnj 3Sg @PRED-AI
'S/he lived thus / make a living thus'

Beyond this, the corpus has been further syntactically tagged by an automatic constraint grammar (Schmirler et al. 2018, Schmirler Forthcoming). Among other features, this constraint grammar marks tokens for their predicate, actor, and goal status.

To create the data set used in this dissertation, I extracted only verbs from the above corpora and further restricted the data set by selecting only verbs that contained a classification as described in Chapter 3. This results in a data set of 13,628 tokens (2032 types). In addition to the morphosyntactic tags seen above, verbs were marked for arguments (and those arguments' morphosyntactic features) when arguments were syntactically present (as opposed to represented only by verbal agreement). This results in an entry such as (14).

(14) pimâtisiw PV/e PV/ohci V AI Cnj 3Sg @PRED-AI AI-state
kikâwînaw N A D Px1Sg Sg @ACTOR> NDA-Relations

From here, each token and its accompanying analyses were transformed into a

Table 4.1: Extract from Data Frame

Lemma	PRED-AI	PV/ahci	...	PV/e	PV/ohci	PV/pe	V	AI	Cnj	3.actor	3.goal	AI-state	Sg.actor
pimâtisiw	TRUE	FALSE	...	TRUE	TRUE	FALSE	TRUE	TRUE	TRUE	TRUE	FALSE	TRUE	TRUE

data frame of 'dummy' variables: every verb lemma token makes up a row, while every morphosyntactic tag constitutes a logical column. For every lemma token, if a morphosyntactic feature is observed, a value of `TRUE` is set for the corresponding column, otherwise a value of `FALSE` is set. Dummy variables allow for easily interpreted results, especially when dealing with covariance (Baayen, 2012). Given the example of (14) the data frame extract in Table 4.1 is produced.

For the sake of fitting Table 4.1 to the page, the majority of the columns are not shown, but every feature present in (14) would have a column value of `TRUE` for the token `pimâtisiw`, and all features not present are given a value of `FALSE`. The exception to this is the actor and goal marking morphemes. Although the corpus marks person and number of morpheme as one unit (e.g. `1Sg`), the data frame used for analysis in this dissertation split the features up (i.e. there were seperate columns for `3` and `Sg` for both actors and goals). Finally, a number of tokens were removed because their part of speech was not reliably identified in the corpus. There were 310 of these tokens, the majority of which (301 tokens) were the verb *ayâw*. In addition to basic locative use, *ayâw* may also be used to describe the state of 'having' something. In the corpus, *ayâw* was marked as both `VAI` and `VTI`. Because the VTI form of the verb inflects the same as the VAI form, and because syntactic arguments are usually not present in a sentence beyond verbal agreement (and even then, only in the VTA), determining which of these two classes the lemma was acting in was difficult for the non-native speakers annotating the corpus. Three further lemmas, *manitowi-kîsikâw* (4 tokens), *misi-paskwâw* (3 tokens), and *nanamipayiw* (1 token), were removed as there was disagreement between the corpus and dictionary sources. In the first two cases, these forms were given in the corpus as VIIs, while dictionary sources cited them as also NIs. This disagreement is understandable, as VIIs that deal with time or space often describe substantives. The final case, *nanamapayiw* is given as an VII in the corpus, while Wolvengrey (2001) analyses it as an VAI and LeClaire et al. (1998) offers an

Table 4.2: Preverb Class Tokens and Types

	Types	Tokens
Discourse	4	277
Position	15	285
Qual	30	316
Quant	7	10
Time	18	4720
Move	4	731
Start/Finish	5	229
Want/Can	4	195

analysis of both VAI and VII. Although context (through either native speaker annotation or translations by native speakers) would quickly resolve these ambiguities, the corpus being used had not yet been disambiguated in this sense, and given the small number of tokens, I opted to remove these 309 tokens from the data set.

Because Nêhiyawêwin contains a large number of possible preverbs (the model underlying the corpus could identify 267 unique preverbs), I undertook a manual classification of these morphemes. I identified 8 unique classes: Discourse, Position, Qual, Quant, Time, Move, Start/Finish and Want/Can. Of the 267 identified preverbs, only 86 preverb types were observed in the corpus. Table 4.2 lists the number of tokens and types in each of the preverb classes.

In all, the resulting data frame of non-imperative forms contains 13,292 lemma rows by 4777 columns. Due to errors in coding, 100 items were excluded from this, creating a data frame of 13,192 items. The use of such a logical data frame for predicting an alternation is present in Arppe (2008) and allows for the assessment of individual values of categorical variables through straightforward application of chi-squared analyses and logistic regression to predict a multinomial alternation, in this case Order.

4.2 Modelling the Alternation

In this dissertation, I will evaluate a univariate analysis given the morphosemantic features mentioned above to model a verb lemma's likelihood of occurring in various Order types. Although Chapter 2 identified five unique Conjunct Orders (along with

Table 4.3: Preverb Class Tokens and Types

		Types	Tokens
Independent		876	4390
ê-Conjunct		1480	6378
kâ-Conjunct		600	1696
Other-Conjunct		393	828
	Subjunctive	75	100
	Initial Change	18	21
	ka-Conjunct	344	707
Total		3349	13,294

the Independent), the majority of these classes have few tokens. Small counts can be problematic for statistical analyses, particularly for regression analyses. To address this, the ka-/ta-Initial, Initial Change, and Subjunctive Conjuncts were conglomerated into a single 'other' class. This results in the Order alternations as seen in Table 4.3.

In order to gain a wholistic understanding of Nêhiyawêwin Order, this dissertation will investigate 3 main alternations of these Orders:

- Independent vs Conjunct
- Independent vs ê-Conjunct
- Conjunct Type: ê-Conjunct vs kâ-Conjunct vs Other-Conjunct

The first of these alternations, Independent vs Conjunct, will inform about the difference between the two Orders broadly. The second, Independent vs ê-Conjunct, will investigate the difference between the two most similar Order forms which are often conceived as synonyms and used roughly interchangeably. The third alternation will be used to model the extent to which we can predict the modes through morphosemantic features from a corpus. Three main data frames were used:

- `AWnImp`: used in analyzing the Imperative vs. Conjunct alternation, representing all non-imperative forms minus the 100 errors previously mentioned
- `AWIvE`: used in analyzing the Independent vs. ê-Conjunct alternation, representing only forms of forms with `TRUE` `Ind` or `PV.e` forms

Table 4.4: `AWnImp` *statistics*

	Types	Tokens
Independent	876	4390
Conjunct	1722	8802
Total	2598	13,192

Table 4.5: `AWIvE` *statistics*

	Types	Tokens
Independent	876	4390
ê-Conjunct	1480	6378
Total	2356	10,768

- `AWCnj`: used in analyzing the Conjunct Type alternation, representing only forms with `TRUE` `Cnj` forms.

In Table (4.4) through (4.6) are relevant counts for each of the three dataframes.

4.3 Univariate Analyses

The term *univariate analysis* refers to an analysis that takes into account only one variable at a time. The most common form of univariate analysis for discrete variables is the chi-square test, originally introduced in Pearson (1900) and refined over the last century to produce the modern day chi-squared test (Agresti, 2013). The chi-square test makes use of contingency tables to measure the association/correlation of a (set of)

Table 4.6: `AWCnj` *statistics*

	Types	Tokens
ê-Conjunct	1480	6378
kâ-Conjunct	600	1696
Other-Conjunct	393	828
Total	2473	8902

variable(s) an outcome. This is calculated by comparing the expected frequency of an outcome/variable pair with with the observed frequencies of the same pairings. Chi-square tests provide a simple statistic, the eponymous χ^2 statistic, whose value reflects an estimated association. This statistic is given for the whole *set* of values of the explanatory and outcome variables tested. If one were to run a chi-square test to determine if the set of variables { 1Sg.actor , 2sg.actor , 3sg.actor , past tense , future tense , present tense } was associated with an increased likelihood of a lemma being in the Independent or Conjunct Order, the resulting χ^2 statistic would indicate the level of association for that set as a whole. To investigate the effect an individual variable has, one must make use of the Standardized Pearson Residual, calculated through the formula in (4.1), where *P* is the Standardized Pearson Residual, *O* is the observed frequency of a variable/outcome pair, *E* is the Expected frequency of a variable/outcome pair, t_i is the sum of a variable across all outcomes, and t_j is the sum of all variables for a given outcome (adapted from (Agresti, 2013, 81)). Note that in (4.1) the denominator represents its standard error.

$$P = \frac{O - E}{\sqrt{E(1 - t_i)(1 - t_j)}} \tag{4.1}$$

This produces a Standardized Residual which can be interpreted based on its magnitude and direction. A positive residual of at least 2.00 represents a significant positive association (i.e. one observes more instances of a variable/outcome pairing than would be expected) while a negative value of -2.00 or lower represents a negative association. Values greater than -2.00 but less than 2.00 represent an association not deemed to be significant (Agresti 2013, 81; exemplified in Arppe 2008, 79).

The chi-square test is best used with higher frequency data sets. According to Cochran (1954), the results of a chi-square test are not reliable when the contingency tables for a given variable has more than 20% of its expected values <5. In these cases, it is suggested that researchers make use of an alternative test, such as the Fisher's Exact Test that forms the basis of Gries' Collostructional Analysis (2004). Some authors, however, believe that Fisher's Exact Test is too conservative (D'Agostino et al., 1988), increasing the risk for Type II errors in hypothesis testing. For this dissertation, I will simply consider phenomena with sufficient frequencies for a chi-square statistic.

Univariate Models

In building models for univariate analysis, all variables with a minimum occurrence of 10 were selected for a given conjugation class for each alternation. This restriction was chosen to exclude incredibly infrequent items which make statistical modelling difficult or unreliable, while including as many variables as possible. Because univariate analysis considers variables on their own basis, manual scrutiny of variable selection was not performed at this point.

4.4 Bivariate Analyses

Following Arppe (2008), after univariate analyses were conducted and a set of variables were selected, I conducted bivariate analyses. Bivariate analysis is simply measuring the assosciation between two variables. Bivariate analysis as done by Arppe (2008) can be a useful tool for creating models for mixed effects modelling. Bivariate analysis for this dissertation makes use of the `associations` function from the `polytmous` package (Arppe, 2013). This function calculates Theil's Uncertainty Coefficient (Henri, 1970a) for every combination of variables passed to it. This coefficient is a mutual information measure and describes the extent to which knowing about one variable can inform our understanding of another variable via a reduction of entropy (Arppe, 2008, 90).

4.4.1 Bivariate models

For this dissertation, I make use of Theil's Uncertainty Coefficient to identify to identify potential covariance which could impede the fitting of mixed effects models. Bivariance was tested for each of the four alternations mentioned above. Variables for each alternation were chosen only from those items with a significant χ^2 statistic ($p < 0.05$). Automatic and manual classes were tested separately, as there was a great deal bivariance between automatic and manual class variables.

4.5 Multivariate Analysis

Using the methodology of Arppe (2008), following bivariate analysis, the resulting variable sets were used to form a set of variables to perform multivariate analysis. The fundamental technique used in this analysis was logistic mixed effects regression. Logistic regression is a generalized form of linear regression as applied to categorical outcomes. Logistic regression models a binary outcome such to what extent individual predictor affects an outcome (Agresti, 2013, 163). Like all generalized linear models, logistic regression attempts to predict outcomes by representing the distribution of the data. Specifically, the technique allows researchers to specify a set of predictors and models the data so that researchers can determine the extent to which an individual predictor influences a particular outcome given a set of parameters (variables/effects).

Logistic regression (with a single independent variable, for example) can be modelled with the equation in (4.2) (Agresti, 2013, 163), where x represents the independent variable, α represents a model intercept, and β is the slope of x.

$$\pi(x) = \frac{e^{\alpha+\beta x}}{1 + e^{\alpha+\beta x}} \tag{4.2}$$

Equation (4.2) represents the odds ratio for the effect of an independent variable on a particular outcome (e.g. the effect of age on the use of one of two synonyms). These ratios are bounded between 0 and ∞. More commonly, logistic regression models are fit with the logit function, derived from (4.2) and seen in (4.3) (Agresti, 2013, 163).

$$\mathtt{logit}[\pi(x)] = \log \frac{\pi(x)}{1 - \pi(x)} = \alpha + \beta x \tag{4.3}$$

The resulting estimates given by the logit are given in log odds, rather than odds. These values are *not* bounded between 0 and ∞, but instead $-\infty$ and $+\infty$. Positive values represent an increase in likelihood of a an outcome for a particular variable; negative values represent a decrease in likelihood; a value of zero represents no effect on the outcome.

This dissertation makes use of mixed effects models in its logistic regression. In terms of regression for language data, mixed effects models have now become the norm (Barth and Kapatsinski, 2018, 100). In comparison to models that make use of only fixed effects,

those variables for which all possible values are represented in the data, mixed effects models allow for the researcher to control for variables in which random variation can be expected (Baayen, 2012). For the data used in this dissertation, morphosyntactic features like `Actor.1`, which are dummy variables that represent the presence or absence of a feature (in this case, whether or not a verb is marked for first person), are **fixed effects** because all possible values (`TRUE, FALSE`) are represented in the data. Conversely, the `Lemma` variable (a multi-level variable containing all lemmas of the corpus) are *samples* of the total lemma set in Nêhiyawêwein and thus can be expected to contain some amount of random variability/outcomes not present in the corpus; thus, `Lemma` is best modelled as a **random effect**. In a mixed effects model, the random variability of a random effect is 'controlled' for, allowing for estimations of fixed effects without the confounds of the random effect.

Fixed effects are analyzed relatively straightforwardly: for each of the dummy variables, one of the two possible levels are chosen to act as a baseline reference (Baayen, 2012). By default, R uses the `0/FALSE` level as a base line, though one could use the alternate level as a reference if needed. For the dummy variables in this dissertation, this means the reference level represents the absence of a particular variable. In modelling an outcome, the logistic regression analyses each observation in its training data and, if an outcome is *not* observed, assigns the variable a value of 0 for the outcome; otherwise, if the variable *is* observed, a value of 1 is given to the variable for the outcome Baayen (2012). Importantly, a model's intercept represents the variables' reference levels (Baayen, 2012). Random effects are not given a reference level; instead, each level can be thought of as adjustments to each fixed effect (Baayen, 2012). As an example, given the fixed effect `actor.1`, the logistic model would make adjustments to `actor.1`'s slope based on observations of each level of `Lemma`. In this sense, there is no reference level the others are compared to.

This analysis makes use of the `lme4` package in R (Bates et al., 2015).

4.5.1 Binarization of the Alternation

Making use of logistic regression, this dissertation will investigate the behaviour of four three alternations based on the order presented in Chapter 2:

1. The Independent vs. the Conjunct (as a whole)
2. The Independent vs. the ê-Conjunct
3. The ê-Conjucnt vs. the kâ-Conjunct vs. the Other-Conjunct (Comparing modes within the Conjuncts)

The comparisons made here allow for investigation of a a wide range of Order behaviour, while still specifying the alternations not generally explainable by semantics: The ê-Conjunct and the Independent along with the general Conjunct and the Independent.

Logistic regression assumes a dichotomous decision by default. This is the case, for example, when comparing the Independent and the Conjunct. For the final two alternations above, however, there are more than two outcomes being compared. In polytomous cases, there are multiple methods by which the data can be binarized. One such technique is the *one-vs-rest* (OVR) heuristic. In one-vs-rest comparisons, a model compares one class against all other possible classes (Frank and Kramer, 2004). In this way it can be thought of as comparing χ against $\neg\chi$. One can also make use of the *pairwise comparison*, which creates pairs of the outcome given a predictor, tests each pair, and selects which outcome is most likely to occur with each predictor (Frank and Kramer, 2004).In the present study, each Conjunct class would be paired with one other class at a time, eventually being paired with each other Conjunct type. For each pairing, which-ever type is most probable given each set of predictors, would be picked as the 'winner' for that pairing, and would be proposed to the model. For each morphological feature, that class which is most often proposed would be selected and given as the likeliest Order type. In addition to one-vs-rest and pairwise comparisons, we can make use of *nested dichotomies*. The concept of a nested dichotomy is straightforwardly described: a group of outcomes being compared is split into mutually exclusive dichotomies repeatedly until unary classifications are created (Frank and Kramer, 2004). Each dichotomy is given a statistical probability which can be multiplied together to determine the overall probability of the dichotomous tree. Similarly, other binarization techniques such as Baseline-Category (Fox, 1997, 468) classification offer alternative binarization techniques. Arppe (2008) presents a brief

overview of all the above techniques. For this dissertation, I will use the OVR heuristic in the polytomous Conjunct Type alternation due to its conceptual and computational ease and simplicity, particularly in modelling maximally three outcomes in a single alternation.

The resulting logistic models provide estimated adjustments for every variable, even if these effects are not considered statistically significant. The results provided by the `lme4` package calculates the p-value for each effect using the asymptotic Wald tests for generalized linear models (Bates et al., 2015). Recognizing that the use of p-values are not without controversy (Gelman, 2016), this dissertation will still use p-values to determine which effects are most pertinent in modelling the Order alternation.

4.6 Model Assessment

In addition to the results described above, one can assess the overall performance of a logistic model. This assessment gives us invaluable information and allows us to see how well, and in what ways, a model represents Order type selection in terms of morphosyntactic and semantic features. In particular, one can see how well a model is able to evaluate a given form as the correct Order type without raising false positives (precision), as well as how many instances of a given Order type it classifies correctly, regardless of false positives (recall). Recall, precision, and overall accuracy are measured per Conjunct type for each conjugation class (not for the model in its entirety). As an additional way of assessing model fit, one may also use the τ value to determine how much better the model performs than selecting based solely on overall proportions/through random assignment (Goodman and Kruskal, 1959, 745-747) (ranging from 0.00 to 1.00, with 1.00 being a perfect model). According to Arppe (2008, 140), τ values of roughly 0.5 and above suggest a 'good' model fit. Because the models used in this dissertation are logistic, a true R^2 *Likelihood* score is inapplicable. Instead, a so called Pseudo-R^2 value must be used. As Hosmer and Lemeshow (2000, 167) point out that Pseudo-R^2 Likelihood scores for logistic regression are generally much smaller than in other statistics, such as R^2 values given in standard linear models. Another important difference between the R^2 measure and Pseudo-R^2 Likelihood is

that the former can be used as a measure of how much variance is explained by the model under consideration; Pseudo-R^2 Likelihood can never report explained variance (Hosmer and Lemeshow, 2000, 164). Instead, Pseudo-R^2 Likelihood can be seen as a measure of reduction in the *badness* of fit. The specific form of Pseudo-R^2 that I will use is McFadden's Pseudo-R^2 (ρ^2) (Domencich and McFadden, 1975) as reported by the `ModelStatistics` function (Arppe, 2013). Macfadden's Pseudo-R^2 appears to have a stable, but non-linear, relationship with a general R^2, wherein a ρ^2 value of 0.2, 0.3, and 0.4 are roughly equivalent to an R^2 of 0.3, 0.5, and 0.73 respectively (Domencich and McFadden, 1975, 124). As with other Pseudo-R^2 measures, a ρ^2 of over 0.25 is indicative of a fairly well fit model. Furether, Han et al. (2013) suggest that, in their experience, Pseudo-R^2 Likelihood scores of nearly 0.30 are indicative of very good models without risk of over-fitting.

Because models are fit separately for each Conjunct type in each conjugation class in the Conjunct Type alternation, estimated probabilities add up to something close to, but not exactly, 1.00. In order to achieve this range of 0.00-1.00, the `ModelStatistics` function (Arppe, 2013) aggregates all models and performs a normalization of estimated probabilities, such that they add up to exactly one.

In addition to the models described above, one can use logistic regression with only random effects. These models present only those lemma-specific effect, and can be used as a base line against which one can assess how much of an effect morphological features have on the ability to predict Conjunct type (cf. the discussion of Harrigan and Arppe (2015) regarding lemma-specific preferences on occurrence in the Independent or Conjunct orders). For each of the mixed-effect models, Pseudo-R^2 Likelihood, Accuracy, and τ measures for models with only random effects will be also be given. By comparing fixed effects models against the mixed effects models, we can determine the extent to which random effects affect the fit of our modelling of Order.

Based on the above methodology, the following predictions are proposed:

1. Overall, modelling will be successful though constrained (likely due to the small size of the corpus).

2. Due to a lack of syntactic data, mixed effects modelling based on the Nêhiyawêwin

corpus will be able to provide some insights, but model fits will rarely be significantly informative (as measured by the exceeding of an ρ^2 of 0.2).

3. Semantic variables will do more to explain variance than morphological variables (as in (Arppe, 2008)).

4. The Conjunct Type alternation will be significantly less cohesive in its results (due to the straightforward syntactic/semantic choices driving it, which are not reflected in the variables of the data set).

5. The alternation between the Independent and the ê-Conjunct will be the most robust and well-fit model (because the two forms are nearly synonymous in many cases).

Chapter 5

Results

5.1 Univariate results

Three separate univariate analyses were undertaken, one for each of the alternations being studied. Generally speaking, these analayses identify those variables with a statistically significant association with a particular alternation outcome.

The following three subsections detail the models used for univariate analysis as well as the resulting (significant) variables. Variables fed into the univariate models followed the selection criteria described in Chapter 4, but certain adjustments were made. Given their low counts, variables indicating argument lemmas (e.g. aya.goal) were removed. Instead, I used the more abstract semantic classes from Chapter 3 in their place. Additionally, corpus-internal tags (like Lemma and Morph, which indicate a lemma or morpheme not present in the semi-automated gold-standard corpus) were not included in analyses. Similarly, tags indicating the direction of the argument in relation to the verb (e.g. @ACTOR>.actor for arguments occurring to the left of the verb) were not used. Although it is possible some syntactic information *could* be helpful, Nêhiyawêwin Order is very flexible, and only slightly less than half of all verbs even contained overt arguments. Further, previous syntactic accounts have not suggested linear order of arguments to be a significant influence on Order. Finally, tags like N.actor and I.actor were removed because they were implicitly reflected in the verb class (e.g. all actors are nouns, all VAIs will have animate actors).[1]

[1] Inanimate actor forms are not included in this corpus

5.1.1 Independent vs. Conjunct

The selected variables were fed into the `nominal`, producing a set of χ^2 test results. Statistically significant results are presented in Tables 5.1 through 5.4. These tables depict the predictor names, the number of tokens for each predictor, their χ^2 statistic, and direction of association between predictor and outcome (i.e. a `+` indicates a positive association, which in turn implies that a predictor occurs more often with a particular alternation construction than would be expected by chance, and a `-` represents the opposite).

Intransitive Inanimate Verbs

Table 5.1: Univariate results for the Independent Vs. Conjunct Alternation: VIIs

	N	χ^2	Cnj	Ind
PV.Time	213	3.<0.001	-	+
II.sense	274	<0.001	-	+
NI.object.actor	144	0.026	+	-
Pron.actor	58	0.02	+	-
Dem.actor	57	0.01	+	-
Med.actor	24	0.03	+	-

For the Independent vs Conjunct alternation VIIs, only preverbs of time and sensory verbs were positively associated with the Independent Order. All other effects such as `NI.object.actor`, as well as pronominal, demonstrative, and medial actors, were positively associated with the Conjunct. Note that both `Dem.actor` and `Med.actor` are features associated with certain pronouns, and so are essentially subtypes of `Pron.actor`.

Intransitive Animate Verb

Table 5.2: Univariate results for the Independent Vs. Conjunct Alternation: VAIs

	N	χ^2	Cnj	Ind
AI.speech	1344	<0.001	-	+
actor.3	3646	<0.001	-	+
PV.Time	2008	<0.001	+	-
PV.Move	442	<0.001	+	-
PV.Qual	173	0.003	+	-
PV.StartFin	143	0.003	+	-
PV.Discourse	137	<0.001	+	-
PV.Position	121	0.004	+	-
AI.do	2125	<0.001	+	-
AI.state	1924	<0.001	+	-
AI.cooking	281	<0.001	+	-
AI.reflexive	276	<0.001	+	-
AI.health	122	0.02	+	-
AI.pray	61	0.005	+	-
RdplW	142	<0.001	+	-
NA.persons.actor	737	<0.001	+	-
Sg.actor	540	0.001	+	-
Pl.actor	295	<0.001	+	-
Pron.actor	403	0.01	+	-
Dem.actor	200	0.02	+	-
NA.beast.of.burden.actor	59	0.02	+	-
NA.food.actor	37	0.03	+	-
actor.1	1825	0.04	+	-
actor.2	250	<0.001	+	-
Obv.actor	45	0.01	+	-

The VAIs showed a number of significant effects, nearly all positively associated with the Conjunct as detailed in Table 5.2. In fact, only verbs relating to speech or those having a third person actor seemed to positively associate with the Independent. Notably, a number of preverbs were positively associated with the Conjunct: those of time, movement, quality, starting/finishing, discourse, and position. In general, it appears that semantic effects were associated with the Conjunct, with the semantic classes of action, state, cooking, reflexive, heath, and praying all having significant positive Conjunct effects. Beyond these and the effect of weak reduplication, all other remaining effects were related to explicitly realized actors (as separate words). Singular and plural actors, pronominal and demonstrative, actors semantically relating to food and beasts of burden, as well as first, second, and obviative actors were all positively associated with the Conjunct.

Transitive Inanimate Verbs

Table 5.3: Univariate results for the Independent Vs. Conjunct Alternation: VTIs

	N	χ^2	Cnj	Ind
TI.cognitive	1160	<0.001	-	+
NA.persons.actor	261	0.02	-	+
Pron.actor	158	<0.001	-	+
Pers.actor	107	<0.001	-	+
actor.1	1202	<0.001	-	+
actor.2	250	<0.001	-	+
Px1Sg.goal	18	0.05	-	+
TI.do	1632	<0.001	+	-
TI.money.count	23	0.03	+	-
PV.Discourse	64	<0.001	+	-
NI.nominal.goal	114	0.002	+	-
NI.natural.force.goal	73	0.03	+	-
NI.place.goal	42	0.001	+	-
Sg.goal	789	<0.001	+	-
Pl.goal	244	<0.001	+	-
D.goal	64	0.01	+	-
NDI.Body.goal	55	0.01	+	-
Px3Sg.goal	43	0.02	+	-
Der.Dim.goal	30	0.01	+	-
actor.3	1514	<0.001	+	-

Like the VAIs, there were a number of VTI effects that showed a significant association, mostly with the Conjunct, as seen in Table 5.3. The only Independent-associated effects were verbs having to do with cognition, actors that had referents that were types of people, pronominal actors (especially personal pronouns), first or second person actors, and goals possessed by singular first persons. The majority of Conjunct associated variables concerned arguments, specifically goals. The only verbal associations were the semantic classes of action and money/counting as well as preverbs of discourse. Goals that were nominalized verbs, natural forces or place names; singular or plural goals, dependent goals, dependent goals specifically relating to body parts, those possessed by a singular third persons, and diminutive goals all associated with the Conjunct. The only actor based effect for the Conjunct was that of third persons actors.

Transitive Animate Verbs

Table 5.4: Univariate results for the Independent Vs. Conjunct Alternation: VTAs

	N	χ^2	Cnj	Ind
TA.speech	1114	<0.001	-	+
goal.3	1498	<0.001	-	+
actor.1	1067		-	+
PV.Time	1189	<0.001	+	-
PV.Move	172	<0.001	+	-
PV.Discourse	68	<0.001	+	-
PV.Qual	62	0.05	+	-
PV.Position	47	0.01	+	-
TA.cognitive	843	0.02	+	-
TA.do	837	<0.001	+	-
TA.food	96	<0.001	+	-
TA.money.count	66	0.04	+	-
goal.obv	702	<0.001	+	-
goal.2	177	0.002	+	-
NA.persons.goal	394	0.001	+	-
Px3Pl.goal	20	0.03	+	-
NA.persons.actor	199	0.01	+	-
NDA.Relations.actor	82	0.02	+	-
Sg.actor	178	<0.001	+	-
D.actor	82	0.02	+	-
actor.3	1266	<0.001	+	-
actor.obv	152	<0.001	+	-

The VTAs followed a similar pattern as seen previously. Nearly all significant effects in Table 5.4 were positively associated with the Conjunct, though verbs having to do with speech, having a first person actor, and having a first person goal all positively associated with the Independent. As in the VAIs, all preverb effects (those of time, movement, discourse, quality, and position) were associated with the Conjunct. Verbs of cognition, action, food, and money/counting were similarly aligned. Both actor and goal effects were present in the VTAs. Second person and obviative goals, those possessed by plural third persons, and goals representing people were all positively associated with the Conjunct. Actor effects such as the semantic classes of person actors and those representing a dependent relationship, singular and dependent actors, as well as third and obviative persons were also positively associated with the Conjunct.

5.1.2 Independent vs. ê-Conjunct

Intransitive Inanimate Verbs

Table 5.5: Univariate results for the Independent Vs. ê-Conjunct Alternation: VIIs

	N	χ^2	ê-Cnj	Ind
II.sense	255	0.001	-	+
PV.Time	186	<0.001	-	+
NI.object.actor	126	0.001	+	-
Sg.actor	158	0.03	+	-
Pron.actor	48	0.007	+	-
Dem.actor	47	0.003	+	-
Med.actor	21	0.01	+	-

Considering the alternation between the Independent and the ê-Conjunct, the only effects positively associated with the Independent were verbal effects: sensory verbs and preverbs of time. All other effects concerned the actor of a verb and were associated with the ê-Conjunct: Object actors, singular actors, as well as pronominal, demonstrative, and medial actors.

Intransitive Animate Verbs

Table 5.6: Univariate results for the Independent Vs. ê-Conjunct Alternation: VAIs

	N	χ^2	ê-Cnj	Ind
AI.speech	1240	<0.001	-	+
actor.3	3109	<0.001	-	+
PV.Time	1654	<0.001	+	-
PV.Move	346	<0.001	+	-
PV.Qual	147	0.001	+	-
PV.StartFin	123	<0.001	+	-
PV.Discourse	116	<0.001	+	-
PV.Position	109	<0.001	+	-
AI.do	1671	<0.001	+	-
AI.state	1578	<0.001	+	-
AI.cooking	231	<0.001	+	-
AI.reflexive	222	<0.001	+	-
AI.pray	46	0.012	+	-
RdplW	124	<0.001	+	-
NA.persons.actor	554	0.004	+	-
NA.beast.of.burden.actor	46	0.03	+	-
Pl.actor	228	0.01	+	-
actor.1	1551	0.002	+	-
actor.obv	138	<0.001	+	-

The VAIs continued the previous trend: verbs of speech with third person actors associated with the Independent, but all other significant effects as described in Table 5.6 were positively associated with the ê-Conjunct. This includes the verbal effects: preverbs of time, movement, quality, starting/finishing, discourse, and position; semantic classes, of verbs of action, state, cooking, praying, and reflexive verbs; and weak reduplication all positively associated with the ê-Conjunct. Actor effects included person actors, beasts of burden, plural actors, first person actors, and obviative actors.

Transitive Inanimate Verbs

Table 5.7: Univariate results for the Independent Vs. ê-Conjunct Alternation: VTIs

	N	χ^2	ê-Cnj	Ind
TI.cognitive	1008	<0.001	-	+
NA.persons.actor	203	0.003	-	+
Pers.actor	95	<0.001	-	+
Pron.actor	129	<0.001	-	+
Px1Sg.goal	15	0.05	-	+
actor.2	181	<0.001	-	+
actor.1	1043	<0.001	-	+
TI.do	1281	<0.001	+	-
TI.money.count	17	0.04	+	-
PV.Discourse	55	<0.001	+	-
NI.natural.force.goal	64	0.008	+	-
NI.place.goal	31	0.002	+	-
Der.Dim.goal	20	0.02	+	-
Pl.goal	205	<0.001	+	-
actor.3	1184	<0.001	+	-

The VTIs showed a more equal distribution for Independent and Conjunct effects. Verbs of cognition, actors representing people, pronominal actors (especially personal pronouns), actors which are possessed by first persons, and verbs with first and second person actors positively associated with the Independent. Conversely, verbs of action, verbs of moeny/counting, preverbs of discourse, goals representing natural forces, goals representing places, and plural goals all positively associated with the ê-Conjunct. The only actor based positive ê-Conjcunt association was third person actors.

Transitive Animate Verbs

Table 5.8: Univariate results for the Independent Vs. ê-Conjunct Alternation: VTAs

	N	χ^2	ê-Cnj	Ind
redoall TA.speech	905	<0.001	-	+
actor.1	892	<0.001	-	+
actor.2	84	<0.001	-	+
goal.3	1185	<0.001	-	+
PV.Time	946	<0.001	+	-
PV.Move	123	<0.001	+	-
PV.Discourse	58	<0.001	+	-
PV.Qual	49	0.03749096	+	-
PV.Position	44	0.001	+	-
PV.StartFin	30	0.03	+	-
TA.cognitive	692	0.003	+	-
TA.do	650	<0.001	+	-
TA.food	80	<0.001	+	-
Sg.actor	138	0.001	+	-
D.actor	68	0.009	+	-
NDA.Relations.actor	68	0.009	+	-
Obv.actor	31	0.02	+	-
actor.3	1060	<0.001	+	-
actor.obv	109	<0.001	+	-
goal.obv	579	<0.001	+	-
NA.persons.goal	290	0.04	+	-
Px3Sg.goal	36	0.01	+	-
Px3Pl.goal	15	0.03	+	-

The VTAs in the Independent vs. ê-Conjunct alternation mostly exhibit significant associations with the ê-Conjunct: only verbs of speech, local actors, and third person goals showed an association with the Independent Order. The usual significant preverb classes, those of time, movement, discourse, quality, position and starting/finishing were associated with the ê-Conjunct, as were the major semantic classes of cognition, acct ion, and food. A number of actor effects positively associated with the ê-Conjunct, including singular and dependent actors, actors representing dependent relations, an non-local actors. Goals which were obviative, representative of persons, and those that were possessed by third persons were also associated with the outcome.

5.1.3 Conjunct Types

Unlike the previous two sections, the alternation described in this section is multinomial. As a result, the positive/negative association for one outcome does not imply the opposite

association in another outcome. Some items may show a 0 mark in the tables representing the lack of a significant effect in one particular outcome.

Intransitive Inanimate Verbs

Table 5.9: Univariate results for the Conjunct Type Alternation: VIIs

	N	χ^2	ê-Cnj	kâ-Cnj	Other-Cnjs
II.sense	171	<0.001	+	-	0
PV.Time	135	0.001	+	-	0
Sg.actor	134	<0.001	+	-	0
NI.object.actor	119	<0.001	+	-	0
II.natural.land	145	<0.001	-	+	0

The VIIs showed significant associations only for the ê- and kâ-Conjuncts, where the two always showed association in the opposite direction (a pattern which can be partially seen throughout the this alternation). Sensory verbs, preverbs of time, singular arctors, and object actors were positively associated with the ê-Conjunct and negatively associated with the kâ-Conjunct. Verbs in the II.natural.land class was the odd one out, positively associating with kâ-Conjunct and negatively associating with the ê-Conjunct.

Intransitive Animate Verbs

Table 5.10: Univariate results for the Conjunct Type Alternation: VAIs

	N	χ^2	ê-Cnj	kâ-Cnj	Other-Cnjs
PV.Discourse	120	0.05	+	-	0
PV.Position	95	0.01	+	-	0
actor.1	1251	0.001	+	-	0
actor.3	2222	<0.001	+	0	-
RdplW	114	0.03	+	0	0
actor.2	207	<0.001	-	+	+
AI.do	1649	0.005	-	+	0
NA.persons.actor	545	<0.001	-	+	0
Sg.actor	392	<0.001	-	+	0
Pron.actor	292	<0.001	-	+	0
Prox.actor	91	<0.001	-	+	0
Dem.actor	149	<0.001	-	+	-
AI.health	99	0.001	-	0	+
Pl.actor	224	<0.001	0	+	-
Med.actor	56	0.05	0	+	0
PV.Time	1442	<0.001	0	-	+
PV.WantCan	45	<0.001	0	-	+
AI.cooking	222	0.03	0	-	0
PV.Qual	133	0.02	0	0	-
D.actor	164	0.003	0	0	-
NDA.Relations.actor	164	0.003	0	0	-
Px1Sg.actor	123	0.02	0	0	-

The VAIs showed a more varied result. Preverbs of discourse and position, as well as first person actors were positively associated with the ê-Conjunct and negatively associated with the kâ-Conjunct. Third person actors were positively associated with the ê-Conjunct and negatively associated with the Other-Conjunct. The final positive association for the ê-Conjunct was weak duplication, which was only significant for the ê-Conjunct. Verbs of action, as well as actors that were people, signular, pronouns, proximate, or demonstrative all positively associated with the kâ-Conjunct while negatively associating with the ê-Conjunct. Plural actors and medial actors were positively associated with the kâ-Conjunct, while preverbs of time, desire/ability and verbs of cooking were negatively associated with the outcome. Interestingly, the Other-Conjunct outcome regularly disagreed in association with the ê-Conjunct: with third person actors had a negative association with the ê-Conjunct, they had a negative association with the Other Conjunct, while the opposite pattern is seen with second person and verbs of health. Other positive associations with the Other-Conjunct outcome were preverbs of time (likely a result of

the ka-Conjunct necessarily having PV.ka, a preverb of time) and desire/ability. The class had negative effects in the form of demonstrative, plural, aand dependent actors, preverbs of quality, actors representing dependent relations, and actors possessed by a singular first person.

Transitive Inanimate Verbs

Table 5.11: Univariate results for the Conjunct Type Alternation: VTIs

	N	χ^2	ê-Cnj	kâ-Cnj	Other-Cnjs
PV.Position	45	0.002	+	-	-
actor.1	693	<0.001	+	0	-
PV.WantCan	51	<0.001	-	+	0
TI.speech	171	<0.001	-	+	0
NA.persons.actor	162	<0.001	-	+	0
Sg.goal	586	<0.001	-	+	+
NI.object.goal	512	<0.001	-	+	0
Dem.goal	216	<0.001	-	+	0
Pron.goal	216	<0.001	-	+	0
Prox.goal	122	<0.001	-	+	0
NI.nominal.goal	95	<0.001	-	+	+
actor.2	137	<0.001	-	0	+
Med.goal	94	0.05	-	0	0
D.goal	54	0.05	-	0	+
PV.Time	860	<0.001	0	-	+
Sg.actor	93	0.01	0	+	0
Pron.actor	88	0.05	0	+	0
actor.3	1195	0.05	0	0	-

The VTIs had only two positive associations for the ê-Conjunct: preverbs of position and first person actors. Second person actors and those which were people, along with singular, object, nominal, demonstrative, pronominal, proximal, medial and dependent goals all negatively associated with this outcome, as did verbs of speech and preverbs of desire/ability. Conversely, only two forms showed a negative association with the kâ-Conjunct: preverbs of position and time. All other significant effects, including preverbs of desire/ability; singular, pronominal, and person actors; verbs of speech; and goals representing objects, nominalized verbs, singular entities, demonstratives, pronouns, and proximals all occurred more often with the kâ-Conjunct than otherwise would be expected based on chance. Preverbs of position and first or third person actors were negatively associated with the Other-Conjunct, while singular, nominal, and dependent

goals were positively associated with the outcome. Beyond these, second person actors and preverbs of time were also positively associated with the Other-Conjunct.

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Table 5.12: Univariate results for the Conjunct Type Alternation: VTAs

	N	χ^2	ê-Cnj	kâ-Cnj	Other-Cnjs
PV.Time	863	<0.001	+	-	+
TA.cognitive	580	<0.001	+	-	+
actor.3	893	<0.001	+	-	-
goal.4	529	<0.001	+	-	-
PV.Position	39	0.01	+	-	0
goal.1	392	<0.001	+	0	-
PV.Discourse	58	0.03	+	0	-
TA.speech	576	<0.001	-	+	0
Sg.goal	195	<0.001	-	+	0
Prox.goal	66	0.02	-	+	0
actor.2	84	<0.001	-	0	+
goal.3	897	<0.001	-	0	+
goal.2	134	0.01	-	0	+
Prox.actor	31	0.01	0	+	0
Px1Sg.goal	67	0.04	0	0	-
actor.1	567	0.03	0	0	-

Results for the VTAs present a number of different significant effects for all outcomes. Preverbs of time, position, and discourse; third person actors, first person and obviative goals, and verbs of cognition all positively associated with the ê-Conjunct. Second and third person goals, proximate goals, singular goals, second person actors, and verbs of speech were all negatively associated with the outcome. The kâ-Conjunct was positively associated with proximate actors, proximate and singular goals, and verbs of speech. Preverbs of time and position, third person actors, obviative goals, and verbs of cognition were negatively associated with the outcome. Finally, preverbs of time, verbs of cognition, second person actor and goals, and third person goals all positively associated with the Other-Conjunct outcome; first person actors, third person actors, first person and obviative goals, and prevebs of discourse all negatively associated with the Other-Conjunct.

5.2 Bivariate Results

Before moving on to the multivariate analysis, the significant effects for each verb class in each alternation were tested for pairwise assoiciation. Pairs which were found to be bivariate (those with Theil's uncertainty coefficients (Henri, 1970b) of > 0.50, indicating that one the presence of absence of one variable provides information about the presence of abscence of another) were dealt with by removing one of the items in the pair. The item for removal was chosen based on its relevance and explanatory value, e.g. if D.goal and NDI.Body.goal are bivariate, the later provides more semantic information than the former, which simply says whether something is dependent.

The following section presents the effects that formed a bivariate pair along with the eventual list of effects to address this bivariance. The resulting list of effects will be used for multivariate analysis in the next subsection.

The bivariance results present the effects that form each bivariate pair (referred to as *category1* and *category2*), the number of tokens for each category (i.e. *N1* is the number of tokens for *category1*, *N2* is the number of tokens for *category2*). The resulting tables also include the number of tokens where each effect co-occur, represented in column *N12*.

5.2.1 Independent vs. Conjunct

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Table 5.13: Bivariate results for the Independent vs. Conjunct Alternation: VIIs

category1	category2	N1	N2	N12
NI.object.actor	Pron.actor	144	58	58
NI.object.actor	Dem.actor	144	57	57
Pron.actor	Dem.actor	58	57	57
Pron.actor	Med.actor	58	24	24
Dem.actor	Med.actor	57	24	24

Biavariance in the VIIs concerned actor variables. Every instance of both Pron.actor and Dem.actor were used along with the NI.object.actor tag. This may suggest that when demonstrative pronouns are used with VIIs as actors, they represent inanimate objects.

Similarly, the bivariate results in Table 5.13 also show that nearly all pronominal actors were demonstrative and that all demonstrative pronouns were medial; less interestingly, all medial pronouns coocurred with pronominal tags. To alleviate bivariance, Pron.actor and Dem.actor were removed, resulting in the following variables to be kept for multivariate analysis: PV.Time , II.sense , NI.object.actor , Med.actor .

Intransitive Animate Verbs

Table 5.14: Bivariate results for the Independent vs. Conjunct Alternation: VAIs

category1	category2	N1	N2	N12
NA.persons.actor	Pron.actor	737	405	405
NA.persons.actor	Dem.actor	737	201	201
Pron.actor	Dem.actor	403	201	201
actor.3	actor.1	3646	1836	0

Again, the VAI's bivariance for the Independent vs. Conjunct focused on actor variables. Whenever a demontrative or more general pronoun was observed so too was an actor from the NA.persons.actor class. As a consequence of demonstrative pronouns being pronouns, the two were similarly bivariate. Finally, third and first person actors were bivariate, as the latter never cooccured with the former. Pron.actor , Dem.actor , and actor.1 were removed to address bivariance, resulting in the following variables for multivariate analysis: PV.Time , PV.Move , PV.Qual , PV.StartFin , PV.Discourse , PV.Position , AI.do , AI.state , AI.speech , AI.cooking , AI.reflexive , AI.health , AI.pray , RdplW , NA.persons.actor , Sg.actor , Pl.actor , NA.beast.of.burden.actor , NA.food.actor , actor.3 , actor.2 , actor.4 .

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Table 5.15: Bivariate results for the Independent vs. Conjunct Alternation: VTIs

category1	category2	N1	N2	N12
TI.do	TI.cognitive	1632	1163	0
NA.persons.actor	Pron.actor	261	158	158
NA.persons.actor	Pers.actor	261	107	107
Pron.actor	Pers.actor	158	107	107
actor.3	actor.1	1508	1202	0
D.goal	NDI.Body.goal	64	55	55

The VTIs show a similar pattern as the above classes: Pronouns, and specifically personal pronouns, always occured with actors representing people, and personal pronouns were necessarily also pronouns. Similarly, all dependent goals having to do with body parts were also classified as dependent nouns. As in the VAI class, first and third person actors never cooccured. Finally, the two main verb classes, TI.do and TI.cognitive were also bivariate, never occurring together. To address this bivariance, TI.cognitive, Pron.actor, Pers.actor, actor.1, and D.goal were removed leaving the following variables: PV.Discourse, TI.do, TI.money.count, NA.persons.actor, actor.3, actor.2, Sg.goal, Pl.goal, NI.nominal.goal, NI.natural.force.goal, NDI.Body.goal, Px3Sg.goal, NI.place.goal, Der.Dim.goal, Px1Sg.goal.

Transitive Animate Verbs

Table 5.16: Bivariate results for the Independent vs. Conjunct Alternation: VTAs

category1	category2	N1	N2	N12
D.actor	NDA.Relations.actor	82	82	82
actor.3	goal.3	1266	1498	0

The VTAs had a much smaller set of covariates than pevious classes. All dependent actors representing people of close relation were also marked as dependent goals (for obvious reasons). Third person actors and goals were also bivariatre, never occurring together. Here, D.actor and actor.3, were removed, leaving the following variables for multivariate analysis: PV.Time, PV.Move, PV.Discourse, PV.Qual, PV.Position,

TA.speech , TA.cognitive , TA.do , TA.food , TA.money.count , NA.persons.actor , Sg.actor , NDA.Relations.actor , actor.1 , actor.4 , goal.3 , goal.4 , goal.2 , NA.persons.goal , Px3Pl.goal .

5.2.2 Independent vs. ê-Conjunct

Intransitive Inanimate Verbs

Table 5.17: Bivariate results for the Independent vs. Conjunct Alternation: VIIs

category1	category2	N1	N2	N12
Sg.actor	NI.object.actor	158	126	119
NI.object.actor	Pron.actor	126	48	48
Pron.actor	Dem.actor	48	47	47
Pron.actor	Med.actor	48	21	21
Dem.actor	Med.actor	47	21	21

Once again, the VII effects concerned only actors. Nearly every instance of NI.object.actor also occurred with Sg.actor . In turn, the Pron.actor tag always occurred with NI.object.actor while Dem.actor always occured with Pron.actor . Similarly, Med.actor always occurred with both Pron.actor and Dem.actor . Removing Sg.actor , Pron.actor , and Med.actor leaves PV.Time , II.sense , NI.object.actor , and Dem.actor as variables.

Intransitive Animate Verbs

There were no bivariate variables for VAIs in the Independent vs. ê-Conjunct alternation.

Transitive Inanimate Verbs

Table 5.18: Bivariate results for the Independent vs. Conjunct Alternation: VTIs

category1	category2	N1	N2	N12
TI.do	TI.cognitive	1281	1008	0
NA.persons.actor	Pron.actor	203	129	129
NA.persons.actor	Pers.actor	203	95	95
Pron.actor	Pers.actor	129	95	95
actor.3	actor.1	1184	1043	0

As in the previous alternation, verbs of cognition and verbs of action were bivariate in that they never occur together. Similar to other classes, Pron.actor and Pers.actor always occured with NA.persons.actor, and Pers.actor did the same with Pron.actor. Finally, third and first person actors never cooccured. To alleviate this covariance, effects of TI.Cognitive, Pron.actor, Pers.actor, and actor.1 were removed, leaving PV.Discourse, TI.do, TI.money.count, NA.persons.actor, actor.3, actor.2, Pl.goal, NI.natural.force.goal, NI.place.goal, Der.Dim.goal, Px1Sg.goal as the final set of variables for multivariate analysis.

Transitive Animate Verbs

Table 5.19: Bivariate results for the Independent vs. Conjunct Alternation: VTAs

category1	category2	N1	N2	N12
D.actor	NDA.Relations.actor	68	68	68
actor.3	goal.3	1060	1185	0

There were only two instances of bivariance: NDA.Relations.actor always occurred with D.actor, and third person actors and goals never occurred together (as one argument would need to be obviative in terms of Nêhiyawêwin grammar). D.actor and actor.3 were removed to produce the following set of variables: PV.Time, PV.Move, PV.Discourse, PV.Qual, PV.Position, PV.StartFin, TA.speech, TA.cognitive, TA.do, TA.food, Sg.actor, D.actor, NDA.Relations.actor, actor.1, actor.4, actor.2, goal.3, goal.4, NA.persons.goal, Px3Sg.goal, and Px3Pl.goal

5.2.3 Conjunct Type

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Table 5.20: Bivariate results for the ê-Conjunct vs. kâ-Conjunct vs. Other-Conjunct Alternation: VIIs

category1	category2	N1	N2	N12
Sg.actor	NI.object.actor	134	119	110

The single instance of bivariance for the VIIs in the Conjunct Type alternation was the relationship between Sg.actor and NI.object.actor, where the latter nearly always occured alongside the former. Removing the Sg.actor prodice the variable set: PV.Time, II.sense, II.natural.land, II.weather, NI.object.actor.

Intransitive Animate Verbs

Table 5.21: Bivariate results for the ê-Conjunct vs. kâ-Conjunct vs. Other-Conjunct Alternation: VAIs

category1	category2	N1	N2	N12
NA.persons.actor	Pron.actor	545	292	292
NA.persons.actor	Dem.actor	545	149	149
Pron.actor	Dem.actor	292	149	149
Pron.actor	Prox.actor	292	91	91
Pron.actor	Med.actor	292	56	56
D.actor	NDA.Relations.actor	164	164	164
D.actor	Px1Sg.actor	164	123	123
NDA.Relations.actor	Px1Sg.actor	164	123	123
Dem.actor	Prox.actor	149	91	91
Dem.actor	Med.actor	149	56	56

In the VAIs, Pron.actor and Dem.actor always cooccured with NA.persons.actor; both Dem.actor, Prox.actor, and Med.actor were always accompanied by Pron.actor; NDA.Relations.actor and Px1Sg.actor always coccured with D.actor; Px1Sg.actor was always accompanied by NDA.Relations.actor. Finally, both Prox.actor and Med.actor always cooccured with Dem.actor. Removing Prox.actor, Pron.actor, Dem.actor, Med.actor, D.actor, Px1Sg.actor results in the following variables: PV.Time, PV.Qual, PV.Discourse, PV.Position, PV.WantCan, AI.do, AI.cooking, AI.health, RdplW, NA.persons.actor, Sg.actor, Pl.actor, NDA.Relations.actor, actor.3, actor.1, actor.2.

Transitive Inanimate Verbs

Table 5.22: Bivariate results for the ê-Conjunct vs. kâ-Conjunct vs. Other-Conjunct Alternation: VTIs

category1	category2	N1	N2	N12
NA.persons.actor	Pron.actor	162	88	88
actor.3	actor.1	1195	693	0
Dem.goal	Pron.goal	216	216	216
Dem.goal	Prox.goal	216	122	122
Dem.goal	Med.goal	216	94	94
Pron.goal	Prox.goal	216	122	122
Pron.goal	Med.goal	216	94	94

The bivariance for VTIs in the Conjunct Type Alternation concerned mostly goal related variables. The variables Pron.goal , Prox.goal , and Med.goal always cooccured with Dem.goal . Both Prox.goal and Med.goal cooccured with Pron.goal . Removing Pron.actor , actor.1 , Dem.goal , Pron.goal results in: PV.Time , PV.WantCan , PV.Position , TI.speech , NA.persons.actor , Sg.actor , actor.3 , actor.2 , Sg.goal , NI.object.goal , Prox.goal , NI.nominal.goal , Med.goal , D.goal .

Transitive Animate Verbs

Table 5.23: Bivariate results for the ê-Conjunct vs. kâ-Conjunct vs. Other-Conjunct Alternation: VTAs

category1	category2	N1	N2	N12
actor.3	goal.3	893	897	0

The final class to discuss is the VTA, which had only a single bivariate pair. In this pair, actor.3 and goal.3 never occurred together. Removing Actor.3 results in the final set of variables: PV.Time , PV.Discourse , PV.Position , TA.cognitive , TA.speech , Prox.actor , actor.1 , actor.2 , goal.3 , goal.4 , goal.1 , goal.2 , Sg.goal , Px1Sg.goal , Prox.goal .

5.3 Multivariate results

The following section details the results of the multivariate logistic regressions described in Chapter 4. These results are presented as a set of tables where each row represents a fixed effect (i.e. those effects identified in the previous section). In addition, each table contains a row labelled *Intercept*. The intercept represents a log-odds of 0 for all included effects. As well, the intercept can be seen as representing the effect for the aggregate of all the implicit values that are excluded from the set of variables used in modeling. As Agresti points out, the intercept is not usually of much explanatory value (Agresti, 2013, 165). Each effect is reported with an estimate and a *p*-value. Only effects where p is less than 0.05, unrounded, are reported. A summary table is given for each of the four verb classes in each of the three alternations being studied.

5.3.1 Independent vs. Conjunct

In this alternation, all effects are reported for their influence on the occurrence of an **Independent** form. If an effect is negative, its occurrence is less likely to occur with an Independent form, and more likely to influence a verb to occur in the Conjunct. In the inverse, a positive effect indicated an effect is more likely to influence a verb to occur in the Independent and less likely to do so for the Conjunct.

Intransitive Inanimate Verbs

Table 5.24: Multivariate results for the Independent vs. Conjunct Alternation: VIIs

	Independent	
	Estimate	*p*-value
(Intercept)	-1.370	< 0.001
PV.Time	0.673	0.001

In the alternation between the Independent and the Conjunct generally, the VIIs had only a single significant effect: preverbs of time, which increase the likelihood of an Independent form. In fact, of the 204 Independent forms, 81 contained a preverb of time, the vast majority of which (57) were the past tense `PV.ki`, as in (25) and (16).

(15) “êy, **kî-miywâsin**,” itwêw, nôcikwêsiw ana ...
Hey, **life used to be good** she said, old woman that ...
‘ “Hey, life used to be good” she said, that old woman ...’ (Bear et al., 1992, 74)

(16) **kî-âyiman** ôtê ka-pê-wîcihiwêyân maskwacîsihk ...
it was hard here I to come live maskwacîsihk ...
‘it was hard to come live here at maskwacîsihk ...’ (Minde, 1997, 2)

In each of the above examples, the verbs represent matrix clause verbs, particularly in (16) where an embedded verb, *ka-pê-wîcihiwêyân*, appears in a Conjunct form. This characterization of the Independent as a matrix form and the Conjunct as an embedded form fits with the description of the Order in Cook (2008).

Intransitive Animate Verbs

Table 5.25: Multivariate results for the Independent vs. Conjunct Alternation: VAIs

	Independent	
	Estimate	*p*-value
(Intercept)	-1.379	< 0.001
PV.Discourse	-0.944	0.001
actor.obv	-0.812	0.001
Sg.actor	-0.472	0.003
PV.Time	0.182	0.013

Again, time increased the likelihood of the Independent, but there are now variables that increase the Conjunct. Discourse preverbs were the most strongly affecting Conjunct, closely followed by obviative actors. Less strongly effecting a Conjunct form is the sg.actor effect. This image of the Conjunct as a form dealing with a preverb of discourse and a non-proximal actor suggests that the Conjunct is an Order that represents a a structure beyond simple declarative clauses.

(17) êkwa, wîhkât nânitaw **kâ-isi-mâyinikêhkâtocik** ôki nêhiyawak
and, ever simply they act thus badly towards each other these Cree
...
...

In (17) we see a Conjunct type verb, *kâ-isi-mâyinikêhkâtocik*, which takes the discourse preverb *-isi-*. A large number of the Independent forms in this alternation and verb class are simply the quotative *itwêw*: 919 of 2157 tokens, to be exact. Despite this, the verb class AI.Speech was not found to be a significant effect on the Independent Order.

Transitive Inanimate Verbs

Table 5.26: Multivariate results for the Independent vs. Conjunct Alternation: VTIs

	Independent	
	Estimate	*p*-value
(Intercept)	-0.199	0.121
PV.Discourse	-2.064	< 0.001
TI.money.count	-1.914	0.019
NI.place.goal	-1.441	0.026
NDI.Body.goal	-1.032	0.044
actor.3	-0.793	< 0.001
NI.nominal.goal	-0.759	0.009
TI.do	-0.766	< 0.001
actor.2	0.372	0.038
NA.persons.actor	0.495	0.001
Px1Sg.goal	1.613	0.005

The VTIs had many significant effects. As with the other classes, the majority of these effects showed influence towards a Conjunct paradigm. Again the Conjunct has to do with discourse. Verbs of action and verbs of money/counting also increased Conjunct. Place goals, nominalized goals, and body part goals similarly increased the likelihood of the Conjunct, as did the third person actors. Person actors and especially second person actors, as well as those with goals possessed by first persons. This suggests the Independent to be an Order more related to local participants or those dependent on them as in (18), while the Conjunct is more likely to have an overt goal and a non-local actor, as in (30).

(18) ... **kikiskêyihtênâwâw** kîstawâw ...
... **you all know it** you all also ...
'... **you all know this** ...' (Ahenakew, 2000, 40)

(19) ... kayâs ayis ês ... **ê-kî-wêpinahkik** ... wîwatiwâwa ...
... long ago for evidently ... **s/he throws it away** ... their medicine-bundles ...
'... for long ago evidently **they had thrown away** their medicine-bundles ...'
(Ahenakew, 2000, 164)

Notably, unlike the VII and VAI classes, preverbs of time were not significant effects for either outcome. Curiously, the prescence of overt goals of any sort were not significant for the Independent Order. Perhaps the most striking aspect of these results, is that no semantic class of overt goals produced a significant effect in modelling the Independent. It is unclear why this might be, though the fact that the Conjunct outcome had more than double the number of observations than the Independent may be the cause.

Transitive Animate Verbs

Table 5.27: Multivariate results for the Independent vs. Conjunct Alternation: VTAs

	Independent	
	Estimate	*p*-value
(Intercept)	-0.386	0.423
TA.food	-1.723	0.007
PV.Position	-1.026	0.014
actor.obv	-0.921	< 0.001
PV.Move	-0.612	0.005
PV.Time	-0.342	< 0.001
Sg.actor	-0.608	0.044
goal.2	-0.487	0.034
NA.persons.goal	-0.352	0.010
goal.obv	-0.314	0.029
actor.1	0.485	< 0.001

For VTAs, verbs which regarded food strongly motivated Conjunct forms. Preverbs of position, movement, and time all increased the likelihood of the Conjunct Order, as did obviative actors/goals, person goals, and singular actor. Only one effect was associated with the Independent in the VTAs, that of first person actors. In this class, it seems the Conjunct Order is, unlike in other cases, non-present in nature, as well as being modified by preverbs. Independent still associated with a local actor, but not second person. That Conjunct is associated with obviative fits with the VII and VAI classes.

(20) êkwatowihk aya ... êkwatowa ê-itikot, manicôsa ê-mowikot,"
‘ um ... like that’ s/he says to him insect.OBV s/he eats him/her
kî-itwêw mâna
He said but/also/used to
‘fing pagex’ (Cecila Masuskapo (Chapter 2))

In (20) we see a VTA, *ê-mowikot*, that represents not only verbs of food and eating, but also those that have an obviative actor.

It is worth noting that the *only* significant effect for the Independent VTAs was first person actors. This discrepency may simply be written off as an issue of data sparsity, as there were 1071 Independent TAs in this alternation and 1931 Conjunct forms, though this difference In data size is not so big that one would expect numerous effects to be significant for the Conjunct while only one was so for the Independent.

5.3.2 Independent vs. ê-Conjunct

As in the previous alternation, positive effects represent an influence of an effect on producing an Independent form; here, however, negative effects represent an increase in likelihood specifically of the ê-Conjunct form.

Intransitive Inanimate Verbs

Table 5.28: Multivariate results for the Independent vs. ê-Conjunct Alternation: VIIs

	Independent	
	Estimate	(*p*-value)
(Intercept)	-0.932	< 0.001
PV.Time	0.654	0.003

As in the alternation between the Independent and the general Conjunct, the VIIs had only one significant effect: preverbs of time, which increased the likelihood of observing an Independent form.

Intransitive Animate Verbs

Table 5.29: Multivariate results for the Independent vs. ê-Conjunct Alternation: VAIs

	Independent	
	Estimate	(*p*-value)
(Intercept)	-1.529	< 0.001
PV.Discourse	-1.087	< 0.001
PV.Time	0.204	0.008
actor.3	0.373	0.007
actor.1	0.632	< 0.001

In the VAIs, discourse preverbs again strongly effected ê-Conjunct forms in the VAIs, while all other significant effects increased the likelihood of the Independent Order: preverbs of time and first and third person actors. The latter of these presented to strongest Independent effects.

These results suggest again an Independent form which is more focused in simple declarative structures, as in (21), where the main verb *kî-atoskêw* take an Independent form.

(21) êwakw âna mâna nisis, Sam Minde, **kî-atoskêw**
There it is that one habitually father-in-law's brother, Sam Minde, **worked**
pêyakwan âta kâ-minihkwêt
similar although he drinks.
'My father-in-law's brother, Sam Minde, **still used to work** the same, even when he drank (Minde, 1997, 102).'

There are no significant effects in the form of semantic classes for the actual verb lemmas. This is true even in spite of the fact that nearly 21% of all Independent VAIs were forms of *itwêw*, 'S/he says.' This quotative is tagged as a AI-Speech verb, yet this effect was not found to be significant in the logistic prediction models for the Independent vs. ê-Conjunct alternation.

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Table 5.30: Multivariate results for the Independent vs. ê-Conjunct Alternation: VTIs

	Independent	
	Estimate	(*p*-value)
(Intercept)	0.188	0.193
PV.Discourse	-2.366	< 0.001
TI.money.count	-2.029	0.019
NI.place.goal	-1.604	0.018
TI.do	-0.912	< 0.001
actor.3	-0.797	< 0.001
NA.persons.actor	0.583	0.001
actor.2	0.851	< 0.001
Px1Sg.goal	1.275	0.043

For VTIs in the Independent vs. ê-Conjunct Alternation, preverbs of discourse again strongly increased the likelihood of an ê-Conjunct form. Unlike the previous verb classes, VTIs also contained significant effects in terms of semantic classes. Verbs of money and action, as well as goals representing places all increased the likelihood of an ê-Conjunct form. Additionally, third person actors corresponded to the ê-Conjunct outcome. Actors representing people, second person actors, and goals possessed by first person actors all increased the likelihood of the Independent Order.

(22) êkoni kahkiyaw ê-kî-wâpahtamân tânis âya **ê-kî-isi-paminahkik** kîkway ...
those all I saw how hm **they look after it** something ...
'I saw all these things, how **they looked after** things ...' (Minde, 1997, 96).

In (22), *ê-kî-isi-paminahkik* represents a third person action verb with a discourse preverb that heads a non-main clause and occurs in the ê-Conjunct. It is worth noting, however, that the main verb in this excerpt, *ê-kî-wâpahtamân* is also in the ê-Conjunct. Using the information from Cook (2008) and the hypothesis that the Conjunct in general is a less *main* or indexical than the Independent, one might expect that *ê-kî-wâpahtamân* to occur in the Independent.

Transitive Animate Verbs

Table 5.31: Multivariate results for the Independent vs. ê-Conjunct Alternation: VTAs

	Independent	
	Estimate	(*p*-value)
TA.food	-1.648	0.003
PV.Position	-1.342	0.001
PV.Discourse	-1.108	0.003
actor.obv	-0.801	0.005
PV.Move	-0.506	0.032
PV.Time	-0.331	0.001
actor.1	0.539	0.001
actor.2	1.807	< 0.001

In the Transitive Animate Verb class, verbs to do with food and preverbs of discourse strongly influenced a verb to occur in the ê-Conjunct. Preverbs of discourse and position, along with verbs with an obviative actor, were mild effects influencing the ê-Conjunct. More mild effect, preverbs of movement and time, were also present. Local actors were moderate to strong effects, with second person actors being the most strong effect and increased the likelihood of the Independent. This again suggests the ê-Conjunct as a marked form associated with discursively marked and less proximate actions, as well as those displaced in time. This is reflected in (23), where the main verb, *ê-kî-ayi-mâkohikot* is given in the ê-Conjunct.

(23) iyikohk mâna **ê-kî-ayi-mâkohikot** anihi wîhtikowa tâpwê ...
so much truly **he pressed him** that windigo.OBV truly ...
'And he was truly pressed upon by that windigo ...' (Ahenakew, 2000, 34)

5.3.3 Conjunct Type: ê-Conjunct vs. kâ-Conjunct vs. Other-Conjunct

The final alternation detailed in this section is multinomial: ê-Conjunct, kâ-Conjunct, and Other-Conjunct forms. As a result, while a positive effect for, as an example, an ê-Conjunct outcome does represent an increased likelihood of ê-Conjunct forms, a negative effect for the same one can not be interpreted as an effect toward some other specific outcome as in the previous alternations. Instead, a negative effect can simply be said to

represent a decrease in likelihood for a given outcome. This is because, while in previous alternations there were only two possible options (and thus the absence of one implies the presence of the other), in multinomial results framed through a one-vs-rest heuristic, the absence of one outcome implies the presence of *any* other possible outcomes. In the tables below, the estimates are given in each cell, with a *p* value being given underneath in parenthesis.

Intransitive Inanimate Verbs

Table 5.32: Multivariate results for the Conjunct Type Alternation: VIIs

	ê-Conjunct	**kâ-Conjunct**	**Other**
	Estimate (*p*-value)	Estimate (*p*-value)	Estimate (*p*-value)
(Intercept)	1.468 (0.004)	-2.554 (< 0.001)	-2.452 (< 0.001)
II.weather		1.596 (0.017)	

In Intransitive Inanimate Verbs, there was a single significant effect: weather verbs strongly increased the likelihood of the kâ-Conjunct. This effect was not significant for other outcomes.

(24) mâka mân ânohc **kâ-kîsikâk** kâ-mâmitonêyihtamân ...
but used to today **it is today** I think about it ...
'But when I think of it today ...' (Bear et al., 1992, 218)

(25) ... âta **kâ-kimiwahk** ...
... allthough **it is raining** ...
'... even when it was raining ...' (Minde, 1997, 36)

In (25), *kâ-kîsikâk* is used nominally. The kâ-Conjunct seems to represent a non-hypothetical conditional form, as opposed to the relativized form as with other verb classes.

Intransitive Animate Verbs

Table 5.33: Multivariate results for the Conjunct Type Alternation: VAIs

	ê-Conjunct	**kâ-Conjunct**	**Other**
	Estimate (*p*-value)	Estimate (*p*-value)	Estimate (*p*-value)
(Intercept)	0.923 (< 0.001)	-1.342 (< 0.001)	-3.052 (< 0.001)
actor.2	-1.147 (< 0.001)		1.849 (< 0.001)
Sg.actor	-0.695 (0.001)	0.633 (0.004)	
actor.1	0.471 (< 0.001)	-0.553 (< 0.001)	
NDA.Relations.actor	0.561 (0.028)		-2.744 (0.01)
actor.3	0.563 (< 0.001)	-0.653 (< 0.001)	
RdplW	0.616 (0.027)		
PV.Discourse	0.791 (0.003)	-0.719 (0.024)	
PV.Position	1.101 (0.001)	-0.985 (0.014)	
PV.WantCan		-1.227 (0.048)	1.83 (< 0.001)
AI.cooking			
PV.Qual			-1.637 (0.026)
AI.health			1.359 (0.005)
NA.persons.actor		0.379 (0.04)	
Pl.actor		0.578 (0.015)	

As previously, effects were far more numerous for VAIs than VIIs. Second person actors decreased the likelihood of the ê-Conjunct while increasing the likelihood of the Other-Conjunct class. Singular actors decreased the likelihood of the ê-Conjunct but increases the likelihood of the kâ-Conjunct, as do third person actors, preverbs of discourse, and

preverbs of position (the latter most strongly). Actors belonging to the class of dependent relations increased the likelihood of ê-Conjunct but strongly decrease the likelihood of the Other-Conjunct class. The final class which affects the the ê-Conjunct is the presence of weak/light reduplication, which acted as an effect for no other outcome. Preverbs of desire/ability strongly decreased the likelihood the kâ-Conjunct and similarly increased the likelihood of the Other-Conjunct. Verbs of cooking moderately decreased the likelihood of the kâ-Conjunct. Preverbs of quality and verbs of health had strong effects on the Other-Conjunct, the former a negative effect and the latter a positive. Finally, actors representing people and plural actors more generally had a mild effect increasing the likelihood of a kâ-Conjunct.

(26) ... êkosi namôya kikiskêyihtênânaw tânitê **ê-isi-pimohtêcik** êkwa
... êkosi NEG we all know it where **they walked thus** and
kitôsk-âyiminawak ...
our kids ...
'... so we do not know where our young people are going ...' (Vandall and Douquette, 1987, 42-43)

(27) â, anohc kâ-kîsikâk, êwak ôhc êtikwê ayisiyiniw **kâ-maskawâtisit** ...
â, today today, this from perhaps person **s/he who is strong** ...
'Well, that must be the reason why people are so strong today ...' (Bear et al., 1992, 364)

(28) tânisi k-êtôtamân, **mêstohtêyêko**
what I will do, **when you have all passed away**
pê-miyikawiyâni wêpinâson ...
if someone comes and gives me flag ...
'What will I do when you are all gone if someone comes and gives me cloth ...' (Bear et al., 1992, 128)

In this alternation as in others, the ê-Conjunct is associated with first and second persons, and those with preverbs of discourse and position, as in (26). The majority of the kâ-Conjunct effects were negatively related, with the only positive effects being actor based: Sg.actor, Pl.actor, and NA.persons.actor, as seen in (27). The effects of the Other-Conjunct don't seem to form a cohesive class, though a verb with a second person

actor and verb of health (in this case, *mêstohtêyêko*, meaning 'when you have all passed away'), is represented in (28).

Transitive Inanimate Verbs

Table 5.34: Multivariate results for the Conjunct Type Alternation: VTIs

	ê-Conjunct Estimate (*p*-value)	**kâ-Conjunct** Estimate (*p*-value)	**Other** Estimate (*p*-value)
(Intercept)	1.468 (< 0.001)	-2.361 (< 0.001)	-2.652 (< 0.001)|
actor.2	-1.21 (< 0.001)		1.847 (< 0.001)
Prox.goal	-1.039 (< 0.001)	0.898 (0.001)	
PV.WantCan	-1.031 (0.003)	1.365 (< 0.001)	
TI.speech	-0.776 (0.024)	0.817 (0.021)	
NI.nominal.goal	-0.753 (0.007)		0.86 (0.013)
Sg.goal	-0.479 (0.015)		
PV.Position	2.362 (0.002)	-2.19 (0.035)	-2.203 (0.045)
NA.persons.actor		0.791 (0.002)	
NI.object.goal			-0.988 (0.004)
Med.goal			0.983 (0.014)

In the Conjunct Type alternation for VTIs, second person actors strongly decreased the likelihood of the ê-Conjunct while similarly increasing the likelihood of an Other-Conjunct outcome. Proximate goals, preverbs of desire and ability, and verbs of speech all strongly decreased the likelihood of the ê-Conjunct while strongly increasing the kâ-Conjunct. Nominalized goals strongly decreased the likelihood of the ê-Conjunct, but instead of being significant in the kâ-Conjunct outcome, this effect strongly increased the likelihood to the Other-Conjunct. Singular goals had a moderate negative effect on

the ê-Conjunct outcome alone. Preverbs of position had extremely strong effects for all outcomes: positive for the ê-Conjunct and negative for the other outcomes. Person actors strongly increased the likelihood of the kâ-Conjunct, and inanimate objects negatively influenced the Other-Conjunct outcome. Finally, medial goals strongly increased the likelihood of the Other-Conjunct class.

These results do not create clear profiles of these outcomes. What can be abstracted is that the ê-Conjunct is less likely to be used with proximal goals, less likely to be a verb of speech, and more likely to indicate physical positionality (as in (29)); that the kâ-Conjunct is more likely to have a proximal goal, have a person actor and not have a preverb of position (as in (30)); and the Other outcome has a second person actor, a medial goal and no a preverb of position (as in (31)).

(29) ... môy **ê-ohci-kaskihtâyâhk** ka-kîsowihkasoyâhk ...
... no **we did not manage** we get warm ...
'... **we did not manage** to get warm ...' (Minde, 1997, 116)

(30) ôhi wiya kayâhtê ayisiyiniwak **kâ-kî-âpacihtâcik** ...
this that before people **those who used to use** ...
'The things that **people used to use** formerly ...' (Bear et al., 1992, 294)

(31) kwayask êkwa anita **ta-kakwê-pimipayihtâyêk** anima kâ-nêhiyawêyêk ...
effort and there **you all try to operate it** this you who speak Cree ...
'**you should make a serious effort** to keep speakings your Cree' (Whitecalf, 1993, 26)

Transitive Animate Verbs

Table 5.35: Multivariate results for ê-Conjunct vs. Other Conjuncts Alternation: VTAs

	ê-Conjunct Estimate (*p*-value)	**kâ-Conjunct** Estimate (*p*-value)	**Other** Estimate (*p*-value)
(Intercept)			-2.601 (0.022)
actor.2	-1.595 (< 0.001)		1.829 (< 0.001)
Prox.actor	-0.938 (0.021)	1.324 (0.001)	
Sg.goal	-0.46 (0.039)	0.585 (0.012)	
actor.1	0.432 (0.007)		-0.751 (0.001)
Px1Sg.goal	0.695 (0.048)		
PV.Discourse	1.359 (< 0.001)		-2.463 (0.018)
PV.Position	1.775 (0.004)	-1.459 (0.05)	
TA.cognitive		-0.428 (0.048)	0.667 (0.016)

Results for the VTAs were similar to those for VTIs. Second person actors strongly decreased the likelihood of the ê-Conjunct and increased the likelihood of the Other-Conjunct outcome. Proximate actors and singular goals were strong and moderate effect decreasing the likelihood for the ê-Conjunct outcome and increasing the likelihood of the kâ-Conjunct. First person actors mildly increased the likelihood of the ê-Conjunct and had a strong negative effect for the Other-Conjunct outcome. Goals possessed by singular first persons were a strong effect for the ê-Conjunct. Preverbs of discourse had a strong positive effect for the ê-Conjunct and a very strong negative effect for the Other-Conjunct. Position preverbs strongly increased the likelihood for the ê-Conjunct and decreased the likelihood of the kâ-Conjunct. Finally, the only verb semantic class that showed a significant effect were those verbs of cognition, which had a moderate negative effect on the kâ-Conjunct and a strong positive effect for the Other-Conjunct.

This creates a profile wherein the ê-Conjunct is associated with first person actors as well as preverbs of discourse, similarly to the way the outcome is framed in the Independent vs. ê-Conjunct alternation. This is exemplified in (32). The kâ-Conjunct class had fewer positive effects, but a verb with a proximate actor (and lacking a position preverb) that has not to do with speech is presented in (33). Finally, the Other Conjunct class as embodied by second person actors on verbs of cognition and a lack of discourse preverb is presented in (34).

(32) ... mêkosi piko ê-isi-wîhtamâtakok ...
... that is all only I tell you about it thus ...
'... that is all I am telling you ...' (Kâ-Nîpitêhtêw, 1998, 66)

(33) ... ahpô êtikwê awa ê-wî-kiskinohtahikoyâhk ...
... maybe it s/he is going to show us the way ...
'... maybe it is going to show us the way ...' (Bear et al., 1992, 130)

(34) ... ka-kitâpamâyêkok iskwêwak ôtê ê-sâkaskinêkâpawicik ...
... you all look at them women over there they stand crowded ...
'... for you watch these women standing crowded over there ...' (Kâ-Nîpitêhtêw, 1998, 126)

5.4 Model Statistics

In assessing the results detailed above, we must also scrutinize the predictive models that produce such results. Arppe (2013) provides a function for this, `modelstats`. This function reports details specifics of how predictive models operate, how often they predict a correct outcome, measures of precision vs recall, tau (τ) measures of how much better than the baseline proportions the model's classifications are, and pseudo-R2 (ρ^2) measures, a measure of *reduction* is baddness-of-fit.

In the following subsections, tables for each of the verb classes are given for each alternation. For the final, tripartite, alternation being studied, a model statistic table is given for each of the outcomes (e.g. ê-Conjunct vs all-other Conjunct forms (*other*). In the model statistics tables, column names with circumflexes over their entirety (e.g. $\widehat{\text{CNJ}}$ and $\widehat{\text{IND}}$) represent how many times the model *predicted* an outcome. Rows without circumflexed titles (e.g. CNJ represents observed outcomes used to train the model. The

cells represent how often a token with a predicted outcome was actually observed with a particular outcome (e.g. the cell $C_{CNJ|\widehat{IND}}$ represents how many Conjunct tokens were predicted to be Independent.).

For all verb classes in the Independent vs. Conjunct alternation, overall model accuracy was roughly 75%. The τ score for the VIIs were 0.35 (representing a moderate increase in model classification efficacy over a baseline), the VAI model had a slightly better score of 0.50, and both VTI and VTA models have τ scores of 0.41. Though the VAI, VTI, and VTA models have slightly large τ values, these are all still only moderate values.

The VII, VTI, and VTA models all have moderate ρ^2 values, of 0.14 (for the VIIs) to 0.18 (for the VTIs and VTAs). The VAI model, on the other hand, has a moderate-to-large ρ^2 value of 0.26. This represents a well fitting model.

In terms of recall and precision, all models show a very high recall for the Conjunct outcome, usually around 90%. Recall for Independent were usually around 35% to roughy 50%. The VII model had a much smaller Independent recall, at only 13%. Precision scores for this alternation were similar for all classes: in predicting the Conjunct, the VII model was 75% precise, the VAI model was 79% precise, and both the VTI and VTA models were 77% precise. In predicting the Independent, the VII models had 65% precision, the VAI models had 74% precision, the VTI model had 67% precision, and the VTA model had 65% precision.

In general, for the Independent vs. Conjunct alternation, all classes appear to have much higher recall than precision for the Conjunct than the Independent. Precision was also higher for the Conjunct than the Independent, but to a lesser extent than in recall.

5.4.1 Independent vs. Conjunct

Table 5.36: VII Independent vs. Conjunct

	$\widehat{\text{CNJ}}$	$\widehat{\text{IND}}$
CNJ	562	44
IND	141	46
Accuracy	0.77	
τ	0.35	
ρ^2	0.13	
	CNJ	IND
Recall	0.93	0.25
Precision	0.80	0.51

Table 5.37: VAI Independent vs. Conjunct

	$\widehat{\text{CNJ}}$	$\widehat{\text{IND}}$
CNJ	3973	282
IND	1045	1037
Accuracy	0.79	
τ	0.53	
ρ^2	0.27	
	CNJ	IND
Recall	0.93	0.50
Precision	0.79	0.79

Table 5.38: VTI Independent vs. Conjunct

	$\widehat{\text{CNJ}}$	$\widehat{\text{IND}}$
CNJ	1982	176
IND	561	336
Accuracy	0.76	
τ	0.42	
ρ^2	0.16	
	CNJ	IND
Recall	0.92	0.38
Precision	0.78	0.66

Table 5.39: VTA Independent vs. Conjunct

	$\widehat{\text{CNJ}}$	$\widehat{\text{IND}}$
CNJ	1765	207
IND	541	494
Accuracy	0.75	
τ	0.45	
ρ^2	0.21	
	CNJ	IND
Recall	0.90	0.48
Precision	0.77	0.71

The models for the Independent vs. Conjunct alternation performed reasonably well. The VII model was reasonably accurate at 77%. The model had a 93% recall for Conjunct and a 25% recall for the Independent. Precision for each outcome are similarly disparate, at 80% for the Conjunct and 51% for the Independent. While the recall and precision scores for the Conjunct outcome seem to suggest an accurate model, the Independent rates suggest a more mediocre model. The ρ^2 measure of 0.12 similarly suggests a middling model, as did a τ measure of 0.35 (suggesting model is only slightly better than baseline classification). The VAI model showed similar accuracy (79%), Conjunct

recall (93%), and a Conjunct precision (79%), though Independent recall was higher at 50% and 79%. The τ and ρ^2 measures were also notably higher: the former at 0.53 and the latter at 0.27. These measures suggest a model with a decent increase over baseline in terms of classification and a large reduction in badness of fit (thus reflecting a model that well describes the variance). The VTI model showed a similar profile as the VII, with an overall accuracy of 76%, a Conjunct recall of 92% and precesion of 78%, with an Independent recall of 38% and precision of 66%. The VTI τ of 0.42 suggest a somewhat mediocre increase in classification over baseline, while the ρ^2 of 0.16 suggest a mediocre model fit. Conversely, the VTA model patterns more closely to the VAI model. The VTA model had an overall accuracy of 75%, a Conjunct recall of 90%, a Conjunct precision of 77%, an Independent recall of 48% and an Independent precision of 0.71. While the τ is mediocre at 0.45, the ρ^2 of 0.21 represents a well fit model.

5.4.2 Independent vs. ê-Conjunct

Table 5.40: VII Independent vs. ê-Conjunct

	ê-CNJ	IND
ê-CNJ	378	33
IND	131	73
Accuracy	0.73	
τ	0.40	
ρ^2	0.17	
	ê-CNJ	IND
Recall	0.92	0.36
Precision	0.74	0.69

Table 5.41: VAI Independent vs. ê-Conjunct

	ê-CNJ	IND
ê-CNJ	2834	266
IND	987	1170
Accuracy	0.76	
τ	0.51	
ρ^2	0.27	
	ê-CNJ	IND
Recall	0.91	0.54
Precision	0.74	0.82

Table 5.42: VTI Independent vs. ê-Conjunct

	ê-CNJ	IND
ê-CNJ	1322	193
IND	468	490
Accuracy	0.72	
τ	0.44	
ρ^2	0.20	
	ê-CNJ	IND
Recall	0.85	0.55
Precision	0.74	0.73

Table 5.43: VTA Independent vs. ê-Conjunct

	ê-CNJ	IND
ê-CNJ	1083	269
IND	409	662
Accuracy	0.72	
τ	0.43	
ρ^2	0.22	
	ê-CNJ	IND
Recall	0.80	0.62
Precision	0.73	0.71

The models in the Independent vs. ê-Conjunct alternation were generally well fitting, with the exception of the VII model. This model had an accuracy of 73%, an ê-Conjunct recall and precison of 92% and 74% respectively, and an Independent recall and precision of 36% and 69%. The model's τ measure was mediocre at 0.40 and its ρ^2 was similar at 0.17. The VAIs showed an increase in nearly all measures: accuracy was 76%, ê-Conjunct recall and precision were 91% and 74%, Independent recall and precision were 54% and 82%, τ was measured at 0.51 (representing a decent increase over baseline in classification), and its ρ^2 was a relatively high 0.27, representing a large reduction

in badness of fit. The VTI model was slightly less effective, with a 72% accuracy, an ê-Conjunct recall and precision of 85% and 74%, an Independent recall and precision of 55% and 73%. The model's τ score was mediocre at 0.44 and a relatively robust ρ^2 of 0.20, representing a very good fit. The VTA model's accuracy was 72%, its ê-Conjunct recall and precision were 80% and 73%, and Independent recall and pecision were 62% and 71%. Finally, the VTA model had a τ 0.43, representing a slight increase in classification over baseline, and a ρ^2 of 0.22, representing a very good reduction in badness of fit.

5.4.3 Conjunct Type

The models for the Conjunct Type alternation were more generally varied and, contrary to the previous alternation, it was not always the case that the VAIs and VTAs showed the best results. In general, the models were not very good at predicting kâ-Conjunct forms, with both precision and recall being *much* higher for the other outcome.

ê-Conjunct

Table 5.44: VII Conjunct Types: ê-Conjunct vs other

	$\widehat{\text{ê} - \text{Cnj}}$	$\widehat{\text{other}}$
ê-Cnj	375	36
other	73	112
Accuracy	0.82	
τ	0.57	
ρ^2	0.33	
	ê-Cnj	other
Recall	0.91	0.61
Precision	0.84	0.76

Table 5.45: VAI Conjunct Types: ê-Conjunct vs other

	$\widehat{\text{ê} - \text{Cnj}}$	$\widehat{\text{other}}$
ê-Cnj	3013	87
other	921	211
Accuracy	0.76	
τ	0.39	
ρ^2	0.17	
	ê-Cnj	other
Recall	0.97	0.19
Precision	0.77	0.71

Table 5.46: VTI Conjunct Types: ê-Conjunct vs other

	$\widehat{\text{ê-Cnj}}$	$\widehat{\text{other}}$
ê-Cnj	1450	65
other	412	185
Accuracy	0.77	
τ	0.44	
ρ^2	0.22	
	ê-Cnj	other
Recall	0.96	0.31
Precision	0.78	0.74

Table 5.47: VTA Conjunct Types: ê-Conjunct vs other

	$\widehat{\text{ê} - \text{Cnj}}$	$\widehat{\text{other}}$
ê-Cnj	1278	74
other	431	179
Accuracy	0.74	
τ	0.40	
ρ^2	0.17	
	ê-Cnj	other
Recall	0.95	0.29
Precision	0.75	0.71

The VII model showed a significantly better fit than the models previously reported. The model has an accuracy of 82%, and ê-Conjunct recall and precision of 91% and 84% and some other Conjunct outcome recall and precision of 61% and 76%. The model had a τ measure of 0.57 and a very high ρ^2 of 0.33, representing a very well fit model. The VAI model was significantly less well fitting with an accuracy of 76%, an ê-Conjunct recall and precision of 97% and 77% and other Conjunct outcome recall and precision of 19% and 71%. The VAI had a somewhat disappointing τ of only 0.39 and a ρ^2 measure of 0.17, representing only a slight reduction in badness of fit. The VTI model performed similarly

in most measures: accuracy was rated at 77%, ê-Conjunct recall at 96%, precision at 78%, other outcome recall at 31% and precision at 74%. The model's τ was 0.44, representing a moderate increase of classification over baseline, and the ρ^2 was 0.22, representing a very good reduction in badness of fit. The final model for this outcome, the VTA model, was less well fit. The VTA model accuracy was rated at 74%, ê-Conjunct recall and precision were 95% and 75%, other outcome recall and precision at 29% and 71%, a moderate τ score of 0.40, and a ρ^2 of 0.17, indicating a only moderate reduction in badness of fit.

kâ-Conjunct

Table 5.48: VII Conjunct Types: kâ-Conjunct vs other

	kâ − CNJ	other
kâ-CNJ	84	77
other	30	405
Accuracy	0.82	
τ	0.54	
ρ^2	0.33	
	kâ-CNJ	other
Recall	0.52	0.93
Precision	0.74	0.84

Table 5.49: VAI Conjunct Types: kâ-Conjunct vs other

	kâ − CNJ	other
kâ-CNJ	53	766
other	26	3387
Accuracy	0.81	
τ	0.40	
ρ^2	0.16	
	kâ-CNJ	other
Recall	0.07	0.99
Precision	0.67	0.82

Table 5.50: VTI Conjunct Types: kâ-Conjunct vs other

	kâ − CNJ	other
kâ-CNJ	36	284
other	18	1774
Accuracy	0.86	
τ	0.44	
ρ^2	0.19	
	kâ-CNJ	other
Recall	0.11	0.99
Precision	0.67	0.86

Table 5.51: VTA Conjunct Types: kâ-Conjunct vs other

	kâ − CNJ	other
kâ-CNJ	23	373
other	13	1553
Accuracy	0.80	
τ	0.39	
ρ^2	0.13	
	kâ-CNJ	other
Recall	0.06	0.99
Precision	0.64	0.81

The kâ-Conjunct outcome models were, overall, less robust than previous models. As in the ê-Conjunct, the VII model was very well fit, with an accuracy of 84%. Interestingly, the kâ-Conjunct recall was low, at only 52%, though precision was at a less deviant 74%. The other outcome recall was quite high at 93% and precision was similar at 84%. The model had a τ of 0.54, representing a decent increase of classification, and a ρ^2 of 0.33, indicating a very well fit model. The VAI was far less effective than the VII model. Accuracy for VAIs was relatively high at 81%, though the kâ-Conjunct recall and precision were very low at 7% and 67% indicate a poor prediction model. The other outcome recall and precision were very high at 99% and 82%. The τ and ρ^2 measures were 0.40 and 0.16 respectively, indicating a model with only a mediocre fit. The VTIs were similar with an accuracy of 86%, kâ-Conjunct recall and precision of 11% and 67%, other outcome recall and precision of 99% and 86%, a τ measure of 0.44, and a ρ^2 of 0.19. Finally, the VTA model was even less well fit, with an accuracy of 80%, kâ-Conjunct recall and precision of 6% and 64%, other outcome recall and precision of 99% and 81%, a τ measure of 0.39 and a ρ^2 of only 0.13.

Other Conjunct

The Other-Conjuncts (that is, the ka-/ta-Initial, Initial Change, and Subjunctive Conjuncts) models had extremely high recall, precision for Other-Conjuncts with a very low recall for other outcomes. In general, these models were very well fit, with large τ and ρ^2 measures.

For VIIs, the model had an accuracy of 96%, Other-Conjunct of 4% and 50% and an alternate outcome recall and precision of 100% and 96% . The model showed a decent improvement in classification resulting in a τ measure of 0.48, and the model had a ρ^2 of 0.33, showing a very good model fit. The VAI model was similar, with an accuracy of 93%, Other-Conjunct recall and precision of 11% and 81% and an other outcome recall and precision of 100% and 93%. The model's τ measure was high, at 0.51, and a strong reduction in badness of fit, indicated by ρ^2 of 0.27. The VTIs had similar results, with an accuracy of 88%, Other-Conjunct recall and precision of 13% and 70%, other outcome recall and precision of 99% and 88%, a τ of 0.47 and a ρ^2 of 0.28. Finally, the VTAs continued this trend with an accuracy of 91%, Other-Conjunct recall and precision of

Table 5.52: VII Conjunct Types: Other-Conjunct vs other

	Other − CNJ	other
Other-CNJ	1	571
other	1	23
Accuracy	0.96	
τ	0.48	
ρ^2	0.33	
	Other-CNJ	other
Recall	0.04	1.00
Precision	0.50	96

Table 5.53: VAI Conjunct Types: Other-Conjunct vs other

	Other − CNJ	other
Other-CNJ	8	3911
other	35	278
Accuracy	0.93	
τ	0.51	
ρ^2	0.27	
	Other-CNJ	other
Recall	0.11	1.00
Precision	0.81	0.93

Table 5.54: VTI Conjunct Types: Other-Conjunct vs other

	Other − CNJ	other
Other-CNJ	16	1819
other	37	240
Accuracy	0.88	
τ	0.47	
ρ^2	0.28	
	Other-CNJ	other
Recall	0.13	0.99
Precision	0.70	0.88

Table 5.55: VTA Conjunct Types: Other-Conjunct vs other

	Other − CNJ	other
Other-CNJ	6	1742
other	38	176
Accuracy	0.91	
τ	0.52	
ρ^2	0.27	
	Other-CNJ	other
Recall	0.18	1.00
Precision	0.86	0.91

18% and 86%, other outcome recall and precision of 100% and 91%, a τ of 0.52 and a ρ^2 of 0.27.

5.5 Exemplar Extraction

The fitted value of a mixed effects logistic model presents a set of probability estimates for every lemma that represent the likelihood of a lemma occurring in a particular outcome. Given the lemma token *itêw* for the VTA Independent vs. ê-Conjunct model, the lemma token produces a probability estimate of 0.85. Thus, there is an 85% chance that the token will occur in the Independent Order; conversely, there is a 15% chance of it occurring in

the ê-Conjunct. These probability estimates allow for the easy extraction of forms most likely to be in one Order over another. By making use of the clause indices that every lemma is marked for, one can extract the most exemplary clauses which may prove useful in educating students of language on how and when to use each Order.

Based on the work of Arppe (2008), I first create dataframes for each conjugation class in each of the three alternation types. These data frames include only the significant effects identified in Chapter 5. Unlike the clustering done in Chapter 3, no distance matrix is used as dataframe is entirely logical.[2] Hierarchical Agglomerative Clustering is used on the logical matrix, to create prototypical classes from which exemplars can be extracted. To determine the appropriate number of clusters to be used, silhouette analysis (Rousseeuw, 1987) was used. In this technique, a *silhouette* is calculated which represents the distance of a cluster member to other members of the same cluster, the distance of a cluster member to all objects in other clusters, and finally the distance of a cluster members to all members of the next nearest cluster (Rousseeuw, 1987). Using these measures, an silhouette is calculated which ranges from -1 (representing an item that certainly misclustered) to +1 (representing an item that is certainly properly clustered). When the silhouette is equal 0, it is unclear where the item belongs, and so can be said to lie between clusters (Rousseeuw, 1987).

Using the `fviz_silhouette` function from the `factoextra` library in `R` (Kassambara and Mundt, 2020), I selected the number of clusters that created an average silhouette (the average silhouette for all classes divided by the number of classes) as close to 1 as possible. This results in some individual classes with low silhouettes, though it ensures the overall clustering is as well fit as possible. In some cases, an average silhouette of 1 could not be achieved even after a large amount of clusters were added. In this case, the highest possible silhouette (in all such cases this was a silhouette of 0.99) with the lowest number of clusters was chosen. In most cases, an optimal number of clusters ranged from 5-50, though in some cases such as the Independent vs. Conjunct VTAs, this number was much higher. Table 5.56 details the optimal number of clusters for each alternation and each class.

[2]When a distance matrix was created, it was functionally just an ordered list with each cell being a distance of 1 from its adjacent neighbor.

Table 5.56: Number of silhouettes used for clustering

		VII	VAI	VTI	VTA
IND V. CNJ		4	17	77	110
IND V. ê-CNJ		4	20	42	55
Cnj Type		4	20	42	55
	ê-CNJ	2	50	69	31
	KÂ-CNJ	4	53	22	16
	Other CNJ	2	13	21	11

From these results, only those exemplars where the predicted outcome matched the *actual* outcome were selected. While all such exemplar verbs and their relevant indices are included in APPENDIX HERE, only the five (or fewer, if there were fewer than five correctly predicted exemplars) exemplars with the highest probability estimates per *outcome* are included. Note that, for the binary alternations, probabilities closer to 0 represent an alternative outcome (i.e. *not Independent*), while the those closer to 1 represent the predicted variable outcome (i.e. *Independent*). For multinomial outcomes, probabilities closer to 0 represent an 'other' form, but this can not be specified further. As such, it is more useful to look only at those numbers closest to 1. For the sake of presentation, the alternative outcome probabilities will be given in the form of $1 - \texttt{probability}$, so that an estimate of 0.1 in the Independent vs. Conjunct alternation (indicating a likely Conjunct form) will be presented as a Conjunct probability of 0.99.

The following sections detail these exemplars. As before, sources are given by the corpus codes (e.g. *AL* for the corpus AL-RL-C.FIN) along with the line number where the exemplar occurs, which are may be accessed by contacting Dr. Antti Arppe. A list of corpus codes and the full name of the corpus file is given in Appendix A and Appendix B. Where translations are quoted verbatim from official translation publications, the relevant book and page numbers are included. Next to the corpus ID and line number is the estimated probability of occurring in a particular outcome. Where official translations were not easily available, only word-by-word glosses are given. The verbs which are being evaluated are in bold face.

5.5.1 Independent vs. Conjunct

Inanimate Intransitive Verbs

Independent

(35) otâkosihk ma cî wiya **kî-pêhtâkwan** kwayask. (CMBK-5-2 20; 0.69)
yesterday NEG Q for it was heard properly

(36) aya mîna nikî-âtotên kayâs, (AL 976; 0.54)
ah, and I told about this long ago,

namôy wîhkâc **ohci-pêhtâkwan** ... (AL 976; 0.54)
not ever **it was heard** ...

There were only two classes containing VIIs with probability estimates of over 0.50 (that is, where the model predicted an Independent form). In both cases, these were past tense forms of *pêhtâkwan*, 'it is heard.' In the first instance, example (35), the verb is used in an interrogative clause.

Conjunct

(37) "tâpwê anim âkosi sâsay **ê-ispayik** (C2GB 40; 0.99)
"truly that thus already **s/he fares thus**

anima kâ-kî-itwêt," itwêw (C2GB 40; 0.01)
that s/he said," s/he said

It is true, and some of what he had said is happening already ... (Bear et al., 1992, 80-81)

(38) êkosi anima mîna êwako **ê-kî-ispayik** mâna ... (SW 41; 0.97)
so that and that **it fared thus** used to ...
That is the way this used to happen ... (Whitecalf, 1993, 36-37)

For the Conjunct, there were also only two classes with probability estimates of less than 0.50. Both instances are forms of the lemma *ispayin* 'it happens thus.' In both cases, the predicted verbs seem to carry the main semantic meaning of the utterance, and both appear to be in past tense forms, though in (37) this does not appear to be marked morphologically. This comports with the finding that the Conjunct Order is some how

less immediate, as discussed previously. The Conjunct forms are well predicted, with the lowest probability being 0.97.

Animate Intransitive Verbs

Independent

(39) vamps aniki, âha, 'asêsinwa' **kî-itwêwak**. (AL 1144; 0.84)
vamps those yes 'asêsinwa' **they said**

(40) ... nititwân mâna, tâspwâw mâna wiya niya **nititwân** ... (SW 140; 0.82)
... I say usually, in fact usually by contrast I **I say** ...
... I usually say, as for myself, as a matter of fact, I usually say ... (Whitecalf, 1993, 76)

(41) êkwa êkosi **kî-itwêw** ana kisêyiniw ... (VDC2 1061-1062; 0.79)
and this **he said** that old man ...
and this is what that old man said ... (Vandall and Douquette, 1987, 106-107)

(42) "a play ôm ê-wî-ayâyâhk ôtê Sandy Lake," (AA 33; 0.75)
"a play then we are going to have over here Sandy Lake,"

itwêw ... (AA 33; 0.75)
he said ...

"that we are going to have a play over here at Sandy Lake," he said ... (Ahenakew, 2000, 44)

(43) **ê-kî-wîhkitisit** mâna, ban- bannock ê-kî-osîhât ... (C6IC 12; 0.5)
It tasted good used to, ban- bannock she made it ...
The bannock used to taste good, and she used to make it ... (Bear et al., 1992, 148)

Of the top five Independent exemplars, all but one were forms of the verb *itêw*, 's/he says.' Used as a quotative in each of these cases, the expected probabilities ranged from 0.75 to 0.84, suggesting decent confidence in the prediction of an Independent outcome. The only non-quotative exemplar, *ê-kî-wîhkitisit* 'It tastes good,' resulted in a remarkably unconfident model which predicted a 0.50 likelihood of the lemma occurring in the Independent form.

Conjunct

(44) ... êkot[a] êkwa kikâh-kî-wîcêwâw (JK 8; 0.97)
... there and you repeatedly got along with him

tânis **ê-isi-mawimoscikêt**. (JK 8; 0.97)
how **he prays thus**

... then you would be able to join him in his way of worship (Kâ-Nîpitêhtêw, 1998, 51)

(45) ... otôsk-âyima êkâ kwayask **ê-isi-wîcêhtoyit**. (JK 6; 0.97)
... young people not properly **they get along with one another**.
... if their young people do not get along with one another. (Kâ-Nîpitêhtêw, 1998, 14)

(46) ... ôma tânisi ê-ispayik, tânisi **ê-kî-isi-mawimoscikêcik** (VDC2 1050-1051; 0.97)
... this how it is, how **they prayed about it so**

nêhiyawak kayâs ... (VDC2 1050-1051; 0.97)
Cree long ago ...

(47) ... kîtahtawê êsa mâna êkwa kî-môyêyihtamwak ... (SW 140; 0.96)
... suddenly apparently used to and they were aware of it

ayisiyiniwak, tânêhki ohci anihi mistahi **kâ-pê-kitoyit** êkota ... (SW 140; 0.96)
people, why from that much **he comes to hoot** then ...

... and then people would realize why he had come to hoot there ... (Whitecalf, 1993, 39)

(48) môy mâka wîhkâc ohci-wîhtamwak awiyiwa (CMBK-5-2 110; 0.95)
not still ever they tell about it someone

anihi **kâ-kî-itahkamikisiyit**, êha. (CMBK-5-2 110; 0.95)
that **she behaves thus**, yes.

Unlike the Independent outcome, there appears to be more variety in regards as to what lemmas occurred in the top five Conjunct exemplar forms. Further, estimated probabilities were much higher, with the model predicting all five exemplars with above a 95% confidence. In all cases, these exemplars showed clearly an subordination as described by Cook (2014) and Wolfart (1973). For example, in (44), the already subordinate clause *êkot*[*a*] *êkwa kikâh-kî-wîcêwâw tânis ê-isi-mawimoscikêt* contains

the exemplar verb *ê-isi-mawimoscikêt*. Here, *ê-isi-mawimoscikêt* references the way someone prays and is subbordinate to the main verb of this clause, *kikâh-kî-wîcêwâw* 'you would be able to join him'. Similarly, in (47) the predicted verb *kâ-pê-kitoyit* is apart of the relative clause subordinate to the maing verb, *kî-môyêyihtamwak* 'They were aware of it.' As previously, the estimated probabilities were quite high, with the lowest of the five exemplars being 0.95

Transitive Inanimate Verbs

Independent

(49) "nikêhcinâhon ôki iskwêsisak, nikotwâw ê-kimotamawicik," (C7MW 75; 0.80)
"I am sure these girls, anytime they stole it from me,"

nititêyiht- **nititêyihtên** ôma niminihkwâcikan. (C7MW 75; 0.80)
I thou **I think** this my cup

"I am sure one of these girls has stolen it from me," I thought with respect to my cup (Bear et al., 1992, 180).

(50) **kikiskêyihtên** kiya? (AL 558; 0.80)
you understand you?

(51) «kiya **kikaskihtân** ê-osîhtâyan,» nititik (AA 76; 0.74)
«you **you are able** you make it,» s/he says to me
"You, you have been able to make it," she says to me (Ahenakew, 2000, 68-69)

(52) nîsta **niwî-nipahi-cîhkêyihtên** (CMBK-3-2 182; 0.76)
I too **I am really going to like it**

(53) «kiyâm tâpwêhta, môy **kika-mihtâtên**,» ê-kî-isit mâna. (CMBK-4-2 114; 0.74)
«please truly, not **you will regret it**» s/he says to me used to.

Independent VTI exemplars mostly had to do with cognition/emotion verbs with the {-yih-} morph. The exception to this is in (51), where a form of *kaskihtâw*, 's/he is able to' occurs in the Independent. Interestingly, in this case the the main verb *ê-osîhtâyan*, 'you make it,' is in the Conjunct, while the Indepdendent verbs is acting more as an abilitative. This is somewhat different from what might be expected based on the previous literature as well as the results of this dissertation (which would predict the main verb to occur in

Indpendent and the abilitative verb to be in a Conjunct); however, it is possible to view the *ê-osîhtâyan* as object of the complementizer phrase *kiya kikaskihtân*. Under this analysis, *ê-osîhtâyan* is c-commanded by *kiya kikaskihtân*. According to (Cook, 2014, 129), if a clause with an antecedent c-commands a clause that refers to it, there exists a relationship of anaphora. Alternatively, if an term referes to a previously stated element, then it also licenses anaphora (Cook, 2014, 129). In either case, if the goal implicit in the VTI *kikaskihtân*, 'you are able to do it' is referring forward to *ê-osîhtâyan*, then then the anaphoric element would be considered *ê-osîhtâyan*. Under this analysis, one would expect this to occur in a Conjunct form, as it does. The estimate probabilities were lower, ranging from 0.73-0.80

Conjunct

(54) kahkiyaw kîkway 'mînisa' k-êsiyîhkâtêki, nanâtohk **ê-kî-isi-osîhtât** (VDC2 315-317; 0.00)
all thing berry it is called, variety **s/he made him**

kîkway wiyâs, ê-osîhtât îwahikana ê-môwât. (VDC2 315-317; 0.00)
what meat, s/he makes it pounded meat s/he eats him.

All these things that are called 'berries', they prepared them in various ways, they prepared the meat and ate pounded meat. (Vandall and Douquette, 1987, 56-57)

(55) â, êkosi pêyakwâw êkota ê-kî-otahot ayi, (C7MW 86; 0.99)
ah, so once there she beat me well,

wiyê [sic] nawac ê-kî-kiskêyihtahk ê-isi- kîkway **ê-isi-osîhtât**. (C7MW 86; 0.99)
for [sic] before s/he knew it ê-isi- what **s/he makes it**

well, and so in that she knew better than I how to make something, this once she did beat me. (Bear et al., 1992, 192-193)

(56) êkwa aya, aya, pêyakwâw ê-kiskisiyân iyikohk ê-kî-miyokihtâyâhk (EM 117; 0.01)
and uh, uh, once I recall when we grew well

askipwâwa, êkosi mân **ê-kî-isi-tipahamâhk**, mitâtahtomitanaw-maskimot
potatoes, thus used to **we measured it thus**, one hundred bags
ê-kî-ayâyâhk (EM 117; 0.01)
we had it

And I remember once, when we grew such a good crop of potatoes, that is how we measured them, we had one hundred bags (Minde, 1997, 84-85)

(57) "kây, êkâya mâto! ê-nôhtêhkatêt ana wîst ôm ê- (C4MF 68; 0.99)
"no, do not cry! s/he is hungry that one s/he too it is this ê-

ê-wâpamiko- ê-wâpahtahk ôma wiyâs **ê-nôhtê-mîcit**," (C4MF 68; 0.99)
ê-wâpamiko- s/he sees it actually meat **s/he wants to eat it**

"Do not cry! That one is hungry, too, and it sees this meat and wants to eat it," (Bear et al., 1992, 112-115)

(58) ... ê-wî-nanâskomot, matotisân ôma **kâ-wî-osîhtât**. (JK 42; 0.98)
... he gives him thanks, sweat lodge actually **he is going to make it**
... that he is about to give thanks, the one who is about to make a sweat lodge (Kâ-Nipitêhtêw, 2007, 84)

The Conjunct exemplars for VTIs were mostly made of forms of *osîhtâw*, 's/he makes it.' In examples (54), (55), and (58) the exemplar verbs were third person singular forms of *osîhtâw*. These verbs occurred in both main and subordinate clauses. Examples (56) and (55) show clearly subordinate clauses. Further, in (56), *ê-kî-isi-tipahamâhk* contains a discourse preverb, while in (57) the exemplar verb *ê-nôhtê-mîcit* is desiderative. The Conjuncts were very well predicted with the lowest estimated probability being 0.99.

Transitive Animate Verbs

Independent

(59) sapiko mân êkosi **nititâwak** nôsisimak, «kayâs ôma (cmbk-4-v2 304; 0.79)
actually used to thus **I say to them** my grandkids, long ago FOC

niyanân mistahi ê-kî-atoskêyâhk ... (cmbk-4-v2 304)
we much we worked ...

(60) ... ômisi mâna **nikî-itâwak** nitawâsimisak ... (EM 66; 0.73)
... thus used to **I said thus to them** my children
... I used to tell my children as follows ... (Minde, 1997, 36)

(61) “îwahikanak niwî-osîhâwak,” **nititâwak** awâsisak. (AL 407; 0.73)
“pounded meats I’m going to make them,” **I say to them** children
“I’m going to make pounded meat,” I told my children. (Bear et al., 1992, 206-207)

(62) “nôsisim!” **nititik** ... (C2GB 14; 0.70)
my grandchildren **I said** ...
“My grandchild!” I said ... (Bear et al., 1992, 68-69)

(63) ... miton ês âwa nôcikwêsiw, “ayiwêpitân,” (C4MF 23; 0.63)
... very apparently this old lady let’s rest

itêw êsa okosisa ... (C4MF 23; 0.63)
she says to him apparently her son ...

... and the old lady aid to her son, “Let’s rest;” ... (Bear et al., 1992, 106-107)

The top five Independent exemplars for the VTAs were all forms of *itwêw*, ‘s/he says to him/her.’ Specifically, each of these tokens were quotatives reporting exact speech. Perhaps unsurprisingly, these tokens were in either first or third person, but not second. Given the nature of the corpus (speeches or conversations), this is unsurprising. In all but one instance, (60), these quotatives all had present tense morphology. Outside of these five exemplars, there was one instance of a non-*itwêw* form occurring in the Independent and being correctly identified as such by the model, *kinisitohtâtinâwâw*, ‘I understand you all’; however, in this instance, the predicted probability was only 0.57, representing a relatively uncertain prediction. Generally, estimate probabilities were lower for this group than previous ranging from 0.63 to 0.79.

Conjunct

(64) îh, êwako anima êsa kayâs êkosi (SW 140; 0.98)
look, this the fact that apparently long ago so

ê-kî-pê-isi-kakêskimâcik otôsk-âyimiwâwa ... (SW 140; 0.98)
they came and counselled thus their young over there

Look, in this wise long ago did they use to counsel their young people ... (Whitecalf, 1993, 76-77)

(65) ... kita-wâpamikot, **ê-pê-minihkwâtâyit**, itwêw. (VDC2 485-486; 0.97)
... looking at him **s/he comes to trade it for a drink** he says
... looking at him, he said, to trade it for a drink (Vandall and Douquette, 1987, 68-69)

(66) ... wâposwa ê-kî-nipahât **ê-wî-kakwê-asamikoyâhk** wiya ... (C8GB 13; 0.97)
... rabbits he killed **they're going to try to feed us** they ...

(67) ... âta tâpiskôc êkâya kîkway wiyasiwêwin wîyawâw (C8GB 232-234; 0.97)
... though like nothing law they

... **ê-ohci-tâwiskâkocik**, nânitaw itinikêtwâwi. (C8GB 232-234; 0.03)
... **they aren't subject to it** something bad when they act thus

... even though it looked as if they were not subject to any formal law when they did do something wrong. (Vandall and Douquette, 1987, 50-51)

(68) êkosi ôma aspin, "ay, kayâs nôcokwêsiw (VDC2-RES 561-562)
so that finally "hey, long ago old lady

ka-wayawî-pakamahosk!" nititikwak. (VDC2-RES 561-562)
she throws you out!" they say to me

So at the end they say to me "hey, for sure, then, the old lady would throw you out, and with a vegence!" they say to me. (Vandall and Douquette, 1987, 74-75)

The Conjunct exemplars for the Independent vs. Conjunct VTA set were mostly subordinate verbs, such as *ê-pê-minihkwâtâyit* 'comes to trade a drink for it' (in (65)) or *ê-wî-kakwê-asamikoyâhk*, 'to try to feed all of us' (in (66)). These results comport with the general descriptions of Order in the literature. Exemplars were all highly predicted, with the Conjunct exemplars never being lower than 0.96.

5.5.2 Independent vs. ê-Conjunct

Intransitive Inanimate Verb

Independent

(69) ... otâkosihk ma cî wiya **kî-pêhtâkwan** kwayask. (CMBK-5-2 20; 0.85)
... yesterday not Q for **it was heard** properly
... Was it not heard properly yesterday? (Ahenakew, 2000, 109-110)

(70) aya mîna **nikî-âtotên** kayâs, namôy wîhkâc ohci-pêhtâkwan ... (AL 976; 0.74)
ah, and **I told** long ago, not ever it was not heard ...

As in the previous alternation, there were fewer than five exemplars available for each outcome in the VII class. Here, there are only two exemplars for the Independent. Given this number, it is hard to draw conclusions, though it is worth noting that in both cases the exemplar verb was a negative form of *pêhtâkwan*, 'it is heard'. The difference between the two exemplars in estimated probabilities ranged from 0.74 to 0.85.

Conjunct

(71) "tâpwê anim âkosi sâsay **ê-ispayik** (C2GB 40; 0.99)
"truly that thus already **s/he fares thus**

anima kâ-kî-itwêt..." (C2GB 40; 0.99)
that s/he said..."

"It is true, and some of what he had said is happening already ... (Bear et al., 1992, 80-81)

(72) êkosi anima mîna êwako **ê-kî-ispayik** mâna ... (SW 41; 0.92)
so that and this **it happens** used to ...
That is the way this used to happen ... (Whitecalf, 1993, 37-38)

(73) ê-pânisamihk anima kahkiyaw, nama kîkway **ê-ohci-wêpinikâtêk**. (EM 97; 0.50)
someone cuts it that all nothing **it is not lost**.
it was cut, and nothing was wasted (Minde, 1997, 120).

The ê-Conjunct outcome had three exemplars, two of which are of the verb *ispayin*, 'it happens.' In (72) and (73) the exemplars are semantically past. Like the Independent, the Conjunct had a large range in estimated probabilities, ranging from 0.50 to 99.

Animate Intransitive Verbs

Independent

(74) '... môy kîhtwâm êkwa nika-pakitinâw wîhkâc awâsis,' **nikî-itwân** ôma
... no again and I will let go never children **I said** this
(CMBK-3-2 170; 0.90)

‘I will not ever let the children go again,’ I said this (Ahenakew, 2000, 44)

(75) nititwân mâna, tâspwâw mâna wiya niya **nititwân** ... (SW 140; 0.88)
I say usually, in fact usually for I **I say**
I usually say, as for myself, as a matter of fact, I usually say ... (Whitecalf, 1993, 76)

(76) êkwa êkosi **kî-itwêw** ana kisêyiniw ... (VDC2 493-494; 0.88)
and so **s/he said** that old man ...
and this is what that old man said. (Vandall and Douquette, 1987, 106-107)

(77) “a play ôm ê-wî-ayâyâhk ôtê Sandy Lake,” (AA 33; 0.85)
“a play then we are going to have over here Sandy Lake,”

itwêw ... (AA 33; 0.75)
he said ...

“that we are going to have a play over here at Sandy Lake,” he said ... (Ahenakew, 2000, 44)

(78) ‘â, mahti! pâmwayês miton ôtâkosik, nika-nitawi-minihkwahastimwân’,
‘well, please! before quite it is evening, I will water the horses,’
k-êtwêyan, **kikî-itwân** ... (CMBK-3-2 488; 0.82)
you said, **you said** ...

As with the previous alternation, the VAI exemplars were all forms of *itwêw*, ‘s/he said.’ In all examples other than (75), the exemplar verbs were semantically past, though not always morphologically so. Given the nature of quotatives, this is perhaps unsurprising. All exemplars were relatively well predicted, with estimated probabilities ranging from 0.89 and 0.88.

Conjunct

(79) ... otôsk-âyima êkâ kwayask **ê-isi-wîcêhtoyit**. (JK 7; 0.97)
... their young people not right **they get along thus**.
... if their young people do not get along with one another. (Kâ-Nîpitêhtêw, 1998, 48-49)

then you would be able to join him in his way of worship (Kâ-Nîpitêhtêw, 1998, 50).

simply got up dirty, I guess (Bear et al., 1992, 210-211).

simply got up dirty, I guess (Bear et al., 1992, 240-241).

(83)

Transitive Inanimate Verbs

Independent

(84) **kikiskêyihtên** kiya? (AL 558; 0.89)
you know you?

(85) kiya **kikaskihtân** ê-osîhtâyan (AA 76; 0.88)
you **you manage it** you prepare it

(86) kiyâm tâpwêhta, môy **kika-mihtâtên** (CMBK-4-2 114; 0.87)
so agree, not **you regret it**

(87) ... môy mâka wîhkât niya wiya **nôh-cîhkêyihtên** ôma (CMBK-4-2 128; 0.87)
... not but ever I for **I like it** this

'radio' k-êsiyîhkâtêk (CMBK-4-2 128; 0.87)
'radio' it is called thus

(88) ... wiya kiyânaw **kikaskihtânaw** kîkway ka-kî-nipahtamâsoyahk ...
... FOC we all **we all succeed** what we all killed it for ourselves
(C2GB 45; 0.80)

As previously, in examples (85), (86), and (87) demonstrate the use of the Independent as the main verb in a multiverb phrase. Interestingly, all examples but 87 were in second person, and all forms had speech act participants as actors. estimated probabilities range from 0.87 and 0.90.

Conjunct

(89) kahkiyaw kîkway 'mînisa' k-êsiyîhkâtêki, nanâtohk **ê-kî-isi-osîhtât** (VDC2 315-317; 1.00)
all thing berry it is called, variety **s/he made him**

kîkway wiyâs, ê-osîhtât îwahikana ê-môwât. (VDC2 315-317; 0.00)
what meat, s/he makes it pounded meat s/he eats him.

All these things that are called 'berries', they prepared them in various ways, they prepared the meat and ate pounded meat (Vandall and Douquette, 1987, 56-57).

(90) êkwa aya, aya, pêyakwâw ê-kiskisiyân iyikohk ê-kî-miyokihtâyâhk (EM 117; 0.99)
and uh, uh, once I recall when we grew well ...

askipwâwa, êkosi mân **ê-kî-isi-tipahamâhk**, mitâtahtomitanaw-maskimot
potatoes, thus used to **we measured it thus**, one hundred bags
ê-kî-ayâyâhk (EM 117; 0.01)
we had it

And I remember once, when we grew such a good crop of potatoes, that is how we measured them, we had one hundred bags ... (Minde, 1997, 84-85) ...

(91) ... mêtoni mân **ê-kî-kanâcihtâcik** êkwa mân ê-kî-kaskâpasahkik. (EM
... very used to they cleaned it and used to they smoked it
268; 0.98)

(92) ... âhci piko pêyakwan iyikohk ê-kî-isi-môcikêyihtamihk. (CMBK-3-2 271;
... still only similar until s/he was excited about this.
0.98)

(93) ê-nôhtêhkatêt ana wîst ôm ê- ê-wâpamiko- ê-wâpahtahk ôma wiyâs
s/he is hungry this one he too and ê- ê-wâpamiko- s/he shows it that meat
ê-nôhtê-mîcit ... (C4MF 68; 0.97)
s/he wants to eat it ...
That one is hungry, too, and it sees this meat and wants to eat it ...

Transitive Animate Verbs

Independent

(94) ... môy êkw êkonik mîna **kikî-wîhâwak** ... (AL 1284; 0.91)
... no and those and **you relied on them**
... now you can't even rely on them ... (Bear et al., 1992, 342-243)

(95) â, **kitayâwâwak** cî (AL 106; 0.86)
ah **you have** them Q
Ah, do you have any of that? (Bear et al., 1992, 250-251)

(96) ... sapiko mân êkosi **nititâwak** nôsisimak ... (CMBK-4-2 304; 0.85)
... actually used to so **I say about** my grandchildren ...

(97) ... **itâwak** mân ôki niwâhkômâkanak ... (EM 160; 0.77)
... **someone says about** used to FOC my relatives ...

(98) ... ômisi mâna **nikî-itâwak** nitawâsimisak ... (EM 66; 0.73)
... thus used to **I told them** my children ...
I used to tell my children as follows (Minde, 1997, 36)

Three of the five top exemplars (examples (94), (96), (98)) were forms of *itêw*, 's/he speaks/tells about someone). In each of the five VTA exemplars, the target verbs were the main, and in fact *only*, verbs in their clauses. Estimated probabilities ranged form 0.73 to 0.91.

Conjunct

(99) îh, êwako anima êsa kayâs êkosi **ê-kî-pê-isi-kakêskimâcik**
look, this that apparently long ago so **they come and counsel them thus**
otôsk-âyimiwâwa ... (SW 140 0.98)
young people ...
Look, in this wise long ago did they use to counsel their young people ... (Whitecalf, 1993, 76-77)

(100) ... wâposwa ê-kî-nipahât **ê-wî-kakwê-asamikoyâhk** wiya
... rabbits s/he kills him
... (C8GB 13; 0.97)
they are going to try to feed us for ...

(101) ... kita-wâpamikot, **ê-pê-minihkwâtâyit**, itwêw. (VDC2 485-486; 0.97)
... looking at him **s/he comes to trade it for a drink** he says
... looking at him, he said, to trade it for a drink (Vandall and Douquette, 1987, 68-69)

(102) ... âta tâpiskôc êkâya kîkway wiyasiwêwin wîyawâw (C8GB 232-234; 0.96)
... though like nothing law they

... **ê-ohci-tâwiskâkocik**, nânitaw itinikêtwâwi. (C8GB 232-234; 0.96)
... **they aren't subject to it** something bad when they act thus

... even though it looked as if they were not subject to any formal law when they did do something wrong (Vandall and Douquette, 1987, 50-51).

(103) miton êsa mân êkotê ê-kî-isi-sôhkêpitikocik (cmbk-5-2 72; 0.96)
very apparently used to over there they promote them thus

The majority of the exemplars for the ê-Conjunct Order in the Independent vs. ê-Conjunct outcome were the same found in the Conjunct outcome in the more Independent vs. Conjunct, with the notable exception of (103). This is liekly due to the fact that the majority of Conjunct forms are, in fact, ê-Conjuncts.

5.5.3 Conjunct Type

In the Conjunct type alternation, it does not make sense to do analyze both outcomes, as one is simply an *other* case. As such, the exemplars here will only be given for the positive case, (e.g. ê-Conjunct, kâ-Conjunct, or Other-Conjunct.

ê-Conjunct

Inanimate Intransitive Verbs

(104) ... namôy êtikwê **ê-miywâsik** ôma ta-nipahtâkêhk. (CMBK-5-2 87; 0.95)
... not apparently **it is good** FOC someone who kills

There was only one correctly identified ê-Conjunct exemplar available, and in this case it was as a main verb of a clause. It's estimated probability is high at 0.95.

Animate Intransitive Verbs

(105) ... môy tâpwê **ê-ohci-ma-miyomahcihot** ... (CMBK-4-2 159; 0.98)
... not truly **he does not really feel well** ...

(106) ... êkos ânima **ê-isi-tâpwêt** êwako. (JK 160; 0.97)
... so that **he speaks truth thus** this

(107) ... ê-wîcêwâyâhk âskaw ê- **ê-papâmi-mawisot** ... (EM 36-37; 0.97)
... we get along with him sometimes ê- **he picks berries about** ...

(108) **ê-papâmi-pa-pêyakoyân** in the spruce - – mâka mîn âsay nitâkayâsîmon.
I'd be going about alone in the spruce - – but and already I speak English
(AL 148-149; 0.97)

I'd be going about alone in the spruce - - and I'm already speaking English again
(Bear et al., 1992, 254-255).

(109) êkos ôma nika-mâc-âcimon nîsta, tânisi **ê-isi-ka-kiskisiyân** ... (CMBK-1-2 14; 0.97)
so this I will tell bad news I too, how **I really remember thus** ...

In the ê-Conjunct outcome for the VAI, all of the top five VAI exemplars make use of preverbs. Interestingly, two of the top five exemplars used the position preverb, {papâmi-} (indicaitng an action is done throughout an area). Another two made use of the discourse preverb {isi-} (describing that an action is done is such a way). Beyond this, the actual semantic criteria of the verbs does not form a cohesive class in this outcome. The estimated probability was high for this outcome, ranging from 0.97-0.98.

Inanimate Transitive Verbs

(110) môy wîhkât nânitaw **ê-ohci-itêyihtamâhk** ... (CMBK-3-2 162; 1.00)
not ever simply **we do not think this** ...

(111) êkwa awa nisîmis, anita wiy êkwa **ê-ohci-nitohtahk**
and this my younger sister, there for and **she listened at my home**...
wîkiwâhk ... (CMBK-4-2 29; 0.98)

(112) ... tâpiskôc namôya kîkway **ê-itêyihtahkik** onêhiyâwiniwâw. (VDC2 20-22; 0.97)
... Just like nothing **they think about** their Cree way.

(113) â, êkos ê-itihtahk anima, «sâncikilôs [sic]» **ê-itêyihtahk**, «in the
yes, so he hears thus this, «sâncikilôs [sic]» **he thinks about it**, «in the
cross» ê-itwêwiht. (AA 191; 0.97)
cross» he make such a noise
Yes, that is what he heard, interpreting it as 'sâncikilôs' when they said 'in the cross.' (Ahenakew, 2000, 124-125)

(114) ... êkâya kîkway ê-pakitinamâkoyahk, tânisi
not what he allows us, what **we think about this**
ê-itêyihtamahk. (VDC2 114-115; 0.90)

... they do not allow us to think for ourselves (Vandall and Douquette, 1987, 42-43).

Of the top five exemplars for VTIs, only one (example 111) was *not* a form of *itêyihtam*, 's/he thinks it'. Interestingly, this exception (a form of *nitohtam*, 's/he listens')

is still a sensory verb, which in the VTI falls under the same umbrella as thinking verbs, TI-nonaction. Estimated probabilities were quite high, ranging from 0.90 to 1.00.

Transitive Animate Verbs

(115) ... ma kîkway wîhkâc **ê-ohci-pakitinicik** aniki nikosis Randy ... (CMBK-2-2 43; 0.97)
... not what ever **they let me go** those my son Randy ...

(116) ... môy âhpô ê-ohci-kiskêyimak awa kâ-wî-wîkimak awa
... not even I do not know him this whom I am going to live with this
Tommy, môy **ê-ohci-kiskêyimak**. (CMBK-4-2 114; 0.97)
Tommy, not **I do not know him**

(117) ... tânsi ê-isi-sîhkimicik, tânisi **ê-isi-nitawêyimicik**, nikî-tôtên. (EM 92; 0.96)
... how he urges me, how **they want me** I do it
... what they urged me, what they wanted me to do, I would do (Minde, 1997, 66-67).

(118) êwakw ânima kêhcinâ aya ê-kî-miywêyihtamân, ê-kî-oh- aya
this that certainly well I was glad ê-kî-oh- well
ê-kî-isi-wâpamak niwîkimâkan ôtê kâ-pê-wîcêwak ... (EM 65; 0.93)
I saw him thus my husband over here I come to marry him
I certainly used to be happy that I could see my husband in this light when I came over here to be married to him ... (Minde, 1997, 36-37)

(119) ... wiy âh-apisîs piko **ê-kî-asamikawiyâhk**. (CMBK-1-2 25; 0.92)
... for very small a bit **some one fed us**

Although the VTA exemplar for the ê-Conjunct outcome have little cohesion, all but (116) represent a past action, even if not represented in the morphology. Beyond this, ê-Conjunct exemplars often contain first person goals, as in (115), (117), (119). These exemplars ranged from 0.92 to 0.97.

kâ-Conjunct

Inanimate Intransitive Verb

(120) ... ita êsa mân êtikwê ê-kî-osâpit, **kâ-kîsikâyik** ...
... there apparently used to apparently he watched from there, **in the day**
(CMBK-5-2 57; 0.75)

(121) ... wiya pîhc-âyihk kâ- **kâ-pipohk** kâ-kî-ayâyâhk. (C2GB 18; 0.63)
... for inside kâ- **it is snowing** he has it

The kâ-Conjunct outcome for the VII had only two valid exemplars. Each of these exemplars were used not as prototypical semantic verbs. In (120) the exemplar, a form of *kîsikâw* is used as a temporal prepositional phrase/adjunct. In (121), the verb *kâ-pipohk* ('it is snowing'), is used nominally to simply mean 'snow'. These exemplars were not as well predicted as those covered previously, ranging from 0.63 to 0.75.

Animate Intransitive Verb

(122) ... mîn êkâ awiyak **kâ-kî-minahot**, âhci piko pêyakwan ê-miyiht wiyâs
... and no someone **he kills**, still a bit one he gives to me meat
... (CMBK-4-2 264; 0.73)

(123) ... êkwa **kâ-minahocik** ôkik nâpêwak ... (C2GB 14; 0.72)
... and **they hunt** these men

(124) cikêmô kikî-miyikonaw kôhtâwînaw, kîstanaw **kâ-nêhiyâwiyahk** ...
of course we were given it by him our father, we too **we are cree**
(JK 7; 0.63)

(125) ... misatimwak ê-têhtapiyâhk, itê **kâ-minahocik** nôhtâwînânak. (CMBK-4-2 250; 0.59)
.. horses we ride, there **they hunt** our fathers

(126) êkwa mîna pikw îta **kâ-pîhtikwêyan** ê-mîcisoyan ... (AL 71; 0.57)
and also only there **you come in** you eat

Three of the five exemplars ((122), (123), and (125)), for the VAIs in the kâ-Conjunct outcome concern forms of the lexeme *minahow* ('s/he hunts/kills'). Beyond this, this is little that can be generalized about these exemplars. Estimated probabilities were relatively low, ranging from 0.57 on the low end to only 0.73 on the high end.

Inanimate Transitive Verb

(127) ... êkosi êkon êkw êkotê ê-wa-wîc-âyâmât – wâhyaw ôm
... so this and over there he always lives with him - far away then

ôma **kâ-itamân**, môy âhpô nikiskisin tânis ânim ê-isiyîhkâtahkik
the fact that **I call something**, not even I know what that they call it
… (CMBK-1-2 237; 0.91)
…

(128) ... ‘iyisâhowin’ anima ka- **kâ-itamihk** aya ... (EM 75; 0.83)
... ‘iyisâhowin’ this ka- **he calls it** this one ...
... ’resisting tempatation’ as they would call it ... (Minde, 1997, 46-47)

(129) êkoyikohk isko ê-kî-nôhtê-âcimostawak awa niwîcêwâkan, êwak ôm ôma
only then until they wanted to tell a story FOC my spouse, this one FOC that
kâ-nitawêyihtahk. (CMBK-3-2 48; 0.66)
he wants it

(130) ... anima **kâ-nôhtê-kiskêyihtahk** nâha, êwako ê-kî-pawâmit
... that **he wants to know about it** that one, this one he had a dream spirit
anima ... (SW 39; 0.61)
that
.. what that one wants to know about, that the woman had a dream spirit ... (Whitecalf, 1993, 36-37)

(131) êwakw ânim ânohc **kâ-mâmiskôtahk** ayamihêwiyiniw ... (EM 78; 0.61)
this that today **he talks about it** priest ...
This is what the priest talked about today ... (Minde, 1997, 52-53)

The VTI exemplars were made up mostly of verbs of speech. In (127) and (128) the exemplar verb *itam* (‘s/he calls it so’) is used; in (131) the verb *mâmiskôtam* (‘s/he talks about it’) is used; and finally in (129) where the exemplar *ê-kî-nôhtê-âcimostawak* regars to telling a story. The remaining exemplar verb, *kâ-nôhtê-kiskêyihtahk*, refers to knowing. As in the previous outcome, all these exemplars fall under the banner of II-nonaction. This class of verbs had a large range in its estimated probabilities, with the lowest exemplar estimated at 0.61 and the highest at 0.91.

Transitive Animate Verb

(132) ... mâk êkwa awa **kâ-pê-wîhtamawit** nitôsim ... (CMBK-4-2 19; 0.71)
... but and this **he comes and tells me about it** my stepson ...

(133) ... kîkway ôki **kâ-wîhtamawicik** nitawâsimisak ... (CMBK-4-2 202; 0.71)
... what these **they talk to me** my children ...

(134) êwakw âwa **kâ-wîhtamawak** anohc ... (JK 4; 0.64)
that one that **I tell him about it** today ...

The VTA kâ-Conjunct exemplars were fewer in number than the VAI and VTI classes with only three valid exemplars present. Similar to what was seen in the VTI class, each exemplar is a form of a speech verb. Probability estimates ranged from 0.64 to 0.71.

Other Conjunct

Intransitive Inanimate Verbs

(135) ... môniyâw ê-pêhtât nêtê **ta-takopayiyiki** anihi. (CMBK-3-2 134; 0.53)
... white man he waits there **when it arrives** FOC

In the final outcome, the Other Conjunct, the VII had only a single valid exemplar. Here the exemplar is a subjunctive form acting as a temporal adjunct. The probability estimate for the one exemplar was quite low at 0.53. *Animate Intransitive Verbs*

(136) ... tânisi k-êtôtamân, **mêstohtêyêko** pê-miyikawiyâni wêpinâson ...
... what I will do, when you are all gone if I am given it cloth
(JK 160; 0.89)

... what will I do when you are all gone if someone comes and gives me cloth ...
(Kâ-Nîpitêhtêw, 1998, 132-133)

(137) ... ahpô kikaskihtân **ta-nipâyan** ... (SW 112; 0.67)
... or you are able to you die ...

(138) ... êkwa awiyak nôhtê-papâmitâpâsoci, ta- **ta-papâmitâpâsohk** ...
... and someone when he wants to ride about. ta- **someone rides around**
(AL 42; 0.63)

(139) misawâc ôta, ispî mêht- [sic] **mêstohtêtwâwi** ... (JK 18; 0.53)
in any way here, when, mêht- [sic] **when they die**
In any case, when all those here will have died ... (Kâ-Nîpitêhtêw, 1998, 64-65)

All four valid VAI exemplars were hypothetical, time dependent, verbs. In most cases, the exemplars were in the subjunctive Conjunct form, though even when simply

in the ka/ta-Conjunct (as in (138)) the conditional meaning is still present. Expected probabilities had quite a large range, from 0.53 to 0.89.

Inanimate Transitive Verbs

(140) ... piko kâwi **ka-kîwêtotamahk** k-âtoskêyahk, ka-kakwê-pimâcihoyahk ...
... a bit again **we return to it** we work, we try to make a living
(EM 96; 0.85)

... so we will have to go back and work to try and make a living ... (Minde, 1997, 72-73)

(141) mistahi ka-miywâsin, êwak ôma kîstawâw,**ka-kiskinowâpahtamêk**
very it is good, this the you all too,
ôma kâ-wî-isîhcikêyâhk oskinîkiskwêwak,
you all learn by watching it this we are going to do it
kwayask ... (JK 158; 0.84)
young women, properly
It will be very good for you too, the young women, to watch what we are going to do and learn from it ... (Kâ-Nîpitêhtêw, 1998, 130-131)

(142) ... wiya kiyânaw kikaskihtânaw kîkway ka-kî-nipahtamâsoyahk,
... for us we can what we killed,
kayâsi-pimâcihowin **ka-otinamahk** ... (C2GB 45; 0.74)
old way of life **we take it** ...
... for we are able to kill things for ourselves and to take up our traditional way of life ... (Bear et al., 1992, 82-83)

(143) môy pikw êkosi k-êsi-mâmitonêyihtamahk, **ka-tôtamahk** anima ... (EM 76; 0.78)
no only so we should think that way, **we should do it** that ...
We should not only think that way, we should do it ... (Minde, 1997, 48-49)

(144) ... ê-miyohtwât an[a] îskwêw ê-wîcihât anih ôskinîkiwa,
... she is good natured that woman she helps him that young man,
ta-pônihtâyit minihkwêwin ... (EM 134; 0.76)
he quits alcohol ...
... that woman is good-natured and helps that young man to quit drinking ... (Minde, 1997, 92-93)

The VTI class has five exemplars, all of which occur in the ka/ta-Conjunct. In most cases, these are translated as infinitive forms and nearly always act as non-main verbs, though in (141) the exemplar *ka-kîwêtotamahk* appears to be the main verb of the clause. For the VTIs, probabilities estimates were reasonably from 0.76 and 0.85

Transitive Animate Verbs

(145) ... âta kâ-nisitohtahkik, âta **kitotatwâwi**, tâpiskôc êkâya
... although they understand, although **if you speak to them**, for instance not
ê-pêhtâskik (VDC2 19-20; 0.84)
they hear you ...

(146) k-âyimômâyahk kîc-âyisiyinînaw, ahpô **ka-pâhpihâyahk**
when we gossip about him our fellow man, or **if we laugh at him**
ê-kitimâkinâkosit ... (JK 9; 0.84)
he is pitiable ...
When we gossip about our fellow man, or if we were to laugh at someone who looks pitiable ... (Kâ-Nîpitêhtêw, 1998, 54-55)

The final class, the VTAs, has only two valid exemplars. Both are conditional verbs, though only (145) had the verb in the subjunctive Conjunct form. Instead, (146) contains *ka-pâhpihâyahk*, 'if we laugh at him', in the ka/ta-Conjunct without any particle that might suggest conditionality. It is also worth noting that in (145) the exemplar verb is, as has been seen previously, one of speech. Both exemplars were well predicted, with probability estimates of 0.84.

Chapter 6

Discussion

This chapter will discuss the results presented in the previous chapter and the ways in which they inform our understanding of Order and alternation in Nêhiywawêwin. The first section will discuss the profiles suggested by the results and how these relate to previous research and the descriptions of Order; the next section will then discuss the statistical veracity of the logistic models. Finally, this chapter will close with a section that discusses and demonstrates how the results of this dissertation can be used to produce exemplars for each alternation outcome, and the ways that this sort of resource can be used in the revitalization of Nêhiywawêwin.

6.1 Independent vs. Conjunct

In the alternation between the Independent and the general Conjunct, the majority of significant effects, regardless of verb class, were predictive of a Conjunct form, rather than the Independent. A general summation of the effects across verb classes in Table 6.1. The effects are split into four main categories: effects of actors, effects of goals, effects of preverbs, and effects representing semantic classes. In this last category, conjugation class information is removed from row names (e.g. TI.do and AI.do would be grouped together if both were significant).

Preverbs seemed to only increase the likelihood of a Conjunct form, with one exception. This behaviour may suggest that the Conjunct is a more modified category. In particular, preverbs of discourse suggest a verb that is not simply declarative in structure, providing some information about the discourse act. This sort of behaviour conforms with

Table 6.1: Multivariate Effects: Independent vs. Conjunct

	Effects	II	AI	TI	TA
Actor	actor.obv		CNJ		CNJ
	actor.sg		CNJ		CNJ
	NA.persons.actor			IND	
	actor.1				IND
	actor.2			IND	
	actor.3			CNJ	
Goal	NI.Place.goal			CNJ	
	NDIbody.goal			CNJ	
	NI.nominal.goal			CNJ	
	NA.persons.goal				CNJ
	goal.obv				CNJ
	px1sg.goal			IND	
	goal.2				CNJ
Preverb	PV.Time	CNJ	IND		CNJ
	PV.Discourse		CNJ	CNJ	
	PV.Position				CNJ
	PV.Move				CNJ
Semantic class	Food				CNJ
	Do			CNJ	
	Money/count			CNJ	

the descriptions of Cook (2008, 162), who purports the Conjunct to be more likely in a medial context; that is, it is more likely to not be at the start of a conversation or story. This description implies the Conjunct order is somehow related to the discourse structure of the utterance. The only preverb associated with the Independent is in the VAIs, where preverbs of time increase the likelihood of the order. This is peculiar for two reasons: Firstly, preverbs of time include PV.ka, an irrealis preverb (usually interpreted as a future definite form in the Independent) that is also present in all ka-Conjunct forms, which make up a large amount of the Other Conjunct class. Following from the first peculiarity, the second is in the disagreement between the VAIs and the VTIs and VTAs in the direction of the effect of PV.Time. Although no single effect was significant in all classes, no effect other than PV.Time differed in its direction of association throughout the verb classes. Actor persons were not significant for all classes, but when present, local actors increased the likelihood of an Independent, while third person actors increased the likelihood of a Conjunct. Also interesting is the distribution of Independent effects across conjugation classes: the VTI had three Independent effects, while the VAI and VTA had only one each. The VII had only one significant effect, that of PV.Time, though this lack of effects is likely due to the lack of tokens in analysis. Also relating to the Independent, is the fact that Independent effects we almost always argument effects, such as actor.1. A final note, and one that affects all classes, is that PV.Position includes the preverb *ohci-*, which can mean 'from', but is also used as a past marker in the Conjunct. As a result, the semantic motivation for this set of preverbs cannot be discerned. Overall, the alternation between the Independent suggests that the Conjunct is a more marked class, and one that is more associated with modifying preverbs, especially of those of time and discourse.

6.2 Independent vs. ê-Conjunct

The pattern of effects is significantly different for the Independent vs. ê-Conjunct alternation than for the Independent vs. Conjunct alternation. This difference suggests a difference in the *type* of alternation. The effects of this alternation are detailed in Table 6.2.

Table 6.2: Multivariate Effects: Independent vs. ê-Conjunct (

	Effects	II	AI	TI	TA
Actor	actor.1		IND		IND
	actor.2		IND	IND	IND
	actor.3			ê-CNJ	
	actor.obv				ê-CNJ
	NA.persons.actor			IND	
Goal	NI.place.goal			ê-CNJ	
	Px1Sg.goal			IND	
Preverb	PV.Discourse		ê-CNJ	ê-CNJ	ê-CNJ
	PV.Move				ê-CNJ
	PV.Position				ê-CNJ
	PV.Time	IND	IND		ê-CNJ
Semantic class	Do			ê-CNJ	
	Food				ê-CNJ
	Money.Count			ê-CNJ	

Similar to the previous alternation, local actors, when significant, always increased the likelihood of an Independent Order, while third person actors increased the likelihood of the ê-Conjunct order for VTIs and obviative actors did the same, but in the VTA class. The presence of an overt actor representing a person also increased the likelihood of the Independent, though only significantly for the VTIs. Together, these effects suggest an Independent order that is associated with higher position in the Nêhiyawêwin person hierarchy (reproduced in (147), while the Conjunct generally associated positions on the lower level of the hierarchy (i.e. non-local participants).

(147) $2 > 1 >$ Unspecified Actor $> 3 > 3' > 3''$

As previously, the Independent was generally associated with effects dealing with actors and goals, with the exception of prteverbs of time. Unlike the previous alternation, preverbs of time significantly increased the likelihood of the Independent for both the VIIs and the VAIs, though it is still associated with the ê-Conjunct in the VTA class. Other than this set, all other preverb effects which were significant were associated with the ê-Conjunct outcome. It is worth noting, that preverb effects were mostly significant only for the VTA class. In fact, only preverbs of discourse and preverbs of time had effects in any other verb class. This suggests, as in the Independent vs. Conjunct alternation, that

the ê-Conjunct is a form that is more marked/altered (except for time). Finally, semantic classes were again only significant when influencing the ê-Conjunct, and even then only in transitive classes.

6.3 Conjunct Type

The Conjunct Type alternation was significantly less 'cohesive'. That is, less can be said about an outcome across verb classes. As can be seen in Table 6.3, even when an effect is present in multiple verb classes, it is not always the case that the effect increased or decreased the likelihood of the same outcome in each conjugation class. (e.g. while PV.Discourse is significant for VAIs and VTAs, the effect increases the likelihood of ê-Conjunct in both, but decreases the likelihood of kâ-Conjunct in the VAIs and Other Conjunct in the VTAs. Similarly PV.Position, increased the likelihood of the ê-Conjunct in the VAIs, VTIs and VTAs, but it decreases the likelihood of kâ-Conjunct in VAIs and VTAs while decreasing the likelihood of the Other Conjunct in the VTIs.

In all classes excluding the VII, preverbs of position increased the likelihood of the ê-Conjunct. Conversely, the ê-Conjunct's likelihood was decreased by the presence of second person actors while the Other Conjunct was increased for the same variable. First person actors significantly increased the likelihood of the ê-Conjunct, but only for the AI and TAs. Third person actors also increased the likelihood ê-Çonjunct, but only significantly for the VAIs.

Perhaps most clear is the effect of II.weather on the kâ-Conjunct. The use of a Conjunct form for weather verbs seems to allow for the use of the verb as a durative state as in (148), where the verb *kâ-pipohk* is used to mean 'during winter', rather than being used as a more declarative statement.

(148) ... awâsisak wâwîs **kâ-pipohk** pîhc-âyih
... children especially **in winter** inside
'... especially for children in winter.' (Minde, 1997, 137)

Table 6.3: Multivariate Effects: Conjunct Type. Each cell is labeled with the outcomes for which an effect is signficant. If a cell is coloured green, the effect increased that outcome, while a red cell represents an effect decreasing likelihood

		II	AI	TI	TA
Actor	actor.1		ê- kâ-		ê- Other-
	actor.2		ê- Other-	ê- Other-	ê- Other-
	actor.3		ê- kâ-		
	NA.persons.actor			kâ-	
	NDA.Relations.actor		kâ- Other-		
	Pl.actor		kâ-		
	Prox.actor			ê-	ê- kâ-
	Sg.actor		ê- kâ-		
	NI.nominal.goal			ê- Other-	
	NI.object.goal			kâ-	
	Med.goal			Other-	
	Sg.goal			ê-	ê- kâ-
	Prox.goal			kâ-	
	Px1Sg.goal				ê-
Preverb	PV.Discourse		ê- kâ-		ê- Other-
	PV.Move				
	PV.Position		ê- kâ-	ê- kâ- Other-	ê- kâ-
	PV.Qual		Other-		
	PV.WantCan		kâ-	ê- kâ-	
Semantic class	Cognitive				kâ- Other-
	Cooking		kâ-		
	Health		Other-		
	Speech			ê- kâ-	
	Weather	kâ-			
Reduplication	RdplW		ê-		

6.4 Model Statistics

In addition to the actual results of alternation modelling, one can assess the performance of a model as in Arppe (2008). This procedure compares the ρ^2 and τ across various models to compare the ability of each model to explain each the three alternations in this dissertation. This section will compare five different models: Fixed Effects-Only (FE) which did not include the random effect `Lemma`, Random Effects-Only (RE) models which only included `Lemma` (specifically as a random effect), Semantic-Only (SE) which included the random effect but only semantic variables for fixed effects, Morphological-Only (MorphE) models which had the random effect but only morphological effects for fixed effects, and finally Mixed-Effect (ME) models which include both types of fixed effects and the random effect. While only the ME models were

discussed in the Results and this Discussion section, these other models are included in comparison so as to judge the efficacy of the ME model. For example, if a ME model contains a lower τ and ρ^2 than, say, an FE or RE model for the same outcome and verb class, it can be determined that use of both fixed and random effects is not advantageous to explaining the alternation, and that a simple generalized linear model would better fit the phenomenon. Similarly, the SE and MorphE models can be compared against each other and the ME to determine the extent to which semantic or morphological information aid in the understanding of the alternations. By default, one would expect the ME models to perform better than either the SE or MorphE (as more information is presumably better for the model), though this may not necessarily be the case. For this dissertation, morphological effects are those which have obvious and easily identifiable morphological exponents, such as `RdplS` or `goal.1`. Although some effects are specified for `actor` or `goal`, these tags are not considered semantic as they are relatively clearly associated with a suffix or suffix chunk. Below is a list of all morphological effect used in any model:

```
actor.1, actor.2, actor.3, actor.4, D.goal, goal.1, goal.2, goal.3,
    goal.4, Pl.actor, Pl.goal, Px1Sg.goal, Px3Pl.goal, Px3Sg.goal, RdplW
    , Sg.actor, Sg.goal
```

Semantic effects are defined as those which do not have clear morphological exponents. This includes semantic classes, preverb groups, and descriptions of arguments (e.g. `dem.goal` for goals which are demonstrative. Below is a list of semantic effects used throughout modelling.

```
AI.cooking, AI.do, AI.health, AI.pray, AI.reflexive, AI.speech, AI.state
    , Dem.actor, Der.Dim.goal, II.natural.land, II.sense, II.weather,
    Med.actor, Med.goal, NA.beast.of.burden.actor,
    NA.beast.of.burden.actor, NA.food.actor, NA.persons.actor,
    NA.persons.goal, NDA.Relations.actor, NDA.Relations.actor,
    NDI.Body.goal, NI.natural.force.goal, NI.nominal.goal,
    NI.object.actor, NI.object.actor, NI.object.goal, NI.place.goal,
    PV.Discourse, PV.Move, PV.Position, PV.Qual, PV.StartFin, PV.Time,
    PV.WantCan, PV.e, PV.kaa, PV.kaa, Prox.actor, Prox.goal, Prox.goal,
    TA.cognitive, TA.do, TA.food, TA.money.count, TA.speech, TI.do,
    TI.money.count, TI.speech
```

Table 6.4 details the difference in τ and ρ^2 between the five different types of models previously described for the Independent vs. Conjunct alternaiton.

In this alternation, it was nearly always the case that ME models had superior performance in both classification improvement (τ) as well as reduction in badness of

Table 6.4: Model Comparisons. Independent vs. Conjunct, bold items represent a very good model fit, per McFadden et al. (1973)

	VII		VAI		VTI		VTA	
	τ	ρ^2	τ	ρ^2	τ	ρ^2	τ	ρ^2
Fixed Effect-Only	0.31	0.05	0.47	0.15	0.32	0.09	0.35	0.10
Random Effect-Only	0.36	0.12	0.52	**0.26**	0.34	0.15	0.42	0.18
Semantic-Only	0.35	0.12	0.52	**0.27**	0.36	0.15	0.44	0.19
Morphological-Only			0.52	**0.27**	0.39	0.16	0.43	0.19
Mixed Effects	0.35	0.12	0.53	**0.27**	0.42	0.16	0.45	**0.21**

fit (ρ^2). This is not the case in two instances: the first is in the VII class, where RE models appeared to have slightly higher τ and ρ^2 than the ME model, despite containing less information in terms of predictor. It is worth noting that the VII were the least numerous class, and due to its inherent semantics is significantly different than the other classes (in that it can refer to things like days of the week or temporal states). Also worth mentioning is that MorphE models were not available for the VII class, as the significant fixed effects for VIIs were all semantic. The other case is in the VTIs where the ρ^2 was the same for ME models as the MorphE models. In all cases, FE models showed significantly lower measures the other models, with RE models showing a significant increase in ρ^2 and τ measures over FE models. This indicates that a significant amount of alternation is explained by random effects only. Put another way, individual lemmata appear to show significant variation in their propensity to occur in the Independent or Conjunct order more so than the use of fixed effects alone. The SE and MorphE models create a slight increase in ρ^2 and τ over the RE models,. While SE and MorphE vary in which produces a better model depending on the verb conjugation class, this difference is usually minimal. As mentioned before, the ME often better than any other model, and excluding the VIIs, they are never *worse* than the other models in their ability to classify or reduce badness of fit.

For the Independent vs ê-Conjunct alternation, a similar pattern to the previous alternation can be seen. In general, FE models provided very little explanation for the variation, while RE models showed a significant higher ρ^2. This again suggests that lemmas have inherent propensities to surface in one order over another. SE and ME

Table 6.5: Model Comparisons. Independent vs. ê-Conjunct

	VII		VAI		VTI		VTA	
	τ	ρ^2	τ	ρ^2	τ	ρ^2	τ	ρ^2
Fixed Effect-Only	0.28	0.04	0.43	0.15	0.33	0.10	0.32	0.12
Random Effect-Only	0.35	0.14	0.49	**0.26**	0.36	0.17	0.38	0.17
Semantic-Only	0.40	0.17	0.50	**0.27**	0.38	0.17	0.41	0.19
Morphological-Only			0.50	**0.26**	0.41	0.19	0.44	**0.21**
Mixed Effects	0.40	0.17	0.51	**0.27**	0.44	**0.20**	0.43	**0.22**

models showed similar reduction in badness of fit and classification efficacy. In all cases, ME models were the best fitting models, except for the VIIs where it was equal to the MorphE model. Similarly, all classes other than the VII showed had ME models with an $\rho^2 \geqslant 0.20$. The lower measure for the VII model is again likely the result of a paucity of data. Taken together, the model performance for the Independent vs. ê-Conjunct alternation suggest a generally better modeled alternation than in the Independent vs. Conjunct general alternation. Although theoretically one may conceive of Order as a class that is split principally between the Independent and Conjunct (as in Chapter 2, these results suggest that such an alternation is harder to model in terms of morpho-semantic properties. Instead, a more clear choice exists in whether one wants to use an Independent form or an ê-Conjunct form. This behaviour is not entirely unexpected, given the semantic differences of the different Conjunct types. Even Cook (2014) describes the ê-Conjunct as more of an elsewhere case and one more closely similar to the Independent in morphosyntactic behaviour. In fact, Cook (2014, 125) describes all conjunct type other then the ê-Conjunct as being disallowed from matrix clauses, which are the domain of the Independent and the ê-Conjunct. This comports with the performance of the above models. Further, the Other Conjuncts are highly semantically representative in a way that does not need accounting for (and was not accounted for) in the models, as will be discussed below. Thus, mixing the ê-Conjunct together with these other, more straightforwardly described forms as in the first alternation, may produce an outcome that a logistic model is simply not fully able to reproduce and explain.

In Conjunct type alternation, as depicted in Table 6.6, models performed variously well depending on the outcome. In all cases, the pattern of the FE models performing

Table 6.6: Model Comparisson. Conjunct Type Alternation, ê-Conjunct outcome

ê-Cnj	VII		VAI		VTI		VTA	
	τ	ρ^2	τ	ρ^2	τ	ρ^2	τ	ρ^2
Fixed Effect-Only	0.31	0.11	0.34	0.04	0.33	0.07	0.31	0.06
Random Effect-Only	0.56	**0.33**	0.34	0.14	0.36	0.18	0.33	0.11
Semantic-Only	0.57	**0.33**	0.35	0.15	0.41	**0.20**	0.35	0.13
Morphological-Only			0.39	0.16	0.40	**0.20**	0.38	0.15
Mixed Effects	0.57	**0.33**	0.39	0.17	0.44	**0.22**	0.40	0.17

kâ-Cnj	VII		VAI		VTI		VTA	
	τ	ρ^2	τ	ρ^2	τ	ρ^2	τ	ρ^2
Fixed Effect-Only	0.31	0.13	0.38	0.03	0.42	0.06	0.38	0.03
Random Effect-Only	0.48	**0.33**	0.46	0.14	0.45	0.16	0.45	0.11
Semantic-Only	0.54	**0.33**	0.40	0.15	0.45	0.19	0.38	0.12
Morphological-Only			0.40	0.15	0.43	0.17	0.38	0.13
Mixed Effects	0.54	**0.33**	0.40	0.16	0.44	0.19	0.39	0.13

Other Cnj	VII		VAI		VTI		VTA	
	τ	ρ^2	τ	ρ^2	τ	ρ^2	τ	ρ^2
Fixed Effect-Only	0.48	0.02	0.47	0.08	0.43	0.07	0.48	0.10
Random Effect-Only	0.48	**0.24**	0.45	0.17	0.42	0.19	0.43	0.17
Semantic-Only	0.48	**0.33**	0.48	**0.26**	0.45	**0.25**	0.45	**0.22**
Morphological-Only			0.50	**0.26**	0.46	**0.26**	0.51	**0.26**
Mixed Effects	0.48	**0.33**	0.51	**0.27**	0.47	**0.28**	0.52	**0.27**

poorly with more morphological and semantic information producing better models continues. Despite this, only in the VII RE, SE, and ME and the VTI SE, MorphE, and ME models were $\rho^2 \geqslant 0.20$. In general then, modelling was not particularly successful for this outcome. The kâ-Conjunct outcome fairs even worse, with only the VII RE, SE, and ME model showing very good fits. Interestingly, the kâ-Conjunct model showed a large increase in ρ^2 from FE to RE models, but SE, MorphE, and ME models showed only minor increases, suggesting that semantic and morphological information do not do much to determine the propensity of a lemma to take the kâ-Conjunct outcome. Instead, the largest amount of variance explanation is found in lemma specific effects, as seen in the very large increase of ρ^2 from FE to RE. The Other Conjunct differed from the other two outcomes in that all SE, MorphE, and ME models were very well fit (as was the RE model for VIIs). While RE models were significantly better fit than FEs as previously, an additional large jump in ρ^2 value is seen when adding semantic or morphological information to the model. The use of both type of effects in the ME model provides a slight increase over other models. These results seem very promising, but when actually evaluating the models ability to predict the correct outcome, however, an interesting pattern emerges. While recall for the alternate outcome is roughly 100% (that is, the model is correctly predicting all forms which do not occur in the Other Conjunct), recall for the Other Conjunct outcome is never higher than 20% for any class. Despite this, precision for both outcomes in all classes in relatively high, especially for the VAIs and VTAs (where it is higher than 80%). This is the behaviour of a model that predominantly predicts one outcome regardless of contextual information, almost never deviating from this pattern. Because the vast majority of training tokens were, in fact, part of the alternate outcome (and not the Other Conjunct), this behaviour produces a technically well fit model, despite not actually being particularly more insightful than frequency counts. In total, the Conjunct Type alternation is a poorly fit alternation when compared with the Independent vs. Conjunct and Independent vs. ê-Conjunct alternations. This is not entirely surprising considering the nature of the alternation. While the Independent vs. Conjunct and Independent vs. ê-Conjunct are alternations between two outcomes that vary based on some unknown factor, the Conjunct Type outcomes are highly motivated by the semantics of the utterance. For example, if a verb is in a relative clause such as

awîniki aniki ***kâ-mêtawêcik*** *anita?*, 'Who are **those that are playing there**' (Okimāsis, 2018, 46), it will occur in a kâ-Conjunct form; if the verb is used for hypotheticality as in ***mîcisoyani*** *kika-miyomahcihon*, 'If you eat, you feel better' (Okimāsis, 2018, 64), then it will occur in a subjunctive form (and thus an Other Conjunct outcome); etc. Because of this relatively straightforwardness, it is unsurprising that the morphosemantic effects used in this dissertation (which are used to model less straightforward variance) would not apply to this alternation.

Speaking more generally about the fitting of the models in this dissertation, in contrast with Arppe (2008) who concludes that while morphosyntactic effects provide some amount predictive power, it is the semantic effects that are most predictive, this dissertation finds that semantic and morphological effects are similarly effective as predictors. This varied by alternation type and conjugation class, but overall the difference between semantic and morphological effects was slight. The reason for the discrepancy between these results and those of Arppe (2008) could be due to differences in the ways semantic classes were defined, or it could be due to differences between the languages being studied. While Finnish is a synthetic language with a rich case system, its verbal system is not as morphological complex, lacking a wide system of preverbs or polypersonal agreement. It is possible that Nêhiyawêwin's polysynthesis bolsters the explanatory power for morphological effects in modelling these alternations. Additionally, the nature of the alternations being studied in Arppe (2008) are significantly different than those in this dissertation. While Arppe (2008) focused on an alternation between near synonyms generally to do with a single semantic domain (*thinking*), the alternation of Order is more structural, as described in Chapter 2. Finally, the research in the dissertation differ from Arppe (2008) methodologically in that the models used in this research make is of mixed effects models. Although it is not immediately obvious how controlling for the random effect of lemma identity would affect the usefullness of semantic and morphological predictors, its inclusion is significant. Despite the differences between Arppe (2008) and this research, both studies demonstrate the ability to model alternations in very divergent languages using logistic modelling.

6.5 Exemplar Extraction

Exemplar extraction was mostly successful, and useful exemplars were presented in Chapter 5. Interestingly, in actually clustering tokens in order to extract exemplars, a pattern emerged. As a reminder, the purpose of clustering tokens was to avoid over-representation of a few items which all contained a very predictive variable . Despite the clustering work done, in some cases this still occurred. For example, nearly all properly predicted (and with high estimated probabilities) Independent VAIs, regardless of which alternation they were seen in, were a form of the lemma *itwêw*. Although one could simply select only one such exemplar for any given lemma, there are a number of isssues in doing so. Most importantly, does so ignores the fact that it is a fact that the estimated probabilities for *itwêw* are significant higher than other lemmas (e.g., in the Independent vs. Conjunct alternation, the lowest estimation for a *itwêw* lemma is 73%, while the next highest rated token of a different lemme is a full 10 percent-points lower). By choosing to ignore all but one *itwêw* lemma, one would be highlighting less certain predictions. Further, it is also worth highlighting the fact that VAI quotatives are closely related to the Independent. A second pattern was the fact that all tokens of a given cluster were predicted to occur from one outcome or another, rather than tokens predicted for both outcomes beings present in a single cluster. This makes sense, given that the clustering was based on dataframes based off only significant variables for the alternation prediction, including the predicted varied (e.g. the presence of a `PV.e` variable in a model predicting if a lemma occurs as an ê-Conjunct).

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Appendix A

Corpus Codes

Table A.1: Offical names in the Ahenakew-Wolfart Corpus and their abbreviations in this dissertation.

Ahenakew-Wolfart Corpus Name	Abbreviations
CMBK-1-2	cmbk-ch1-vers2
CMBK-2-2	cmbk-ch2-vers2
CMBK-3-2	cmbk-ch3-vers2
CMBK-4-2	cmbk-ch4-vers2
CMBK-5-2	cmbk-ch5-vers2
C2GB	C2GB-ARC
AL	AL-RL-C.FIN
SW	SW-CFIN2.D91
VDC2	VDC2-RES.782
EM	EM-CREE5.N97
C7MW	C7MW-ARC.792
JK	JK-C4ARC.798
C4MF	C4MF-ARC.792
AA	AA-c2rev.899
C6IC	C6IC-ARC.792
C8GB	C8GB-ARC.792

Appendix B

Corpus2 Codes2

Table B.1: Offical names in the Ahenakew-Wolfart Corpus and their abbreviations in this dissertation.

Ahenakew-Wolfart Corpus Name	Abbreviations
CMBK-1-2	cmbk-ch1-vers2
CMBK-2-2	cmbk-ch2-vers2
CMBK-3-2	cmbk-ch3-vers2
CMBK-4-2	cmbk-ch4-vers2
CMBK-5-2	cmbk-ch5-vers2
C2GB	C2GB-ARC
AL	AL-RL-C.FIN
SW	SW-CFIN2.D91
VDC2	VDC2-RES.782
EM	EM-CREE5.N97
C7MW	C7MW-ARC.792
JK	JK-C4ARC.798
C4MF	C4MF-ARC.792
AA	AA-c2rev.899
C6IC	C6IC-ARC.792
C8GB	C8GB-ARC.792