Syntax, prosody, and metrical structure in Blackfoot

by

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Abstract

This dissertation investigates the correspondences between syntactic, prosodic, and metrical constituents in Blackfoot (Algonquian), a polysynthetic language. I propose that the syntax-prosody correspondence is distinct from the alignment of prosodic and metrical structure. In a parallel constraint-based model of phonology, this predicts that a language might satisfy isomorphic syntax-prosody correspondence at the expense of prosodic and metrical alignment, or vice versa. To determine the generalizations in Blackfoot, I gathered data by conducting fieldwork with speakers and consulting published reference materials. Some arguments in the dissertation are based on original morphological and phonological analyses of Blackfoot stems.

For the syntax-prosody correspondence, I hypothesize that each syntactic phase corresponds to a particular prosodic constituent by default. Specifically, the *v*P phase (the predicate of events), matches to a Prosodic Word (PWd) constituent, and the DP and CP phases match to Phonological Phrase (PPh) constituents. I model these relationships using a modified version of Match Theory (Selkirk 2011), where mismatches between syntactic phases and prosodic structure only occur in order to satisfy prosodic wellformedness constraints. For the relation between prosody and metrical structure, I hypothesize that the edges of metrical constituents align to different prosodic constituents (prosodic word, phonological phrase, or intonational phrase).

Regarding structure in Blackfoot, I argue that a constraint which requires sister nodes within the prosodic structure to be of the same type outranks the syntax-prosody MATCH constraints. This forces each DP argument and also the remainder of the CP (e.g. the verbal complex) to be matched to a PPh constituent. The *v*P phase and every higher *v*P projection corresponds to a PWd constituent, which is distinct from the PPh. I argue that the metrical constituents in Blackfoot align to PPh edges, and that syllables frequently span PWd edges. This is a predicted outcome, given that the MATCH and ALIGN constraints are violable. The model I propose accounts for the correspondence relations in Blackfoot, and leads to a typology of predicted language types, with implications for extending Match Theory to account for polysynthetic languages.

Lay Summary

This dissertation investigates the structure of words in Blackfoot in terms of the (1) grammar (syntax), (2) speech sounds, and (3) stress assignment on syllables. I focus on verbs elicited in original fieldwork and taken from published resources, with several results. First, verbs are grammatically complex, and can convey the same information as some entire sentences do in a language like English. Second, sounds exhibit unique patterns and processes within a smaller unit which is contained in the larger sentence-sized word. Third, each verb contains a single syllable with primary stress, much like a single word in a language like English. I conclude that the word in Blackfoot emerges from the combination of these three properties. I propose a model of the correspondence relations between representations of grammar, speech sounds, and stress assignment in Blackfoot. This research contributes to our understanding of linguistic structure in words of all languages.

Preface

This dissertation is an original intellectual product of the author, Natalie Weber. The fieldwork reported in Chapters 2–4 was covered by UBC Ethics Certificate numbers H07-01365 and H16-00986. The map in Figure 1.2 was created by Eric Leinberger and used with permission. The map in Figure 1.3 was created by Kevin McManigal and used with permission.

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Abbreviations

1	first person
21	first person inclusive
2	second person
3	third person
3′	third person obviative
0	third person inanimate
X	unspecified subject
AI	animate intransitive
AN	animate
APPL	applicative
ASSOC	associative
BERRY	small, round, solid object
BP	body part marker
CAUS	causative
CMD	command clause
CNJ	conjunctive order
COM	comitative
CONJ	conjunction
CORD	one-dimensional flexible material
DEG	degree marker
DEM	demonstrative
DEP	dependent clause
EVID	evidential
EXT	medial extension

FUT	future
GET	acquire, gather, make (light verb)
IC	initial change
II	inanimate intransitive
IMP	imperative
IN	inanimate
IND	independent order
INS	instrumental
INV	inverse
INVS	invisible
IPFV	imperfective
LOC	locative
MANNER	manner
MEANS	means/instrumental
METAL	metal, blade
MOOD	mood suffix
NEG	negative
NMLZ	nominalizer
NONAFF	nonaffirmative
OBJ	object
OBV	obviative
PL	plural
POSS	possessive
PRF	perfect
PRX	proximate
PST	past
Q	question particle
REFL	reflexive
SAP	speech act participant
SBJ	subjunctive order

SG	singular
SHEET	two-dimensional flexible material
STICK	stick, wood
SUB	subject
SUPPORT	one-dimensional rigid material
TA	transitive animate
TI	transitive inanimate
TI1	transitive inanimate (Class 1)
TI2	transitive inanimate (Class 2)
TI3	transitive inanimate (Class 3)
TIME	temporal linker
UNR	unreal order
WARD	direction/locative nominal
WHEN	temporal anchor ('when')

Symbols

–	affix separator
=	clitic separator
/	head-adjoined root separator
\	non-concatenative morphology
( )	optional
%	dialectal variant
*	unattested or unacceptable
!	fatal constraint violation
☹	actual pronunciation but non-optimal candidate
☞	optimal candidate
$*$	constraint violation marker
v	light v^0 head
v*P	first verbal phase
IPH	intonational phrase
PPH	phonological phrase
PWD	prosodic word
C	consonant
G	glide
N	nasal
V	syllable nucleus (vowel or moraic [s])

Acknowledgments

Completing this dissertation is the hardest thing I have ever done in my life. No academic project is completed in a vacuum, and in my case I have many people to thank for helping me get to this point. If we take the beginning of the project to be the beginning of my journey as a linguist, then there are people at (at least!) four institutions to thank.

At Rice, I have Claire Bowern and Laura Robinson to thank for introducing me to fieldwork and documentation in linguistics—I was hooked from the beginning. Katherine Crosswhite was my very first phonetics and phonology teacher, and probably was the first to set me on this path. Two years out of undergrad when I was considering applying to graduate school, Robert Englebretson suggested I take a look at the program at UBC, and it's lucky for me that he did.

At UBC, I worked quite closely with Gunnar Ólafur Hansson for my first several years of grad school, as a student, a TA, and an RA. Although he did not end up supervising me on this project, his mark is on my work quite strongly if you know how to see it and on my thoughts around phonology in general. My advisor, Rose-Marie Déchaine, rather comfortably took me on as a student, even though I knew little syntax at the time, and guided me through the maze of Algonquian literature. Her mentorship went far beyond theory, and her lessons on how to student and how to survive academia have been invaluable in more ways than I can express. My co-advisor, Doug Pulleyblank, joined my committee later and never ceased to question the hidden assumptions in all of my work. He also sent comments back on *every* draft within days—an act that now as a professor I see clearly as true mentorly love.

At Lethbridge, Inge Genee really served as an advisor away from home for the eight months I spent there as an RA and a Sessional Instructor. She was invaluable with helping to connect me with Blackfoot speakers, making sure I had enough paid work to keep a roof over my head, and in offering advice on all manner of interpersonal issues. Don Frantz was truly inspirational to meet! How wonderful to be able to share an office and to chat about Blackfoot together. Judith Lapadat and Rob Sampson let me house- and petsit for them on a second trip to Lethbridge. Graduate research often hangs by a financial thread, and if they had not given me this opportunity I don't think I could have returned. I'm very grateful.

At Yale, I must thank my excellent colleagues here for being amazing, welcoming, helpful, and great to talk shop with. The graduate and undergraduate students have also been amazing. I look forward to each mentoring meeting every week.

Beyond the ivory tower, there were many more people who supported me. First and foremost, this dissertation would not have been possible without the support from many Blackfoot speakers, especially Totsinámm (Beatrice Bullshields), Ááhsaikamo'sáákii (Natalie Creighton), and Rod Scout. My colleagues of Algonquian linguistics have been very supportive as well. I especially have Sarah Murray and Monica Macaulay to thank for mentoring me as a junior colleague. More generally, Richard Rhodes, David Pentland, Ives Goddard, Conor Quinn, and Taylor Miller all come to mind as Algonquianists who have gone out of their way to support me.

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Chapter 1

Introduction

1.1 Overview

This dissertation is an empirical and theoretical study of the relationship between syntactic structure and phonological form (prosodic and metrical structure) in Blackfoot, an Algonquian language spoken in southern Alberta, Canada and northern Montana, USA. As such, it addresses questions at the interface between syntax and phonology. In particular, this is a study of structural correspondences across several grammatical domains. To a lesser extent, I also look at the phonological exponence of morphemes (allomorphy) and how this is conditioned by prosodic structure. Blackfoot is an ideal case for the study of “word” level correspondences between syntax, prosody, and metrical constituents, because it is a polysynthetic and strongly head-marking language. This means there is likely to be syntactic and phonological structure “below the word”.

Consider the biclausal examples in (1) and (2). These illustrate the puzzle of Blackfoot correspondence, which can be informally stated as follows. In terms of syntax, each verbal complex has the syntax roughly of a CP phrase. In terms of prosody, each verbal complex exhibits phonological generalizations similar to prosodic words in other languages. For example, syllabic prominence (expressed via a pitch peak, and bolded below) is obligatory over the entire verbal complex but not over any smaller portion, and each verbal complex is a single domain of syllabification. The question is how to model the fact that the verbal complex is both a syntactic CP phrase and a prosodic word.

(1)	[[ejʔ.**kís**.tsː̩.saː.kiː.ni.ki]$_{CP}$	ni.t͡sɪ.**tɔ́ː**.tois.siː.ˢt͡s]$_{CP}$
	Ai’kísstsssaakiiniki	*nitsitáótoissiists*
	a–iksist–[ssi–aki]–in–ik–i	nit–it–a–oto–[ssi–iist/i]–(hp)
	IPFV–finish–[wipe–AI]–SBJ–MOOD–DEP	1–LOC–IPFV–go.to.do–[wipe–by.water/AI]–(IND)

‘When I finish doing my dishes, I go and take a shower.’ (BB; 2012-06-28, Daily Routine)

(2) $_{\text{CP}}$[i.ta.**ní**.ˢt͡si.k͡si.ms̩ː.ta.ja

Itanístsiksimsstaya

it–anist–iksim–[sst–aa]–yi=aawa

LOC–MANNER–secret–[wish–AI]–PL=PRX.PL

$_{\text{CP}}$[o.max.ks̩ː.**t͡sóː**.toxʷ.pʊm.max.sâː sá.**t͡sáː**.pi.njo.wʌn]$_{\text{CP}}$]$_{\text{CP}}$

omaahksstsóótohpommaxsáa	*sátsáápiniowan*
o–m–aahk–sstsi–oto–[ohpomm–a]–hsi=aawa	pisatsaapiniowan
3–3–might–town–go.to.do–[buy–AI]–CNJ=PRX.PL	candy

'They decided to go to town to buy some candy.' (BB; 2013-02-13, Old Woman in the Cold)

I propose that linguistic utterances are arranged into three types of representational structure, (3): syntactic, prosodic, and metrical. Each structure is a hierarchical arrangement of a universal set of categories which is unique to that type of structure.

(3)

	STRUCTURE	CATEGORIES
a.	Syntax	Complementizer Phrase (CP), ... verb phrase (*v*P/VP), ...
b.	Prosody	Intonational Phrase (IPh), Phonological Phrase (PPh), Prosodic Word (PWd)
c.	Metrical	Foot, Syllable (σ), Mora (μ)

I propose there is a direct correspondence relationship between prosodic and syntactic structure and between prosodic and metrical structure, but that there is no direct relationship between syntactic and metrical structure. First, there is a universal 'default' correspondence between syntactic phases and a universal set of prosodic constituents. Specifically, the first phase (v*P) corresponds to a Prosodic Word (PWd) constituent, while the second phase (CP) corresponds by default to a Phonological Phrase (PPh). Second, I propose that the edges of prosodic and metrical constituents align by default. The different alignment strategies are encoded via ranked, violable constraints which interact with language-specific constraint rankings in different ways.

In this dissertation I develop independent diagnostics to determine syntactic, prosodic, and metrical constituents within the Blackfoot verbal complex. I then show how the particular correspondence relationships in Blackfoot can be accounted for with the model that I propose in the next section. In Blackfoot, metrical constituents like feet, syllables, and moras must align to PPh edges but are not required to align to PWd boundaries, resulting in misalignments within the PPh between syllable edges and PWd boundaries. A schematic representation of these correspondence relations is in (4).

(4) SYNTAX-PROSODY-METRICAL CORRESPONDENCES IN BLACKFOOT

Syntax		**Prosody**		**Metrical**
CP	$\longleftrightarrow$	PPh	$\longleftrightarrow$	Ft, σ, μ
v*P	$\longleftrightarrow$	PWd		

Any model of syntactic and prosodic correspondence must also account for mismatches between the three structures. There are two points of flexibility in my model. The first point of flexibility is that I conceive of the syntax-to-prosody correspondence relations as a family of ranked but violable constraints within the broader phonological grammar. Specifically, I modify the MATCH constraints in Match Theory (Selkirk 2009, 2011) to refer to syntactic phases. Prosodic structure differs from syntactic structure when markedness constraints on prosodic wellformedness dominate the MATCH constraints. A full factorial typology of the MATCH and prosodic markedness constraints would make predictions about possible and impossible languages. The second point of flexibility are the Alignment constraints (McCarthy and Prince 1993a) between prosodic and metrical structures. These constraints can align any one of the prosodic and metrical constituents together, which also make predictions about possible and impossible languages when ranked freely.

In the following section I discuss my assumptions about linguistic architecture and the relation between the syntactic and phonological components of grammar. I conceive of the syntax-prosody interface as a translation from syntactic structure to prosodic structure. Only certain types of syntactic phrases have some kind of correspondent in prosodic structure, and prosodic structure itself is subject to prosodic wellformedness constraints that syntactic structure is not. These facts account for why some aspects of prosodic structure may track syntactic constituency quite closely while others are non-isomorphic.

A final note before laying out the proposal: throughout this dissertation, I use the words 'prosodic' and 'prosody' to refer to phonological domains which correspond to syntactic units, such as the Prosodic Word (PWd), Phonological Phrase (PPh), or Intonational Phrase (IPh), and their hierarchical structure. I do not use 'prosodic' or 'prosody' to refer to suprasegmental properties such as pitch, stress, and duration. However, suprasegmental properties and prosody do bear some relation in the sense that pitch or stress assignment may be delimited by one of the prosodic constituents.

1.2 Proposal

In this section I discuss the elements needed for my proposal of the syntax-prosody interface and the connection between prosodic domains and metrical structure. Some of these elements simply clarify my assumptions about syntax, prosody, and metrical constituents. Others are novel contributions which are intrinsic to the model. I discuss my views of the syntax-prosody interface in Section 1.2.1, syntax in Section 1.2.2, phonology (prosodic and metrical structure) in Section 1.2.3, and the correspondence retlationships between syntax, prosody, and metrical structure in Section 1.2.4.

1.2.1 Spell Out and the interface

I adopt a "Y-model" of the cognitive system of language, whereby the syntactic derivation is the input to the phonological and semantic components of grammar. This model is laid out in more detail in the Minimalist Program (Chomsky 1993, 1995b, 2000), as well as earlier works. The path of derivation is schematized by Figure 1.1. At a certain point during the derivation called "Spell Out", the syntactic derivation is submitted to Phonological Form (PF), an interface system which interprets the input syntactic representation into a phonological representation.

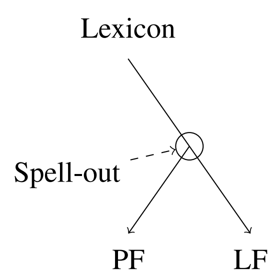


Figure 1.1: Model of grammar within the Minimalist Program

I assume that a mix of syntactic and phonological elements are simultaneously visible at PF. Following Selkirk (2011), I assume that PF is responsible for at least three aspects of the interface between syntax and phonology: (1) the correspondence of syntactic and prosodic representations, (2) phonological exponence of abstract syntactic feature bundles and lexical items, and (3) the linearization of elements. Because syntax and phonology are copresent at PF, phonological constraints are able to influence each of these three interface issues.

Regarding representational correspondence, my proposal is couched within a modified version of Match Theory (Selkirk 2011), which assumes that Spell Out to PF occurs only once during the syntactic derivation. However, the syntactic elements which are relative to structural correspondences are syntactic phases, of which there are several in any given clause. I argue that particular syntactic phases correspond to particular prosodic categories, which means that syntactic phases and prosodic categories must both visible to PF. (See Section 1.2.4 for details on the correspondence relations between syntactic and prosodic structure.) I take the first phase (v*P) to be a predicate of events, which is the *v*P/VP phrase at which point the predicate of events is complete. (For a similar interpretation of the first phase, see Ramchand 2008. Other research which equates the *v*P to a predicate of events include Davidson 1967; Higginbotham 2000; Kratzer 1996; Pustejovsky 1995.) In addition to v*P, I also assume that a CP is a phase, following Chomsky (2001).

Regarding phonological exponence, I assume that the underlying phonological form of each lexical item is determined relatively "late", once agreement has taken place. This can be modeled in an interpretive theory of morphology (e.g. Anderson 1992; Halle and Marantz 1993) – for example, as post-syntactic context-free or context-sensitive Vocabulary Insertion in Distributed Morphology (Halle and Marantz 1993), with the options given in (5). In (a), the terminal element X has a single phonological form /A/ which occurs in all contexts. In (b), the terminal element X has one form /B/ which occurs in the presence of a feature [F] on X, and a second form /A/ which occurs elsewhere. In (c), the terminal element X has one form /C/ which occurs in the presence of a feature [G] on a locally adjacent head Y^0, and a second form /A/ which occurs elsewhere. Allomorphs with more specific contexts take precedence over forms with less specific contexts. In this way, Vocabulary Insertion can account for syntactically-conditioned allomorphy in phonological exponence.

(5) VOCABULARY INSERTION

a.	$/A/ \leftrightarrow X^0$	context-free
b.	$/B/ \leftrightarrow X^0$ / [F]	conditioned by a feature [F] on X^0
	$/A/ \leftrightarrow X^0$	default
c.	$/C/ \leftrightarrow X^0$ / $\_\_Y^0_{[G]}$	conditioned by a feature [G] on adjacent Y^0
	$/A/ \leftrightarrow X^0$	

In my model, allomorphy can be conditioned by syntactic or phonological contexts, which follows in a model where syntactic features and phases as well as prosodic boundaries are both visible at PF. Observationally, there is a divide between how allomorphy is conditioned for an XP-adjoined $\sqrt{\text{ROOT}}$ versus a syntactic X^0 head or an X-adjoined $\sqrt{\text{ROOT}}$ in Blackfoot. (For a description of root syntacticization, see Section 1.2.2.2.) XP-adjoined $\sqrt{\text{ROOT}}$ allomorphy is phonologically optimizing (Mascaró 2007) and is often conditioned by phonological restrictions at prosodic boundaries. X-adjoined root and X^0 head allomorphy is conditioned by syntactic features, as in (5). I do not have an explanation for why this divide occurs, and I leave a full discussion of the typology of conditioning factors on phonological exponence for future research.

This thesis does not directly address issues of linearization. However, since syntactic and phonological elements are both available at PF, my model predicts that linearization could be affected by syntactic or phonological properties. Indeed, linearization has been argued to follow purely from syntactic precedence (see Embick 2010 for one formal model) as well as phonological properties, such as minimality constraints, interaction with stress or tone, or syllable shape (see Bennett, Elfner and McCloskey 2016; Elfner 2012; Harizanov 2014; McCarthy and Prince 1993a; Werle 2009, among others).

1.2.2 Syntax

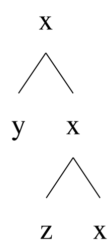
In this section I lay out my assumptions about the mechanics of phrase structure and the syntacticization of roots. Both elements are necessary for the proposal of syntax-prosody correspondence I discuss below.

1.2.2.1 Phrase structure

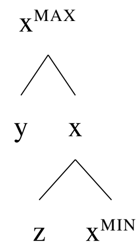
Following Bare Phrase Structure (Chomsky 1995a), I take an explicitly derivational approach to syntactic construction. A derivation is simply the pairwise combination of items drawn from the lexicon to build up a constituent structure using the syntactic operations Select, Merge, and Move. I further assume that phrases and words are constructed via 'syntax all the way down', such that stems and words are built via the same syntactic operations as phrases. As such, I explicitly reject the Lexicalist hypothesis (Chomsky 1970; Halle 1973) and adopt a constructionist view of syntax. A constructionist approach is used in a variety of other frameworks, including Distributed Morphology (Embick and Noyer 2007; Hale and Keyser 1993; Halle and Marantz 1993; Harley and Noyer 1999), Borer's Exoskeletal Model (Borer 2013), and Nanosyntax (Starke 2009, 2011).

Bare Phrase Structure eliminates bar levels as formal elements, and syntactic features instead project directly. In (6) below, x is a complex category which first Merges with y and then subsequently Merges with z. Unlike in X-bar theory (Chomsky 1970; Jackendoff 1977), rules cannot refer specifically to x^0, x', or x'', because these are not formal elements. However, certain relational properties of categories can be determined by structure. For any complex category, X, an X which does not dominate another x is the minimal projection of that category, X^{MIN}, and an x which is not dominated by another x is the maximal projection of that category, X^{MAX}. The tree in (7) includes the same structure as (6), with maximal and minimal projections explicitly labelled.

(6)

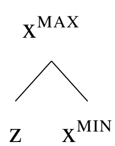


(7)

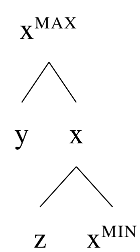


Maximal and minimal projections are not syntactic primitives, but structurally determined, which means that in a derivational framework these properties may change after each step of the derivation. For example, in the first step of the derivation for the tree above, *x* Merges with *z* and projects *x*, (8a). At this point in the derivation, the projection which immediately dominates *z* and *x* is the maximal projection. In the second step of the derivation, the complex category *x* Merges with *y* and projects *x*, (8b). At this point in the derivation, the projection which immediately dominates *z* and *x* is no longer the maximal projection. Nevertheless, at an earlier step in the derivation it was maximal, and this fact will be relevant for root syntacticization, as I discuss in Section 1.2.2.2.

(8) a. STEP 1: MERGE {z,x}

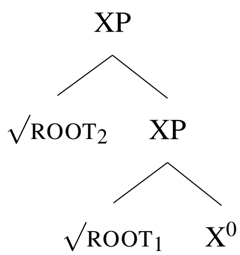


b. STEP 2: MERGE {y,x}

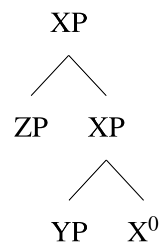


Although category labels like X^0, X', and XP are not formal elements, it is common practice to use these as informal labels in trees, and this thesis is no exception. I use X^0 to designate minimal projections, and XP for any higher projection of a complex category, as in (9) and (10). In (9) a head X^0 merges with multiple a-categorical $\sqrt{\text{ROOT}}$ adjuncts, represented by $\sqrt{\text{ROOT}}_1$ and $\sqrt{\text{ROOT}}_2$. (See the next section for an explanation of root syntacticization in my proposal.) In (10) a head X^0 merges with two phrasal elements, represented by YP and ZP. Following Kayne (1994), I take the basic structural contrast to be complement versus non-complement; consequently, there is no structural difference between specifiers and adjuncts, and the only difference is the order in which they Merge. This is also in conformity with the Inclusiveness Condition of Bare Phrase Structure (Chomsky 2007, 2008, 2013), which states there are no bar level distinctions in syntactic representations.

(9) $\sqrt{}$ROOT MERGES WITH HEAD X^0



(10) PHRASE MERGES WITH HEAD X^0



1.2.2.2 Root syntacticization

Recent analyses treat roots as category-neutral formatives introduced uniformly as complements to a categorizing head. In one variant, the root is sister to a categorizing lexical head, such as a verbalizing *v*, (11a); this is found with Distributed Morphology (Marantz 1997; Siddiqi 2009) and Asymmetric Morphology (Di Sciullo 2005). In another variant, the root is sister to a functional head which serves to categorize the root, as in (11b); this is found with Exoskeletal Syntax (Borer 2013).

(11) a. [*v* [$\sqrt{}$ROOT]]

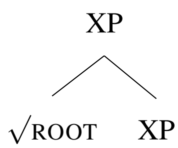
b. [F [$\sqrt{}$ROOT]]

The claim that roots are invariably complements is problematic, both theoretically and empirically. The theoretical problem is that if a $\sqrt{}$ROOT is a syntactic atom, it should be able to Merge as a head, complement, or adjunct. Despite this, the theories discussed above stipulate that a $\sqrt{}$ROOT must merge in one particular way—as sister to a syntactic head. There is no theory-internal reason for this to be the case. The empirical problem is that roots in Blackfoot do not have a uniform morphosyntax, as is predicted by the syntactic accounts in (11), where all $\sqrt{}$ROOTs merge in the same fashion. As I discuss in Section 4.1, many Blackfoot roots have the distribution of phrasal adjuncts, while others are restricted to verbal contexts and co-occur only with a verbalizing head.

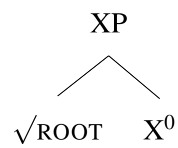
To account for these distinct distributions, I adopt a version of the proposal in Déchaine and Weber (2018). I propose that a-categorical roots are uniformly adjuncts, but that roots differ in the type of syntactic structure they adjoin to: some roots only adjoin to X^{MAX} (where X^{MAX} is calculated w.r.t. the syntactic structure at the point in the derivation where the root merges), while other roots only adjoin to X^{MIN}. Following the informal labelling conventions I discussed in Section 1.2.2.1, a $\sqrt{}$ROOT either (i) adjoins to an XP phrase, (12a) or (ii) adjoins to an X^0 head, (12b). I discuss the implications of this proposal more fully in Section 4.1.

(12) ROOT SYNTACTICIZATION STRATEGIES

a. √ROOT ADJOINS TO XP



b. √ROOT ADJOINS TO X^0



This proposal solves the theoretical problem discussed above, because there is no external stipulation that a √ROOT can only merge in one way. Although a √ROOT in this theory is always introduced via adjunction, one hypothesis is that this restriction arises via theory-internal reasons. For example, De Belder (2011) suggests that a √ROOT cannot project because it lacks syntactic features; this would explain why a √ROOT only occurs as an adjunct. The proposal also solves the empirical problem discussed above, because the two different classes of Blackfoot √ROOTs emerge from the two different Merge sites. This type of analysis of roots as a bare elements which does not need to be categorized on first Merge differs from most recent analyses, but is not without precedent. More recent developments in Distributed Morphology acknowledge the modificational nature of roots (Marantz 2013), and De Belder (2017) specifically argues that the non-head element of primary compounds in Dutch is a bare √ROOT.

1.2.3 Phonology

Research on the prosody-syntax interface over the past 40 years has shown that phonological domains are independent from, but closely related to, syntactic structure. Even early observations indicated that the domains of phonological generalizations correspond systematically to syntactic constituents (Chomsky and Halle 1968; McCawley 1968; Selkirk 1974). However, these domains are often non-isomorphic to syntactic constituents and can be influenced by language-specific phonological properties, including rate of speech, weight/size of constituents, or stress or tonal properties (cf. Nespor and Vogel 2007; Selkirk 1986, 2011). Because of this, I adopt a version of the Prosodic Hierarchy Theory (PHT), whereby phonological generalizations apply to a hierarchical prosodic structure which is independent from syntactic structure.

In many instantiations of the Prosodic Hierarchy Theory, such as that in Nespor and Vogel (2007), the prosodic hierarchy is non-uniform. Itô and Mester (2012) call the higher levels "interface categories", which are extrinsically defined by their relation to syntax, while the lower levels are "rhythmic categories", which are intrinsically defined by sonority-related phonetic factors and rhythmic stress. Although the division is purely conceptual in most instantiations of the Prosodic Hierarchy Theory, Inkelas (1990, 1993) explicitly treated the Prosodic Hierarchy and the Metrical Hierarchy as two separate hierarchies. This idea was taken up by much subsequent work (Branigan, Brittain and Dyck 2005; Downing 1999; Dyck 2009; Inkelas 1990; Itô and Mester 2012). I also adopt this approach. I discuss my assumptions about prosodic structure in Section 1.2.3.1 and metrical structure in Section 1.2.3.2.

1.2.3.1 Prosodic structure

Prosodic Hierarchy Theory (PHT) was first developed in Selkirk (1978, 1980, 1981b) and further developed by many researchers (a partial list: Beckman and Pierrehumbert 1986; Downing 1999; Hayes 1989b, 1995; Hyman 1985; Inkelas 1990; Itô and Mester 2003, 2009a,b, 2012; Ladd 2008; Nespor and Vogel 1982, 1983, 2007; Pierrehumbert and Beckman 1988; Selkirk 1984, 1996, 2009, 2011). Therefore, PHT itself has many different instantiations, but all of them assume there is a finite set of ordered prosodic categories, which are the domains for sets of phonological generalizations.

The prosodic categories which I adopt are shown in (13). I follow the majority of researchers who assume that this set of prosodic categories is universal. Not all researchers share this view; some argue that not all levels of the prosodic hierarchy are instantiated in every language (Green 1997; Jun 2005; Labrune 2012), or that prosodic constituents are emergent (Schiering, Bickel and Hildebrandt 2010).

(13) PROSODIC CATEGORIES

IPh intonational phrase
|
PPh phonological phrase
|
PWd prosodic word

The exact number of categories within the prosodic hierarchy differs among researchers. Many works also assume an Utterance (Utt) category above the IPh (Nespor and Vogel 2007; Selkirk 1978, 1980, 1986; and subsequent work), but recent work has argued that the Utt can be viewed as the maximal IPh (Itô and Mester 2012; Kawahara and Shinya 2008, later incorporated into Match Theory; Selkirk 2011). Still others have argued to expand the number of 'phrasal' categories (Nespor and Vogel 2007; Pierrehumbert and Beckman 1988; Poser 1984; Vogel 2009), or to add prosodic categories below the word level (Downing 1999; Inkelas 1990). However, these relatively minor differences do not affect the underlying core assumption that there is a finite set of distinct prosodic categories.

Phonological generalizations (e.g. phonotactic restrictions, segmental rules, suprasegmental rules) take a particular prosodic category as their domain of application. Said another way, phonological generalizations can diagnose prosodic constituents within a hierarchical structure structure. Nespor and

Vogel (2007: 58*ff*) discuss four criteria which can be used to motivate phonological constituents. A string is considered a constituent in phonology if:

(14) PROPERTIES WHICH MOTIVATE PHONOLOGICAL CONSTITUENTS

a. there are rules of the grammar that need to refer to it in their formulation, or

b. there are rules that have precisely that string as their domain of application, or

c. if the string is the domain of phonotactic restriction, or

d. if the string must be posited as a domain which delimits the domains of stress patterns, in order to explain the relative prominence relations (stress) within a given string.

(Nespor and Vogel 2007: 58*ff*)

In other words, if a phonological generalization cannot be stated without reference to a phonological domain then the phonological generalization is evidence for a phonological constituent. The exact type of phonological category cannot be determined by purely phonological factors, but can be extrinsically defined by its correspondence to syntax. I turn to these correspondence relationships in Section 1.2.4.

Finally, there are inviolable constraints on hierarchical constituent structures which contain the ordered categories in (13). Early proposals of PHT followed the Strict Layer Hypothesis (SLH; Beckman and Pierrehumbert 1986; Nespor and Vogel 2007; Pierrehumbert and Beckman 1988; Selkirk 1981b, 1984, 1986), which assumed that prosodic structures were strictly organized and had different properties than syntactic structure. This formulation has since been split into a set of more primitive components (e.g. Inkelas 1989; Itô and Mester 2003; Nespor and Vogel 2007; Selkirk 1996). I take the dominance relations in (13) to represent containment relations (see Pak 2008 for a good discussion of this point), as required by PROPER BRACKETING in (15). Proper bracketing follows from basic tree structure requirements and I assume it is one of three inviolable constraints on constituent structure, along with PROPER HEADEDNESS, (16), and LAYEREDNESS, (17).[1]

(15) PROPER BRACKETING

Every C_j ($\neq C^{\text{MAX}}$) has one and only one mother node (i.e., a given constituent cannot simultaneously be part of two or more higher prosodic constituents).

(Itô and Mester 2003; Nespor and Vogel 2007)

[1]A similar proposal in Peperkamp defines 'proper nesting' by using alignment constraints to require prosodic edges to coincide (Peperkamp 1997: 37, (42)). Because alignment constraints are violable, this predicts that some languages tolerate violations of proper nesting. In contrast, I take the containment relations to be inviolable and any apparent mismatches are due to mismatches between prosodic and metrical categories as I discuss in Section 1.2.4.2 below.

(16) PROPER HEADEDNESS

Every (nonterminal) prosodic category of level i must have a head; that is, it must immediately dominate a category of level $i-1$.

(Itô and Mester 2003; Nespor and Vogel 2007; Selkirk 1996)

(17) LAYEREDNESS

No prosodic category of level i dominates a category of level j, $j > i$.

(Nespor and Vogel 2007; Selkirk 1996)

Other components of the original Strict Layer Hypothesis, such as NONRECURSIVITY and EXHAUSTIVITY (Selkirk 1996) were later shown to be violable. For example, recursive prosodic structures were first described by Ladd (1986, 1988), and his findings were later corroborated by Dobashi (2003), Elfner (2012), Féry (2011), Féry and Truckenbrodt (2005), Frota (2000), Gussenhoven (2004), Itô and Mester (2003, 2012), Kabak and Revithiadou (2009), Kubozono (1987, 1989), van der Hulst (2010), & Wagner (2005, 2010), among others. I follow Selkirk (2011), who takes the strong position that constraints like NONRECURSIVITY and EXHAUSTIVITY are not part of the universal constraint set CON in Optimality Theory (Prince and Smolensky 1993). Instead, any instance of prosodic recursion or level-skipping is the direct result of *satisfying* some syntax-prosody correspondence constraint.

1.2.3.2 Metrical structure

Metrical structure refers to a hierarchical representation of phonological units which are designated as relatively "strong" or "weak" (Halle and Vergnaud 1987; Liberman 1975; Liberman and Prince 1977). Stress is seen as a relational property obtaining between strong and weak units. In line with many common metrical theories, I interpret metrical structure as a branching tree-like structure composed of the set of ordered metrical categories in (18).[2]

(18) METRICAL CATEGORIES

Ft   foot
|
σ   syllable
|
μ   mora

[2]The other widely-used representation in metrical theory is a grid-like structure of many levels, where prominence is determined mainly by edge alignment and rhythmic constraints (Gordon 2002; Prince 1983). Other models combine both representations.

The exact number of categories within the metrical hierarchy differs among researchers. For example, some do not include the mora as the lowest metrical category, and instead treat moras as a property of syllables rather than a prosodic unit (Itô and Mester 2003; Lunden 2006; McCarthy and Prince 1993a). Again, I take the dominance relations in (18) to represent containment relations. Hierarchical structures containing these categories must obey PROPER BRACKETING in (15), PROPER HEADEDNESS in (16), and LAYEREDNESS in (17).

In addition, a relative prominence relation is defined for sister nodes within the tree: one node is assigned the value strong (*s*) and all the other nodes are assigned the value weak (*w*); the strong node is referred to as the head of the constituent it is contained in.[3] I assume that stress is simply the property of being a foot head (Halle and Vergnaud 1987; Hayes 1995; Liberman and Prince 1977; Selkirk 1980), and that the abstract phonological property of stress may be expressed by some type of phonetic prominence which may take different forms in different languages. However, not all foot heads must be overtly realized with phonetic prominence. I analyze prominence in Blackfoot (realized as a pitch peak on a single syllable) as the manifestation of stress on a head foot within the domain of stress in Section 3.2.2; the heads of secondary feet have no acoustic manifestation. For discussion on the existence of 'stressless' feet see Bennett (2012), Buckley (2009), Crowhurst (1996), González (2007), & Halle and Vergnaud (1987).

Following Inkelas (1990, 1993), the metrical categories exist in a hierarchy which is separate from the prosodic hierarchy entirely. Because prosodic and metrical structure form two distinct representations, there must be rules of correspondence between them. I discuss these in Section 1.2.4.2.

1.2.4 Correspondence

In this section I discuss how the correspondences between syntactic, prosodic, and metrical constituents is regulated. In Section 1.2.4.1 I describe the constraints which require syntactic phases and certain prosodic constituents to correspond exactly, as well as the constraints which contribute to non-isomorphism between the two representations. In Section 1.2.4.2 I describe the constraints which require edge alignment between prosodic and metrical constituents.

1.2.4.1 Syntax-prosody correspondence

The proposal I lay out in this section follows many recent theories of prosodic phonology which derive the correspondence of syntactic and interface constituents via a set of ranked and violable constraints within an Optimality Theoretic (OT) framework (McCarthy and Prince 1993a,b; Prince and Smolensky 1993), including Alignment Theory (Selkirk 1986, 1995), Wrap Theory (Truckenbrodt 1995, 1999),

[3] The prominence relationship is often conflated with Proper Headedness. My definition of prominence follows Nespor and Vogel (2007), who distinguished Proper Headedness and prominence relations in their formulation of the Strict Layer Hypothesis.

and Match Theory (Elfner 2012; Selkirk 2009, 2011).[4] Within these models, syntactic structure (post-movement) forms the input to the phonological component of grammar, and theory-specific constraints control the correspondence between syntactic constituents and prosodic constituents of particular types.

I take Match Theory (Selkirk 2009, 2011) as my starting point, whose correspondence constraints (MATCH) require exact correspondence between syntactic constituents and prosodic constituents of particular types. Because phonological constraints in OT are evaluated in parallel, this predicts that the default correspondence between syntactic and prosodic structure can be violated in order to satisfy higher-ranked constraints.[5] The MATCH constraints regulate correspondences between syntactic constituents of certain types and prosodic constituents, represented informally in (19).

(19) SYNTAX-PROSODY CORRESPONDENCES IN MATCH THEORY

"syntactic clause"	([Comp, C] or [Comp, Force])	$\longleftrightarrow$	ι	(intonational phrase)
"syntactic phrase"	(XP)	$\longleftrightarrow$	ϕ	(phonological phrase)
"syntactic word"	(X^0)	$\longleftrightarrow$	ω	(prosodic word)

As I demonstrate in later chapters, these correspondence relationships are too strict for Blackfoot. (Just as they are in other polysynthetic languages; see Miller 2018 for arguments.)

- MATCH(ω) constraints extend too low:
  - The terminal X^0 elements are bound suffixes and are never prosodified as a PWd.
  - The smallest constituent which has a prosodic correlate is the v*P phase.
- MATCH(ϕ) constraints extend too low:
  - Not all XPs are prosodified as PPhs. In particular, the v*P phase as well as each *v*P/VP projection above this are prosodified as a PWd in Blackfoot.
- MATCH(ϕ) constraints extend too high:
  - Not all XPs are prosodified as PPhs. In particular, some functional projections between the first and second phase are prosodified outside the PWd but inside the PPh.

[4]There are also earlier rule-based accounts in Nespor and Vogel (2007) and the Edge-Based model in Selkirk (1986).

[5]Match Theory represents a sharp break from earlier theories of syntax-prosody correspondence such as Align-XP (Selkirk 1986, 1995), Wrap Theory (Truckenbrodt 1995, 1999). Rather than assuming that prosodic structure has different properties than syntactic structure, with algorithms designed to 'flatten' syntactic structure into a well-formed prosodic representation, Selkirk (2011) assumes that prosodic structure exactly matches syntactic structure by default. As a consequence, recursive and weakly-layered structures are typical, and there are no markedness constraints against such structures in the theory. Other types of prosodic wellformedness constraints exist though, such as those requiring binarity.

I propose instead a Phase-Based Match Theory which is based on syntactic phases,[6] as in (20). (See Guekguezian 2017 for a recent proposal along similar lines.)

(20) PHASE-BASED CORRESPONDENCES FOR BLACKFOOT

Phase II	CP	$\longleftrightarrow$	PPh	(phonological phrase)
Phase I	*v*P/VP	$\longleftrightarrow$	PWd	(prosodic word)
	v*P	$\longleftrightarrow$	PWd$^{\text{MIN}}$	(minimal prosodic word)

A further problem is how to formulate the MATCH constraints themselves. As originally formulated in Selkirk (2009, 2011), the correspondence of syntactic and prosodic constituents is governed by a violable family of syntax-prosody correspondence (MATCH) constraints, which require exact correspondence between the left and right edges of syntactic constituents and prosodic constituents of particular types. These constraints were later redefined in Elfner (2012) in terms of exhaustive dominance. However, Itô and Mester (2018) argue that the MATCH constraints as originally formulated in Selkirk (2011) are redundant in the sense that they not only (a) require the *existence* and *correspondence* of particular syntactic and prosodic constituents, but also (b) require an exact match of edges between the two. They suggest that we formally disentangle the two uses of MATCH constraints: MATCH should be redefined to only require the *existence* of particular constituents (which they call MATCH-∃ for clarity), and MATCH constraints regulate the details of exact correspondence. I adopt this idea here as well.

The definitions below are modified from MATCH-∃ as defined in Itô and Mester (2018: 185, (43)). Specifically, I require that each v*P (the predicate of events) in the input representation must correspond (McCarthy and Prince 1993b) to a PWd constituent in the output representation, and vice versa. Similarly, each CP or DP phase must correspond to a PPh, and vice versa. There are two syntax-to-prosody correspondence constraints, (21), and two prosody-to-syntax constraints, (22).

(21) SYNTAX-TO-PROSODY

a. MATCH-∃(CP→PPH)

Abbreviation: MATCH-∃ (CP) or M-∃ (CP)

Given an input syntactic representation *S* and an output phonological representation *P*, such that $S\mathfrak{R}P$, assign a violation mark for every CP phase in *S* which does not have a correspondent PPh constituent in *P*.

b. MATCH-∃(V*P→PWD)

Abbreviation: MATCH-∃ (v*P) or M-∃ (v*P)

Given an input syntactic representation *S* and an output phonological representation *P*, such

[6] To my knowledge, no published work exists on Blackfoot intonational phrases, and nothing in this thesis bears on the status of IPh. I focus instead on the "word" level.

that $S\mathfrak{R}P$, assign a violation mark for every projection of a *v*/V in *S* which either (1) is a v*P phase, or (2) dominates a v*P phase, which does not have a correspondent PWd constituent in *P*.

(22) PROSODY-TO-SYNTAX

a. MATCH-∃(PPH→CP)

Abbreviation: MATCH-∃ (PPh) or M-∃ (PPh)

Given an input syntactic representation *S* and an output phonological representation *P*, such that $S\mathfrak{R}P$, assign a violation mark for every PPh constituent in *P* which does not have a correspondent CP phase in *S*.

b. MATCH-∃(PWD→V*P)

Abbreviation: MATCH-∃ (PWd) or M-∃ (PWd)

Given an input syntactic representation *S* and an output phonological representation *P*, such that $S\mathfrak{R}P$, assign a violation mark for every PWd constituent in *P* which does not have a correspondent constituent in *S* which either (1) is a v*P phase, or (2) dominates a v*P phase.

For the MATCH constraints which require exact correspondence, I modify the definition of MATCH-PHRASE in Elfner (2012), which is based on the concept of *exhaustive dominance*.

(23) EXHAUSTIVE DOMINANCE

A syntactic node α *exhaustively dominates* a set of terminal nodes β iff α dominates all and only the terminal nodes in β. (Elfner 2012: 27, (17))

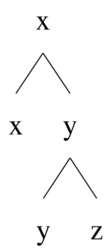
(24) MATCH-PHRASE (to be revised)

Suppose there is a syntactic phrase (XP) in the syntactic representation that exhaustively dominates a set of one or more terminal nodes α. Assign one violation mark if there is no phonological phrase (ϕ) in the phonological representation that exhaustively dominates all and only the phonological exponents of the terminal nodes in α. (Elfner 2012: 28, (19))

The advantage of this definition is that it is defined precisely, and that any phonologically null morphemes or traces are ignored. The disadvantage is that it is formulated too strictly and is violated whenever elements are epenthesized or deleted.

To see this, suppose that *x* exhaustively dominates a set of terminal nodes, $\alpha = \{$ x, y, z$\}$, as in the following tree.

(25)



Suppose further that the phonological exponents of the terminal nodes in α are as follows:

(26) a. $x \leftrightarrow$ /bc/

b. $y \leftrightarrow$ Ø

c. $z \leftrightarrow$ /def/

Then a PPh which dominates all and only the phonological exponents of those terminal nodes, as in candidate (a) below, satisfies MATCHPHRASE. If a terminal node as a null phonological exponent, as for *y* above, this does not affect the PPh. However, a PPh which dominates an epenthetic segment, like [a] in candidate (b), or a PPh which does not dominate a deleted segment, like [f] in candidate (c), will violate this constraint. (PPh boundaries in the output are designated with curly braces { }.)

(27)

/bc-def/	MATCHPHRASE
a. {bcdef}	
b. {$\boxed{\text{a}}$bcdef}	*
c. {bcde$\boxed{}$}	*

This behavior does not seem desirable. Because MATCH-∃ already requires a correspondence between syntactic and prosodic constituents, I propose the following redefinition of MATCHPHRASE, which is localized to the strings of elements dominated by CP or PPh, and which ignores segments that do not have correspondents in both the input and the output. Following Guekguezian (2017), I split MATCHPHRASE into two definitions, which penalize undermatches and overmatches, respectively, with violations evaluated per segment.

(28) MATCH(CP) (ALL)

Abbreviation: MATCH(CP) (All) or M_A(CP)

Let *S* be an input syntactic representation and *P* be an output phonological representation. Suppose there is a CP constituent in *S* that exhaustively dominates a set of one or more terminal nodes $\alpha \in S$, and there is PPh constituent in *P* and CP $\mathfrak{R}$ PPh. Let S_2 be the output string in P.

Assign a violation mark for every element that (1) is an exponent of a morpheme in α and (2) has a correspondent in S_2 which is not dominated by the PPh.

(29) MATCH(CP)(ONLY)

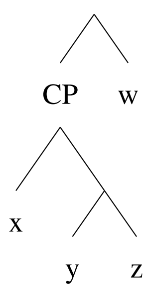
Abbreviation: MATCH(CP) (Only) or M_O(CP)

Let S be an input syntactic representation and P be an output phonological representation. Suppose there is a CP constituent in S that exhaustively dominates a set of one or more terminal nodes $\alpha \in S$, and there is PPh constituent in P and CP $\mathfrak{R}$ PPh. Let S_2 be the output string in P.

Assign a violation mark for every element that (1) is an exponent of a morpheme that is not in α and (2) has a correspondent in S_2 which is dominated by the PPh.

These definitions maintain the advantages from MATCHPHRASE but do not assign violations for epenthesized and deleted segments. To see this, suppose there is a CP in an input representation which exhaustively dominates a set of terminal nodes, $\alpha = \{\, x, y, z\}$, as in the following tree.

(30)



Suppose further that the phonological exponents of all the terminal nodes are as follows:

(31) a. $x \leftrightarrow$ /bc/

b. $y \leftrightarrow \emptyset$

c. $z \leftrightarrow$ /def/

d. $w \leftrightarrow$ /ghi/

Now a PPh which dominates all and only the correspondents of the exponents of the terminal nodes in α, as in (a) below, satisfies both constraints. And a PPh which dominates an epenthetic segment, like [a] in candidate (b), or a PPh which does not dominate a deleted segment, like [f] in candidate (c), satisfies both constraints. Finally, candidates where one terminal element has either been moved outside the PPh (d) violate MATCH(CP) (All), and candidates where one terminal element has been moved inside (e) violate MATCH(CP) (Only). Intuitively, these are the types of prosodifications that entail a mismatch between syntactic and prosodic boundaries. (PPh boundaries in the output are designated with curly braces { }.)

(32)

/bc-def-ghi/	M_A(CP)	M_O(CP)
a. {bcdef}ghi		
b. {$\boxed{\text{a}}$bcdef}		
c. {bcde$\boxed{}$}		
d. {bcde}fghi	*	
e. {bcdeg}hi		*

There are analogous MATCH(v*P) (All) and MATCH(v*P) (Only) constraints, as below.

(33) MATCH(V*P) (ALL)
Abbreviation: MATCH(v*P) (All) or M_A(v*P)

Let S be an input syntactic representation and P be an output phonological representation. Suppose there is a projection of a *v*/V in S which either (1) is a v*P phase, or (2) dominates a v*P phase, which exhaustively dominates a set of one or more terminal nodes $\alpha \in S$, and there is PWd constituent in P and *v*P $\mathfrak{R}$ PWd. Let S_2 be the output string in P.

Assign a violation mark for every element that (1) is an exponent of a morpheme in α and (2) has a correspondent in S_2 which is not dominated by the PWd.

(34) MATCH(V*P)(ONLY)
Abbreviation: MATCH(v*P) (Only) or M_O(v*P)

Let S be an input syntactic representation and P be an output phonological representation. Suppose there is a projection of a *v*/V in S which either (1) is a v*P phase, or (2) dominates a v*P phase, which exhaustively dominates a set of one or more terminal nodes $\alpha \in S$, and there is PWd constituent in P and *v*P $\mathfrak{R}$ PWd. Let S_2 be the output string in P.

Assign a violation mark for every element that (1) is an exponent of a morpheme that is not in α and (2) has a correspondent in S_2 which is dominated by the PWd.

By default then, MATCH constraints create a prosodic structure which is completely isomorphic to syntactic structure. Subsequent works have redefined these constraints in various ways (Guekguezian

2017; Itô and Mester 2018; Kalivoda 2018; Lee and Selkirk 2016), but the basic idea remains the same: syntactic and prosodic structural correspondences are regulated via ranked and violable constraints. Because phonological constraints in OT are typically evaluated in parallel, this predicts that the default correspondence between syntactic and prosodic structure can be violated in order to satisfy higher-ranked prosodic wellformedness constraints. Because MATCH is violated for every segment that is misaligned, these definitions predict that misalignments will be *minimal* and at prosodic edges.

To see how the constraints are assigned violations, see the tableau below, which uses the CP/PPh MATCH constraints as an illustration. The CP phase constituents in the input are marked with [ ]; the PPh prosodic constituents in the output are marked with ( ); corresponding constituents are marked by identical subscripts; x and y stand for strings of sounds. The MATCH-∃ constraints are assigned a violation whenever the number of corresponding constituents do not match. The MATCH constraints are violated if a prosodic constituent dominates not all or not only the exponents associated with the corresponding XP.

(35)

$[\ x\ [\ y\ ]_1\ ]_2$	M-∃ (CP)	M-∃ (PPH)	M_A(CP)	M_O(CP)
a. $(\ x\ (\ y\ )_1\ )_2$				
b. $(\ x\ (\ y\ )_3\ )_2$	*	*		
c. $((\ x\ )_3\ (\ y\ )_1)_2$		*		
d. $(\ x\ )_2\ (\ y\ )_1$			*y	
e. $(\ x\ y\ )_2$	*			
f. $(\ x\ y\ )_1$	*			*y

When prosodic wellformedness constraints dominate MATCH constraints, mismatches occur. There are two constraints relevant for this thesis, defined below, although other prosodic wellformedness constraints have been proposed.

(36) EQUALSISTERS (EQSIS)

Sister nodes in prosodic structure are instantiations of the same prosodic category. (Myrberg 2013)

(37) BINMIN (BIN)

A PPh must consist of at least two prosodic words. (Inkelas and Zec 1995)

The perfectly matched candidate (a) satisfies all the MATCH constraints but violates EQUALSISTERS and BINMIN. Because constraints are rankable, the MATCH constraints and prosodic wellformedness constraints together predict a typology of languages.

(38)

$[\ x\ [\ y\ ]_1\ ]_2$	EqSis	Bin	M-∃ (CP)	M-∃ (PPh)	M_A(CP)	M_O(CP)
a. $(\ x\ (\ y\ )_1\ )_2$	*	*				
b. $((\ x\ )_3\ (\ y\ )_1)_2$		**		*		
c. $(\ x\ )_2\ (\ y\ )_1$		**			*y	
d. $(\ (\ x\ )_1\ y\ )_2$	*	*			*y	*x
e. $(\ (\ x\ )_2\ y\ )_1$	*	*			*y	*x
f. $(\ x\,y\ )_2$			*			

In the final section, I turn to the question of prosodic and metrical alignment.

1.2.4.2 Prosody-metrical alignment

Since the prosodic and metrical hierarchies are separate, there must be some mechanism to force them to align. Recall that the dominance relations in (13) and (18) are essentially containment relations (see Pak 2008 for a good discussion of this point). This is why categories within each hierarchy must obey Proper Bracketing (Itô and Mester 2003, discussed above). For example, PWds are contained entirely within PPhs, and syllables are contained entirely within Feet. There are no misaligned boundaries of the sort in (39) or (40).

(39) Misaligned prosodic boundaries (disallowed)

*	(xxxx)(xxxx)	PPh
	…(xxxx)…	PWd

(40) Misaligned metrical boundaries (disallowed)

	(xxxx)(xxxx)	Foot	
*	…(xxxx)…	σ	(after Pak 2008: 47)

The relationship between prosodic and metrical categories must be something other than a containment relationship, because there are many types of misalignments between prosodic and metrical constituents, including extrametricality of various kinds at edges and resyllabification across prosodic boundaries. Inkelas (1990) describes some of the mismatches between metrical and prosodic constituents, showing that they do not obey strict layering. Consequently, misalignments like those in (41) and (42) are tolerated.

(41) Misaligned prosodic and metrical boundaries (allowed)

(xxxx)(xxxx)	PWd
…(xxxx)…	Foot

(42) MISALIGNED PROSODIC AND METRICAL BOUNDARIES (ALLOWED)

(xxxx)(xxxx)	PWd
. . . (xxxx). . .	σ

I proposed that edge-based Alignment constraints govern the relation between prosodic and metrical structure (McCarthy and Prince 1993a; Selkirk 1986).[7]

(43) GENERALIZED ALIGNMENT TEMPLATE

Align (Cat1, Edge1, Cat2, Edge2) ≡

$\forall$ Cat1 $\exists$ Cat2 such that Edge1 of Cat1 and Edge2 of Cat2 coincide.

Where

Cat1, Cat2 are one of the prosodic or metrical categories, and

Edge1, Edge2$\in$ {Right, Left} (McCarthy and Prince 1993a)

There are entire families of constraints, like the ones defined below which require the edges of feet to align to different prosodic constituents. And indeed, languages make different rankings amongst these constraints. For example, in French stress is culminative at the phrasal level, but not necessarily at the word level, since rules of destressing may eliminate word stresses on the surface (Dell 1984). In Iwaija, the IP may be the domain of stress (Birch 2002). Later in Section 3.2.2 I argue that stress in Blackfoot is culminative at the phrasal level as well.

(44) a. ALIGN (IPh, L, Ft, L)

b. ALIGN (PPh, L, Ft, L)

c. ALIGN (PWd, L, Ft, L)

(45) a. ALIGN (IPh, R, Ft, R)

b. ALIGN (PPh, R, Ft, R)

c. ALIGN (PWd, R, Ft, R)

If the prosodic and metrical hierarchies are decoupled and instead aligned at edges, there is an interesting prediction: there is the potential for a foot or a syllable to span a PWd boundary. I return to this point in Section 5.2, where I argue that Blackfoot is such a language. To see how this would work, consider a case where a prefix attached to a v*P phase, such that the v*P phase will be MATCH-ed to a PWd in the tableaux below, I use ( ) for PWd, and [ ] for an input v*P or for a syllable in the output.

Consider cases where the prefix ends in an open syllable, represented below by V-, and the PWd begins in another vowel. Candidate (a) parses each vowel to a separate syllable, which satisfies both MATCH constraints and ALIGN-IO(PWd,σ), but violates ONSET because the second vowel is parsed

[7] Generalized Alignment Theory (McCarthy and Prince 1993a) allows morphological and prosodic/metrical categories to be aligned directly. In my proposal the relationship between morphosyntactic and prosodic categories is regulated via MATCH constraints, and the relationship between morphosyntactic and metrical categories is indirectly mediated via the prosodic categories.

to an onsetless syllable. If this is a language with distinctive vowel length, then both vowels can be parsed to a single syllable, as in the remaining candidates. Candidates (b) and (c) satisfy Align-IO(PWd,σ) by allowing imperfect correspondences between the input v*P and the output PWd, violating Match(PWd) (All) and Match(PWd) (Only), respectively. The partial ranking Align-IO(PWd,σ) would make (d) the optimal candidate, where both vowels are parsed to a single syllable, but the PWd boundary falls between the two moras in the middle of a syllable, satisying the two Match constraints.

(46)

V- [V μ μ]	Al(PPh,σ)	Onset	M_A(PWd)	M_O(PWd)	Al(PWd,σ)
a. { [V] ([V] [σ]) }		*			
b. { [VV] ([σ]) }			*		
c. { ([VV] [σ]) }				*	
d. { [V (V] [σ]) }					*

Now consider cases where the prefix is a single consonant, or ends in a single consonant, represented below by a C, and the PWd begins in a vocoid. Again, if the Match constraints outrank Align-IO then misalignments between prosodic and metrical structure are expected.

(47)

C- [V μ μ]	Al(PPh,σ)	Onset	M_A(PWd)	M_A(PWd)	Al(PWd,σ)
a. { [CV] ([σ]) }			*		
b. { ([CV] [σ]) }				*	
c. { [C (V] [σ]) }					*

For languages where feet and syllables span PWd boundaries, the evidence for the PWd itself would be entirely morphophonological. Since there is a prosodic boundary at the left edge of the PWd, we might expect this boundary to condition other generalizations, such as phonological exponence of morphemes. We would also *not* expect any metrical generalizations to hold of the PWd. For example, if there are generalizations which hold of stress at the PPh level, such as obligatoriness, culminativity, or edge demarcation, then those properties should not hold of the PWd.

1.3 Language overview

The empirical focus of this dissertation is Blackfoot, a language of the Algonquian family,[8] which extends across North America from British Columbia to Labrador and as far south as North Carolina (Mithun 1999). Blackfoot is spoken in northern Montana, USA and southern Alberta, Canada, making

[8]The Algonquian family is well-established by lexical reconstructions based on regular sound changes (cf. Aubin 1975; Bloomfield 1946; Hewson 1993; Pentland 1979; Siebert 1967).

it the westernmost language within Algonquian. The location of Blackfoot in relation to the rest of the family is shown in Figure 1.2. On this map, a dashed line outlines Wiyot and Yurok, two Californian languages which, together with Algonquian, form the Algic language family (Goddard 1975; Haas 1958; Sapir 1913, 1922).

In terms of similarities to other Algonquian languages, Blackfoot is one of the so-called "Plains Algonquian" languages, an areal grouping which includes Cheyenne and Arapaho-Atsina. In the map in Figure 1.2, Cheyenne and Arapaho-Atsina are represented by the non-contiguous gray area to the southeast of Blackfoot. Any shared features within this group have been argued to be the result of contact instead of shared innovations (Goddard 1994; Mithun 1999). However, it is clear that Blackfoot also shares many features of other Algonquian languages. For example, the Plains Cree dialect of the Cree-Montaignais-Naskapi dialect continuum is spoken to the north and east of Blackfoot, and the two languages share many morphosyntactic features (see Bliss, Déchaine and Hirose 2013; Déchaine and Weber 2015, 2018; Hirose, Déchaine and Bliss 2020).

Blackfoot is spoken on three reserves in southern Alberta and a fourth reservation in northern Montana, shown in gray in Figure 1.3. The Siksiká (Blackfoot) reserve is slightly southeast of Calgary near Gleichen. The Aapátohsipikani (Peigan, or Northern Peigan) reserve is located at Brocket, southwest of Fort Macleod, Alberta. The Káínai (Blood) reserve is southeast of the Piikáni, near Cardston and Stand Off, Alberta. The Aamsskáápipikani (Blackfeet, or Southern Piegan)[9] reservation is located in northwest Montana in Glacier County. Each of the four reserves is associated with a different dialect. The four dialects are mutually intelligible, but contain lexical, morphosyntactic, and phonological differences (Frantz 2009; Frantz and Russell 2017; Peter 2014). There is also interspeaker variation within each dialect, and the preface to the dictionary notes that 'there is as much variation between speakers from the same reserve as there is between speakers from different reserves' (Frantz and Russell 2017: *xiii*). The dialects are thus determined based on geographic location, but are probably not the only locus of variation.

According to the 19th edition of the Ethnologue, the Blackfoot population is approximately 15,000 in Canada, and another 1,600 in the United States (Lewis, Simons and Fennig 2016). There are roughly 3,250 speakers of Blackfoot in Canada (Statistics Canada 2011), and 50 speakers in the U.S. (p.c. Daryl Kipp to Mizuki Miyashita in 2011; documented in Fish and Miyashita 2017). This number is similar to the estimate of 4,315 speakers given in Russell and Genee (2006). In the author's estimation most speakers are age 50 or older, and the language is rarely, if ever, the first language of acquisition for children.

In terms of genetic affiliation, Blackfoot has been called 'the most divergent language within the Algonquian family' (Goddard 2015), containing archaic retentions (Goddard 1994, 2015) as well as

[9] The spelling is usually 'Peigan' in Canada, but 'Piegan' in the States.

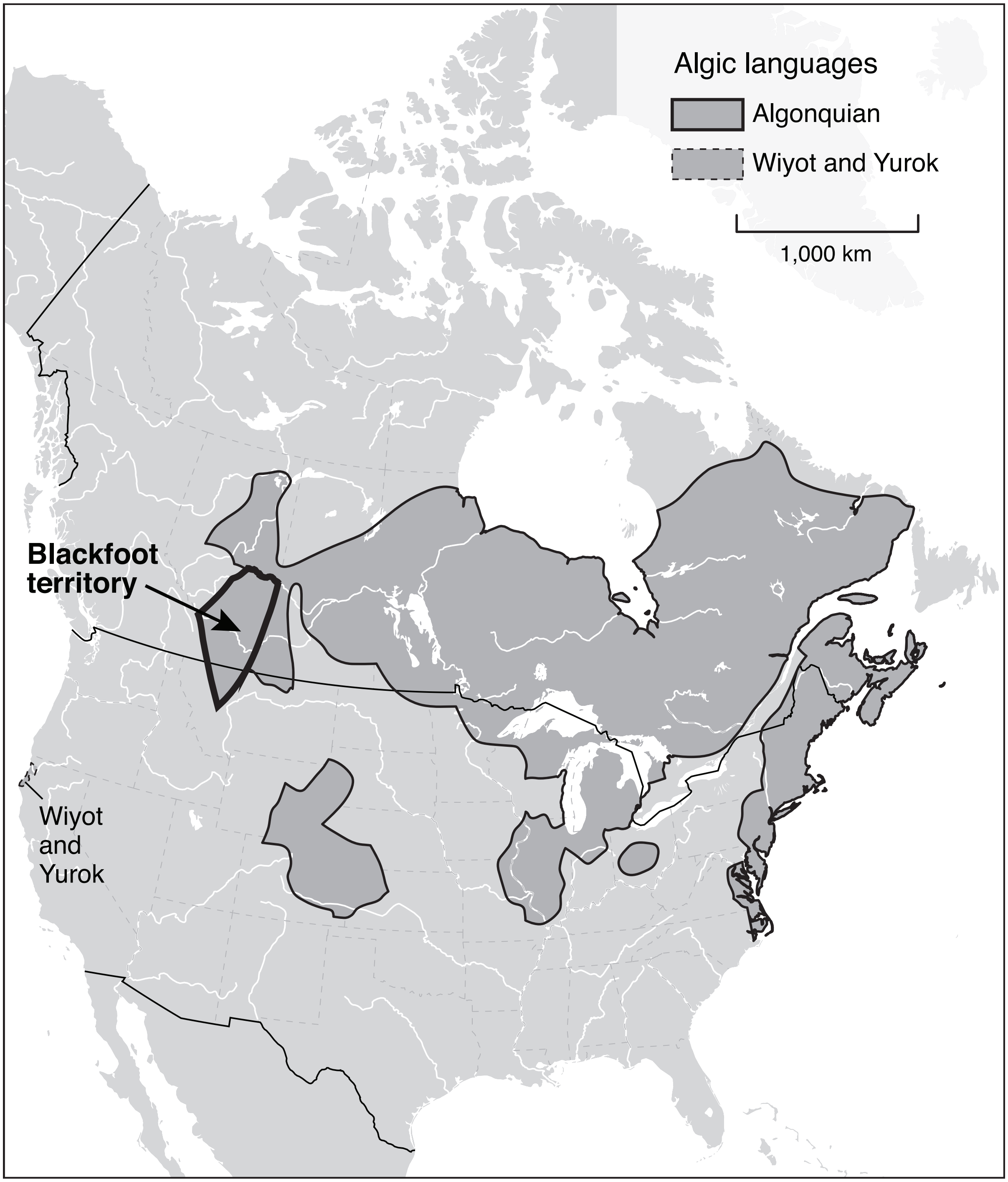


Figure 1.2: Location of Blackfoot in relation to the Algonquian and Algic languages. Map by Eric Leinberger.

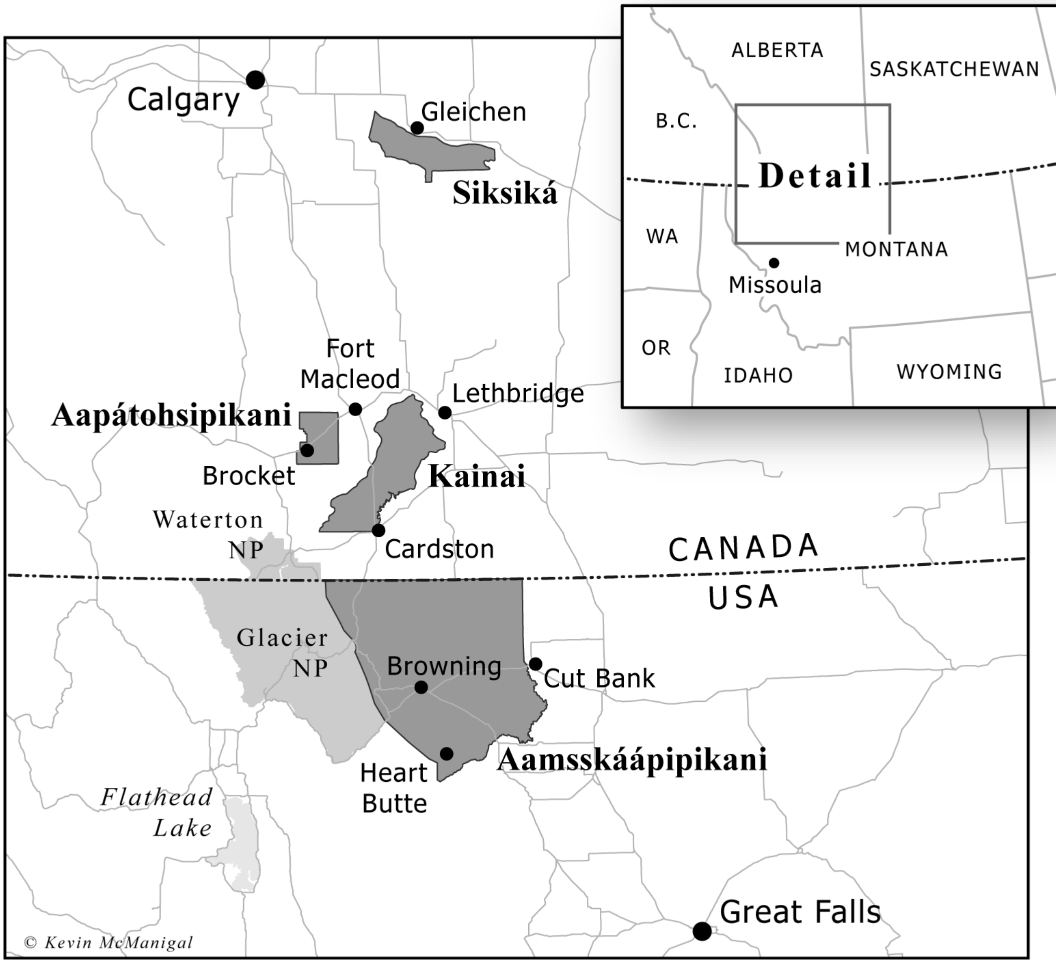


Figure 1.3: Locations of Blackfoot reserves. Map by Kevin McManigal.

substantial phonological innovation (Berman 2006, 2007). Goddard (2015) argues that Blackfoot was the first to diverge from a Proto-Blackfoot-Algonquian ancestor, and that Proto-Algonquian can be defined as a subgroup by several innovations. Many cognates to other Algonquian languages have been claimed (Berman 2006, 2007; Goddard 2015; Michelson 1935; Proulx 1989, 2005; Taylor 1960; Thomson 1978; Weber 2017), but the many unresolved details of Blackfoot phonology and morphology mean that there is still no full comparative reconstruction of Blackfoot historical phonology. My hope is that the contributions in this dissertation move us towards a better understanding of the relationship of Blackfoot to the other Algonquian languages.

1.4 Data and methods

1.4.1 Sources

The data in this dissertation come from two main sources. The first is original fieldwork by the author (2011–present), primarily with speakers of the Káínai (Blood) dialect. The person who first introduced me to Blackfoot and taught me is Beatrice Bullshields (29 May 1945–1 July 2015), who was called Totsinámm (Resembles Her Family). She was from the Káínai (Blood) reserve, and was a monolingual Blackfoot speaker until age 7, when she began attending St. Paul's residential school in Cardston. At the time that I met Beatrice, she had lived in Seattle and Vancouver for many years, but often visited her family for the Akóka'tssini (Sundance) in the summers. She was an experienced language consultant, and served as the language consultant for three field methods classes at UBC (1998–1999, 2004–2005, 2011–2012). The data in Section 3.2.2 in particular is drawn from elicitation sessions with Beatrice, and I describe my methods for elicitation in that section. I am also indebted to Natalie Creighton from the Káínai reserve, who is called Ááhsaikamo'sáákii (Always Conquering Woman), and Rod Scout, who grew up in Siksiká. Other people from the Blackfoot community have also shared their language with me, but their words are not in this dissertation.

The second source of data is the Blackfoot dictionary (Frantz and Russell 2017), which includes forms from all four major dialects. If a lexical item is restricted to one or two dialects, that information is often noted in the dictionary entry. All entry headers and examples are written using an orthography which maps transparently to a phonemic or broad phonetic transcription (Frantz 1978). When I include examples from the dictionary, I often include a phonetic transcription, which I derive from the orthographic representation following the explanation of the orthographic system in Frantz (1978, 2009). This derivation is made explicit in Section 1.4.3.

1.4.2 Presentation

I present data in a four- or five-line interlinear gloss. If the first line exists, it is a **phonetic transcription** given in square brackets, as in (48). Where data is taken from my own fieldwork, (48a), the first line is a broad IPA transcription given in square [ ] brackets, and the second line is an orthographic representation. I mark examples from my own fieldnotes with an abbreviation of the speaker's name and often with the date it was elicited. Where data is taken from a written source, (48b), the second line is reproduced faithfully from the original source and the phonetic transcription in the first line is derived using the rules in Section 1.4.3 and given in double square ⟦ ⟧ brackets. If the written source is Frantz and Russell (2017), the example has no citation; all other sources are cited. If the morphemic analysis and/or gloss lines differ from the original source, the source will be preceded by 'Adapted from'.

(48) EXAMPLES OF A FIVE-LINE INTERLINEAR GLOSS

a. FROM FIELDWORK

[içpʊ́mːa]
iihpómmaawa
[ii\ohpomm–aa]–Ø–wa
[IC\buy–AI]–IND–3
'she bought' (BB; 2013-14-01)

b. FROM WRITTEN SOURCES

⟦sɛːpíːs⟧
saipíís
[sa–ip/i–:s]–Ø
[out–bring/*v*–2SG:3.IMP]–CMD
'bring her out!'

If the phonetic transcription line does not exist, then the top line is a faithful reproduction of the original source's **orthographic transcription** and is given in an italicized font, (49) and (50). In other words, all examples from written sources begin either with a broad phonetic transcription in double square brackets, ⟦ ⟧, or with an orthographic transcription in italics.

(49) *áakoohtoyiiwa*
aak–[yooht–o–yii]–Ø–wa
FUT–[listen–*v*–3SUB]–IND–3
's/he will hear him/her'

(50) *áaksipapainoyiiwáyi*
aak–[ipapa–in/o–yii]–Ø–w=ayi
FUT–[dream–by.sight/*v*–3SUB]–IND–3=OBV.SG
'she will see him in a dream'

The orthographic line is followed by two lines for a **morphemic analysis** and **gloss**. I mark the first phase of events (v*P) in square brackets in these two lines. This constituent is equivalent to the traditional Algonquian theme (Bloomfield 1946). I separate an X^0-adjoined $\sqrt{\text{ROOT}}$ from the head X^0 it adjoins to with a slash. For example, the v^0 *-o* occurs alone in (49) but adjoined to the root $\sqrt{\text{IN}}$ 'by sight' in (50). The v^0 in transitive stems and the V^0 in intransitive stems are equivalent to the traditional Algonquian final, which determines valency and the animacy of one of the arguments. A $\sqrt{\text{ROOT}}/X^0$ complex is equivalent to a complex Algonquian final, which consists of a more concrete element followed by an abstract element which only determines valency and animacy. The slash in the transcriptions follows the practice in Denny (1984) of demarcating the concrete and abstract finals from each other with a slash.

In general, I follow the *Leipzig glossing rules* (2015), such that any punctuation mark from the set { ( ) – = * \ / } in the morphemic analysis line is repeated in the gloss line. The \ symbol is used to mark non-concatenative morphology, such as the vowel ablaut in (48a). When multiple words or features in the gloss line correspond to a single unit of the morphemic analysis line, the glosses are separated by a period. Parentheses around a morpheme or phrase indicate that element's optionality, in the sense that the speaker produced the utterance with and without the optional element and judged both as acceptable within the given context. Other judgement marks (* % ?) precede the entire interlinear gloss. In cases where the example was judged unacceptable, I will preface the translation with 'Target' or 'Intended'.

The final line is a **free translation** as given by the speaker or reproduced faithfully from the original written source. Some examples from Frantz and Russell (2017) are words which have been extracted from longer examples; in those cases I change the free translation accordingly (for example, to use pronouns instead of full DPs).

1.4.3 Transcription

The orthography developed in Frantz (1978) matches a broad phonetic or phonemic transcription fairly closely (see the phonemic inventory in Chapter 2), except that <’> is used for [ʔ], <y> for [j], and <h> for /x/. Long consonants and vowels use doubled letters; e.g. <pp> is a geminate [pː] and <aa> is a long [aː]. The long mid open vowels [ɛː] and [ɔː] are represented uniformly with the digraphs <ai> and <ao>. The diphthong [oi] is written straightforwardly as <oi>.

I made the following changes when deriving phonetic transcriptions from orthography:

- I replace with <VV> with [Vː].
- In Section 2.4 I argue that vowel length is distinctive in open syllables, but neutralized to short in closed syllables. (See similar arguments in Elfner 2006b.) Therefore, I transcribe <ai> and <ao> as long vowels [ɛː] and [ɔː] in open syllables and short vowels [ɛ] and [ɔ] in closed syllables.
- The only exception to this rule is before glottal stop. Frantz (2017) includes words with both <V> and <VV> before <’>, so I have maintained vowel length distinctions before glottal stop. Frantz (1978, 2009) describes <ai> and <ao> as diphthongs before glottal stop, so I transcribe [ejʔ] for <ai’> and [awʔ] for <ao’>.
- In Section 2.2 I show that vowels are short and lax before geminate consonants or coda [s]. Frantz (1978, 2009) states that vowels are short and lax before doubled consonants; geminates and coda [s] are both written with doubled consonants. Therefore, I transcribe [ɪ, ʊ, ɛ, ɔ, ʌ] for <i, o, ai, ao, a> before doubled consonants.
- The trigraph sequences <aii>, <aai>, <aoo>, and <aao> are not explicitly discussed in Frantz (1978, 2009). In my own fieldwork, I typically hear these sequences as a vowel sequence: [ɛːi] for <aii> or <aai>, and [ɔːo] for <aoo> and <aao>. The same sorts of transcriptions are used by Taylor (1969), who worked with speakers of a different dialect in Montana. I have continued to use these transcriptions for orthographic trigraphs.
- I replace <’> with [ʔ] and <y> with [j].
- I replace intervocalic <CC> with [Cː]. For syllabified transcriptions, I use two consonants to represent the geminate, separated by a syllable boundary, as in [C.C].

- I replace the prevocalic sequences <ts> and <ks> with the assibilants [t͡s] and [k͡s]. I replace prevocalic <tts> and <kks> with [tː͡s] and [kː͡s]. For syllabified transcriptions, I use [t.t͡s] and [k.k͡s].

- I replace interconsonantal <s> with a syllabic [s̩]. This is true even if the immediately preceding consonant is <t> or <k>.

- I replace a sequence like <Css> with [Csː]. For syllabified transcriptions, if the long [sː] is followed by a consonant, I interpret the long [sː] as a bimoraic nuclear sibilant, and I transcribe it like [Cs̩ː.C]. If the long [sː] is followed by a vowel, I interpret the long [sː] as a nuclear sibilant which is simultaneously parsed to the onset of the following syllable, and I transcribe it like [Cs̩.sV].

- The sequence <sss> only occurs between a consonant and an orthographic vowel: <CsssV>. I replace this sequence with [Csːː]. For syllabified transcriptions, I interpret the superlong [sːː] as a bimoraic nucleic sibilant which is simultaneously parsed to the onset of the following syllable, and I transcribe it like [Cs̩ː.sV].

- I replace the post-vocalic sequence <st> with [ˢt]. I replace post-vocalic <stt> with [ˢtː]. For syllabified transcriptions, I use [ˢt.t].

- I replace the post-vocalic sequence <ssC> with [sC].

- I transcribe <h> as [ç] if it follows orthographic <i>, [x] if it follows orthographic <a>, and [xʷ] if it follows orthographic <o>. If the vowel before the dorsal fricative was written with a doubled letter or digraph that represents a monophthong (e.g. <ii>, <oo>, <aa>, <ai>, <ao>) then I transcribe a short vowel before the dorsal fricative. If the vowel before the dorsal fricative was written with a single letter (e.g. <i>, <o>, <a>) then I transcribe the dorsal fricative as a syllabic fricative with no vowel. Examples: <aah> becomes [ax], but <ah> becomes [x̩].

- The only exception to the preceding rule is at the beginning of an orthographic word. A short vowel before <h> is always voiced in this environment, so I follow the same procedure as if the vowel were a digraph.

- I transcribe verbs in indicative and unreal clauses with a final devoiced vowel. I transcribe suffixed nouns with a final devoiced vowel.

- Speakers of the Káínai dialect often have no acoustic or articulatory reflexes of the verbal suffix *-wa* '3' or the nominal suffix *-wa* 'PRX'. This is discussed in many sources, including Bliss (2013), Bliss and Gick (2009), Bliss and Glougie (2010), Gick et al. (2012), & Windsor (2017a,b).

I made the conservative decision to transcribe these everywhere that they occur in the orthography, even though this may be an inaccurate transcription for some dialects.

1.5 Outline of the dissertation

Chapter 2 discusses aspects of Blackfoot phonology, with a focus on the phonemic inventory and syllable structure. The analysis of syllable structure will be relevant to later analyses of vowel hiatus resolution in Section 3.2.1 and Section 4.2 and primary stress in Section 3.2.2.

Chapter 3 lays out the correspondence between CP phrases and PPh constituents. I argue that the verbal complex in Blackfoot has the syntax of a CP with *pro* arguments in Section 3.1. Then in Section 3.2 I present two phonological generalizations which are delimited by the PPh constituent in this prosodic structure. Finally, I argue in Section 3.3 that each DP and CP phase corresponds by default to a PPh. A high-ranked prosodic markedness constraint which requires prosodic sisters to be of the same type forces the verbal complex in Blackfoot to correspond to a PPh constituent as well.

Chapter 4 lays out the correspondence of transitive *v*P and intransitive VP phrases to PWd constituents. In Section 4.1 I discuss the internal syntax of the *v*P/VP phrase in Blackfoot, including the syntacticization of √ROOTs. Then in Section 4.2 I present a process of epenthesis which is unique to the PWd constituent. Finally, I argue in Section 4.3 that the first phase (the event predicate) corresponds by default to a PWd.

Chapter 5 discusses some of the broader theoretical implications of my proposals of correspondence. I argue in Section 5.1 that the PPh and the PWd are distinct in Blackfoot, and point out that some phonological generalizations at both prosodic levels require the PWd to fall in the middle of a syllable. In Section 5.2 I discuss why this is expected, given my proposal that metrical constituents are dominated directly by the PPh in Blackfoot. I suggest that other languages with so-called "clausal words" are like Blackfoot in that the PPh is the domain of metrical constituents.

Chapter 6 concludes.

Chapter 2

Blackfoot phonology

This chapter discusses aspects of Blackfoot phonology which are relevant for the remainder of the thesis. Many examples throughout this dissertation include a phonetic transcription, so I begin by discussing the contrastive units and allophones for consonants (Section 2.1) and vowels (Section 2.2). Some of my arguments go against the analyses from reference grammars like Frantz (2009), Taylor (1969), & Uhlenbeck (1938). In particular, I argue that the pre-assibilants /^{s}t/ and /^{s}tː/ contrast with plain /t/ and /tː/, and that the assibilant [k͡s] contrasts with plain /k/. For the vowel inventory I argue that Blackfoot has three short vowels but five contrastive long vowels. I then introduce the phonetic characteristics of suprasegmentals (Section 2.3), because the location of stress is a major diagnostic of the Phonological Phrase (PPh), which I discuss in Chapter 3. Finally, I discuss syllable structure in Section 2.4 because syllable structure conditions several phonological processes at the Phonological Phrase (PPh) and Prosodic Word (PWd) levels, and because many of the phonetic transcriptions in this thesis include syllabification.

2.1 Consonants

This section lays out evidence for the phonemic consonant inventory in Table 2.1. I discuss regular allophony within the system and also point out ways in which my analysis differs from previous researchers. In particular, I argue that the (pre-)assibilants /^{s}t/, /^{s}tː/, and /k͡s/ are phonemic. Appendix A includes additional minimal pairs which support the claims in this section.

2.1.1 Phonemic inventory

The inventory of phonemic consonants is given in Table 2.1. The glide /w/ occurs in the labial column and also in parentheses in the dorsal column because it has a complex (labio-velar) place of articulation. The coronal sounds are all dental/alveolar, except for the palatal glide /j/. For some speakers /s/

is retracted and distributed for the plain fricative and in the post-assibilants,[1] approximately [ç], [t͡ç], and [k͡ç]. The alveolar post-assibilants [t͡s] and [tː͡s] are not included in Table 2.1, because they are regular phonological variants of /t/ and /tː/ (see Section 2.1.2). There is no laryngeal contrast in obstruents, and plosives are voiceless and unaspirated. As shown here, many consonants have short and long counterparts. According to Derrick (2006), long consonants are approximately 100% longer than their short counterparts.

Table 2.1: Blackfoot phonemic consonant inventory

	Labial	Coronal	Dorsal	Glottal
Stops	p pː	t tː	k kː	ʔ
Assibilants		ˢt ˢtː	k͡s	
Fricatives		s sː	x	
Nasals	m mː	n nː		
Glides	w	j	(w)	

Several of these consonants have an unusual distribution with respect to the other consonants, which I discuss in Section 2.4 on syllable structure below. Specifically, the dorsal fricative /x/ occurs only before obstruents, the glottal stop /ʔ/ usually occurs before consonants (but can rarely occur between vowels), and the alveolar sibilant /s/ can occur next to either vowels or consonants.

Blackfoot includes alveolar pre-assibilants ([ˢt] and [ˢtː], which are distinct from the cluster [st]), alveolar post-assibilants ([t͡s] and [tː͡s], and velar post-assibilants ([k͡s] and [kː͡s]). The status of the assibilants has been discussed frequently in the literature (Armoskaite 2006; Chávez Peón 2015; Denzer-King 2009, 2012; Derrick 2006, 2007; Goad and Shimada 2014a,b). I treat [ˢt], [t͡s] and [k͡s] as single, complex consonants for the following reasons: (a) they have the same distribution as simplex consonants in onset positions, (b) there are alternations between plosives and assibilants, which I discuss below, and (c) the duration of [s] in assibilants is shorter than the duration of [s] in other clusters (Derrick 2006, 2007). Some of the assibilants have a predictable distribution and are not included in the inventory above. The alveolar post-assibilants [t͡s] and [tː͡s] are predictable variants of /t/ and /tː/ before [i] Section 2.1.2. As far as I know, the long (pre-)assibilants [ˢtː], [tː͡s], and [kː͡s] always alternate with geminate plosives [tː] and [kː]. I discuss why I take /ˢt/, /ˢtː/, and /k͡s/ to be phonemic further in the following paragraphs.

[1] Trask (1996) defines an assibilant as '[a]n affricate whose fricative element is a sibilant, such as the affricate [ts]'. While [t͡s] is clearly an affricate since both places of articulation are alveolar and therefore homorganic, the complex segment [k͡s] arguably is not an affricate since the two places of articulation are not homorganic. The Blackfoot literature frequently refers to [t͡s] and [k͡s] using the same term, whether that term is an 'affricate' (e.g. Denzer-King 2009; Elfner 2006a; Frantz 2017; Kaneko 1999; Taylor 1969) or 'assibilant' (Derrick 2006, 2007). Derrick used 'assibilant' to refer to *morphologically derived* [t͡s] and [k͡s] and 'affricate' to refer to morpheme-internal or non-derived [t͡s] and [k͡s]. I see no reason to distinguish between them and use 'assibilant' for both cases.

I list /k͡s/ in the inventory above because it contrasts with /k/, as shown by the minimal pair in (51).[2]

(51) CONTRAST BETWEEN [k] AND [k͡s]

a. ⟦ɪs**k**ít⟧
isskít
[iss**k**–Ø–i]–t–Ø
[by.body–*v*–TI1]–2SG.IMP–IMP
'break it!'

b. ⟦ɪs**k͡s**ít⟧
iss**ks**ít
[iss**k**–i]–t–Ø
[urinate–AI]–2SG.IMP–IMP
'urinate!'

The pre-assibilants /ˢt/ and /ˢtː/ only occur after a front vowel or diphthong, [i], [ɛ], or [oi], but in that position they can occur in the same phonological environments as the plain plosives /t/ and /tː/. For example, [ˢt] and [t] can both occur in the environment [. . . aːni __ a. . .], (52)–(53). I take this to mean that /ˢt/ and /t/ contrast.

(52) [áː.ni.**ˢt**a]
ááni**st**aa
[aan–i**st**–aa]–Ø–wa
[say–*v*–3OBJ]–IND–3
's/he is called/named' (BB)

(53) ⟦maː.ni.**t**á.piː.k͡si̥⟧
maani**t**ápiiksi
[maan–i**t**api]–iksi
[recent–person]–AN.PL
'young people'

Similarly, [ˢtː] and [tː] can both occur in the environment [ˀaːk͡si __ x̩. . .], (54)–(55). I take this to mean that /ˢtː/ and /tː/ contrast.

(54) ⟦âː.k͡sɪ**ˢt.t**x̩.ka.pi.wḁ⟧
áaksi**stt**ahkapiwa
aak–[i**stt**a–hkap/i]–Ø–wa
FUT–[under–drag/AI]–IND–3
'the sun will set'

(55) ⟦âː.k͡sɪ**t.t**x̩.si.wḁ⟧
áaksi**tt**ahsiwa
aak–[i**tt**ahs–i]–Ø–wa
FUT–[triumph–AI]–IND–3
'he will be triumphant'

There are five reasons to consider /ˢt/ to be a complex consonant rather than a consonant cluster. First, vowel length is distinctive before the pre-assibilant /ˢt/, (56). As I argue in Section 2.4.2, vowel length is neutralized to short in closed syllables, so the fact that vowel length is distinctive before /ˢt/ means that the sibilant is not parsed to a syllable coda position.

[2]Most works concentrate on the behavior of [k] and [k͡s] before a following [i] (e.g. Armoskaite 2006). However, the distribution of [k͡s] is much broader than this. It can occur before any vowel quality, which I discuss in Appendix A.1.3.

(56) SHORT OR LONG VOWELS BEFORE [ˢt] ASSIBILANT

a. ⟦âː.k͡si.ˢta.waʔ.si.wḁ⟧
áaksistawa'siwa
aak–[istaw–a'si]–Ø–wa
FUT–[grow–AI]–IND–3
'he will grow'

b. ⟦âː.k͡siː.ˢta.pi.na.kaʔ.si.wḁ⟧
áaksiistapinaka'siwa
aak–[iistap–inak/a'si]–Ø–wa
FUT–[away–roll/AI]–IND–3
'it will roll away'

Second, the pre-assibilant /ˢt/ is distinct from a heterosyllabic cluster /st/. Phonetically, the duration of the sibilant [s] is much shorter in the pre-assibilant than in the cluster. Phonologically, vowels are predictably short before the cluster, (57). Vowels are predictably lax before clusters and geminates, which I discuss below. I argue in Section 2.4.2.1.2 that the [s] in [sC] clusters is parsed to a syllable coda, which is why vowel length is neutralized to short.

(57) ONLY SHORT VOWELS BEFORE [st] CLUSTER

a. ⟦âː.k͡sɪs.to.ji.wḁ⟧
áaksisstoyiwa
aak–[issto–yi]–Ø–wa
FUT–[beard–AI]–IND–3
'he will have whiskers'

b. *[iːst]

Third, pre-assibilation also occurs on a geminate, [ˢtː], as in (58). However, there are no clusters in Blackfoot where the second consonant is a geminate. That is, there are no sequences like *[stː], *[xtː], or *[ʔtː]. This again shows that pre-assibilation patterns differently than a consonant cluster.

(58) PRE-ASSIBILATION ON GEMINATE [tː]

⟦âː.k͡sɪˢt.tx̩.ka.pi.wḁ⟧
áaksisttahkapiwa
aak–[istta–hkap/i]–Ø–wa
FUT–[under–drag/AI]–IND–3
'the sun will set'

Fourth, pre-assibilation only occurs on a homorganic plosive [t]. There are no other pre-assibilated consonants. However, a moraic coda [s] is not so limited in distribution and can precede any obstruent, as I discuss in Section 2.4.2.1.2. This suggests that pre-assibilation is tightly bound to [t] specifically, and that they form a single unit together.

Fifth, morphemic alternations also support the idea that [ˢt] is a unit. There is a process of gemination where a stem-final [t] followed by one of the inverse morphemes which begin in *-ok* will geminate to [kk]. For example, the stem *kot-* 'give' ends in a /t/, which assibilates to [t͡s] before [i] in (59a). When *kot-* 'give' is followed by *-oki* '2→1', the sequence /t-ok/ is realized as [kk], (59b).

(59) GEMINATION OF STEM-FINAL /t/

a. [ko.**t͡s**ís]
kotsís
[ko–**t**–:s]–Ø
[give–*v*–2SG:3.IMP]–IMP
'give it to him!' (BB)

b. [kʊ**k.k**ít]
kó**kk**it
[ko–**t**–oki]–t–Ø
[give–*v*–INV.21]–2SG.IMP–IMP
'give it to me!' (BB)

The same process of gemination occurs when the stem ends in [ˢt]. For example, the stem *aanist-* 'tell' ends in /ˢt/, (60a). When *aanist-* 'tell' is followed by *-okoo* 'X→SG', the sequence /ˢt-ok/ is realized as [kk], (60b). Crucially, gemination affects the entire [ˢt] unit, suggesting that it is a single complex consonant.

(60) GEMINATION OF STEM-FINAL /ˢt/

a. [áː.ni.**ˢt**a]
ááni**st**aa
[aan–i**st**–aa]–Ø–wa
[say–*v*–3OBJ]–IND–3
's/he is called/named' (BB)

b. [ni.tá.nɪ**k.k**o]
nitáni**kk**oo
nit–[aan–i**st**–okoo]–(hp)
1–[say–*v*–INV.X:SG]–(IND)
'I am called/named' (BB)

The inventories in Kaneko (1999, 2000) and Peterson (2004) also include a bilabial assibilant /p͡s/, presumably for reasons of symmetry with alveolar [t͡s] and velar [k͡s]. However, /p/ is never followed by a short sibilant the way that /t/ and /k/ are. The examples in (61a) and (61b) show that [t] and [k] can be followed by both short and long [s], where short [s] has been interpreted as one half of a complex assibilant consonant, and long [s] as a bimoraic syllable nucleus. (See Section 2.4.3 below for syllabic consonants.) The examples in (61c) show that /p/ can be followed by a long [sː] but never a short [s].

(61) DISTRIBUTION OF LONG AND SHORT [s] AFTER OBSTRUENTS

		Transcription	*Orthography*	*Gloss*
a.	t͡s	⟦ni**t͡s**amáxkima**ʔt͡s**isi̥⟧	*ni**ts**amááhkima'**ts**isi*	'my broom'
	tsː	⟦ɪs**tsː**áːkojiwḁ⟧	*is**stss**áákoyiwa*	'it dripped'
b.	k͡s	⟦i**k͡s**áʔsiwḁ⟧	***iks**á'siwa*	's/he hid'
	ksː	⟦iːtɛ́ç**ksː**akjoʔpi̥⟧	*iitáíh**kss**akio'pi*	'clothesline'
c. *	p͡s	—	—	
	psː	⟦áʔ**psː**apópiːt⟧	*á'**pss**apópiit*	'ride around (in a vehicle)!'

2.1.2 Allophony

I describe regular allophones in this section. In Section 2.1.2.1 I argue that [t͡s] is a positional variant of /t/, and in Section 2.1.2.2 I describe the three realizations of the dorsal fricative /x/.

2.1.2.1 Short alveolar assibilant [t͡s]

The assibilant [t͡s] is the positional realization of underlying /t/ before [i].[3] However, an opaque process of deletion often removes the conditioning vowel. First, consider the distribution of [t] and [t͡s] before different vowel qualities as summarized below. (Vowel length is unspecified in the table.) Only [t͡s] occurs before [i] or [iː]. Both [t] and [t͡s] can occur before all the other vowels.

Context:	__ [i]	__ [ɛ]	__ [a]	__ [ɔ]	__ [o]
[t]	✘	✓	✓	✓	✓
[t͡s]	✓	✓	✓	✓	✓

The following examples include [t] and [t͡s] in overlapping phonological environments before each of the vowels in the above table.

[3] The alveolar assibilant /t͡s/ is transcribed in various fashions. It is included in phonemic inventories as [tˢ] in Derrick (2007) & Kaneko (1999), as an affricate [t͡s] in Elfner (2006a), as an affricate [ts] in Denzer-King (2009), and as a 'complex stop' [t͡s] in Goad and Shimada (2014a,b).

(62) [t] VS. [t͡s] BEFORE [i]

a. *[ti]

b. ⟦a**t͡s**ísḁ⟧
atsísa
[a**ts**is]–a
[pants]–PRX
'pants'

(63) [t] VS. [t͡s] BEFORE [o]

a. ⟦k͡siːˢ**t**ojíwḁ⟧
ksiis**t**oyíwa
[ksiis**t**o–yi]–Ø–wa
[hot–II]–IND–3
'It is/was hot.'

b. ⟦miːˢ**t͡s**ójisi̥⟧
miis**ts**óyisi
[miis**ts**is–oyis]–i
[wood–lodge]–IN.SG
'house of wood'

(64) [t] VS. [t͡s] BEFORE [ɛ]

a. ⟦iː**t**ɛ́ːsokçtakjoʔpi̥⟧
ii**t**áísokihtakio'pi
[ii\i**t**–a–[isok–iht/aki]–o'p]–i
[IC\LOC–IPFV–[above–put$_v$/AI]–21.IND]–IN.SG
'shelf'

b. ⟦âːk͡sɪˢt͡ːsi**t͡s**ɛːsokçkaʔsiwḁ⟧
áaksisttsi**ts**aisokihka'siwa
aak–isttsi**ts**a–[isok–ihk/a'si]–Ø–wa
FUT–no.longer–[good–behave/AI]–IND–3
'In the beginning he will act good, but not later.'

(65) [t] VS. [t͡s] BEFORE [ɔ]

a. ⟦iː**t**ɔ́ːmatapapit͡sit͡sɪsːkoji̥⟧
ii**t**áómatapapitsitsisskoyi[5]
[ii\i**t**–a–omatap–[apitsitsissko]–Ø]–yi
[IC\LOC–IPFV–start–[change.color?.II]–IND]–IN.SG
'September' (lit: 'when the leaves change color')

b. ⟦ɪˢt͡ːsi**t͡s**ɔ́ːmatapaʔpoʔtakiwḁ⟧
isttsi**ts**áómatapa'po'takiwa
isttsi**ts**a–omatap–[a'p–o't/Ø–aki]–Ø–wa
no.longer–start–[around–take/v–AI]–IND–3
'At the beginning she started to work but she no longer does.'

[5]Frantz and Russell (2017) also lists *iitaomatapapitsitssko* as an alternative, where the penultimate syllable [t͡sɪs] <tsiss> has been reduced to [tsːː] <tss> with a long [sːː] as the syllable nucleus peak.

(66) [t] VS. [t͡s] BEFORE [a]

a. ⟦ɪstáːkaʔsiwḁ⟧
isstááka'siwa
[[issta–Ø–aki]–a'si]–Ø–wa
[[stake–*v*–AI]–AI]–IND–3
'It lodged, landed on end.'

b. ⟦ɪs**t͡s**áːkaʔsiwḁ⟧
iss**t͡s**ááka'siwa
[iss**t͡s**aak–a'si]–Ø–wa
[praise–AI]–IND–3
'He bragged (about himself).'

The examples in (66) are a minimal pair, which establishes that the choice between [t] and [t͡s] can distinguish lexical items. However, these two examples likely have different abstract phonological representations as well, for the following reason. The suffix *-a'tsis* attaches to animate intransitive (AI) stems to form an instrumental nominalization (Bliss, Ritter and Wiltschko 2016). As you can see, an underlying [i] before a non-[i] vowel like the [a] in *-a'tsis* becomes a glide after a consonant like [p], (67a). But it deletes all together after an underlying /t/, even though it causes the /t/ to assibilate to [t͡s], (67b). Therefore, the [ts] in (66) could be derived from an abstract underlyingly sequence /tiV/. I assume that all instances of [t͡s] before non-[i] vowels are derived from sequences of /tV/.

(67) a. ⟦ɪsːap**j**áʔt͡siːˢt͡si̥⟧
issap**i**á'tsiistsi
[[issap–**i**]–a'tsis]–istsi
[[watch–AI]–NMLZ]–IN.PL
'binoculars'

b. ⟦kax**t͡s**aʔt͡siːˢt͡si̥⟧
kaah**ts**a'tsiistsi
[[kaaht–**i**]–a'tsis]–istsi
[[game–AI]–NMLZ]–IN.PL
'playing cards'

There are also morphemic alternations which support the neutralization of /t/ and /t͡s/ before high, front vowels. All morphemes which end in [t] before non-high, non-front vowels end in [t͡s] before high front vowels. This pattern is exhibited in (68) using a wide-scoping negative prefix, which is [maːt-] before [a], (68a), and [o], (68b), but [maːt͡s-] before [i], (68c). (For a description of the syntax and semantics of *maat-* 'NEG', see Bliss 2013.) Because the alternant [maːt-] occurs in a wider number of environments than [maːt͡s-], I assume the underlying form of this morpheme is /maːt-/ 'NEG'. There are no prefixes which are realized with a final [t͡s] in all positions, supporting the idea that [t͡s] only exists as a positional realization of underlying /t/.

(68) a. ⟦máː.**t**aʔ.si.mi.wḁ⟧
máá**t**a'simiwa
maa**t**–[a's–im/i]–Ø–wa
NEG–[young–body/AI]–IND–3
'he is not young'

b. ⟦máː.**t**o.ma.niː.waː.t͡si.k͡si̥⟧
máá**t**omaniiwaatsiksi
maa**t**–[om–an/ii]–Ø–w=atsiksi
NEG–[truth–say/AI]–IND–3=NONAFF.3SG
'he did not tell the truth'

c. ⟦máː.**t͡s**i.t͡si.nó.píː.waː.t͡si.k͡si̥⟧
máá**ts**itsinópííwaatsiksi
maa**t**–itsin–[op–ii]–Ø–w=atsiksi
NEG–among—[sit–AI]–IND–3=NONAFF.3SG
'he did not sit among them' (Frantz and Russell 2017)

2.1.2.2 Dorsal fricatives [ç], [x], and [xʷ]

The dorsal fricative has several allophones depending on the quality of the preceding vowel: [ç] after the front vowels [i] and [ɛ], and the diphthong [o͡i], (69a), [x] after the low vowels [a], (69b), and [xʷ] after the round vowels [o] and [ɔ], (69c). The phonetic realization of /x/ after low vowels is quite far back, and some researchers write it as a uvular [χ] (Denzer-King 2009; Uhlenbeck 1938).

(69) ALLOPHONES OF [x] AFTER VOWELS

a.	⟦i**ç**kit͡síkawḁ⟧	*ii**h**kitsíkawa*	'seven'
	⟦ákɛ**ç**kit͡siwḁ⟧	*ákai**h**kitsiwa*	'it is dry'
	⟦ɛ́ːso͡i**ç**taːwḁ⟧[6]	*áísoi**h**taawa*	'he is plating his food'
b.	⟦k͡sá**x**koji̥⟧	*ksáá**h**koyi*	'dirt'
c.	⟦ó**xʷ**kotoki̥⟧	*óó**h**kotoki*	'stone'
	⟦mɔ́**xʷ**k͡sinʌtt͡siwḁ⟧	*máó**h**ksinattsiwa*	'it looks red'

All three allophones can also occur between consonants.

(70) ALLOPHONES OF [x] BETWEEN CONSONANTS

a.	⟦âːk**ç̩**kit͡sikawḁ⟧	*áaki**h**kitsikawa*	'she will freeze her feet'
b.	⟦aʔk**x̩**kóji̥⟧	*a'ka**h**kóyi*	'curved geographical feature'
c.	⟦nítx̩ʷkʊkkḁ⟧	*níto**h**kokka*	'she gave to me'

I discuss the distribution of /x/ more in Section 2.4.

[6]The vowel [o͡i] resulted from /o+i/ coalescence. I have also heard something closer to [ɤ] as a variant of this dipthong before /x/ and /sː/. Miyashita (2018: 225) actually transcribes <aisoçtaa> [ɛːsoçtaː], where there is no reflex of the high vowel [i] in the vowel itself. The occurrence of [ç] in this example is opaque, since the front vowel that conditions the occurrence of [ç] never appears in the surface pronunciation.

2.2 Vowels

This section lays out evidence for the phonemic vowel inventory in Table 2.2. I discuss regular allophony within the system and also point out ways in which my analysis differs from previous researchers. In particular, I argue that the long mid vowels /ɛː/ and /ɔː/ are phonemic. Appendix A includes additional minimal pairs which support the claims in this section.

2.2.1 Phonemic inventory

The inventory of phonemic vowels is given in Table 2.2. There are three short vowels /i o a/, and five long vowels /iː oː ɛː ɔː aː/. The short vowels [ɛ] and [ɔ] are not contrastive, but do occur as allophones of long [ɛː] and [ɔː] before geminates and consonant clusters (Section 2.4.2). In Section 4.2.1 I show that high front vowels come in two types, which I label [i_1] and [i_2], which have different morphophonological effects on neighboring consonants.

Table 2.2: Blackfoot phonemic vowel inventory

	front	central	back
high	i iː		o oː
mid	ɛː		ɔː
low		a aː	

I have maintained [o] as the transcription for the high back rounded vowel, because [o] reflects the most common pronunciation, but I treat it as [+high]. The vowels [u] and [uː] are free variants of /o/ and /oː/, respectively, with the closed vowel occurring more readily in accented syllables rather than unaccented, but there is no contrast between these two vowel qualities. In Chapter 3 I discuss two processes where [i] and [o] pattern together to the exclusion of the other vowels. The first process is vowel hiatus resolution when the second vowel (V2) is long. A [w] is epenthesized between the two vowels if V2 is [ɛ], [ɔ], or [a]; otherwise, vowel hiatus is resolved via coalescence. The second process is the calculation of stress in indicative clauses with no person prefixes. Stress falls on an initial heavy syllable if it contains [ɛ], [ɔ], or [a], and otherwise falls on a predictable syllable. In both cases, the vowels [i] and [o] pattern differently than [ɛ], [ɔ], and [a]. Because of this, I suggest that the relevant feature is [±high], and that [i] and [o] are [+high] while [ɛ], [ɔ], and [a] are [-high].[7]

The inventory I propose here is novel, as most researchers assume a symmetrical six-vowel inventory that does not include /ɛː/ or /ɔː/ (e.g. Elfner 2006b; Frantz 2017). Others do include either short or

[7] But see Elfner (2006b) for a different interpretation. She treats only [i] as [+high], and the relevant feature that splits [i] and [o] from the remaining vowels is [±ATR].

long versions of the mid vowels [ɛ] and [ɔ] in the inventory but also state that these two vowel qualities always result from vowel coalescence (Kinsella 1972; Stacy 2004; Taylor 1969; Van Der Mark 2003).

The argument for why the long mid vowels /ɛː/ and /ɔː/ are phonemic is that some instances of [ɛː] and [ɔː] occur infrequently in non-derived environments (e.g. morpheme-internally), where they contrast with other long vowels. I have found one minimal pair, in (71), which shows that /ɔː/ and /aː/ can distinguish lexical items.

(71) MINIMAL PAIR: LONG [ɔː] VS. LONG [aː]

a. ⟦**ɔː**níːt⟧
aonííť
[**ao**–n/i–i]–t–Ø
[hole–by.needle/*v*–TI1]–2SG.IMP–IMP
'pierce it!'

b. ⟦**aː**níːt⟧
aanííť
[**aa**n–ii]–t–Ø
[say–AI]–2SG.IMP–IMP
'say (s.t.)!'

I know of no minimal or near minimal pairs which show a lexical contrast between /ɛː/ and other vowels, but there are examples which demonstrate that long /ɛː/ and /ɔː/ can occur in overlapping contexts with the other long vowels. For example, [ɛː], [aː], and [oː] can all occur in the environment [#s __ ta...]; that is, after a PPh-initial [s] and before [ta...], as shown in (72).

(72) OVERLAPPING ENVIRONMENTS: LONG [ɛː] VS. LONG [aː] VS. LONG [oː]

a. % ⟦s**ɛː**tamit⟧
s**ai**tamit
[s**ai**t–am/i]–t–Ø
[breathe–be/AI]–2SG.IMP–IMP
'breathe!' (Piikáni dialect)

b. ⟦s**aː**tápik͡sɪt⟧
s**aa**tápiksit
[s**aa**t–apik/i–Ø]–t–Ø
[across–throw/*v*–TI3]–2SG.IMP–IMP
'throw it out!'

c. ⟦s**óː**tamaniˢtaːwḁ⟧
s**óó**tamanistaawa
s**oo**tam–[an–ist–aa]–Ø–wa
despite–[tell–*v*–3OBJ]–IND–3
'I told her in spite of all else!'

Similarly, [ɔː], [aː], and [oː] can all occur in the environment [#m __ to…]; that is, after a PPh-initial [m] and before [to…], as shown in (73).

(73) OVERLAPPING ENVIRONMENTS: LONG [ɔː] VS. LONG [aː] VS. LONG [oː]

a. ⟦m**ɔ́ː**toʔkiːk͡si̥⟧
   m**áó**to'kiiksi
   [m**ao**to'kii]–iksi
   [Buffalo.Women]–AN.PL

   'Buffalo Women's Society'

b. ⟦m**áː**tokamoʔt͡sipokáːwaːt͡si̥⟧
   m**áá**tokamo'tsipokááwaatsi
   m**aa**t–okamo't–[ipok–aa]–Ø–w=aatsi
   NEG–normal–[small–AI]–IND–3=NONAFF.3SG

   'he wasn't born normal'

c. ⟦m**óː**tokiʔpi̥⟧
   m**óó**toki'pi
   [m**oo**toki'p]–i
   [skull]–IN.SG

   'skull'

There are more examples of non-derived [ɛː] and [ɔː] in the appendix (Appendix A.2.3). Because the mid vowels in the previous examples are unpredictable in the sense that they are not the result of vowel coalescence across a morpheme boundary, I consider them phonemic. Even so, these phonemes are marginal in the sense that there are relatively few instances of non-derived [ɛː]/[ɛ] and [ɔː]/[ɔ].

Blackfoot is not the only Algonquian language with asymmetrical numbers of short and long vowels. For instance, Nishnaabemwin (Valentine 2001: 34–41), Oji-Cree (Slavin 2012), and Plains Cree (Russell 2008; Wolfart 1973: 79) each have three short vowel qualities /i a o/ but four long vowels /iː eː aː oː/, where the long /eː/ has no phonemic short counterpart. However, Russell (1992) suggests that /eː/ in Plains Cree is a heavy diphthong with the underlying representation /ai/, fused by a late, possibly phonetic rule which is widely attested in external sandhi processes. If this is true, then Plains Cree has a symmetrical system at a more abstract level (three short vowels, and three long vowels, but with a fourth long vowel quality on the surface). Northern Plains Cree apparently truly has only three long vowels /iː aː oː/ (Wolfart and Carroll 1973).

A less clear example exists with Shawnee, which has four short ([i e a o]) and four long ([iː eː aː oː]) phonetic vowels. Although Muzaffar (1997) states that all four long vowels are used in transcriptions in Voegelin (1935, 1938), the long vowels in Shawnee were long assumed to be allophonic variants of short vowels. For instance, Voegelin claims that '[q]uantitative differences in Shawnee vowels are however not phonemic' (Voegelin 1935: 36), even though he does not describe the conditioning factors for length.

More recently, Andrews (1994: 23) has claimed that two of the long vowels, /iː/ and /aː/, are phonemic. He bases this claim on the two minimal pairs in (74) and (75) below, which respectively show that short /i/ contrasts with long /iː/ and that short /a/ contrasts with long /aː/.

(74)	a.	ho-w**ii**ši'-ta	3-head-TI	'he was in charge' (of the Shawnee)
	b.	w**i'**ši	dog	(Chrisley 1992: 48)

(75)	a.	č**aa**ki aama	'all this' (Voegelin 1953, episode 3a)
	b.	č**a**ki	'small' (Chrisley 1992: 8)

Since he finds no such minimal pairs for [eː] and [oː], he assumes they are not contrastive. In other words, Andrews privileges the criteria of lexical distinction above all others for determining contrast, even though there often are few minimal pairs in Algonquian languages.

He concludes – presumably speaking about all four vowel qualities – that 'most vowel length alternations [. . .] are phonetic and perhaps conditioned by following segments. More research is needed to clarify the nature of these alternations in Shawnee' (Andrews 1994: 23). Without a description of those vowel length alternations, it is impossible to say whether all instances of [eː] and [oː] are derived from short vowels or not. Perhaps, as is the case for Blackfoot /ɛː/ and /ɔː/ discussed below, there are underived instances of [eː] and [oː] in Shawnee, even if no minimal pairs can be found. If so, that would be a good argument to include long /eː/ and /oː/ as phonemes.

2.2.2 Allophony

Vowels have several predictable variants, which I describe in this section. In Section 2.2.2.1 I describe positional variants of mid vowels before glottal stops, and in Section 2.2.2.2 I show that lax vowels occur before some types of consonants.

2.2.2.1 Mid vowels

Before a glottal stop, [ɛː] is pronounced as a short diphthong [ej], (76a), and [ɔː] is pronounced as a diphthong [aw], (76b). For some speakers this diphthong begins with a mid vowel quality and is closer to [ɔw] or [ow].

(76) MID VOWEL DIPHTHONGIZE BEFORE GLOTTAL STOP

a. [**ê͡j**ʔpoji]
á-i'poyiwa
a–[**i'**po–yi]–Ø–(wa)
IPFV–[speak–AI]–IND–(3)
'he is speaking' (BB)

b. [ák**aw**ʔto]
ák**ao**'toowa
ak**aa**–[**o**'t–oo]–Ø–(wa)
PRF–[here–go.AI]–IND–(3)
'he has arrived' (BB)

2.2.2.2 Lax vowels

Short, lax vowels [ɪ], [ɛ], [ʌ], [ɔ], [ʊ], occur predictably before [sC] clusters, (77), and geminates, (78). There are no short or long non-lax vowels in these positions.

(77) SHORT LAX VOWELS BEFORE [sC] CLUSTERS

[**ɪ**st͡sí͡ːjit]	***i**sstsííyit*	'listen!' (BB)
[nit**ɛ́**spɪnːiʔp]	*nit**áí**sspinnii'pa*	'I'm lifting it' (BB)
[p**ʌ**skaːni]	*p**a**sskaani*	'dance' (BB)
*[ɔsC]	—	—
[m**ʊ́**skit͡sipx̥pi̥]	*mósskitsipahpi*	'heart' (BB)

(78) SHORT LAX VOWELS BEFORE GEMINATES

[k**ɪ**pːo̥xʷkʊ́kːit]	*k**i**ppohkókkit*	'please give me it!' (BB)
[**ɛ́**kːamoks̥kaʔsi]	***áí**kkamokska'siwa*	'he runs fast' (BB)
[nit**ʌ́**kːa]	*nit**á**kkaawa*	'my friend' (BB)
[**ɔ́**tːaki]	***áó**ttakiwa*	'bartender' (BB)
[m**ʊ**tːok͡sís]	*m**o**ttoksísa*	'knee' (BB)
[**ɪ**ˢtːoʌ́n]	***i**sttoán*	'knife' (BB)
[**ɛ́**ˢt͡ːsi]	***áí**sttsiiwa*	'it hurts' (BB)
[ɪnː**ô͡i**ˢtːoʌni]	*inn**óí**sttoaniwa*	'American (lit: has long knife)' (BB)

In the next section I turn to suprasegmental properties in Blackfoot.

2.3 Suprasegmentals

This section describes the phonetic characteristics of suprasegmental properties, because the location of stress is one major diagnostic of the Phonological Phrase (PPh) constituent that sets it apart from the

Prosodic Word (PWd) constituent. I return to the phonological characteristics of stress in Section 3.2, where I argue that prominence is best analyzed in terms of metrical stress.

Syllabic prominence in Blackfoot is signaled primarily with a higher F_0, as well as greater intensity and duration (Van Der Mark 2003). The pitch of syllables without pitch accent is interpolated between the edges of the PPh and the pitch peak on the most prominent syllable; that is, pitch rises to a pitch peak and falls steeply after the pitch peak (Miyashita and Weber 2020; Weber and Allen 2012). The most prominent syllable in a PPh is marked in the orthography by an acute (´) accent (Frantz 2009; Taylor 1969).

Because pitch is the salient property, prominence in Blackfoot is commonly referred to as 'pitch accent' (Frantz 2009: 3), and this term has been widely adopted (Kaneko 1999; Miyashita 2011; Van Der Mark 2003; Weber 2016a,b). This can be misleading, especially because Blackfoot displays different characteristics than other pitch accent languages; for example, Japanese allows unaccented words while Blackfoot does not allow unaccented PPhs (see discussion in Stacy 2004). Moreover, Hyman (2006) argues convincingly that 'pitch accent' is not a distinct word prosodic type. Instead, pitch accent languages display properties of both stress and tone languages. Under this view, a more accurate description is that Blackfoot has a privative tonal contrast (H vs. Ø). It is a 'sparsely' tonal language because there is at most one H and at least one H within a PPh. The location of the pitch peak on nouns is not predictable (Weber and Allen 2012), but later in Section 3.2.2 I show that the location of the pitch peak on verbs is predictable, and displays rhythmic metrical properties. This leads me to an analysis where prominence is the acoustic manifestation of primary stress in Blackfoot. One way to model this would be to associate the single obligatory H tone within the PPh to the head syllable of the PPh. These are pitch accents in the sense of Ladd (1986, 2008). (See Miyashita and Weber 2020 for one Autosegmental Metrical account of Blackfoot pitch contours.)

Prominence in Blackfoot has different phonetic realizations depending on the location of the syllable in the PPh (Frantz 2009; Stacy 2004; Taylor 1969). It is realized as a level high on any syllable but the last, as in *iihkíítaawa* [iç̩.kíː.ta] 's/he baked', and the pitch of the utterance as a whole gradually rises or falls to/from that peak. Before glottal stops, as for *isî'katsiiwa* [i.sîʔ.ka.tˢi] 's/he kicked him/her', the accent is often realized as a falling tone. On the final syllable of a PPh, the pitch may be falling in careful speech, but more usually is signalled through greater intensity, as for *inihkíwa* [in.ʔç̩.kî]∼ [in.ʔç̩.ˈki] 's/he sang'. This variation is summarized in Table 2.3 using transcriptions of the person's speech who informed my analysis of stress in Section 3.2.2. When creating phonetic transcriptions from orthographic sources, I use an acute accent in all of these environments.

Although Frantz (2009) claims that pitch can also rise over a long vowel as well, as in [maː.áx.si̥] 'his/her grandparent', these can be analyzed as two separate syllables with pitch accent on the second syllable only. To my ears there are always two distinct sonority or intensity peaks (one for each syllable). Additional evidence is the fact that long vowels in this position can be superlong (i.e. longer than a

Table 2.3: Positional realization of prominence

	Level high	Falling	Intensity
PPh-medially	[iç.kíː.ta]	—	—
Before [ʔ]	—	[i.sî.ka.t͡si]	—
PPh-finally	—	[in.ʔç̩.kî]	[in.ʔç̩.ˈki]

normal long vowel), which is expected if there is a sequence of two syllables, and one or both of the syllables contains a long vowel. And finally, the vowel quality can change between the two syllables, as in [mɔː.ó.ji̥] 'his/her mouth'. I know of no cases of a rising pitch across a short vowel. Because of this, I claim that prominence in Blackfoot is a property of entire syllables and not of individual moras. That is, the stress-bearing unit is the syllable.

Only one pitch peak tends to be marked in the orthography per orthographic word, although there are some exceptions. For example, certain DP enclitics add a pitch peak to the syllable immediately to their left (Bliss 2013; Glougie 2009), and this tends to be marked in the orthography. From my own fieldwork, I sometimes hear secondary pitch peaks, which do not have as high an F_0 as the first, distributed rhythmically throughout the PPh, although these depend on rate of speech and person. Secondary pitch peaks do not tend to be marked in the orthography.

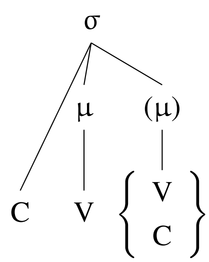
2.4 Syllable structure

In this section I address syllable structure in Blackfoot. This is relevant throughout the dissertation, because I transcribe syllable boundaries in many of the phonetic transcriptions, and those transcriptions follow the analyses I discuss here. Additionally, syllable structure conditions several phonological processes at the PPh level (e.g. [w]-epenthesis in the onset of heavy syllables and the location of primary stress) and the PWd level (e.g. epenthesis). I discuss these processes in Chapter 3 and Chapter 4.

This section is organized as follows. In Section 2.4.1 I discuss open syllables in Blackfoot and show that vowel length is distinctive in open syllables. Then in Section 2.4.2 I turn to closed syllables and show that vowel length is neutralized to short in closed syllables. Finally, in sections Section 2.4.3 and Section 2.4.4 I turn to two unusual aspects of Blackfoot syllable structure. In Section 2.4.3 I discuss syllabic fricatives in Blackfoot. In Section 2.4.4 I discuss how the right edge of the PPh hosts an extra consonant slot; I analyze these as onsets to degenerate syllables which contain no nucleus. Throughout the chapter I analyze syllabic structure using tenets of Moraic Theory (Hayes 1989a; Hyman 1985; Pulleyblank 1994) and Optimality Theory (McCarthy and Prince 1993a,b; Prince and Smolensky 1993).

Syllables in Blackfoot may be (C)V, (C)VV, or (C)VC.[8] Crucially, there are no syllables like CVVC. Using Moraic Theory (Hayes 1989a; Hyman 1985; Pulleyblank 1994), I argue in this section that the maximal syllable in Blackfoot is bimoraic, (79), and that codas in Blackfoot are moraic. A constraint against trimoraic syllables explains why long vowels cannot occur before moraic codas.

(79) MAXIMAL SYLLABLE



In the next section I argue that vowel length is distinctive in open syllables. After that I show that vowel length is neutralized to short in closed syllables. I take this as evidence that the coda is moraic.

2.4.1 Open syllables: contrastive vowel length

2.4.1.1 Data

Vowel length is distinctive in open syllables. As I will show later, vowel length is neutralized before coda consonants, so this property provides crucial evidence that the following consonant is in a syllable onset position. Examples (80)–(83) include minimal pairs which show that short and long vowels contrast before short consonants. There are relatively few known minimal pairs in Blackfoot, although I collate many more in Appendix A. In order to help catalog the existing minimal pairs, I give a citation after each pair to give credit to the researchers who first noticed that pair. The mid [-ATR] vowels are not shown here because they do not contrast for length.

[8] Onsetless syllables are only tolerated at the left edge of the PPh. The right edge of the PPh allows an extra consonant, which I analyze Section 2.4.4 as a degenerate syllable.

(80) a. ⟦oːt͡siˢt͡s**í**ni̥⟧
ootsistsı**́**ni
[ootsistts**in**]–i
[3.palate]–OBV
'palate, his/her palate'

b. ⟦oːt͡siˢt͡s**íː**ni̥⟧
ootsists**íí**ni
[ootsist–**ii**n]–i
[strawberry–berry]–IN.SG
'strawberry'
(Denzer-King 2009: 18; Taylor 1969: 34)

(81) a. ⟦áj**a**moːwḁ⟧
áy**a**moowa
[ayam–oo]–Ø–wa
[aggrieved–go.AI]–IND–3SG
'he left with hurt feelings'

b. ⟦áj**aː**moːwḁ⟧
áy**aa**moowa
[ayaam–oo]–Ø–wa
[misdirected–go.AI]–IND–3SG
'he went in a different direction'
(Denzer-King 2009: 18)

(82) a. ⟦âːkoʔk**o**wḁ⟧
áako'k**o**wa
aak–[o'k–**o**]–Ø–wa
FUT–[fall–II]–IND–3SG
'it will be fall'

b. ⟦âːkoʔk**oː**wḁ⟧
áako'k**oː**wa
aak–[o'k–**oo**]–Ø–wa
FUT–[raw–go.AI]–IND–3SG
'she will become exhausted'
(Denzer-King 2009: 18)

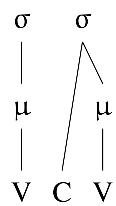
(83) a. ⟦âːk**o**kaːwḁ⟧
áak**o**kaawa
aak–[**o**k–aa]–Ø–wa
FUT–[rope–AI]–IND–3SG
'he will rope'

b. ⟦âːk**oː**kaːwḁ⟧
áak**oo**kaawa
aak–[**oo**k–aa]–Ø–wa
FUT–[Sundance–AI]–IND–3SG
'she'll sponsor a Sundance'
(Frantz 2009: 2)

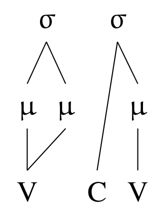
Singleton consonants are parsed as the onsets to the syllable containing the following vowel rather than as a coda, (84). This follows from the cross-linguistic generalization that CV sequences are always parsed into the same syllable (often termed the Onset Principle or Core CV syllable formation; see Clements and Keyser 1983; Itô 1986; Kahn 1976; Selkirk 1982; Steriade 1982).

(84) INTERVOCALIC ONSETS

a. AFTER A SHORT VOWEL



b. AFTER A LONG VOWEL



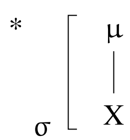
2.4.1.2 Analysis

In an Optimality Theory framework, the cross-linguistic typology of syllable shapes is regulated via syllable markedness constraints ONSET and *CODA, which require onsets and prohibit codas, respectively (McCarthy and Prince 1993a; Prince and Smolensky 1993). I utilize a Moraic Theory for syllable structure (Hayes 1989a; Hyman 1985; Pulleyblank 1994) which does not include structural positions like "onset" or "coda" nodes. Therefore, I do not make direct reference to onsets and codas. Instead, these definitions are construed of as positional markedness constraints that prohibit particular structures at the left and right edges of syllables.

ONSET is defined in (85) as a categorical markedness constraint (McCarthy 2003). This definition of ONSET penalizes any syllable whose left edge aligns with a mora, regardless of whether that mora dominates a consonant or vowel.

(85) ONSET

Abbreviation: ONS



For each syllable, assign a violation mark if the leftmost segment is dominated by a mora.

Onsetless syllables violate this constraint because the moraic syllable nucleus would be aligned with the left edge of the syllable, but moraic onsets also violate this constraint because the mora associated with the onset consonant would be aligned to the left edge of the syllable. This behavior is favorable, since there are no moraic onsets in Blackfoot and moraic onsets are typologically rare (but see Topintzi 2010 for evidence in favor of moraic onsets in some languages).

This formulation is superior to constraints that require the syllable to begin with a consonant (McCarthy and Prince 1993a) or prohibit the syllable from beginning with a vowel (Kager 1999; McCarthy 2003), both of which require the terms “consonant” and “vowel” to be defined. One natural definition utilizes the features [+consonantal] for consonants and [-consonantal] for vowels. The problem is that under these definitions, intervocalic glides do not satisfy ONSET because glides are [-cons]. However, as I discuss in Section 3.2.1.1, vowel length is contrastive before glides just as it is for other onsets; glides therefore seem to satisfy ONSET. The formulation in (85) avoids this problem by defining ONSET in terms of moraic segments, rather than consonants or vowels.[9]

The definition of *CODA in (86) below uses a positional markedness constraint to prohibit any syllable that ends in a (non-glide) consonant, regardless of whether that consonant is the syllable nucleus or not. This makes sense for Blackfoot. As I discuss in Section 2.4.2.1.2, moraic [s] can be parsed as a syllable nucleus or coda consonant. It has the same distribution in both positions; namely, both types of moraic [s] occur only before obstruents. *CODA has the benefit of incurring a violation for any moraic [s], regardless of whether it occurs as a nucleus in an open syllable, or as a coda.

(86) *CODA

Abbreviation: *COD

$$* \left. \begin{array}{c} \text{X} \\ | \\ \text{[+cons]} \end{array} \right]_{\sigma}$$

For each syllable, assign a violation mark if the right edge of the syllable is aligned with the right edge of a segment associated with a [+cons] feature.

The syllable markedness constraints, ONSET and *CODA, account for why short intervocalic consonants are preferentially parsed as onsets: this parse optimally satisfies both constraints. In the tableau below, the optimal candidate (a) satisfies both ONSET and *CODA by parsing the intervocalic consonant C as an onset. The competing candidate (b) violates *CODA, because it has a segment C that follows a tautosyllabic moraic segment (V), and ONSET, because the syllable begins with a moraic segment (V). Candidate (b) will always be less optimal than candidate (a), no matter where ONSET is ranked in relation to faithfulness constraints.

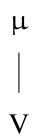
[9] See Smith 2002, 2004, 2012 for a discussion of different formulations of ONSET, and an alternative definition to mine that requires syllables to have a segment, *a* to the left of the syllable head, regardless of whether *a* is dominated by a mora or directly by the syllable node.

(87)

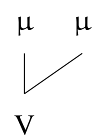
. . . VCV. . .	ONS	*COD
☞ a. V.CV		
b. VC.V	∗!	∗!

Distinctive vowel length is represented in moraic theory as a difference in weight. Following Hayes (1989a) & Pulleyblank (1994), I assume that short vowels are associated with one mora in their underlying representation, (88a), while long vowels are associated with two moras, (88b).

(88) a. SHORT VOWELS



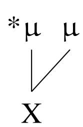
b. LONG VOWELS



Long vowels violate a general markedness constraint that prohibits segments from associating to two moras. Consonants are unable to violate this constraint because consonants are never bimoraic in Blackfoot (and potentially universally), so I have named the constraint *Vː, as in Benua (1995), Hammond (1997), Holt (1997), Keer (1999), Prince and Smolensky (1993), Rosenthall (1994), & Sherer (1994).[10]

(89) *LONGVOWEL

Abbreviation: *Vː



Assign a violation mark for every segment which is associated to more than one mora.

To derive the contrast between short and long vowels before simple onsets in Blackfoot, a faithfulness constraint must rank above the markedness constraint *Vː. Faithfulness will be measured using Correspondence Theory (McCarthy and Prince 1995, 1999). The correspondence relation can be defined as follows. For our purposes, S_1 = input and S_2 = output.

[10]There is also a constraint which prohibits moraic consonants, *μ/C, which I define and discuss Section 2.4.2. But see Moren (1999), who explicitly argues against constraints like *LONGVOWEL and *GEMINATE and provides a unified theory of moraicity across segment types (i.e. both consonants and vowels).

(90) CORRESPONDENCE

Given two strings S_1 and S_2, **correspondence** is a relation $\mathfrak{R}$ from the elements of S_1 to those of S_2. Elements $\alpha \in S_1$ and $\beta \in S_2$ are referred to as **correspondents** of one another when $\alpha \mathfrak{R} \beta$.

(McCarthy and Prince 1995, 1999)

The correspondence constraints that are relevant to long vowels are constraints that regulate correspondence between input and output moras: MAX-IO(μ) in (91) and DEP-IO(μ) in (92) below.

(91) MAX-IO(μ)

Abbreviation: MAX(μ)

Given an input string S_1 and and output string S_2, such that $S_1 \mathfrak{R} S_2$, assign a violation mark for every mora $\alpha \in S_1$ that does not have a correspondent $\beta \in S_2$. ("No mora deletion.")

(McCarthy 2000)

(92) DEP-IO(μ)

Abbreviation: DEP(μ)

Given an input string S_1 and and output string S_2, such that $S_1 \mathfrak{R} S_2$, assign a violation mark for every mora $\beta \in S_2$ that does not have a correspondent $\alpha \in S_1$. ("No mora epenthesis.")

(McCarthy 2000)

In a word like [âːkoːkaːwḁ] 'she'll sponsor a Sundance', (82b), the [o] in the second syllable is linked to two moras in the input. For this vowel to surface faithfully, the faithfulness constraint MAX-IO(μ) must be ranked above *Vː. In the tableaux below, I have represented a long vowel (a vowel linked to two moras) as [Vː], and a short vowel (a vowel linked to one mora) as [V]. The optimal candidate (a) violates the constraint *Vː because it has a long vowel in the output. Candidate (b) has a short vowel in the output, but incurs a violation of MAX-IO(μ) because there is a mora in the input which does not have a correspondent in the output.

(93) [âː.koː.kaː.wḁ] *áakookaawa* 'she'll sponsor a Sundance'

/aːk-oːkaː-wa/	MAX(μ)	*Vː
☞ a. aːkoːkaːwḁ		*
b. aːkokaːwḁ	*!	

Crucial rankings: MAX-IO(μ) ≫*Vː

2.4.2 Closed syllables: vowel length neutralization

Having shown that vowel length is distinctive in open syllables, I now show that vowel length is neutralized to short in closed syllables. I use this distribution to argue that codas are moraic in Blackfoot.

2.4.2.1 Data

Syllables can be closed by (a) a dorsal fricative, (b) an alveolar sibilant, (c) a moraically-licensed constricted glottis ([CG]) feature (which surfaces as a glottal stop), or (d) a geminate consonant. I describe each of these in turn.

2.4.2.1.1 Heterosyllabic clusters [çC] ∼ [xC] ∼ [xʷC]

Dorsal fricatives only occur immediately before a consonant. They can either occur after a vowel, which I discuss here, or after a consonant, which I discuss in Section 2.4.3. In a post-vocalic position, the place and rounding of the consonant is conditioned by the features of the immediately preceding vowel, as described above in Section 2.1.2. The examples in (94) show that all three allophones of the coda dorsal fricative can occur before obstruents, but not before nasals or glides. (A post-consonantal dorsal fricative has the same distribution: it can only occur before obstruents.)

(94) CODA /x/ BEFORE OBSTRUENTS

a. BEFORE [p]

⟦kit͡sí:ki**çp**a⟧	*kitsíikii**hp**a?*	'what did you do?'
⟦nitáji:t͡sɪma**xp**ɪn:a:n⟧	*nitáyiitsimaa**hp**innaan*	'we are storing food'
⟦o**xʷp**íni̥⟧	*o**hp**íni*	'his/her lung'

b. BEFORE [t]

⟦â:k͡sɪmi**çt**akiwḁ⟧	*áaksimii**ht**akiwa*	's/he will make a mess'
⟦stá**xt**oxʷt͡si̥⟧	*stáá**ht**oohtsi*	'(towards) underneath'
⟦o**xʷt**ó:kɪsi̥⟧	*o**ht**óókisi*	'his/her ear'

c. BEFORE [k]

⟦at͡sikí**çk**a:t⟧	*atsikíí**hk**aat*	'buy shoes!'
⟦na:má**xk**imaʔt͡sɪs⟧	*naamáá**hk**imaa'tsis*	'broom'
⟦ó**xʷk**otoki̥⟧	*óó**hk**otoki*	'rock'

d. BEFORE [s]

*⟦içs⟧		
⟦â:k͡si:taʔpaka**xs**iwḁ⟧	*áaksiita'pakaa**hs**iwa*	'he will really get hurt'
⟦o**xʷs**ójɪsi̥⟧	*o**hs**óyisi*	'his/her tail'

e. BEFORE [t͡s]

⟦kiʔt͡síː**çt͡s**iːs⟧	*ki'tsíí**hts**iisa*	'put it aloft!'
⟦iˢta**xt͡s**ɪˢtotoxʷsɪn⟧	*istaa**hts**istotoohsin*	'underwear'
⟦ɪskó**xʷt͡s**ɪkḁ⟧	*isskóó**ht**sika*	'in the past', 'long ago'

f. BEFORE [k͡s]

⟦âːk͡sipí**çk͡s**iniːwáji̥⟧	*áaksipíí**hks**iniiwáyi*	'she will slit it (e.g. a hide)'
⟦á**xk͡s**ɪkːamaʔpamiwḁ⟧	*áá**hks**ikkama'pamiwa*	'it might be him'
⟦ɪnːó**xʷk͡s**isiː⟧	*innóó**hks**isii*	'elephant'

g. BEFORE NASALS

*[çm], *[xm], *[xʷm]

*[çn], *[xn], *[xʷn]

h. BEFORE GLIDES

*[çw], *[xw], *[xʷw]

*[çj], *[xj], *[xʷj]

Crucially, long vowels never occur before dorsal fricatives. The negative data in (95) uses the [xʷ] allophone, but the same generalization holds for the other two allophones as well.

(95) NO LONG VOWELS BEFORE CODA [x]

a. NON-SIBILANT OBSTRUENTS

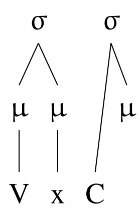
*[oː**xʷp**íni̥]	—	—
*[oː**xʷt**óːkɪsi̥]	—	—
*[óː**xʷk**otoki̥]	—	—

b. SIBILANT OBSTRUENTS

*[oː**xʷs**ójɪsi̥]	—	—
*[ɪskóː**xʷt͡s**ɪkḁ]	—	—
*[ɪnːóː**xʷk͡s**isiː]	—	—

I adopt a version of the analysis in Elfner (2006b), where /x/ is treated as an independent consonant which forms a moraic coda in syllables, as in (96). This analysis also explains why long vowels are prohibited before [xC] clusters: a syllable that contained a long vowel and a coda consonant would be trimoraic. Consequently, vowels are shortened in order to conform to a bimoraic syllable template.

(96) VELAR FRICATIVE AS CODA



This moraic analysis of /x/ cannot account for the severely restricted distribution of [x] before short obstruents. For this there is a diachronic explanation, since /x/ is the reflex of the first segment in a true consonant cluster in Proto-Algonquian (Berman 2006; Weber 2017). The second consonant of a true consonant cluster in Proto-Algonquian was always an obstruent. Therefore, the synchronic distribution of /x/ reflects the distribution of pre-consonantal consonants in Proto-Algonquian.

Before moving on to discuss the distribution of moraic [s̩], it is worth noting the differences between the moraic analysis here and two previous analyses of for /x/. The first analysis does not treat /x/ as an independent segment at all, but only as the phonetic manifestation of pre-aspiration on the following consonant (Reis Silva 2008; Weber 2016a,b). Under this proposal, Blackfoot obstruents have a three-way distinction: singleton unaspirated, geminate unaspirated, and preaspirated. This analysis successfully explains why [x] has such a limited distribution: it can only occur before voiceless obstruents because it is the surface reflex of the preaspiration associated with the following obstruent. The surface fricatives [ç] ∼ [x] ∼ [xʷ] under this analysis are a redundant secondary characteristic of pre-aspiration (Silverman 2003; Steriade 1999). However, this analysis fails to account for why pre-aspiration cannot occur on geminate consonants, nor for why vowel length is neutralized before [x].

The second analysis treats [x] as an allophone of /k/, because [x] and [k] occur in complementary distribution (Kaneko 2000). The [x] occurs post-vocalically before another obstruent while [k] occurs pre-vocalically or before an interconsonantal [s]. As I argued above, this means that [x] occurs in PPh-medial syllable codas while [k] occurs in PPh-medial syllable onsets. Additionally, [k] can occur PPh-finally but [x] cannot. She suggests that the velar stop /k/ spirantizes to [x] post-vocalically except PPh-finally.[11] There are two issues with such an analysis. First, [x] is in complementary distribution with all short obstruents, nasals, and glides, because all of these sounds have the same distribution as [k]; namely, they occur in syllable onsets. Thus, there is no reason to assume [x] is an allophone of /k/ in particular. Second, Blackfoot actively repairs consonant clusters which arise across morpheme boundaries via two types of epenthesis, and crucially *not* via spirantization. For example, in (97) the [k]-final prefix [pok-] ‘small’ combines with a [k]-initial noun [kaxt͡saʔt͡sis] ‘(playing) cards’. Instead of the prefix-final [k] spirantizing to [x], a high front vowel [i] is epenthesized, which causes the preceding [k] to assibilate to [k͡s].

[11] Kaneko (2000) refers to the PPh as the ‘word’.

(97) a. ⟦kaxt͡saʔt͡siːˢt͡si̥⟧
kaahtsa'tsiistsi
[[kaaht–i]–a'tsis]–istsi
[[game–AI]–NMLZ]–IN.PL
'playing cards'

b. ⟦pók͡s**i**kx̩t͡saʔt͡siːˢt͡si̥⟦ (not *⟦pó**x**ʷkx̩t͡saʔt͡siːˢt͡si̥⟧)
pók**si**kahtsa'tsiistsi
pok–[[ikaht–i]–a'tsis]–istsi
small–[[game–AI]–NMLZ]–IN.PL
'little playing cards'

In Section 4.2.1.2 I argue that head-adjoined root /-p/ 'tie' begins with an underlying /p/. A high front vowel [i] is epenthesized after the consonant-final root /aak-/[12] 'wrap with otter' which causes the preceding [k] to assibilate to [k͡s], (98). Again, the root-final [k] in /aak-/ 'wrap with otter' does not spirantize to [x].

(98) ⟦âːkak͡s**i**piˢtaːwḁ⟧ (not *⟦âːka**x**piˢtaːwḁ⟧)
áakaksipistaawa
aak–[aak–p/ist–aa]–Ø–wa
FUT–[otter.wrap–tie/*v*–AI]–(IND)
'he will wrap the pole with the fur of an otter'

2.4.2.1.2 Heterosyllabic clusters [sC]

The alveolar sibilant [s] in Blackfoot can occur in many positions of the word, including next to vowels as well as next to other consonants, and has been widely discussed in the literature (Denzer-King 2009; Derrick 2006, 2007; Elfner 2006b; Goad and Shimada 2014a,b). However, pre-consonantal [s] has the same distribution as pre-consonantal /x/: both occur only before obstruents.[13] Examples of pre-consonantal [s] are given in (99). Note that an /s/ before an /s/ is indistinguishable from a geminate, and I assume that this sequence is parsed as a single ambisyllabic geminate (Section 2.4.2.1.4). (Moraic [s] also occurs between consonants, which I discuss in Section 2.4.3.)

[12] This morpheme has a short vowel after consonants.

[13] The term 'pre-consonantal [s]' does not include the pre-assibilant [ˢt], for which see Section 2.1.1. Pre-consonantal [s] is longer in duration than the sibilant portion of [ˢt] and occurs before a wider range of consonants other than just [t].

(99) [s] OCCURS BEFORE OBSTRUENTS

a. NON-SIBILANT OBSTRUENTS

⟦**ɪsp**íks̩ːkoji̥⟧	***issp**íksskoyi*	‘high forest (of tall trees)’
⟦apʌ**st**áːni̥⟧	*apa**sst**ááni*	‘bridge’
⟦mʊ́**sk**it͡sipx̩pi̥⟧	*mó**ssk**itsipahpi*	‘heart’

b. SIBILANT OBSTRUENTS

[kitáʔpɛ**sː**ʌmːokḁ]	*kitá’pai**ss**ammoka*	‘he is looking around for you’
[mʊ́**st͡s**iːwḁ]	*mó**ssts**iiwa*	‘vein’
[otx̩kó͡i**sk͡s**isi̥]	*otahkóí**ssks**isi*	‘brown-nosed horse’

c. NASALS

*[sm]

*[sn]

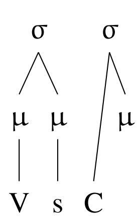
d. GLIDES

*[sw]

*[sj]

Crucially, there are no examples with long vowels before pre-consonantal [s]. Following the same logic as above, I will assume that coda [s] is moraic. Long vowels are prohibited before [sC] clusters because a syllable that contained a long vowel and a coda consonant would be trimoraic. Consequently, vowels are shortened in order to conform to a bimoraic syllable template. Again, this analysis does not explain why coda /s/ occurs only before obstruents. For this there is a diachronic explanation, since /s/ is the reflex of the first segment in a true consonant cluster in Proto-Algonquian after PA * i or * i·
(Berman 2006; Weber 2017).

(100) ALVEOLAR SIBILANT AS CODA



2.4.2.1.3 Heterosyllabic clusters [ʔC]

The glottal stop /ʔ/ occurs before any of the permissible onset consonants. The examples in (101) illustrate [ʔ] before short non-sibilant obstruents, sibilant obstruents, nasals, and glides.[14]

(101) [ʔ] OCCURS BEFORE ONSETS

a. NON-SIBILANT OBSTRUENTS

⟦á**ʔp**oʔtakiwḁ⟧	*a’**p**o’takiwa*	‘he worked’
⟦o**ʔt**akí́ːwḁ⟧	*o’**t**akííwa*	‘it is round’
⟦ko**ʔ**kíji̥⟧	*ko’kíyi*	‘(a) corner’

b. SIBILANT OBSTRUENTS

⟦somó**ʔs**ɪt⟧	*somó’**s**it*	‘fetch water!’
⟦ma**ʔt͡s**ít⟧	*ma’**ts**it*	‘take it!’
⟦ka**ʔk͡s**imóji̥⟧	*ka’**ks**imóyi*	‘sage’

c. NASALS

⟦apá**ʔm**ɪsḁ⟧	*apá’**m**isa*	‘lull her!’
⟦iːsa**ʔn**aːwḁ⟧	*iisa’**n**aawa*	‘he lost a fingernail’

d. GLIDES

⟦kikʌ́ta**ʔw**áːnojoʔs̩ːpa⟧	*kikáta’**w**áánoyo’sspa*	‘did you make archery equipment?’
⟦ɪská**ʔj**ɪsːiwḁ⟧	*isská’**y**issiwa*	‘he is exceptionally tough’

The glottal stop has a variable realization as a full glottal stop, creaky voice, or length on the preceding vowel, as discussed by Peterson (2004) and shown in (102). The exact realization depends on the speaker, rate of speech, and morphophonological context.

(102) SURFACE REALIZATIONS: [VʔC] ∼ [VV̰C] ∼ [VːC]

aikaiʔni *‘He dies’*

a. [aɪkaɪʔni]

b. [aɪkaɪɪ̰ni]

c. [aɪkajni] (= Peterson 2004, (3))

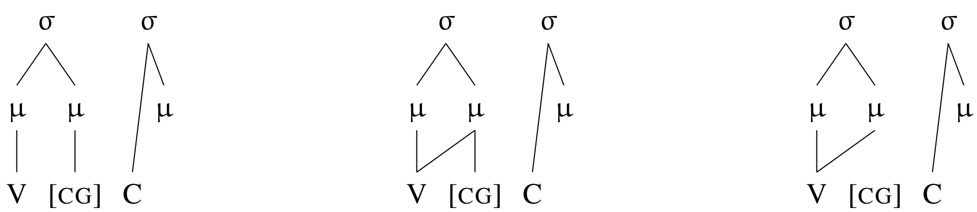
Crucially, vowel length is not distinctive before a glottal stop. Following the same logic as above, I will assume that the glottal stop [ʔ] is moraic. Long vowels are prohibited before [ʔC] clusters because a syllable that contained a long vowel and a coda consonant would be trimoraic. Consequently, vowels

[14] The glottal stop also occurs infrequently between vowels (Peterson 2004).

are shortened in order to conform to a bimoraic syllable template. Specifically, I follow the analysis laid out in Peterson (2004). To account for this variable phonetic realization, as well as some unusual morphophonological processes that the glottal stop undergoes in Blackfoot, Peterson (2004) argues that the glottal stop in Blackfoot is a subsegmental constricted glottis ([CG]) feature which is moraically licensed. He accounts for the three surface realizations in (102) in the following way. If the [CG] feature is parsed to the final mora of the syllable, the vowel is short and the [CG] feature surfaces as a glottal stop, (103a). If it is parsed to the final mora of the syllable which is also linked to the vowel, then the vowel is long and the [CG] feature surfaces as creaky voicing on the vowel, (103b). If the [CG] feature is left unparsed to the syllable, then the vowel simply surfaces as long, (103c).

(103) SUBSEGMENTAL MORAIC [CG]

a. [VC] b. CREAKY VOWEL c. LONG VOWEL



2.4.2.1.4 Geminates

Length is distinctive for obstruents and nasals. For example, the words [ɛ́ːpotaːwḁ] 'he is getting a beating' and [ɛ́ːpʊtːaːwḁ] 'he is flying' in (30b) only differ in the length of the medial consonant [t] or [tː] and the quality of the preceding vowel. (For further examples that short and long consonants contrast, see Appendix A.1.2.)

(104) a. ⟦ɛ́ːpo**t**aːwḁ⟧
áípo**t**aawa
a–[ipot–aa]–Ø–wa
IPFV–[beat.*v*–3OBJ]–IND–3
'he is getting a beating'

b. ⟦ɛ́ːpʊ**tː**aːwḁ⟧
áípo**tt**aawa
a–[ipo**tt**–aa]–Ø–wa
IPFV–[fly–AI]–IND–3
'he is flying'

(Denzer-King 2009: 16, (7*k*,*l*))

Geminates have the same distribution as heterosyllabic clusters; they occur intervocalically and cannot be followed or preceded by another consonant. As discussed in Elfner (2006b) & Frantz (2009), vowel length is neutralized before geminates, and only short, lax vowels can occur in this position. Some examples are shown in (105). In contrast, no long vowels occur before geminates, (106).

(105) SHORT V BEFORE GEMINATES

a. NON-SIBILANT OBSTRUENTS

[kɪpːo̥xʷkʊ́kːɪt]	*kippohkókkit*	‘please give me it!’ (BB)
⟦m**ʊ**tːok͡sís⟧	*m**o**ttoksís*	‘knee’
⟦nit**ʌ́**kːaː⟧	*nit**á**kkaa*	‘my friend’

b. SIBILANT OBSTRUENTS

⟦**ʌ́**sːâːkɪpːópiːt⟧	***á**ssáakippópiita*	‘stop and sit for a moment!’
⟦k**ʊ**t͡ːsíːs⟧	*k**o**ttsíísa*	‘stuff it!’ (ANIM)
⟦k͡s**ɪ**k͡ːsinʌ́t͡ːsiwḁ⟧	*ks**i**kksináttsiwa*	‘it is white’

c. NASALS

⟦**ɪ**mːojáːn⟧	***i**mmoyáán*	‘fur coat’
⟦ij**ɪ́**nːakiːkoan⟧	*iy**í**nnakiikoan*	‘policeman’

d. GLIDES

*[jː]

*[wː]

(106) NO LONG V BEFORE GEMINATES

a. NON-SIBILANT OBSTRUENTS

*[k**iː**pːo̥xʷkʊ́kːɪt]	—	—
*[m**oː**tːok͡sís]	—	—
*[nit**aː**kːaː]	—	—

b. SIBILANT OBSTRUENTS

*[**áː**sːâːkɪpːópiːt]	—	—
*[k**oː**t͡ːsíːs]	—	—
*[k͡s**iː**k͡ːsinʌ́t͡ːsiwḁ]	—	—

c. NASALS

*[**iː**mːojáːn]	—	—
*[ij**íː**nːakiːkoan]	—	—

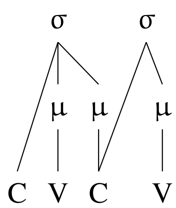
d. GLIDES

*[jː]

*[wː]

This pattern suggests that geminates are, like heterosyllabic clusters, parsed to a moraic coda position. Following Hayes (1989a) I assume that an intervocalic geminate is parsed ambisyllabically to a moraic coda position as well as to the following syllable node in order to satisfy ONSET, as in (107). Following the same logic as above, long vowels are prohibited before geminates because a syllable that contained a long vowel and a coda consonant would be trimoraic. Consequently, vowels are shortened in order to conform to a bimoraic syllable template.

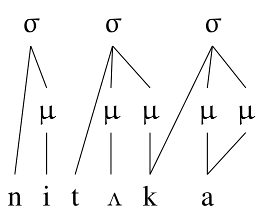
(107) GEMINATE CONSONANT



In transcriptions with syllable boundaries (.), I write geminates as doubled sounds with the period in the middle, to parallel the transcription of CC clusters, (109).

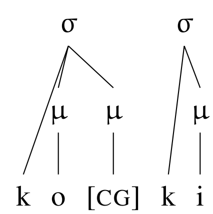
(108) AMBISYLLABIC GEMINATE

[ni.tʌ́k.kaː] ‘my friend’ =



(109) HETEROSYLLABIC CLUSTER

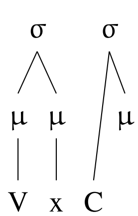
[koʔ.ki] ‘corner’ =



2.4.2.2 Analysis

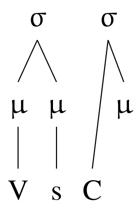
The preceding sections discussed four environments where vowel length is neutralized to short: before a dorsal fricative, (110), an alveolar sibilant, (111), moraically-licensed [CG] feature, (112), or a geminate consonant, (113). I argued that all four environments can be united under a moraic analysis: they all create a closed syllable with a moraic coda. This causes the preceding vowel to shorten in order to conform to a bimoraic syllable template.

(110) VELAR FRICATIVE AS CODA



=(96)

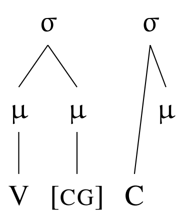
(111) Alveolar sibilant as coda



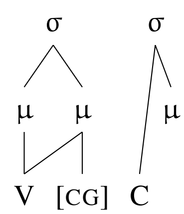
=(100)

(112) Subsegmental [cg] as coda

a. [VʔC]

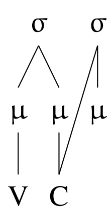


b. Creaky vowel



=(103a), (103b)

(113) Geminate consonant



=(107)

In the next sections, I address the analysis of vowel neutralization before heterosyllabic clusters and geminates in turn.

2.4.2.2.1 Heterosyllabic clusters

In this section I present an Optimality Theory analysis of vowel length neutralization in closed syllables in Blackfoot. Because onsetless syllables[15] and syllables with codas are tolerated, the two faithfulness constraints Max-IO(Seg) and Dep-IO(Seg) must dominate the two markedness constraints Onset and *Coda.

[15] Onsetless syllables are tolerated only at the beginning of the PPh. PPh-internal onsetless syllables violate the more stringent constraint *Hiatus. See Elfner (2006b) for discussion.

(114) ⟦oʔ.takí̃ː.wḁ⟧ *o'takíwa* 'it is round'

/o'takii-wa/	MAX(Seg)	DEP(Seg)	ONS	*COD
☞ a. [oʔ.ta.kíː.wi̥]			*	*
b. [toʔ.ta.kíː.wi̥]		*!		*
c. [o.ta.kíː.wi̥]	*!		*	

Crucial rankings: {MAX(Seg), DEP(Seg)} ≫ {ONS, *COD}

Codas are predictably moraic, which is regulated by the constraint Weight-By-Position (WBP). Since there are no "coda" structural positions in Moraic Theory, I have formulated WBP as an alignment constraint (McCarthy and Prince 1993a). The constraint is satisfied by a mora at the right edge of a syllable regardless of whether that mora is linked to a consonant or a vowel. Therefore, open syllables satisfy WBP. The constraint is formulated in such a way that degenerate syllables, which contain no moras, vacuously satisfy this constraint. (Degenerate syllables are discussed in Section 2.4.4.)

(115) WEIGHT-BY-POSITION = ALIGN(σ, R, μ, R)

Abbreviation: WBP

For every syllable (σ) which contains at least one mora, align the right edge of the syllable to the right edge of a mora. (Based on Hayes 1989b)

Any moraic consonant violates a general markedness constraint, *μ/C.

(116) * μ | [+cons] — Abbreviation: *μ/C

Assign a violation mark for any mora which dominates a [+cons] segment.

(Broselow, Chen and Huffman 1997; Moren 1999)

The weight of coda consonants is predictable, meaning that non-moraic consonants in the input will become moraic in the output if they are parsed to a coda position, thus incurring faithfulness violations. The following tableau for (101) [koʔkíji̥] '(a) corner' uses an input that contains a short vowel before a non-moraic glottal stop. The faithful candidate (a) is not optimal, because it violates WBP, which is undominated. The winning candidate (b) satisfies WBP by epenthesizing a mora. This violates DEP-IO(μ) because there is a mora in the output that does not have a correspondent in the input. This candidate also violates the general markedness constraint, *μ/C. Candidates (c) and (d) avoid violations of WBP and *CODA by deleting or epenthesizing a segment, respectively.

(117) ⟦koʔ.kí.ji̥⟧ *ko'kíyi* '(a) corner'

/koʔki-ji/	WBP	MAX(Seg)	DEP(Seg)	MAX(μ)	DEP(μ)	*μ/C	*COD
a. koʔ.kí.ji̥	∗!						∗
☞ b. koʔ$^{\mu}$.kí.ji̥					∗	∗	∗
c. ko.kí.ji̥		∗!					
d. ko.ʔi.kí.ji̥			∗!		∗		

Crucial rankings: WBP ≫ {DEP-IO(μ), *μ/C}; MAX-IO(Seg) ≫ {DEP-IO(μ), *μ/C, *CODA}; DEP-IO(Seg) ≫ {*μ/C, *CODA}

Under the Richness of the Base hypothesis (Prince and Smolensky 1993), there are no constraints on the input. The moraicity of codas is predictable, so an input which already has a mora should also generate the same output. The coda in candidate (a) does not retain the mora, violating WBP and MAX-IO(μ). The optimal candidate retains the mora, confirming that WBP must be crucially ranked above *μ/C. Note that since WBP ≫ *μ/C, candidate (b) will be optimal no matter where MAX-IO(μ) and *CODA are ranked with respect to WBP. Candidates (c) and (d) avoid violations of *μ/C and *CODA via deletion and epenthesis, respectively. Since MAX-IO(Seg) ≫ {*μ/C, *CODA}, MAX-IO(μ) is not crucially ranked; candidate (c) will be suboptimal no matter where MAX-IO(μ) is ranked. And finally, the ranking DEP-IO(Seg) ≫ {*μ/C, *CODA} ensures that candidate (d) is suboptimal no matter where MAX-IO(μ) and DEP-IO(μ) rank.[16]

(118) ⟦koʔ.kí.ji̥⟧ *ko'kíyi* '(a) corner'

/koʔ$^{\mu}$ki-yi/	WBP	MAX(Seg)	DEP(Seg)	MAX(μ)	DEP(μ)	*μ/C	*COD
a. koʔ.kí.ji̥	∗!			∗!			∗
☞ b. koʔ$^{\mu}$.kí.ji̥						∗	∗
c. ko.kí.ji̥		∗!		∗!			
d. ko.ʔi.kí.ji̥			∗!	∗!	∗!		

I now turn to an analysis of vowel length neutralization before clusters. The driving force behind vowel shortening is a maximality constraint on syllables, *3μ, which is undominated in Blackfoot.

[16]There is a fifth candidate which looks just like candidate (d) but which involves reassociating the mora linked to /ʔ/ in the input to the following (epenthesized) [i] in the output. This candidate would violate DEP-IO(Seg) as well as constraints which prohibit the reassociation of moras. For one possible set of definitions against mora reassociation, see McCarthy (2000).

(119) *3μ

Assign a violation for every syllable which dominates more than two moras. ("No trimoraic syllables.") (Based on Prince 1990)

The problem can be seen most clearly when the input contains a long vowel followed by a moraic consonant, such as the input /koːʔ^μki/ for [koʔ.kı́] 'corner'. In the tableau below, the faithful candidate (a) violates *3μ. Candidates (b) and (c) satisfy *3μ by incurring violations of MAX-IO(μ) and deleting a mora associated with the consonant [ʔ] and the vowel [o], respectively. Deleting the mora associated with the consonant in candidate (c) also incurs a violation of WBP, which is undominated. The optimal candidate (b) deletes one mora associated with [o] and satisfies *3μ and WBP. This tableau crucially shows that *3μ dominates MAX-IO(μ). Candidates (d) and (e) satisfy *3μ by deleting the [ʔ] and the mora associated with it, and by epenthesizing a vowel, respectively.

(120) ⟦koʔ.kı́.ji̥⟧ *ko'kíyi* '(a) corner'

/koːʔ^μki-yi/	*3μ	WBP	MAX	DEP	MAX(μ)	DEP(μ)	*Vː	*μ/C	*COD
a. koːʔ^μ.kı́.ji̥	*!						*	*	*
☞ b. koʔ^μ.kı́.ji̥					*			*	*
c. koːʔ.kı́.ji̥		*!			*!		*		*
d. koː.kı́.ji̥			*!		*!		*		
e. koː.ʔi.kı́.ji̥				*!	*!	*	*		

Crucial rankings: *3μ ≫ MAX-IO(μ)

To summarize, vowel length is neutralized before heterosyllabic clusters in order to avoid violations of *3μ. Deleting a mora associated with a coda consonant would incur violations of WBP, but deleting a mora associated with a vowel avoids violations of *3μ without incurring a fatal violation. The tableaux above used examples which contain a coda [CG] feature, but the same ranking would also work for syllables with coda /x/ or /s/. In the next section I turn to vowel neutralization before geminate consonants.

2.4.2.2.2 Geminate consonants

Following Davis (2003, 2011), Hayes (1989a), McCarthy and Prince (1996), Moren (1999), & Spaelti (1994) among others, contrastive consonant length is derived from an underlying moraic contrast. Under this view, geminate consonants are underlyingly moraic while short consonants are not.

(121) MORAIC REPRESENTATION OF GEMINATES

a. SHORT CONSONANT

C

b. GEMINATE CONSONANT

μ
|
C

Non-moraic consonants are parsed preferentially to onset positions in order to satisfy ONSET, which prohibits moras at the left edge of the syllable. The same constraint causes geminate consonants to be parsed to a coda position, because a moraic onset would violate ONSET. (For arguments that onsets can contain moraic segments, see Hajek and Goedemans 2006; Hart 1991; Muller 2001; Topintzi 2006, 2008.) Ambisyllabic 'flopping' ensures the following syllable has an onset (Hayes 1989a).

In the tableau below, the solid lines represent the crucial rankings *3μ ≫ MAX-IO(μ) from (120) and MAX-IO(μ) ≫ *LONGVOWEL from (93). Candidate (a) parses a moraic consonant to an onset position, violating ONSET but satisfying *CODA, while the optimal candidate (b) parses the moraic consonant to a coda position, violating *CODA but satisfying ONSET. Since these two candidates otherwise incur the same violations, this shows that ONSET dominates *CODA. Candidate (c) does not have a moraic consonant at all, which avoids violations of ONSET, *μ/C, and *CODA, but incurs a violation of MAX-IO(μ). This shows that MAX-IO ≫ {*μ/C, *CODA}.

(122) ⟦ɛ́ːpʊt.taː.wḁ⟧ *áípottaawa* 's/he is flying, flies'

/a-ipot$^{\mu}$-aa-wa/	*3μ	ONS	MAX(μ)	*Vː	*μ/C	*COD
a. ɛ́ː.po.t$^{\mu}$aː.wḁ		*!*		**	*	
☞ b. ɛ́ː.pʊt$^{\mu}$.taː.wḁ		*		**	*	*
c. ɛ́ː.po.taː.wḁ		*	*!	**		

Crucial rankings: ONSET ≫ *CODA; MAX-IO(μ) ≫ {*μ/C, *CODA}

Under the Richness of the Base hypothesis, there are also inputs that contain a long vowel followed by a moraic consonant. Candidates (a) and (b) are faithful to the moraic associations in the input, violating *3μ and ONSET, respectively. Candidates (c) and (d) satisfy *3μ by removing a mora associated with the vowel or the consonant, respectively, violating MAX-IO(μ) in both cases. Because the optimal candidate is (c), *Vː must dominate *CODA and *μ/C.

(123) ⟦ɛ́ːpʊt.taː.wḁ⟧ *áípottaawa* ‘s/he is flying, flies’

/a-ipoːt$^{\mu}$-aa-wa/	*3μ	ONS	MAX(μ)	*Vː	*μ/C	*COD
a. ɛ́ː.poːt$^{\mu}$.taː.wḁ	*!	*		***	*	*
b. ɛ́ː.poː.t$^{\mu}$aː.wḁ	*!	*!*		***	*	
☞ c. ɛ́ː.pʊt$^{\mu}$.taː.wḁ		*	*	**	*	*
d. ɛ́ː.poː.taː.wḁ		*	*	***!		

Crucial rankings: *Vː ≫ {*μ/C, *CODA}

Note that it is crucially the ranking of ONSET over MAX-IO(μ) in the tableau above that makes candidate (b) suboptimal, because the only reason candidate (b) violates *3μ is that the geminate consonant is an onset to a syllable with a long vowel. For words with a short vowel following the geminate consonant, like [ɪm.mo.jáː.n] ‘fur coat’, below, candidate (b) violates ONSET but not *3μ.

(124) ⟦ɪm.mo.jáː.n⟧ *immoyáán* ‘fur coat’

/iːm$^{\mu}$oji-aan/	*3μ	ONS	MAX(μ)	*Vː	*μ/C	*COD
a. iːm$^{\mu}$.mo.jáː.n	*!	*		**	*	*
b. iː.m$^{\mu}$o.jáː.n		*!*		**	*	
☞ c. ɪm$^{\mu}$.mo.jáː.n		*	*	*	*	*
d. iː.mo.jáː.n		*	*	**!		

Crucial rankings: ONSET ≫ MAX-IO(μ); *Vː ≫ {*μ/C, *CODA}

This ranking of general markedness constraints (*Vː ≫ {*CODA, *μ/C}) means that long vowels in Blackfoot are more marked than moraic consonants. An alternative analysis would instead index the faithfulness constraints MAX-IO(μ) and DEP-IO(μ) to be specific to vowels versus consonants. Under such an analysis, faithfulness to moraic consonants would rank higher than faithfulness to bimoraic vowels. Now that I have shown an analysis of vowel length neutralization in all types of closed syllables, I briefly discuss how to account for the restrictions on the first consonant in a heterosyllabic clusters. The current constraint ranking predicts that illicit consonant sequences will be repaired via epenthesis, which I argue in Section 4.2.1 is true.

2.4.2.2.3 Restrictions on clusters

The analysis above accounts for vowel length neutralization in closed syllables but does not account for why the first consonant in a heterosyllabic cluster is restricted to /ʔ/, /x/, or /s/. The only allowable pre-consonantal consonants are the voiceless continuants (e.g. /x/ and /s/) or a subsegmental unit which is unspecified for voice and continuancy (e.g. [CG]). However, all possible geminates are allowed.

I hypothesize that some markedness constraints apply to specific clusters, and that geminates escape the effects of these constraints because they are not clusters, but single consonants linked to a mora. There are two relevant constraints. The first is *[-cont][+cons], (125), which prohibits clusters where the first segment is a plosive or assibilant. The second is AGREE(voice), (126), which requires adjacent consonants to have the same value for voicing.

(125) *[-cont][+cons]

Assign a violation for each sequence of consonants if the first consonant is [-cont].

(126) AGREE(voice)

Assign a violation for each sequence of consonants if the first consonant is [αvoice] and the second consonant is [-αvoice].

A cluster like /sk/ or /xk/, (127), does not violate either markedness constraint. Such clusters satisfy *[-cont][+cons] because [s] and [ç], [x], [x^w] are not [-cont] segments. Such clusters satisfy AGREE(voice) because /s/ and /x/ are both [-voice] and only occur before obstruents, all of which are also [-voice] in Blackfoot. The clusters surfaces faithfully, even though the optimal candidate incurs a violation of *CODA. Note that (117) already determined that DEP-IO(Seg) ≫ *CODA, so candidate (b) is suboptimal no matter where DEP-IO(μ) ranks.

(127)

...sk...	*[-cont][+cons]	AGR(voi)	MAX	DEP	MAX(μ)	DEP(μ)	*COD
☞ a. s.k							*
b. si.k				*!		*!	
c. Ø.k			*!				

Crucial rankings: MAX-IO(Seg) ≫ *CODA

A cluster like /ʔk/, (128), also violates neither markedness constraint, because [ʔ] is a subsegmental [CG] feature which has no [voice] or [cont] features (Peterson 2004). Both markedness constraints are satisfied regardless of the features of the following segment. This predicts that /ʔ/ should be able to occur freely before any licit onset, which is true (see data in Section 2.4.2.1.3).

(128)

… ʔk…	*[-cont][+cons]	AGR(voi)	MAX	DEP	MAX(μ)	DEP(μ)	*COD
☞ a. ʔ.k							*
b. ʔi.k				*!		*!	
c. Ø.k			*!				

Crucial rankings: MAX-IO(Seg) ≫ *CODA

A cluster like /pk/, (129), violates *[-cont][+cons] because [p] is a [-cont] segment. Since (117) shows that DEP-IO(Seg) ≫ *CODA, the tableau below shows that *[-cont][+cons] crucially dominates DEP-IO(Seg), and that either *[-cont][+cons] or *CODA must dominate DEP-IO(μ). The optimal candidate (b) violates DEP-IO(Seg) and DEP-IO(μ). An alternative candidate (c) avoids violations of *[-cont][+cons] by deleting one of the consonants, which shows that MAX-IO(Seg) outranks the DEP constraints.

(129)

…pk…	*[-cont][+cons]	AGR(voi)	MAX	DEP	MAX(μ)	DEP(μ)	*COD
a. p.k	*!						*
☞ b. pi.k				*		*	
c. Ø.k			*!				

Crucial rankings: *[-cont][+cons] ≫ DEP-IO(Seg); MAX-IO(Seg) ≫ {DEP-IO(Seg), DEP-IO(μ)}

A cluster like /nk/, (130), violates AGREE(voice) because the nasal is [+voice] while the following plosive is [-voice].[17] Since (117) shows that DEP-IO(Seg) ≫ *CODA, the tableau below shows that AGREE(voice) crucially dominates DEP-IO(Seg), and that either AGREE(voice) or *CODA must dominate DEP-IO(μ). The optimal candidate (b) violates DEP-IO(Seg) and DEP-IO(μ). An alternative candidate (c) avoids violations of AGREE(voice) by deleting one of the consonants, which shows that MAX-IO(Seg) outranks the DEP constraints. In Chapter 4 I present concrete evidence that illicit clusters are avoided via epenthesis rather than deletion.

[17]Nasals in Blackfoot pattern as a class with [s] for at least one alternation: all three segments delete at the right edge of noun stems in particular morphophonological contexts (Frantz 2009; Weber 2016d). Nasals in many languages pattern with [+cont] segments (Mielke 2008), and so I have assumed that nasals in Blackfoot are [+cont]. No noun stems end in /x/, /w/, or /j/, which means that the only [+cont] segments which occur at the end of noun stems is exactly the class {m, n, s}.

(130)

...nk...	*[-cont][+cons]	AGR(voi)	MAX	DEP	MAX(μ)	DEP(μ)	*COD
a. n.k		∗!					∗
☞ b. ni.k				∗		∗	
c. Ø.k			∗!				

Crucial rankings: AGREE(voice) ≫ DEP-IO(Seg); MAX-IO(Seg) ≫ {DEP-IO(Seg), DEP-IO(μ)}

Geminates are parsed to a coda position and the optimal, faithful candidate violates *CODA, (131). Candidate (b) violates DEP-IO(Seg) and DEP-IO(μ). This creates a marked vowel hiatus context, thus violating a constraint like *HIATUS. (See discussion in Section 3.2.1.3.1 for this constraint.) Candidate (c) violates MAX-IO(μ) in order to resyllabify the consonant as an onset.

(131)

...Vp^{μ}V...	*HIAT	AGR(voi)	MAX	DEP	MAX(μ)	DEP(μ)	*COD
☞ a. Vp^{μ}.pV							∗
b. Vp^{μ}.pi.V	∗!			∗!		∗!	
c. V.pV					∗!		

Crucial rankings: MAX-IO(μ) ≫ *CODA

In the final two sections of this chapter I turn to two unusual aspects of syllable structure which feature in the transcriptions throughout the dissertation. In Section 2.4.3 I discuss the distribution of interconsonantal fricatives. This discussion augments previous research which argues that interconsonantal fricatives in Blackfoot are parsed to a syllable nucleus on the basis of distribution and patterns of alternation (Denzer-King 2009; Goad and Shimada 2014a,b; Miyashita 2018). In Section 2.4.4 I discuss degenerate syllables, which I define as a syllable without a nucleus. These syllables occur only at the right edge of the PPh in Blackfoot and so serve as evidence for that edge.

2.4.3 Syllabic fricatives

Only two types of consonants can occur between consonants in Blackfoot: /x/ and /s/. The transcriptions throughout this dissertation treat interconsonantal /x/ and /s/ as syllabic consonants. This section includes the data which supports this analysis. I discuss interconsonantal /x/ and interconsonantal /s/ in turn.

Dorsal fricatives can occur between two consonants. The examples in (132) show that all three allophones of the dorsal fricative occur before obstruents but not before nasals or glides. This means that interconsonantal /x/ has the same distribution as post-vocalic (coda) /x/ (discussed above in Section 2.4.2.1.1).

(132) NUCLEAR /x/ BEFORE OBSTRUENTS

a. BEFORE [p]

⟦nit͡síːpç̩**p**ɪnːaːn⟧	*nitsíípi**hp**innaan*	'we have/had bows and arrows'
⟦máːks̩ːtx̩**p**ikoʔtoːwḁ⟧	*mááksst**ahp**iko'toowa*	'why did she come here?'
⟦âːk**x̩ʷp**ejʔpiːjiwḁ⟧	*áak**ohp**ai'piiyiwa*	'she will jump'

b. BEFORE [t]

⟦âːkx̩ʷpç̩**t**aːwḁ⟧	*áakohpi**ht**aawa*	'she will use sugar'
⟦âːk͡spx̩**t**aniʔsiwḁ⟧	*áaksip**aht**ani'siwa*	'she will accidentally cut her hand'
⟦inʔç̩k**x̩ʷt**ómoːs⟧	*inihk**oht**ómoosa*	'sing for him!'

c. BEFORE [k]

⟦âːk**ç̩k**it͡sikawḁ⟧	*áak**ihk**itsikawa*	'she will freeze her feet'
⟦aʔk**x̩k**ój⟧	*a'k**ahk**óyi*	'curved geographical feature'
⟦nít**x̩ʷk**ʊkːḁ⟧	*nít**ohk**okka*	'she gave to me'

d. BEFORE [s]

*[ç̩s]

⟦ɪsːk**x̩s**íʔt͡sit⟧	*issk**ahs**í'tsit*	'forget about it!'
⟦âːk**x̩ʷ**simḁ⟧	*áák**ohs**ima*	'she boiled it'

e. BEFORE [t͡s]

⟦its̩ːáp**ç̩t͡s**iʔpḁ⟧	*itssáp**ihts**ii'pa*	'there is something inside of it'
⟦âːk͡sip**x̩t͡s**aʔps̩siwḁ⟧	*áaksip**ahts**a'pssiwa*	'she will make a mistake'
⟦âːk**x̩ʷt͡s**itokoːwḁ⟧	*áak**ohts**itokoowa*	'he will go through (e.g. a crowd)'

f. BEFORE [ks]

*[ç̩k͡s]

⟦âːk͡sip**x̩k͡s**imɪmːḁ⟧	*áaksip**ahks**imimma*	'he will smell like urine'
⟦âːk͡sip**x̩ʷk͡s**iːmɪnːakiwḁ⟧	*áaksip**ohks**iiminnakiwa*	'she will prune'

g. BEFORE NASALS

*[çm], *[çn]

*[xm], *[xn]

*[xʷm], *[xʷn]

h. BEFORE GLIDES
*[çj], *[çw]
*[xj], *[xw]
*[xʷj], *[xʷw]

When the dorsal fricative occurs in a nuclear position, the place and rounding of the consonant is conditioned by the immediately preceding vowel in the underlying representation.[18] Morphophonological alternations support such abstract representations. This can be illustrated with a minimal pair using the verb stems /opiː-/ 'sit' and /opi-/ 'possess archery equipment', as discussed in Frantz (1997: 6). The stem-final vowel of /opiː-/ 'sit' is long before the glide [w] in (133a). This vowel surfaces as a short voiced vowel before the indicative clause-typing suffix *-hp* (/-xp/) and the dorsal fricative is parsed as a coda [ç], (133b). In other words, long vowels in open syllables alternate with short vowels before the dorsal fricative /x/: [Vː] ∼ [V]. (This length alternation also occurs before other coda consonants and geminates, as I discussed in Section 2.4.2.)

(133) a. ⟦âːkop**iː**wḁ⟧
áakop**ii**wa
aak–[op–**ii**]–Ø–wa
FUT–[sit–AI]–IND–3
'she will sit' (Frantz and Russell 2017)

b. ⟦nit͡síːp**i**çpɪnːaːn⟧
nitsíip**ii**hpinnaan[20]
nit–[ii\op–**ii**]–hp–innaan
1–[IC\sit–AI]–IND–1PL
'we sat/stayed' (Frantz 1997: 6)

In contrast, the stem-final vowel of /opi-/ 'possess archery equipment' is short before the glide [w] in (134a). When followed by the dorsal fricative in the indicative clause-typing suffix *-hp* (/-xp/), the underlying sequence /ix/ surfaces as a nuclear [ç̩], as shown in (134b). Alternations like this one lend credence to the idea that a nuclear dorsal fricative arises from an underlying sequence of a short vowel plus a consonant.

[18]This interaction is not opaque, even though the conditioning vowel is not present in the output. Miyashita (2018) argues that nuclear dorsal consonants could be viewed as the product of coalescence between an underlying vowel-consonant sequence. The details of this proposal in OT remain to be worked out, but such a proposal would circumvent opacity, which is not analyzable in parallel OT.

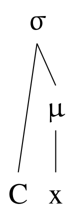
[20]The first vowel of the stem in this example and also in (134b) exhibits a vowel ablaut to [iː] which occurs for stems which begin in a short vowel whenever they occur in past tense indicative clauses for third persons; see Appendix C.

(134) a. ⟦âːkop**i**wḁ⟧
áakop**i**wa
aak–[op–**i**]–Ø–wa
FUT–[archery.gear–AI]–IND–3
'she will have archery equipment'
(Frantz and Russell 2017)

b. ⟦nit͡síːp**ç̩**pɪnːaːn⟧
nitsííp**i**hpinnaan
nit–[ii\op–**i**]–hp–innaan
1–[IC\archery.gear–AI]–IND–1PL
'we (excl.) have/had bows and arrows'
(Frantz and Russell 2017)

I treat interconsonantal /x/ as a monomoraic fricative which forms the nucleus of the syllable.

(135) MONOMORAIC NUCLEIC /x/



The alveolar sibilant [s] can also occur between two consonants (Goad and Shimada 2014a,b), where it may be short, (136), or long, (137). Just like post-vocalic (coda) [s] (discussed in Section 2.4.2.1.2), interconsonantal [s] only occurs before obstruents.

(136) INTERCONSONANTAL [s̩] OCCURS BEFORE OBSTRUENTS

a. NON-SIBILANT OBSTRUENTS

⟦âːk͡sik͡síˢt**s̩p**iʔtakiwḁ⟧	*áaksiksístspi'takiwa*	'she will be eager to begin'
⟦âːkok**s̩t**akiwḁ⟧	*áakokstakiwa*	'she will read'
⟦sɛːp**s̩k**ápatoːt⟧	*saipskápatoot*	'stretch it!'

b. SIBILANT OBSTRUENTS

⟦nisím**s̩s**iːˢt͡si̥⟧	*nisím**ss**iistsi*	'my drinks'
⟦ɔːk**s̩t͡s**ít⟧	*aokstsít*	'gnaw a hole in it!'
⟦âːkit**s̩k͡s**íʔpojiwḁ⟧	*áakitsksí'poyiwa*	'she will imply/insinuate'

c. NASALS
*[Csm]
*[Csn]

d. GLIDES
*[Csj]
*[Csw]

(137) INTERCONSONANTAL [s̩ː] OCCURS BEFORE OBSTRUENTS

a. NON-SIBILANT OBSTRUENTS

⟦íːk**s̩ːpi**ːwḁ⟧	*íík**ssp**iiwa*	‘it (wooden) is high’
⟦aʔp**s̩ːt**óːs⟧	*a’p**sst**óósa*	‘beckon to her!’
⟦ɪst**s̩ːk**áːn⟧	*isst**ssk**áán*	‘dust’

b. NON-SIBILANT OBSTRUENTS

⟦ót**s̩ːsi**t͡simaːni̥⟧	*ót**sss**itsimaani*	‘his/her baby’
⟦aːp**s̩ːt͡s**ít͡sikinit⟧	*aap**ssts**ítsikinit*	‘take off your shoes!’
⟦níts̩ː**k͡s**iniʔpḁ⟧	*nít**ssks**inii’pa*	‘I know it’

c. NASALS

*[Csːm]

*[Csːn]

d. GLIDES

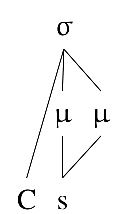
*[Csːj]

*[Csˑw]

I follow Goad and Shimada (2014a,b) in treating interconsonantal [s] as a mono- or bimoraic sibilant which forms the nucleus of the syllable.

(138) a. MONOMORAIC NUCLEIC /s/

b. BIMORAIC NUCLEIC /s/



To summarize, preconsonantal /x/ and /s/ have the same distributional restrictions, regardless of whether they occur after a vowel or a consonant. Under my analysis, this is because the constraints *[-cont][+cons] and AGREE(voice) (defined in Section 2.4.2.2.3) are satisfied by a sequence of /x/ or /s/ followed by an obstruent. A moraic analysis of interconsonantal segments accounts for the evidence above from alternations and segmental distribution (see also Denzer-King 2009; Goad and Shimada 2014a,b).

A full analysis of Blackfoot moraic consonants goes well beyond the scope of this thesis. For example, why is it that the only consonants which can be parsed to as a syllable nucleus are [x] and [s], but more sonorous segments cannot? And why does [s] contrast for length in this position (like a vowel) but /x/ does not? Nevertheless, I adopt the moraic analysis in my transcriptions.

The final main section of this chapter discusses degenerate syllables, which consist of an onset consonant but no nucleus. These occur at the right edge of the Phonological Phrase (PPh) in some dialects.

2.4.4 Degenerate syllables

The transcriptions throughout this dissertation, and especially in Section 3.2.2 on primary stress, often include a final consonant which is syllabified into a syllable of its own without a following nucleus. Anticipating those transcriptions, in this section I present an analysis of degenerate syllables in Blackfoot. These types of syllables occur for many speakers of the Káínai dialect in the same position where other speakers have a final devoiced vowel. I first show that consonants at the right edge of a phonological phrase (PPh) have the distribution of PPh-medial onsets rather than PPh-medial codas. I use this evidence to argue that final consonants do not form a complex coda. I then use evidence from minimal size constraints to argue that final consonants are not extrametrical, because they count towards the minimal PPh size. If minimality constraints are calculated over prosodic units, the suggests that the final consonants are parsed to either a syllable or a mora. However, as I show in Section 3.2.2, PPh-final consonants do not contribute to syllable weight nor affect the location of primary stress. From this I conclude that PPh-final consonants are parsed to a degenerate syllable. I then present an analysis.

2.4.4.1 Data

The phonological phrase (PPh) in Blackfoot can end in one or two consonants for many speakers. I will show that the final consonant in both cases has the distribution of an onset rather than a coda. There are five ways that PPh-final consonants differ from PPh-medial codas. First, the types of consonants which occur in PPh-medial codas are not the same as the types of consonants which occur in PPh-final position. PPh-medial codas are restricted to /x/, /s/, /ʔ/ (which is the realization of a moraically-licensed [CG] feature), or a geminate (a moraic consonant). However, these consonants are not allowed PPh-finally. This suggests that the final consonant of a PPh is not parsed to a coda position.

(139) NO PPH-FINAL CODAS

a.	*[...**paʔ**]	—	—
b.	*[...**pax**]	—	—
c.	*[...**pʌs**]	—	—

Second, the consonants which are allowed PPh-finally are a subset of the consonants which are allowed in PPh-medial onset position, shown in (140). The bilabial stop /p/ occurs PPh-finally, but only as part of a cluster (also noted in Denzer-King 2009: 14; Goad and Shimada 2014b,a).[21] The assibilants /t͡s/ and /k͡s/ and the glides /w/ and /j/ also do not occur PPh-finally.

(140) a. PPH-FINAL, POST-VOCALIC SHORT PLOSIVES

*[. . . **p**]	—	—	
[saː.k͡sí.**t**]	*saaksí**t***	'go out!'	(NC)
[oː.jí.**k**]	*ooyí**k***	'(you all) eat!'	(NC)

b. PPH-FINAL, POST-VOCALIC SIBILANTS

[a.t͡sí.**s**]	*atsísa*	'pants'	(NC)
*[. . . **t͡s**]	—	—	
*[. . . **k͡s**]	—	—	

c. PPH-FINAL, POST-VOCALIC NASALS

[só.kaʔ.sɪ.**m**]	*sóka'si**m**i*	'jacket, dress, shirt'	(NC)
[siʔ.káː.**n**]	*si'káá**n**a*	'blanket'	(NC)

d. PPH-FINAL, POST-VOCALIC GLIDES

*[. . . w]	—	—
*[. . . j]	—	—

The segments in (140) are a proper subset of the consonants that can occur as onsets. The chart below compares PPh-final consonants, PPh-medial onsets, and PPh-medial codas. Onset segments are listed to the left of the dotted line, while canonical codas are listed to the right. The PPh-final consonants pattern with onsets rather than codas.

Table 2.4: Distribution of consonants by position

	p	t	k	s	t͡s	k͡s	m	n	w	j	ʔ	x
PPh-medial onsets	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘
PPh-medial codas	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✓	✓
PPh-final consonants	✘	✓	✓	✓	✘	✘	✓	✓	✘	✘	✘	✘

Third, vowel length remains contrastive before PPh-final consonants, even though I argued in Section 2.4.2 that vowel length is neutralized before PPh-internal codas. Examples (141)–(142) show that a PPh-final [t] can occur after either a short or long [i]. Similarly, examples (143)–(144) show that a PPh-final [n] can occur after either a short or long [a].[22] In this behavior, PPh-final consonants pattern

[21] Although there is a single *p*-final stem listed in the dictionary, *nííp-* 'leaf', this stem is vowel-final in the speech of all of my consultants. It is pronounced [níːpi], with a final voiced [i], even in syntactic contexts which require a bare noun stem.

[22] Strangely, short vowels sound lax to my ears before PPh-final consonants. Lax vowels occur in closed syllables before moraic /s/ or a geminate consonant, but not typically in open syllables. I do not have a solution for this, but note that the

with PPh-medial onsets rather than codas, because vowel length is also distinctive before PPh-medial onsets.

(141) [ɪs.sa.p**í**.t]
issap**í**t
[issap–i]–t–Ø
[look–AI]–2SG.IMP–CMD
'look!' (NC)

(142) [a.p**íː**.t]
ap**íí**t
[ap–ii]–t–Ø
[sit–AI]–2SG.IMP–CMD
'sit!' (NC)

(143) [pɪs.k**ʌ́**.ni̥]
pissk**á**ni
[pissk–an]–i
[herd–NMLZ]–IN.SG
'buffalo jump' (NC)

(144) [pʌs.k**áː**.ni̥]
passk**áá**ni
[[passk–aa]–n]–i
[[dance–AI]–NMLZ]–IN.SG
'dance' (NC)

Fourth, the Káínai dialect allows bare nouns, which are noun stems without any inflectional suffixes, in certain syntactic contexts (see Section 3.1.3). Noun stems can end in either a short /m/, /n/, /s/ consonant, (145), or a long /mː/, /nː/, or /sː/ consonant, (146). These happen to be the only geminates which occur at the right edge of nominal stems.[23]

(145) PPH-FINAL SHORT [m, n, s]

	Transcription	Orthography	Gloss	
a.	[a.t͡sí.**s**]	*atsísa*	'pants'	(NC)
b.	[á.to.ʔx̩.sɪ.**m**]	*átoahsima*	'sock'	(NC)
c.	[aː.kíː.ko.a.**n**]	*aakííkoana*	'girl'	(NC)

problem is not confined to Blackfoot. For example, high vowels in Quebec French have a lax variant that surfaces variably before internal codas and categorically before PPh-final consonants, as in (1), despite the fact that PPh-final consonants in French have the distribution of onsets (Dell 1995).

(i) a. [bɪŋ.go] 'bingo'

b. [pʊtr] ∼ [pʊt] 'beam'

c. [kʏb] 'cube' (Côté 2011)

Blackfoot exhibits the same pattern, where PPh-final consonants pattern with syllable codas in terms of vowel laxing but pattern with syllable onsets for all other characteristics.

[23]The verbal complex never ends in a geminate, for the simple reason that verb stems are always followed by at least one suffix. The inflectional suffixes always end in either a vowel or a short consonant.

(146) PPH-FINAL LONG [m, n, s]

	Transcription	Orthography	Gloss	
	Transcription	Orthography	Gloss	
a.	[ka.to.jí**sː**]	*katoyíssa*	'sweet pine'	(NC)
b.	[mí̥ʔ.ks̥ː.kɪ**mː**]	*mi'ksskímma*	'metal'	(NC)
c.	[ox.kí**nː**]	*ohkínna*	'necklace'	(NC)

Assuming that a bare noun is contained within a PPh, this means that short and geminate consonants contrast at the right edge of the PPh. However, short and geminate consonants never contrast in PPh-medial codas. Short nasal consonants only occur in syllable onsets, while geminate consonants are parsed to a moraic coda position as well as the onset of the following syllable. Although short and long [s] contrast before [t], I argued in Section 2.1 that short pre-consonantal [s] forms a complex onset with the following consonant. In general, no geminate consonant can be followed by another consonant, *[mːC], *[nːC], which means that geminates cannot occur in a coda position. All of these facts suggest that the final consonant of the PPh is not a coda.

Fifth, clusters are also allowed at the right edge of bare nouns, even though PPh-medial codas are never complex. For example, coda /x/ and coda /ʔ/ can both precede /s/ in PPh-final position, (147). The clusters that are allowed PPh-finally are a subset of those allowed as PPh-internal heterosyllabic clusters. If the PPh-internal clusters are composed of a coda and an onset, then this suggests that the PPh-final clusters are also composed of a coda and an onset.

(147)	Transcription	Orthography	Gloss	
a.	[o.nɪ.^{s}tá**x.s**]	*onistááhsa*	'calf'	(BB)
b.	[sí̥.kx̥^{w}.ko**ʔ.s**]	*síkohko'sa*	'cast iron pan'	(BB)

Final consonants count towards minimal PPh size, which is bimoraic. The smallest bisyllabic PPhs are CVCV, (148). The only two unambiguously CVCV words I could find are *mini* (a word which was unknown to the speakers I worked with, but which is listed in Frantz and Russell 2017) and *moto-wa* 'it is spring'.

(148) MINIMAL VOWEL-FINAL PWDS

[mi.ní̥]	*min-yí*	'island'
[mo.tó]	*motó-wa*	'it is spring'

The smallest monosyllabic PPhs are either CVVC or CVCC, (321).

(149) MINIMAL CONSONANT-FINAL PWDS

a.	[píː.t]	*píí-t*	'enter!'
	[sóː.t]	*sóó-t*	'go to war!' (var. [so.woː.t])
	[néː.j] ∼ [néː.i]	*nááí-wa*	'it is six'
	[nɔ́ː.w] ∼ [nɔ́.o]	*nááo-wa*	'it is six'
	[kóː.n]	*kó:n*	'ice'
	[póː.s]	*póós*	'cat'
b.	[pɔ́n.n]	*pónn*	'bracelet'
	[kín.n]	*kínn*	'necklace'
	[kóʔs]	*kó's*	'dish, bowl' (metal)
	[máʔ.s]	*má's*	'Indian turnip' (edible root)

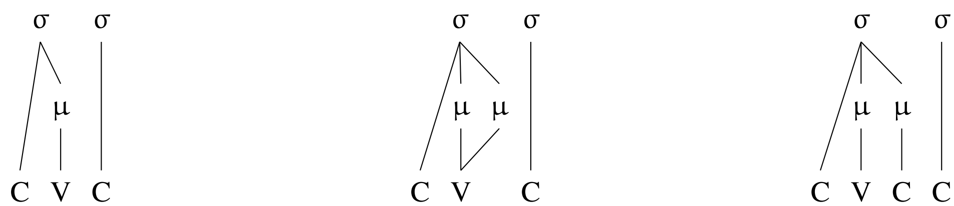
Crucially, there is no PPh which is *CVV or *CVC, even though these are also bimoraic. This means that the minimal PPh is a heavy syllable plus a final consonant. If minimality constraints are calculated over metrical units, the suggests that the final consonants are parsed to either a syllable or a mora. However, as I show in Section 3.2.2, PPh-final consonants do not contribute to syllable weight nor affect the location of primary stress. The analysis I pursue in the next section is that the final consonant is parsed to a moraless syllable, which accounts for why it contributes to minimal size but does not add weight.

2.4.4.2 Analysis

The analysis below treats PPh-final consonants as dominated by a degenerate syllable that lacks a mora or rhyme. These have been called 'minor syllables' (Bye and de Lacy 2000; McCarthy 1979), 'degenerate syllables' (Crowhurst 1996; Dell 1995; Iverson 1990; Selkirk 1981a), 'semisyllables' (Cho and King 2003), 'defective syllables' (Côté 2011), or 'syllables with a null vowel' (Burzio 1994). In Blackfoot, degenerate syllables are restricted to the right edge of the PPh and can follow a light open syllable, (150a), a heavy open syllable, (150b), or a heavy closed syllable, (150c). I will further assume that degenerate syllables in Blackfoot never dominate a mora, which accounts for why PWd-final consonants are never moraic.

(150) PWD-FINAL CONSONANTS ARE PARSED TO DEGENERATE SYLLABLES

a. AFTER SHORT VOWEL b. AFTER LONG VOWEL c. AFTER CONSONANT



This analysis accounts for the properties discussed above. First, PPh-medial codas cannot occur PPh-finally because they are not parsed to a moraic coda in that position. The consonants which can occur in a coda position PPh-medially are highly restricted in their distribution: /ʔ/ *usually* occurs before a consonant (except for a few cases where it occurs between vowels), /x/ *only* occurs before an obstruent, and pre-consonantal /s/ *only* occurs before an obstruent.[24] Clearly there are restrictions on coda consonants, perhaps enforced by some sort of CODACOND constraint(e.g. Itô 1989), but PPh-final consonants escape these restrictions because they are not parsed to a coda position. Second, PPh-final consonants are restricted to a subset of onset consonants because they are parsed directly to a syllable node, just like an onset. Third, vowel length is not neutralized before PPh-final consonants because they are not moraic and not tautosyllabic with the preceding vowel, so they do not add to syllable weight. Fourth, final consonants can occur after either vowels or consonants because they are not tautosyllabic with the preceding segment; they are part of a following degenerate syllable which may follow either open or closed syllables. Fifth, short and geminate consonants contrast in PPh-final position, because the geminate is parsed to a moraic coda position while short consonants are parsed into a degenerate syllable. This means that the contrast between moraic and non-moraic consonants can be maintained precisely at the right edge of the PPh.

In the next sections, I first show that an analysis where all PPh-final consonants are parsed as codas cannot account for the distinction between Pph-final short and geminate consonants. I then show that an analysis which allows PWd-final degenerate syllables accounts for the data.

2.4.4.2.1 Failed analysis: all PPh-final consonants are codas

An analysis where all PPh-final consonants are parsed as codas cannot account for the distinction between short and geminate consonants. The tableau below considers the noun [aːkiːkoan] 'girl'. Recall that WBP $\gg$ {DEP-IO(μ), *μ/C} (from (117)) and MAX-IO(μ) $\gg$ *LONGVOWEL $\gg$ {*μ/C, *CODA} (from (93) and (123)). Candidate (a) parses the final [n] to a non-moraic coda positions, violating WBP

[24]The phoneme /s/ also occurs between vowels or post-consonantally.

and *CODA. The optimal candidate (b) satisfies WBP by violating the lower-ranked constraints DEP-IO(μ), *μ/C, and *CODA. The current ranking predicts that an underlying non-moraic consonant in PPh-final position will be parsed to a moraic coda position.

(151)

aːkíːkoan	WBP	MAX-IO(μ)	DEP-IO(μ)	*Vː	*μ/C	*CODA
a. aː.kíː.ko.an	*!			**		*
☞ b. aː.kíː.ko.an$^{\mu}$			*	**	*	*

On the other hand, PPh-final geminates retain their mora, as shown in the tableau below for /oxkinː/ 'necklace'. The moraically faithful candidate (a) only violates *CODA and *μ/C. Candidate (b) ends in a non-moraic consonant but is non-optimal, because it violates the highly-ranked constraints WBP and MAX-IO(μ).

(152)

oxkin$^{\mu}$	WBP	MAX-IO(μ)	DEP-IO(μ)	*Vː	*μ/C	*CODA
☞ a. ox.kɪn$^{\mu}$					*	**
b. ox.kɪn	*!	*!			*	**

Thus, an analysis where PPh-final consonants are uniformly parsed to a coda position predicts that the distinction between short and long consonants should be neutralized PPh-finally. Since short and long consonants contrast PPh-finally in Blackfoot, I conclude that this type of analysis is incorrect. Next, I show that an analysis that allows degenerate syllables easily accounts for this distinction.

2.4.4.2.2 Correct analysis: PPh-final consonants are non-moraic degenerate syllables

In this analysis I will treat PPh-final short consonants as onsets to a degenerate syllable, and PPh-final long consonants as true moraic codas. Degenerate syllables violate the markedness constraint SYL-μ in (153). (This is one of a family of HEADEDNESS constraints in Selkirk 1996.)

(153) SYLLABLE-μ

Abbreviation: SYL-μ

For every syllable, assign a violation mark if that syllable does not dominate a mora.

(Adapted from Cho and King 2003)

Degenerate syllables are restricted to the right edge of the PPh. Following Cho and King (2003), I formalize this using alignment constraints (McCarthy and Prince 1993a), as in (154).

(154) ALIGN(σ/*μ, R; PPh, R)

Abbreviation: ALIGN(σ/*μ)

For every syllable which does not dominate a mora, align the right edge of that syllable with the right edge of a PPh.

This constraint is undominated and outranks an analogous constraint which aligns degenerate syllables to the left edge of a PPh, (155).

(155) ALIGN(σ/*μ, R; PPh, R) ≫ ALIGN(σ/*μ, L; PWd, L)

The tableau below shows how this ranking forces degenerate syllables to occur at the right edge of the PPh. Candidate (a) is optimal because it satisfies ALIGN(σ/*μ, R; PPh, R). Candidates (b) and (c) violate ALIGN(σ/*μ, R; PPh, R), making them non-optimal.

(156)

	ALIGN(σ/*μ, R; PPh, R)	ALIGN(σ/*μ, L; PPh, L)
☞ a. σ σ σ △ △ | … … C		*
b. σ σ σ △ | △ … C …	*!	*
c. σ σ σ | △ △ C … …	*!	

I now show how the weight distinction is maintained PPh-finally under this analysis. The remaining tableaux in this section do not include the two Align constraints from above, and I do not include candidates which violate ALIGN(σ/*μ, R; PPh, R).

The tableau below contains the same input as in the failed analysis above, [aːkiːkoan] 'girl', with a PPh-final non-moraic consonant. I have added a third candidate with a final degenerate syllable. Recall that WBP ≫ {DEP-IO(μ), *μ/C} (from (117)) and MAX-IO(μ) ≫ *LONGVOWEL ≫ {*μ/C, *CODA} (from (93) and (123)). Candidate (a) parses the final [n] to a non-moraic coda position, violating WBP and *CODA. Candidate (b) contains a moraic [n^{μ}] and violates DEP-IO(μ), *μ/C, and *CODA. Instead, the optimal candidate (c) satisfies all of the constraints except for SYL-μ. For (c) to be more harmonic than (a), SYL-μ must rank below either WBP or *CODA. For (c) to be more harmonic than (b), SYL-μ must rank below either DEP-IO(μ), *μ/C, or *CODA. One hypothesis might be that SYL-μ is dominated by *μ/C, giving the partial ranking {WBP, MAX-IO(μ)} ≫ *μ/C ≫ SYL-μ.

(157)

aːkiːkoan	WBP	MAX(μ)	DEP(μ)	*Vː	*μ/C	*COD	SYL-μ
a. aː.kiː.ko.an	*!			**		*	
b. aː.kiː.ko.an$^{\mu}$			*!	**	*	*	
☞ c. aː.kiː.ko.a.n		*		**			*

The tableau below contains an input with a final moraic consonant. The optimal candidate (b) parses the moraic consonant to a coda position, violating *μ/C and *CODA. Candidate (a) contains a non-moraic final consonant, and is non-optimal because it violates WBP and MAX-IO(μ), both of which dominate *μ/C. Candidate (c) parses the final [n] to a non-moraic onset of a degenerate syllable, violating MAX-IO(μ), which dominates *μ/C.

(158)

oxkin$^{\mu}$	WBP	MAX(μ)	DEP(μ)	*Vː	*μ/C	*COD	SYL-μ
a. ox.kɪn	*!	*!				**	
☞ b. ox.kɪn$^{\mu}$						**	
c. ox.kɪ.n		*!				*	*

To sum up this section, PWds can end in consonants that have the distribution of onsets. A degenerate syllable analysis accounts for the distinction between short and geminate consonants PPh-finally whereas analyses without degenerate syllables cannot. Note that although phonological phrases can end in sequences like CVVC and CVCC, there are no ‘superheavy’ syllables in Blackfoot; the final consonant in these sequences never affects the location of primary stress (discussed in Section 3.2.2). Under my analysis, the final C in these sequences is always parsed to a degenerate syllable, and the maximal syllable template is bimoraic (either CVC or CVV).

2.5 Chapter summary

In this chapter I presented several aspects of Blackfoot phonology. I first discussed the contrastive and allophonic consonants (Section 2.1) and vowels (Section 2.2). The inventories I proposed differ in several ways from previous studies of Blackfoot phonology. The most radical departure is in terms of the vowel inventory: I argued that Blackfoot has five contrastive long vowels, instead of the three that are typically assumed. This is relevant in Section 3.2 when discussing alternations of roots which begin in underlying long vowels, where I specifically include roots which begin in /ɛː/ and /ɔː/. For both the consonant and vowel systems, I prioritize distributional evidence when arguing for contrast, modulated by known predictable sandhi effects which can sometimes obscure this distribution, and I include further evidence of minimal pairs in Appendix A.

Then in Section 2.3 I laid out some phonetic and phonological aspects of prominence in Blackfoot. Prominence is realized primarily via a raised F_0, and is a property of syllables, not moras. Later in Section 3.2.2 I argue that prominence is best analyzed in terms of metrical stress.

Finally, in Section 2.4 I discussed syllable structure, because syllable structure conditions several phonological processes at the Phonological Phrase (PPh) and Prosodic Word (PWd) levels. I discussed open and closed syllables in Blackfoot and argued that vowel length is neutralized to short in closed syllables. I also showed that some fricatives in Blackfoot have the distribution of vowels, and argued that these fricatives are parsed to the nucleus of a syllable (following Goad and Shimada 2014a,b; Miyashita 2018, among others). Finally, I ended this section by discussing PPh-final consonants and arguing that these are not parsed to a syllable coda. In fact, they have the same distribution as PPh-medial onsets, and so I argued that they are parsed as onsets to a degenerate syllable without a nucleus. These degenerate syllables count towards word minimality, but do not add weight to a preceding syllable, nor affect stress (which I discuss in Section 3.2.2).

With these phonological preliminaries as background, I now turn to a discussion of the syntax and phonology of the CP and Phonological Phrase (PPh) level in Chapter 3, and the *v*P/VP and Prosodic Word (PWd) level in Chapter 4. The arguments for each prosodic category rely on determining particular domain-limited phonological generalizations which take a prosodic category as their domain.

Chapter 3

Correspondence of CP phrases and phonological phrases

This chapter discusses the correspondence between a CP phrase and prosodic structure. The CP in Blackfoot consists of overt or *pro* nominal expressions plus the VERBAL COMPLEX,[1] which consists of the remainder of the clause. Example (159) illustrates a transitive clause with two overt nominal expressions.

(159) $_{CP}$[*ma* *saahkómaapiwa* *áákomimmiiwa* *ami*
am–wa saahkomaapi–wa [aakom–imm–ii]–Ø–wa ami
DEM–PRX boy–PRX [favor–by.mind.*v*–3SUB]–IND–3 DEM–OBV
aakííkoani]$_{CP}$
[[aakii]–ikoan]–yi
[[woman]–young.being]–OBV
'The boy loves the girl.' (Bliss 2005: 104, (80a))

As I discuss in Section 3.2, the verbal complex and each nominal expression corresponds to a phonological phrase (PPh). Therefore, a model of the syntax-prosody correspondence should take into account whether or not the verbal complex is a syntactic constituent and, regardless of the answer, explain why the verbal complex maps to a PPh.

The verbal complex can be easily defined in terms of a morphological template (Bliss 2013; Frantz 1971; Louie 2015; Taylor 1969), with a first approximation below. As I discuss in the next section, a person prefix occurs in certain clause types and agrees with one of the nominal arguments of the clause. Inflectional suffixes occur in all clause types and also exhibit agreement with nominal arguments.

[1]The term 'verbal complex' is borrowed from Bliss (2013) & Louie (2015) and is a traditional term in the structuralist literature (e.g. Michelson 1917). I use it to refer to Bloomfield's 'minimal free form' (Bloomfield 1926: 156) plus any phrasal clitics.

All clause types contain a stem (itself complex, with the syntax of a transitive *v*P or intransitive VP; see Section 4.1), and may contain optional prefixes, which have a variety of syntactic and semantic properties. Finally, the stem is followed by inflectional suffixes.

(160) person– (prefix)*– $[\text{STEM}]_{v\text{P/VP}}$ –inflectional suffixes

The verbal complex may also include affirmative and non-affirmative enclitics (Bliss 2013; Fox and Frantz 1979; Frantz 2009). These enclitics stand in complementary distribution with post-verbal DPs and their form is determined by uninterpretable features of the DP (specifically: animacy, obviation, number). They have some properties of words (e.g. the free form) and some of affixes (Zwicky 1985; Zwicky and Pullum 1983). For example, the affirmative enclitic =*aawa* indexes third person proximate plural arguments. As shown in (161a), no enclitic is used when the DP argument follows the verb. An enclitic must be used when the DP argument precedes the verb, (161b), or is pro-dropped, (161c). Because the presence of enclitics is in complementary distribution with full DP nominals, I will assume they are pro-DPs. Phonologically, enclitics are syllabified into the same PPh as the rest of the verbal complex; i.e. they are phonologically bound. However, unlike other suffixes, they are stackable and in some cases add a second pitch peak to the PPh onto the immediately preceding syllable (Bliss 2013; Glougie 2009).[2]

(161) a. *Ííksspitaayi* *nohkóíksi.*
ii\ik–[ssp–it/aa]–Ø–yi n–[ohko]–iksi
IC\DEG–[high–fellow/AI]–IND–3PL 1–[son]–AN.PL
'My sons are tall.' (Frantz 1997: 47, (b))

b. *Nohkóíksi* *ííksspitaay**aawa**.*
n–[ohko]–iksi ii\ik–[ssp–it/aa]–Ø–yi=**aawa**
1–[son]–AN.PL IC\DEG–[high–fellow/AI]–IND–3PL=PRX.PL
'My sons are tall.' (Frantz 1997: 47, (a))

c. *Ííksspitaay**aawa**.*
ii\ik–[ssp–it/aa]–Ø–yi=**aawa**
IC\DEG–[high–fellow/AI]–IND–3PL=PRX.PL
'They are tall.' (Frantz 1997: 47, (c))

Despite the fact that the verbal complex can be easily described via a template, it is not itself a syntactic constituent. It must be defined *negatively* in terms of syntax: it is the complement of all the nominal arguments within a CP. This is clear when all of the nominal expressions are non-overt.

[2]While there are questions that remain about how these enclitics are prosodified, I leave these for future research and concentrate in this dissertation on the PWd/PPh distinction.

Polysynthetic languages often allow *pro*-drop (Baker 1996; Hale 1983) and Blackfoot is no exception. Example (162) is the same as (159) with all arguments *pro*-dropped. In this case, the verbal complex is *exactly* as large as a CP.

(162) $_{\text{CP}}$[*pro* *áákomimmiiwáyi* *pro*]$_{\text{CP}}$
[aakom–imm–ii]–Ø–w=ayi
[favor–by.mind.*v*–3SUB]–IND–3=OBV.SG
'S/he loves him/her.'

The model of syntax-prosody correspondence that I propose capitalizes on the fact that each nominal expression maps to a PPh constituent. I argue that each DP and CP phase corresponds by default to a PPh, but that some prosodic wellformedness constraints in Blackfoot force mismatches between syntactic and prosodic structures. This causes the nominal expressions and the remainder of the clause to map to one PPh constituent each.

The remainder of the chapter proceeds as follows. In Section 3.1 I argue that the verbal complex plus all overt or *pro* nominal expressions is a CP, because it has the internal and external syntax of a CP. In terms of internal syntax, the verbal complex contains a C^0. In terms of external syntax, the verbal complex has the distribution of a CP. At the end of that section, I review the syntax of nominal arguments within the clause and show that they are DPs. This section confirms that the verbal complex and nominal expressions together form a CP clause, and that the nominal expressions are DPs while the verbal complex is the remainder of the CP.

Then in Section 3.2 I discuss the phonological correlates of the PPh constituent. Glides are uniquely prohibited at the left edge of the PPh, but not at the left edge of the PWd. The PPh is also the domain over which pitch accent is calculated: it is the domain of obligatory pitch accent; it is calculated from the left edge of the PPh but not the PWd; and affixes affect the location of pitch accent, but neighboring PPhs typically do not.

Finally, in Section 3.3 I discuss the mapping from syntax to phonology. In my analysis, the correspondence between syntax and prosody is construed of as modified MATCH constraints (Selkirk 2011) between DP and CP phases and PPhs. I argue that a markedness constraint requiring prosodically similar sisters (such as EQUALSISTERS; Myrberg 2013) must dominate a MATCH constraint and BINMIN, which forces the DPs and the verbal complex alike to MATCH to a PPh constituent.

3.1 Syntax of the CP phrase

I suggested above that the verbal complex is the remainder of a CP phrase when all nominal arguments are *pro*, as in (163b).

(163) a. $_{\text{CP}}$[*ma* *saahkómaapiwa* *áákomimmiiwa* *ami*
am–a saahkomaapi–wa [aakom–imm–ii]–Ø–wa ami
DEM–PRX boy–PRX [favor–by.mind.*v*–3SUB]–IND–3 DEM–OBV
aakííkoani]$_{\text{CP}}$
[[aakii]–ikoan]–i
[[woman]–young.being]–OBV
'The boy loves the girl.' (Bliss 2005: 104, (80a))

b. $_{\text{CP}}$[*pro* *áákomimmiiwáyi* *pro*]$_{\text{CP}}$
[aakom–imm–ii]–Ø–w=ayi
[favor–by.mind.*v*–3SUB]–IND–3=OBV.SG
'S/he loves him/her.'

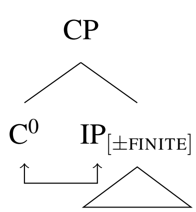
The goal of this section is to discuss the internal and external syntax of the CP in Blackfoot. It is important to establish the CP as a syntactic constituent, because later in this chapter I discuss the phonological phrase (PPh) constituent in Blackfoot, which is the prosodic constituent which corresponds to CPs and DPs by default. The data in this section focuses on the verbal complex. If the verbal complex is essentially the CP with *pro* arguments then (i) it should contain a C^0, and (ii) it should have the distribution of a CP clause.

In the following sections, I address each of these points in turn. In Section 3.1.1 I argue that the verbal complex contains a morpheme that has the properties of C^0. In Section 3.1.2 I argue that the verbal complex has the distribution of a CP.

3.1.1 The verbal complex contains a C^0

In this section I show that the clause in Blackfoot has the internal syntax of a CP. If it is a CP, then it should contain a C^0 merged with an IP complement, as in (164). If so, we expect there to be dependencies between the C^0 and its complement IP, such that C^0 selects the finiteness of the complement IP phrase.

(164)



In Blackfoot, the relevant finiteness distinction is realis/irrealis rather than tense (Déchaine and Wiltschko 2010), where (ir)realis is a type of finiteness contrast (Cowper 2005; Hak 1990).[3] Roughly speaking, a [+REALIS] clause is one where the proposition holds in a real or possible world, but a [-REALIS] clause yields a construal where there is no commitment to the proposition holding in a real or possible world.[4] As I discuss below, some types of C^0 require a [+REALIS] IP complement, some require a [-REALIS] IP complement, and some are neutral to the realis/irrealis distinction.

As argued in Déchaine and Wiltschko (2010), the realis/irrealis distinction has a morphological reflex; namely, person proclitics are only used in clauses which are [+REALIS]. This means that [+REALIS] clauses use prefixal and suffixal inflectional morphology for at least some persons, while [-REALIS] clauses only use suffixal inflection.[5] There are five morphological clause types: independent (IND), unreal (UNR), conjunctive[6] (CNJ), subjunctive (SBJ), and imperative (IMP). As shown in Table 3.1, the subjunctive and imperative clause types prohibit person proclitics entirely, indicated via ✘. (The imperative only allows second persons as subjects of the clause.) In contrast, the independent, unreal, and conjunctive clause types require person proclitics for at least some person types. The third person proclitic *ot-* is in parentheses in the independent and unreal clause types because it only agrees with third person objects when the subject of the clause is also third person (see Bliss 2013; Frantz 2009).

Table 3.1: Person proclitics in Blackfoot clause types

Subject	[+REALIS]			[-REALIS]	
	IND	UNR	CNJ	SBJ	IMP
1s	nit-	nit-	nit-	✘	—
2s	kit-	kit-	kit-	✘	✘
1p	nit-	nit-	nit-	✘	—
2p	kit-	kit-	kit-	✘	✘
21/X	Ø-	Ø-	Ø-	✘	—
3s/3p	(ot-)	(ot-)	ot-	✘	—
4s/4p	(ot-)	(ot-)	ot-	✘	—

[3] A similar argument is made in Ritter and Wiltschko (2009). Working with a different set of assumptions about the relevant features, they suggest that some C^0 in Blackfoot select for a [+person] Infl while others select for [-person].

[4] Déchaine and Wiltschko (2010) suggest that [+REALIS] clauses are used if the proposition holds only in the real world. I have changed their definition because some realis clauses are used for counterfactual situations. Counterfactual situations by definition do not hold in the real world, but they do hold in an alternate possible world.

[5] This continues a generalization from Proto-Algonquian, where independent indicative clauses used prefixal and suffixal morphology, while conjunct clauses used only suffixes (cf. Bloomfield 1946; Goddard 1974, 1979; Oxford 2014).

[6] The Blackfoot "conjunctive" is sometimes called the CONJUNCT (e.g. Bliss 2013; Frantz 1971). However, Blackfoot conjunctive clauses are not related to the Proto-Algonquian conjunct clause; instead they are an innovated nominalized clause similar to the Proto-Algonquian independent indicative. (See Goddard 1974 on the nominal origins of the Proto-Algonquian independent indicative.) I maintain Frantz's (2009) use of 'conjunctive', in order to not suggest that the conjunctive and the Proto-Algonquian conjunct are related

Examples of each clause type using a second person subject are given in (165) and (166). Realis clause types are shown in (165), where the second person is indexed via the person proclitic *kit-* '2' (underlined), as well as in some of the inflectional suffixes. Each clause type is associated with a set of dedicated suffixes which instantiate I^0 (Déchaine and Wiltschko 2010; Ritter and Wiltschko 2014); I have bolded these in the examples below.

(165) REALIS CLAUSE TYPES HAVE PERSON PROCLITICS

a. INDEPENDENT

*Kitsówatoo'**p**oaawa*
kit–[io–wat–oo]–**'p**–oaa–wa
2–[eat–*v*–TI2]–**IND**–2PL–3
'You all ate it.'

b. UNREAL

*Kitó'takihpowáwo**htópi***	*si'káániks*
kit–[o't–Ø–aki]–hp–oaa–wo**ht**–opi	[[si'k–aa]–n]–iksi
2-[take–*v*–AI]–IND–2PL–**UNR**–MOOD	[[cover–AI]–NMLZ]–AN.PL

kimááttaki'nipítspowááwa
ki–maat–aak–[i'nipit–i]–hp–oaa=wa
2–NEG–FUT–[cold–AI]–IND–2PL=NONAFF

'If you guys had taken blankets, you wouldn't get cold.' (BB; 2014-09-24)

c. CONJUNCTIVE

Nítssksinii'pa	*kitsówatoo**hs**oaayi*
Nit–[ssk–in/Ø–i]–'p–a	kit–[io–wat–oo]–**hs**–oaa–yi
1–[return–by.sight/*v*–TI1]–IND–3	2–[eat–*v*–TI2]–**CNJ**–2PL–DEP

'I know you ate it.' (Frantz 2009: 109, (f); re-glossed)

Irrealis clause types are shown in (166), where there is no person prefix and all of the inflectional morphology is suffixal.

(166) IRREALIS CLAUSE TYPES DO NOT HAVE PERSON PROCLITICS

a. SUBJUNCTIVE

*Ikkamáyo'ka**in**oainiki,*	*nitáakahkayi.*
ikkam–a–[yo'k–aa]–**in**–oaa–inik–i	nit–aak–[ahka–yi]–(hp)
if–IPFV–[sleep–AI]–**SBJ**–2PL–MOOD–DEP	1–FUT–[go.home–AI]–(IND)

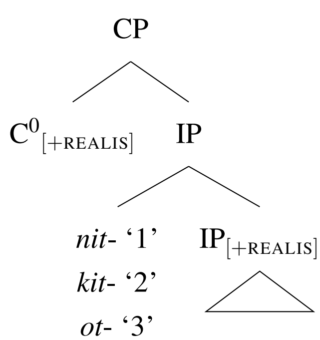
'If you (pl.) are sleeping, I'll go home.' (Frantz 2009: 110, (l); re-glossed)

b. IMPERATIVE

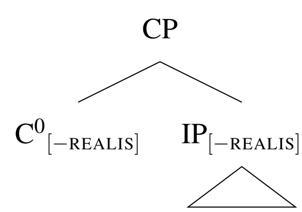
*Oowátoo**k***
[oo–wat–oo]–**k**–Ø
[eat–*v*–TI2]–**2PL.IMP**–IMP
'(you all) eat it!'

If all verbal complexes contain a C^0 which agrees with the finiteness of the complement IP, then we expect three types of C^0. The first will only occur with [+REALIS] clause types and will co-occur with person prefixes, (167a). The second will only occur with [-REALIS] clause types and will not co-occur with person prefixes, (167b). The third will be neutral with respect to the realis/irrealis distinction.

(167) a. FINITENESS: REALIS



b. FINITENESS: IRREALIS



In the following sections, I describe each of these three types of C^0 in turn and show that this is true. In all clause types, the morpheme that exhibits these types of dependencies is the final suffix within the minimal free form of the word (e.g. the final suffix before any DP enclitics). (See also Bliss 2013, who also argues that these suffixes instantiate C^0.) The generalizations are given in Table 3.2.

Table 3.2: Dependencies between C^0 and IP features

C^0	Features of the IP	Clause types
-wa, *-yi*, *-yini*	[+REALIS]	independent (assertive)
-wa	[+REALIS]	independent (non-assertive)
-Ø, *-yi*, *-yini*	[+REALIS]	unreal
-i 'DEP'	*neutral*	conjunctive, subjunctive
-Ø 'IMP'	[-REALIS]	imperative

3.1.1.1 C^0 = *-wa*, *-yi*, *-yini*

The C^0 which is found in affirmative independent clauses has three forms, as in (168).

(168) *After consonants* *After vowels*

a.	*-a*	*-wa*
b.	*-i*	*-yi*
c.	*-ini*	*-yini*

The phonological exponence of the affirmative independent C^0 is determined by the phi-features of IP-internal nominal arguments (e.g. this C^0 exhibits a type of Complementizer Agreement; van Koppen 2017). To illustrate this, I have included the intransitive paradigm for the independent clause type in Table 3.3. I have boxed the suffix which instantiates C^0. The ellipsis (. . .) represents the stem. (Abbreviations: 21 = first person plural inclusive, X = unspecified subject, 3 = third person proximate, 4 = third person obviative.)[7]

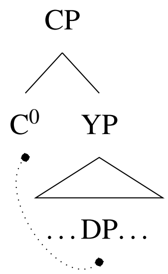
Table 3.3: Exponents of C^0 in intransitive independent clauses (Frantz 2009)

	[Spec, I]	. . . I^0		C^0
1s	nit-	. . . (-hp)[8]		
2s	kit-	. . . (-hp)		
1p	nit-	. . . -hp	-innaana[9]	
2p	kit-	. . . -hp	-oaawa	
21		. . . -o'pa		
X		. . . -o'pa		
3s		. . . -Ø		-wa
4s		. . . -Ø		-yini
3p/4p		. . . -Ø		-yi

[7] Obviation is a discourse-based tracking system (Aissen 1997; Dahlstrom 1991; Genee 2009; Goddard 1984, 1990; Junker 2004; Mühlbauer 2008; Russell 1991, 1996). However, nominal arguments are obligatorily obviative in certain syntactic positions. A nominal argument that is possessed by another third person argument is always obviative, as is a third person object if the subject is also a third person (Frantz 2009).

There is no overt instantiation of C^0 when there is no third person in the clause; otherwise, C^0 agrees with a third person argument in terms of number and obviation (Bliss 2013). Within the Minimalist Program (Chomsky 2000, 2001), morphological agreement is the result of a long-distance syntactic relation, Agree, between a target (in this case, C^0) and a goal (a DP nominal expression), as in (169). The Agree relation occurs in order to value unvalued features on the target, C^0.

(169)



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[8]The parentheses around *-hp* for first and second person singular in the table above signal that the suffix is not pronounced word-finally, which only happens in affirmative intransitive verbs with a first or second singular person argument, (1).

(i) a. *nitáóoyi*
nit–a–[oo–yi]–(**hp**)
1–IPFV–[eat–AI]–(**IND**)
'I am eating' (Frantz 2009: 18)

b. *kitáóoyi*
kit–a–[oo–yi]–(**hp**)
2–IPFV–[eat–AI]–(**IND**)
'You are eating' (Frantz 2009: 18)

However, the *-hp* is pronounced for these persons when a suffix follows, such as a plural agreement suffixes *-nnaan* '1PL', (1a), and *-oaa* '2PL', (1b), or the non-affirmative enclitic *=aa* 'NONAFF.SAP' in negated clauses, (1), and yes/no questions, (2).

(i) a. *nitáóoyi**hp**innaana*
nit–a–[oo–yi]–**hp**–nnaana
1–IPFV–[eat–AI]–**IND**–1PL
'We (excl.) are eating' (Frantz 2009: 18)

b. *kitáóoyi**hp**oaawa*
kit–a–[oo–yi]–**hp**–oaawa
2–IPFV–[eat–AI]–**IND**–2PL
'You (pl.) are eating' (Frantz 2009: 18)

(i) *nimáátáóoyi**hp**a.*
ni–maat–a–[oo–yi]–**hp**=aa
1–NEG–IPFV–[eat–AI]–**IND**=NONAFF
'I'm not eating' (Frantz 2009: 82)

(ii) *kikáta'yáaka'po'taki**hp**a?*
ki–kata'–yaak–[a'p–o't/Ø–aki]–**hp**=aa
2–Q–FUT–[around–take/*v*–AI]–**IND**=NONAFF
'Will you work?' (Frantz 2009: 131, (j))

In other words, the suffix *-hp* is overt or non-overt based on an interaction with phonology: it is overt word-medially, but non-overt word-finally. The cognates of this suffix in other Algonquian languages also exhibit the same distribution; see Goddard (2007).

[9]The verbal complex contains the suffixes *-innaan* '1PL' and *-oaawa* 'PL', which agree with plural local (first and second person) arguments. These are linearized between the clause-typing suffixes, which instantiate I^0, and the final suffix, which instantiates C^0. The syntactic position of these suffixes is still debated; Bliss (2013) suggests they form a complex pro-DP with the person proclitic, while Ritter and Rosen (2014) argue that they instantiate a functional head (at least within the nominal domain).

The phonological form of this head C^0 is determined relatively "late", once agreement has taken place. This can be modeled in an interpretive theory of morphology (e.g. Anderson 1992; Halle and Marantz 1993) – for example, as post-syntactic Vocabulary Insertion in Distributed Morphology (Halle and Marantz 1993). I model the phonological exponence of this head with the post-syntactic spell-out rules below.[10] I follow Frantz (2009) in assuming that the underlying forms of these morphemes begin with a glide, which is deleted after consonants.[11]

(170) SPELL-OUT OF C^0 IN THE INDEPENDENT CLAUSE TYPE

a. *-yini* ↔ C^0 / [3, SG, OBV]
b. *-yi* ↔ C^0 / [3, PL]
c. *-wa* ↔ C^0 / [3]

Now that I have explained the exponence of C^0 in the affirmative independent clause type, I argue that this type of C^0 occurs in realis clauses. Morphological evidence supports this analysis, because this C^0 co-occurs with person proclitics for some types of arguments, as shown in Table 3.3. Semantic evidence also supports this analysis, because this C^0 is used for positive assertions, as in (171). Positive assertions are propositions which hold in the real world and therefore have realis force.

(171)

Iikákomimmiiwa	*nohkówa*	*kitániksi.*
ii\ik–[akom–imm–ii]–Ø–wa	n–ohko–wa	k–itan–iksi
IC\DEG–[favor–by.mind.*v*–3SUB]–IND–3	1–son–PRX	2–daughter–AN.PL

'My son (PRX) loves your daughters (OBV).' (Frantz 2009: 54, (p))

3.1.1.2 C^0 = *-wa*

The C^0 found in non-affirmative independent clauses is invariantly *-wa*. Bliss (2013) argues that the contrast between *-yini* '3SG.OBV', *-yi* '3PL', and *-wa* '3' in affirmative independent clauses is neutral-

[10] I have assumed that C^0 probes specifically for third person arguments. Agreement "fails" in clauses with no third persons without crashing the derivation (Preminger 2014), resulting in no suffix at all. However, since third persons are typically treated as featurally underspecified compared to first or second persons (Déchaine 1999; Harley and Ritter 2002), it is unclear to me how a target could probe specifically for third persons. An alternative analysis would assume that there is a phonologically null *-Ø* exponent of C^0 in clauses with non-third persons, and allow C^0 to probes for any person. Under this analysis, Agreement never "fails", but the fact that only third person arguments result in an overt suffix is accidental.

[11] However, note that the alternation is also compatible with an analysis that epenthesizes a glide between vowels. There are problems with both analyses. The deletion analysis is unusual, because consonants can be followed by [j] (though not by [w]) in surface forms, such as in [kjájo] 'bear' (BB). The epenthesis analysis is unusual, because some vowel-initial suffixes do not have an epenthetic glide after a vowel, and instead they coalesce with a preceding vowel. No matter which analysis is ultimately correct, I assume that the {w, j} ∼ Ø alternation in suffixes is phonologically regular.

ized to *-wa* ‘3’ in independent clauses which either have a high clausal negator *maat-* ‘NEG’ or the yes/no question marker *kata’-* ‘Q’.[12]

For example, consider the yes/no question in (172), which is formed with the prefix *kata’-* ‘Q’.[13] This example uses an intransitive verb with a plural animate argument. In an affirmative context, C^0 would be expressed as *-yi* ‘3PL’ to agree with the third person plural argument, but in yes/no questions the verbal complex must end in *-wa* ‘3’. (Bliss 2013 shows that other third person arguments in yes/no questions also use *-wa*, in both intransitive and transitive sentences.)

(172) a.

*Kataa’wápsspiinao’si**wa***	*annisk*	*oksíssts*	*ki*	*annisk*
kata’–[wapssp–iina/o’si]–Ø–**wa**	ann–i–hk	w–iksisst–i	ki	ann–i–hk
Q–[eye–dress/AI]–IND–**3**	DEM–OBV–INVS	3–mother–OBV	CONJ	DEM–OBV–INVS

ónni?
w–inn–i
3–father–OBV

‘Do her mother and father wear glasses?’

b.

* *Kataa’wápsspiinao’si**yi***	*annisk*	*oksíssts*	*ki*	*annisk*
kata’–[wapssp–iina/o’si]–Ø–**yi**	ann–i–hk	w–iksisst–i	ki	ann–i–hk
Q–[eye–dress/AI]–IND–**3PL**	DEM–OBV–INVS	3–mother–OBV	CONJ	DEM–OBV–INVS

ónni?
w–inn–i
3–father–OBV

Intended: ‘Do her mother and father wear glasses?’ (Bliss 2013: 227, (33); re-glossed)

Similarly, the head C^0 neutralizes to *-wa* in clausally negated sentences. The prefix *maat-* ‘NEG’ in (173) takes scope over the entire proposition including the CP (Bliss 2013; Louie 2008). The following example again uses an intransitive verb with a plural animate argument. In an affirmative context, C^0 would be expressed as *-yi* ‘3PL’, but under clausal negation the verbal complex must end in *-wa* ‘3’. (Bliss 2013 shows that other third person arguments under clausal negation also use *-wa*, in both intransitive and transitive sentences.)

[12] Bliss (2013) takes this neutralization as evidence that C^0 in independent clauses is sensitive to illocutionary force (Austin 1962), which she takes to be a property of the CP domain (cf. Cheng 1991; Chomsky 1995b; Rizzi 1997). She takes the main difference here to be assertive contexts (i.e. affirmative declarative) versus non-assertive (i.e. yes/no questions, and clausally negated sentences, which she calls DENEGATED CLAUSES). She also includes imperatives as a non-assertive clause, arguing that the contrast in third person agreement suffixes is neutralized to a phonologically null morpheme; I discuss the C^0 in imperative clauses below.

[13] Since wh-movement is also associated with the CP domain (Cheng 1991), we might also expect neutralization of C^0 in wh-questions. However, wh-questions are either bi-clausal or involve a pseudo-scope marking construction (Barrie 2014; Bliss 2013). This unusual syntax makes it difficult to investigate the exponence of C^0 in wh-questions in Blackfoot.

(173) a. *Máátaoyi**wa*** *anna* *Leo* *ó'siks.*
maat–a–[oo–yi]–Ø–**wa** ann–a Leo w–i's–iksi
NEG–IPFV–[eat–AI]–IND–**3** DEM–PRX Leo 3–older.brother–AN.PL
'Leo's brothers weren't eating.'

b. **Máátaoyi**ii*** *anna* *Leo* *ó'siksi.*
maat–a–[oo–yi]–Ø–**yi** ann–a Leo w–i's–iksi
NEG–IPFV–[eat–AI]–IND–**3PL** DEM–PRX Leo 3–older.brother–AN.PL
Intended 'Leo's brothers weren't eating.' (Bliss 2013: 230, (44); re-glossed)

Table 3.4 summarizes the distribution of overt C^0 exponents in independent clauses for assertive clauses (affirmative statements) versus non-assertive clauses (questions, and clausal negation).

Table 3.4: Partial neutralization of Agree C^0 in independent clauses (after Bliss 2013: 234)

	Singular			Plural
	3 PRX	3 IN	3 OBV	3 PL
Assertive statements	*-wa*	*-wa*	*-yini*	*-yi*
Yes/no questions with *kata'-*	*-wa*	*-wa*	*-wa*	*-wa*
Denegated statements with *maat-*	*-wa*	*-wa*	*-wa*	*-wa*

Now that I have explained the exponence of C^0 in non-affirmative independent clauses, I argue that this type of C^0 occurs in realis clauses. Morphological evidence supports this analysis, because this C^0 occurs with the independent clause type, which means it co-occurs with person proclitics for some types of arguments, as shown in Table 3.3. Semantic evidence also supports this analysis, because this C^0 is used in propositions which hold in the real world and therefore have realis force. This is clear for clausally negated statements, (173), because the negative statement is a proposition which holds in the real world. For yes/no questions, (172), I assume that realis force obtains because the question presupposes that one of the two alternative answers holds in the real world.

3.1.1.3 C^0 = *-Ø, -yi, -yini*

The C^0 which is found in the unreal clause type has three forms: *-Ø*, *-yi*, *-yini*. Just as in the independent clause type, the phonological exponence of the affirmative independent C^0 is determined by the phi-features of IP-internal nominal arguments. To illustrate this, I have included the intransitive paradigm for the unreal clause type in Table 3.5. I have boxed the suffix which instantiates C^0. The ellipsis (...) represents the stem. (Abbreviations: 21 = first person plural inclusive, X = unspecified subject, 3 = third person proximate, 4 = third person obviative.)

Table 3.5: Exponents of C^0 in intransitive unreal clauses (Frantz 2009)

	[Spec, I]	... I^0		MOOD	C^0
1s	nit-	...-ht		-opi	
2s	kit-	...-ht		-opi	
1p	nit-	...-hp	-innaan	-opi	
2p	kit-	...-hp	-oaa	-wopi	
21		...-o't		-opi	
3s		...-waht		-opi	-Ø
4s		...-waht		-opi	-yini
3p/4p		...-waht		-opi	-yi

The exponence of C^0 in the unreal clause type is nearly the same as in the independent clause type, except that the form of agreement when the argument of the clause is a proximate singular third person suffix is null instead of *-wa*. I hypothesize that these suffixes also enter an Agree relation (Chomsky 2000, 2001) with third person DP arguments in the same way that they do in independent clauses.[14] The only difference is that the spell-out rule for *-a* ∼ *-wa* is missing in the unreal clause.

(174) SPELL-OUT OF C^0 IN THE UNREAL CLAUSE TYPE

a. *-yini* ↔ C^0 / [3, SG, OBV]

b. *-yi* ↔ C^0 / [3, PL]

c. *-Ø* ↔ C^0

Now that I have explained the exponence of C^0 in the unreal clause type, I argue that this type of C^0 occurs in realis clauses. Morphological evidence supports this analysis, because this C^0 co-occurs with person proclitics for some types of arguments, as shown in Table 3.5. Semantic evidence also supports this analysis, because this C^0 is used for counterfactual situations, (175) (Bliss 2013; Déchaine and Wiltschko 2010; Frantz 2009; Louie 2015). These propositions do not hold in the real world, but they do hold in a possible, alternative world. I take this to mean they have realis force.

[14] As for the independent clause type, I have assumed that C^0 probes specifically for third person arguments.

(175) *Context:* You were thinking of buying a blanket, but decided not to. There is a cold snap and now you are cold.

[**kit**úʔtakç̩powáwʔ**x̩ʷtúpi**	siʔkáːnɪk͡s
kitó’takihpowáwo**htópi**	si’káániks
kit–[o’t–Ø–aki]–hp–oaa–wo**ht**–opi	[[si’k–aa]–n]–iksi
2-[take–*v*–AI]–IND–2PL–**UNR**–MOOD	[[cover–AI]–NMLZ]–AN.PL

kɪmáːtakiʔnipíts̩powáːwa]
kimáátaki’nipítspowááwa
ki–maat–aak–[i’nipit–i]–hp–oaa=wa
2–NEG–FUT–[cold–AI]–IND–2PL=NONAFF

‘If you guys had taken blankets, you wouldn’t get cold.’ (BB; 2014-09-24)

3.1.1.4 C^0 = *-i*

There is a person-invariant C^0 *-i* (∼ *-yi* after vowels) which occurs in the conjunctive and subjunctive clause types. I gloss this C^0 as ‘DEP’ because it only occurs in dependent clauses, as I discuss in Section 3.1.2 below. Table 3.6 and Table 3.7 include the intransitive paradigms for both the conjunctive and subjunctive clause types, respectively.[15] I have boxed the suffix which instantiates C^0. The ellipsis (. . .) represents the stem. (Abbreviations: 21 = first person plural inclusive, X = unspecified subject, 3 = third person proximate, 4 = third person obviative.)

[15]The subjunctive clause typing suffix has at least three main forms: *-in* for first or second persons, *-o’k* for 21/X, and *-s* for third persons. There is also a suffix *-ik* or *-inik* which follows the clause-typing suffix and the plural agreement suffixes for first and second persons. The gaps in the paradigm may be explainable by haplology, where any sequence like [inin] or [ininn] is shortened by one syllable.

In support of this idea, at least one other suffix exhibits a synchronic process of haplology. The form of the suffix *-in* ‘by blade’ can be seen after a consonant, (1a). When this suffix follows a morpheme like *-ihkin* ‘hair’, (1b), only one syllable *in* surfaces instead of expected **inin*. The full form of the morpheme *-ihkin* can be confirmed from other contexts, (1c).

(i) a. *áakaniits**in**itsiiwa*
aak–[aaniit–**in**/it–ii]–Ø–wa
FUT–[scatter–**by.blade**/*v*–3OBJ]–IND–3

‘she will butcher him’

b. *áaksamihk**in**itsiiwáyi*
aak–[iam–ihkin–**in**/it–ii]–Ø–w=ayi
FUT–[scatter–hair–**by.blade**/*v*–3OBJ]–IND–3=OBV.SG

‘she will shave his head’

c. *máóhkihkiniwa*
[maohk–ihkin–i]–Ø–wa
FUT–[red–hair–AI]–IND–3

‘he has red hair’

Table 3.6: Exponents of C^0 in conjunctive clause types (Frantz 2009)

	[Spec, I]	. . . I^0		C^0
1s	nit-	. . . -hs		-i
2s	kit-	. . . -hs		-i
1p	nit-	. . . -hs	-innaan	-i
2p	kit-	. . . -hs	-oaa	-yi
21		. . . -o's		-i
X		. . . -o's		-i
3s	ot-	. . . -hs		-i
4s	ot-	. . . -hs		-i
3p/4p	ot-	. . . -hs		-i

Table 3.7: Exponents of C^0 in subjunctive clause types (Frantz 2009)

	. . . I^0		MOOD	C^0
1s	. . . -in		-ik	-i
2s	. . . -in		-ik	-i
1p	. . .	-innaan	-ik	-i
2p	. . . -in	-oa	-inik	-i
21	. . . -o'k			-i
X	. . . -o'k			-i
3s	. . . -s			-i
4s	. . . -s			-i
3p/4p	. . . -s			-i

To my knowledge, the final vowel in the conjunctive and subjunctive clause types has not been analyzed as C^0 before. In other research, *-hsi* and *-iniki* are sometimes treated as an atomic clause-typing suffix for the conjunctive and subjunctive clauses types, respectively. This cannot be correct for the conjunctive clause, because *-hs* and the final suffix *-i* can be separated by a plural agreement suffix like *-oaa* 'PL', as illustrated in (176).[16]

(176) CONJUNCTIVE CLAUSE TYPE

$_{CP}$[*Nítssksinii'pa* $_{CP}$[*kitsówatoohsoaa**yi***]$_{CP}$]$_{CP}$

nit–[ssk–in/Ø–i]–'p–a kit–[io–wat–oo]–hs–oaa–**yi**

1–[return–see/*v*–TI1]–IND–3 2–[eat–*v*–TI2]–CNJ–PL–**DEP**

'I know you ate it.' (Frantz 2009: 109, (f); re-glossed)

[16]Note that Bliss (2013) does treat final *-i* as a separate morpheme and glosses it like the nominal obviative suffix. While these two suffixes bear some similarities in form, they differ in distribution and the nominal obviative suffix is subject to final devoicing, while C^0 is not. I therefore take them to be separate morphemes.

Meanwhile, it is clear from Table 3.7 that *-iniki* is not used for all persons in the subjunctive clause; for example, third persons end in *-si*. Since the final vowel *-i* is the only portion which is consistent throughout the paradigm, I treat it as a separate suffix, (177).

(177) SUBJUNCTIVE CLAUSE TYPE

$_{CP}$[$_{CP}$[*Ikkamáyo'ka**in**oainiki,*]$_{CP}$ *nitáakahkayi.*]$_{CP}$

ikkam–a–[yo'k–aa]–**in**–oaa–inik–i nit–aak–[ahka–yi]–(hp)

if–IPFV–[sleep–AI]–**SBJ**–2PL–MOOD–DEP 1–FUT–[go.home–AI]–(IND)

'If you (pl.) are sleeping, I'll go home.' (Frantz 2009: 110, (l); re-glossed)

Now that I have explained that C^0 *-i* 'DEP' occurs in the conjunctive and subjunctive clause types, I argue that this type of C^0 can co-occur with realis or irrealis clause types. First I show that the conjunctive clause type has realis force. Then I show that the subjunctive has irrealis force. Since C^0 *-i* 'DEP' occurs in both clause types, I conclude that this C^0 is neutral with respect to the realis/irrealis distinction.

The conjunctive clause type has realis force. Morphological evidence supports this analysis, because the conjunctive clause type includes person proclitics, as shown in Table 3.6. Semantic evidence also supports this analysis, because the conjunctive clause type is used for propositions which hold in the real world: a complement clause to factive verbs like 'it is good', and to verbs like 'know', 'tell', 'believe', 'want' (Frantz 2009: 109–110), (178); a temporal adjunct 'when' clause referring to a past event, (179); and a counterfactual consequent clause of a conditional antecedent clause, which I showed in (175).

(178) $_{CP}$[*Nítssksinii'pa* $_{CP}$[*kitsówatoo**hs**oaayi*]$_{CP}$]$_{CP}$

Nit–[ssk–in/Ø–i]–'p–a kit–[io–wat–oo]–**hs**–oaa–yi

1–[return–see/*v*–TI1]–IND–3 2–[eat–*v*–TI2]–**CNJ**–2PL–DEP

'I know you ate it.' (Frantz 2009: 109, (f); re-glossed)

(179) $_{CP}$[*Áyo'kaawa* $_{CP}$[*nitáí'to'too**hs**i.*]$_{CP}$]$_{CP}$

a–[yo'k–aa]–Ø–wa nit–a'–it–[o't–oo]–**hs**–i

IPFV–[sleep–AI]–IND–3 1–WHEN–LOC–[at–go.AI]–**CNJ**–DEP

'He was sleeping when I got there.' (Frantz 2009: 109, (b); re-glossed)

The subjunctive clause type has irrealis force. Morphological evidence supports this analysis, because the subjunctive clause type prohibits person proclitics, as shown in Table 3.7. Semantic evidence also supports this analysis, because the subjunctive clause type is used for propositions which do not hold in the real world: a suppositional antecedent clause ('if'-clause) for consequent matrix clauses (Louie 2015), (180); a temporal 'when' clause which refers to the future, (181); or an iterative temporal antecedent clause, (182).

(180) $_{\text{CP}}[_{\text{CP}}[$*Ikkamáyo'ka**in**oainiki,* $]_{\text{CP}}$ *nitáakahkayi.* $]_{\text{CP}}$

ikkam–a–[yo'k–aa]–**in**–oaa–inik–i   nit–aak–[ahka–yi]–(hp)

if–IPFV–[sleep–AI]–**SBJ**–2PL–MOOD–DEP   1–FUT–[go.home–AI]–(IND)

'If you (pl.) are sleeping, I'll go home.' (Frantz 2009: 110, (l); re-glossed)

(181) $_{\text{CP}}[_{\text{CP}}[$*Áó'too**yiniki**,* $]_{\text{CP}}$ *áakitsoyo'pa.* $]_{\text{CP}}$

a–[o't–oo]–**yin**–ik–i   aak–it–[io–yi]–o'p–a

IPFV–[at–go.AI]–**SBJ**–MOOD–DEP   FUT–LOC–[eat–AI]–21.IND–3

'When you/I arrive, (then) we'll eat.' (Frantz 2009: 111, (o); re-glossed)

(182) $_{\text{CP}}[_{\text{CP}}[$*Kanáísootaa**s**i,* $]_{\text{CP}}$ *itáípimma.* $]_{\text{CP}}$

kan–a–[isoot–aa]–**s**–i   it–a–[ip–ii]–mm–a

all–IPFV–[rain–AI]–**SBJ**–DEP   LOC–IPFV–[enter–AI]–IND–3

'Whenever it rains, he goes in.' (Frantz 2009: 111, (q); re-glossed)

Because C^0 *-i* 'DEP' occurs with realis (conjunctive) and irrealis (subjunctive) clauses, I conclude that it is neutral with respect to the realis/irrealis distinction.

3.1.1.5 C^0 = -*Ø*

Lastly, there is a person-invariant C^0 in the imperative clause which is phonologically null, -*Ø* 'IMP', as shown in Table 3.8. I have included intransitive verbs with animate subjects (AI), transitive verbs with inanimate objects (TI) and transitive verbs with animate objects (TA). I have boxed the suffix which instantiates C^0. The ellipsis (. . .) represents the stem. (Abbreviations: 21 = first person plural inclusive, X = unspecified subject, 3 = third person proximate, 4 = third person obviative, s =singular, p =plural. A person without *s* or *p* following it means that the suffix is used regardless of the number of that person.)

Because there is no overt exponent of C^0, the morphology of imperative clauses is compatible with either a CP or an IP analysis, (183). In the CP analysis, the imperative paradigm includes a phonologically null C^0, as in (183a), which is the structure assumed in Bliss (2013) and in the present work. In the IP analysis, the imperative is simply an IP, (183b). This relates to a larger debate about the typology of imperatives, and whether they should be treated as full CP clauses (Beukema and Coopmans 1989; Han 2000; Potsdam 2007, 2017) or defective clauses (Platzack and Rosengren 1997; Rupp 2003).

[17] The length marker (ː) in the suffix -*ːs* signifies the unusual pattern of allomorphy exhibited by this suffix. The suffix -*ːs* is [-is] after consonant-final morphemes. After vowel-final morphemes, the suffix -*ːs* lengthens a preceding [i] or [o], and fuses with a preceding vowel [a] to create long [ɛː].

Table 3.8: Exponents of C^0 in imperative clause types (Frantz 2009)

			V^0	I^0		C^0
AI	2s	…		-t		-Ø
	2p	…		-k		-Ø
TI	2s:0	…		-t		-Ø
	2p:0	…		-k		-Ø
TA	2s:1s	…	-oki	-t		-Ø
	2p:1s	…	-oki	-k		-Ø
	2:1p	…	-oki		-innaan	-Ø
	2s:3	…	-:s[17]			-Ø
	2p:3	…	-ok			-Ø

(183) TWO POSSIBLE ANALYSES OF IMPERATIVE CLAUSES

Evidence from clausal suppletion when the subject is first person plural inclusive provides weak support for the CP analysis in (183a). In other Algonquian languages, the imperative paradigm includes forms with a first person plural inclusive subject (cf. Valentine 2001; Wolfart 1973). In Blackfoot, an imperative with a first person plural inclusive subject must be expressed using the independent clause type, (184)–(185). The first line in both cases is taken verbatim from the original source, and the second line gives the same form in the standard orthography from Frantz (1978, 2009).

(184) *á χkunsikstaki**òp***
ááhkonssikstaki**o'p**
aahk–on–[sik–st–aki]–**o'p**
might–??–[bite–by.mouth.*v*–AI]–**21.IND**
'let us bite!' (Uhlenbeck 1938: 158)

(185) *áksikakaw ʔaxkanyaaky**o** ʔ**p**a*
áaksikaka'wahkaniaaki**o'p**
aak–ikak–a–[ahka–n/i–aki]–**o'p**
FUT–even–IPFV–[sew–by.tool/*v*–AI]–**21.IND**
'let us sew!' (Taylor 1969: 305)

Crucially, when this suppletion occurs with third person objects, the third person must be indexed on the verb using an exponent of C^0 which is used in affirmative independent clauses, such as *-wa* '3' in (186). This suggests that not only is the imperative clause type (an IP) replaced by the independent clause (also an IP) when the subject is first person plural inclusive, but that the resulting structure is itself embedded in a CP. Assuming that a projection XP can only be suppleted by a clause of the same projection, XP, this is weak evidence in favor of the structure in (183a). Further evidence comes from the fact that imperative clauses have the distribution of a CP, which I discuss below in Section 3.1.2.

(186) *axkítsyowata ʔ**wa***
aahkítsyowataa**wa**
aahk–it–[io–wat–aa]–Ø–**wa**
might–LOC–[eat–*v*–3OBJ]–IND–**3**
'let us eat him!' (Taylor 1969: 304)

The C^0 *-Ø* 'IMP' occurs in irrealis clauses. Morphological evidence supports this analysis, because this C^0 does not co-occur with person proclitics for any persons, as shown in Table 3.8. Semantic evidence also supports this analysis, because imperatives are not propositions which hold in the real world and therefore they do not have realis force.

3.1.1.6 Summary: internal syntax

To summarize this section, all five clause types contain a C^0 head and an IP clause which is typed for (ir)realis force. Each type of C^0 selects a particular kind of IP complement, with the generalizations repeated below in Table 3.9. All clauses therefore have the internal syntax of a CP. In the next section I show that all clauses also have the distribution of a CP.

Table 3.9: Dependencies between C^0 and IP features (repeated)

C^0	Features of the IP	Clause types
-wa, *-yi*, *-yini*	[+REALIS]	independent (assertive)
-wa	[+REALIS]	independent (non-assertive)
-Ø, *-yi*, *-yini*	[+REALIS]	unreal
-i 'DEP'	*neutral*	conjunctive, subjunctive
-Ø 'IMP'	[-REALIS]	imperative

3.1.2 The verbal complex has the distribution of a CP

In this section I show that the clause in Blackfoot has the external syntax of a CP. Clauses differ in terms of how they are integrated into larger syntactic structures: a CP may either exist in matrix clauses, (187), or it may be embedded as a complement clause, (188), or adjunct clause, (187).

(187) MATRIX CP

$\boxed{\text{CP}}$

(188) COMPLEMENT CP

$[_{\text{VP}}\ \text{V}\ \boxed{\text{CP}}\ ]$

(189) ADJUNCT CP

$[_{\text{CP}_i}\ \text{CP}_i\ \boxed{\text{CP}_j}\ ]$

If the clause (the verbal complex plus any overt or *pro* nominal expressions) is a CP, then we expect the clause to have three types of distribution: some clauses only occur in matrix clauses, some only occur in embedded contexts, and some are neutral with respect to this distinction. The generalizations are given in Table 3.10, organized by the different types of C^0 discussed in the previous section. In this section I discusses clauses containing each of these types of C^0 in turn and show that they exhibit sensitivity to the matrix/embedded distinction.

Table 3.10: Dependencies between C^0 and embeddedness

C^0	Matrix/embedded?	Clause types
-wa, *-yini*, *-yi*	matrix	independent (assertive)
-wa	matrix	independent (non-assertive)
-Ø, *-yini*, *-yi*	*neutral*	unreal
-i 'DEP'	embedded	conjunctive, subjunctive
-Ø 'IMP'	matrix	imperative

3.1.2.1 C^0 = *-wa*, *-yi*, *-yini*

The C^0 realized as *-wa*, *-yi*, and *-yini* occurs in assertive independent clauses, which are restricted to matrix clauses (Bliss 2013; Déchaine and Wiltschko 2010; Frantz 2009). An example of a transitive indicative clause is given in (190). I conclude that clauses containing C^0 *-wa*, *-yi*, and *-yini* are restricted to matrix contexts.

(190) *Iikákomimmiiwa* *nohkówa* *kitániksi.*
ii\ik–[akom–imm–ii]–Ø–wa n–ohko–wa k–itan–iksi
IC\DEG–[favor–by.mind.*v*–3SUB]–IND–3 1–son–PRX 2–daughter–AN.PL
'My son (PRX) loves your daughters (OBV).' (Frantz 2009: 54, (p))

3.1.2.2 C^0 = *-wa*

The C^0 in independent clauses is neutralized to *-wa* in non-assertive contexts. Since clauses containing C^0 *-wa* still use the independent clause type, they are still restricted to matrix clauses. An example of an independent clause with the yes/no question marker *kata'*- 'Q' is given in (191), and an example of an independent clause with the clausal negator *maat*- 'NEG' is given in (192).

(191)

*Kataa'wápsspiinao'si**wa***	*annisk*	*oksíssts*	*ki*	*annisk*
kata'–[wapssp–iina/o'si]–Ø–**wa**	ann–i–hk	w–iksisst–i	ki	ann–i–hk
Q–[eye–dress/AI]–IND–**3**	DEM–OBV–INVS	3–mother–OBV	CONJ	DEM–OBV–INVS

ónni?
w–inn–i
3–father–OBV

'Do her mother and father wear glasses?' (Bliss 2013: 227, (33); re-glossed)

(192)

*Mááktaoyi**wa***	*anna*	*Leo*	*ó'siks.*
maat–a–[oo–yi]–Ø–**wa**	ann–a	Leo	w–i's–iksi
NEG–IPFV–[eat–AI]–IND–**3**	DEM–PRX	Leo	3–older.brother–AN.PL

'Leo's brothers weren't eating.' (Bliss 2013: 230, (44); re-glossed)

3.1.2.3 C^0 = *-Ø*, *-yi*, *-yini*

The C^0 which is realized as *-Ø*, *-yi*, and *-yini* occurs in unreal clauses. The unreal clause type typically occurs in adjunct (embedded) antecedent clauses to a counterfactual consequent (Bliss 2013; Déchaine and Wiltschko 2010; Frantz 2009). One example is repeated in (193); see Louie (2015) for other examples.

(193) *Context:* You were thinking of buying a blanket, but decided not to. There is a cold snap and now you are cold.

$_{\text{CP}}$[$_{\text{CP}}$[**kit**úʔtakç̩powáwʔx̩ʷ**túpi**	siʔkáːnɪk͡s	]$_{\text{CP}}$
kitó'takihpowáwo**htópi**	si'káániks	
kit–[o't–Ø–aki]–hp–oaa–wo**ht**–opi	[[si'k–aa]–n]–iksi	
2-[take–*v*–AI]–IND–2PL–**UNR**–MOOD	[[cover–AI]–NMLZ]–AN.PL	

kɪmáːtakiʔnipítʂ̩powáːwa]$_{\text{CP}}$
kimáátaki'nipítspowááwa
ki–maat–aak–[i'nipit–i]–hp–oaa=wa
2–NEG–FUT–[cold–AI]–IND–2PL=NONAFF

'If you guys had taken blankets, you wouldn't get cold.' (BB; 2014-09-24)

The unreal clause type also occurs marginally in matrix clauses, which to my knowledge has not been discussed in the Blackfoot literature. The facts are as follows. Most speakers reject the unreal clause type in matrix consequent clauses which occur alone without an adjunct antecedent clause, such as the example in (194).

(194) * [níts:apópi**çt**opi]
nítssapópii**ht**opi
nit–isap–[op–ii]–**ht**–opi
1–contain–[sit–AI]–**UNR**–MOOD
Target: ‘I was going to ride the bus (but didn’t).’ / ‘I didn’t ride the bus’. (BB; 2014-09-24)
Speaker’s comment: That means ‘if I had ridden’. You have to add something else or it’s no good.

However, unreal clauses are apparently marginally acceptable for some speakers in matrix consequent clauses which are supported by an adjunct antecedent, (195) and (196). If antecedent clauses are clausal adjuncts to a matrix consequent clause, then this means that examples like the following show that unreal clauses can occur in matrix contexts.

(195) $_{\text{CP}}$[$_{\text{CP}}$[*Náwaistoohtopiwa* *na* *Jaani* *matónni*]$_{\text{CP}}$
na–[waist–oo]–ht–opi–wa ann–a Jaani matonni
EVID–[toward–go.AI]–UNR–MOOD–3 DEM–PRX John yesterday
*áákstai’tsinoowawa**ht**opi.*]$_{\text{CP}}$
aak–sta’–it–[in–o–waa]–**ht**–opi
FUT–NEG–LOC–[see–*v*–3OBJ]–**UNR**–MOOD
‘Had John come last night, we would have seen him’ (Bliss 2013: 201, (67); re-glossed)

(196) $_{\text{CP}}$[$_{\text{CP}}$[*Ikkamaistoo’si* *na* *Jaan,*]$_{\text{CP}}$
ikkam–[aist–oo]–’s–i ann–a Jaan
if–[toward–go.AI]–CNJ–DEP DEM–PRX John
*ááksopowahtsi’sataa**ht**opi* *niksisk*
aak–[[sopo–wahtsi’si]–at–aa]–**ht**–opi ann–iksi–hka
FUT–[[clear–inquire.AI?]–*v*–3OBJ]–**UNR**–MOOD DEM–AN.PL–INVS
iihtáóhpommao’pi.]$_{\text{CP}}$
iiht–a–[ohpomm–aa]–o’p–i
MEANS–IPFV–[buy–AI]–21.IND–IN.SG
‘If John had come (to the dance), we could have asked him about the money.’ (RE; 2011-02-14)[18]

Since unreal clauses can occur in either embedded or matrix contexts, I conclude that clauses containing C^0 -*Ø*, -*yi*, and -*yini* are neutral with respect to embeddedness.

[18]This example is from Heather Bliss’s fieldnotes elicited with Rachel Ermineskin, p.c. 2018-04-17.

3.1.2.4 C^0 = *-i*

The C^0 which is realized as person-invariant *-i* occurs in conjunctive and subjunctive and is restricted to embedded contexts. Conjunctive clauses can occur as complements, as in (197), or as adjuncts, as in (198); both examples are repeated from above. According to Frantz (2009), conjunctive clauses cannot be used in matrix clauses.

(197) $_{CP}$[*Nítssksinii'pa* $_{CP}$[*kitsówatoo**hs**oaayi*]$_{CP}$]$_{CP}$
Nit–[ssk–in/Ø–i]–'p–a kit–[io–wat–oo]–**hs**–oaa–yi
1–[return–see/*v*–TI1]–IND–3 2–[eat–*v*–TI2]–**CNJ**–2PL–DEP
'I know you ate it.' (Frantz 2009: 109, (f); re-glossed)

(198) $_{CP}$[*Áyo'kaawa* $_{CP}$[*nitáí'to'too**hs**i.*]$_{CP}$]$_{CP}$
a–[yo'k–aa]–Ø–wa nit–a'–it–[o't–oo]–**hs**–i
IPFV–[sleep–AI]–IND–3 1–WHEN–LOC–[at–go.AI]–**CNJ**–DEP
'He was sleeping when I got there.' (Frantz 2009: 109, (b); re-glossed)

Subjunctive clauses only occur in adjunct (embedded) clauses. For example (199) includes a subjunctive clause as a temporal adjunct 'when' clause referring to a future event. According to Frantz (2009), subjunctive clauses cannot be used in matrix clauses.

(199) $_{CP}$[$_{CP}$[*Áó'too**yini**ki,*]$_{CP}$ *áakitsoyo'pa.*]$_{CP}$
a–[o't–oo]–**yin**–ik–i aak–it–[io–yi]–o'p–a
IPFV–[at–go.AI]–**SBJ**–MOOD–DEP FUT–LOC–[eat–AI]–21.IND–3
'When you/I arrive, (then) we'll eat.' (Frantz 2009: 111, (o); re-glossed)

I conclude that clauses containing C^0 *-i* 'DEP' are restricted to embedded contexts, because they only occur in complement or adjunct contexts, but never in matrix contexts.

3.1.2.5 C^0 = *-Ø*

The C^0 *-Ø* 'IMP' occurs in imperative clauses, which are restricted to matrix clauses, (200). I conclude that clauses containing C^0 *-Ø* 'IMP' are restricted to matrix contexts.

(200) [kʊ́kːit]
Kókkit!
[ko–t–oki]–t–**Ø**
[give–*v*–INV.21]–2SG.IMP–**IMP**
'Give it to me!' (BB)

(201) [kɪpːo̥xʷkʊ́kːit]
Kippohkókkit!
kipp–[ohko–t–oki]–t–**Ø**
[give–*v*–INV.21]–2SG.IMP–**IMP**
'Please give me it!' (BB)

3.1.2.6 Summary: external syntax

To summarize this section, the clauses that contain each instantiation of C^0 are all sensitive to the matrix/embedded distinction, with the generalizations repeated below in Table 3.11. This distinction has to do with how the CP connects to external structure. It is the entire clause (the verbal complex plus any overt or *pro* nominal expressions) which occurs in a matrix or embedded context. This means that in cases where all nominal expressions are *pro*, the verbal complex itself has the distribution of a CP.

Table 3.11: Dependencies between C^0 and embeddedness (repeated)

C^0	Matrix/embedded?	Clause types
-wa, *-yini*, *-yi*	matrix	independent (assertive)
-wa	matrix	independent (non-assertive)
-Ø, *-yini*, *-yi*	*neutral*	unreal
-i 'DEP'	embedded	conjunctive, subjunctive
-Ø 'IMP'	matrix	imperative

Before concluding this section, I draw attention to the relation between the forms of C^0 and clause embedding, summarized in Table 3.12. There is a three-way division between the C^0 in unreal clauses, which occurs in either matrix or embedded clauses, versus the other forms of C^0, which are restricted to either matrix or embedded clauses. The unreal C^0 is therefore the 'unrestricted' or 'elsewhere' case, whereas the distribution of the other types of C^0 is controlled by the matrix versus embedded status of the clause.

Table 3.12: Relation of Blackfoot C^0 to embedding

	Matrix	Embedded
C^0 = *-Ø*, *-yini*, *-yi*	✓	✓
C^0 = *-wa*, *-yini*, *-yi*	✓	✗
C^0 = *-wa*	✓	✗
C^0 = *-Ø*	✓	✗
C^0 = *-i*	✗	✓

There is a similar connection in Plains Cree between clause-typing and the matrix/embedded distinction, discussed in Cook (2008). Indexical clauses and anaphoric clauses are expressed morphologically via the independent and conjunct clauses, respectively. Syntactically, indexical/independent clauses are restricted to matrix contexts, while anaphoric/conjunct clauses have no restrictions, as in Table 3.13.

This shows that in Blackfoot and Plains Cree, there is a relation between clause typing and embeddedness. Both languages include a set of clause types which are restricted to either matrix or embedded

Table 3.13: Indexicality vs. embedding in Plains Cree (after Cook 2008: 3)

	Matrix	Embedded
Indexical (independent)	✓	✘
Anaphoric (conjunct)	✓	✓

clauses, and both languages also include at least one unrestricted clause type. The typology of these types of restrictions across the Algonquian family are unknown but may be an interesting area for future study.

The preceding sections discussed the internal and external syntax of the clause in Blackfoot. I showed that all clauses contain a C^0 which agrees with an (ir)realis IP complement, and that the clause has the distribution of a CP. In the next section I briefly discuss the syntax of nominal expressions. This is important because nominal expressions and CP phrases both have the same phonological correlates, which means that they both seem to be prosodified as PPhs. In my model of the syntax-prosody correspondence, each DP and CP phase corresponds by default to a phonological phrase. Therefore, it is important to establish whether or not each nominal expression is a DP.

3.1.3 Syntax of nominal expressions

Most nominal expressions[19] consist of a demonstrative and a noun, like the subject in (202). Syntactically, a noun with a demonstrative is a DP (Ritter and Rosen 2010). The demonstrative itself is complex and phrasal (Bliss 2013; Schupbach 2013).

(202) SUBJECT DP

[ʌnːá	imitá	ɔ́xʷki]
anná	imitá	áóhki
ann–a	imitaa	a–[ohk–i]–Ø–wa
DEM–PRX	dog	IPFV–[bark–AI]–IND–3

‘That dog is barking.’ (BB)

“Bare” nouns (nouns without a demonstrative) occur only as the object of particular types of verb stems. Previous research argues that morphological complexity in nominal expressions corresponds to syntactic complexity; that is, that bare nouns lack some of the functional structure that nouns with demonstratives have (Bliss 2013). In this section I briefly review previous research and argue that all nominal expressions are compatible with a DP analysis.

[19] I limit the discussion here to grammatical arguments of the verb. Oblique nominal expressions can also be linked to the clause via prefixes called ‘relative roots’ (Rhodes 2006; Rhodes 2010) or ‘linkers’ (Bliss 2013). Like grammatical arguments, oblique nominal expressions consist of a demonstrative plus a noun.

There are three types of morphological verbs stems associated with semantically bi-valent verbs: 'transitive animate' (TA), 'transitive inanimate' (TI), and 'animate intransitive plus object (AI+O) (Bloomfield 1946; Frantz 2009). The three transitive stem types combine with different types of complements.[20] TA verbs combine with grammatically animate DPs, (203), TI verbs combine with grammatically inanimate DPs, (204), and AI+O verbs combine with bare nouns of either animacy, (205).

(203) TA STEMS OCCUR WITH ANIMATE DP COMPLEMENTS

naowatsiw	*amo*	*mamii*
na–[**oo–wat–ii**]–Ø–wa	amo–yi	mamii
PST–[**eat–*v*–3SUB**]–IND–3	DEM–OBV	fish.AN

'S/he ate this fish.' (Adapted from Ritter and Rosen 2010: 134)

(204) TI STEMS OCCUR WITH INANIMATE DP COMPLEMENTS

naowatoom	*ani*	*akoopis*
na–[**oo–wat–oo**]–m–a	ann–i	akoopis
PST–[**eat–*v*–TI2**]–IND–3	DEM–IN	soup.IN

'S/he ate that soup.' (Adapted from Ritter and Rosen 2010: 134)

(205) AI+O STEMS OCCUR WITH ANIMATE OR INANIMATE BARE NOMINAL COMPLEMENTS

naoyiw	*(mamii/akoopis)*
na–[**oo–yi**]–Ø–wa	(mamii/akoopis)
PST–[**eat–AI**]–IND–3	(fish.AN/soup.IN)

'S/he ate (fish/soup).' (Adapted from Ritter and Rosen 2010: 134)

The complements to each of the three transitive stem types differ in terms of their internal syntax, external syntax, and semantics. Regarding internal syntax, Weber and Matthewson (2014, 2017) show that TA/TI stems can combine with DPs (as above), as well as 'certain' NPs (which themselves contain a demonstrative) and numeral NPs.[21] In contrast, AI+O stems can combine with bare NPs, bare plural NPs, numeral NPs, or null complements. A summary of the distribution of complement types across verb stems is given in Table 3.14. For data supporting these distributions, see Bliss (2012, 2013), Glougie (2000), Kim (2018), & Weber and Matthewson (2017).

Regarding external syntax, Bliss (2013) shows that the complements to TA and TI verbs can be linearized to the left or right of the verb, but the complements to AI+O verbs must occur in a post-verbal

[20] In many Algonquian languages, AI+O verb stems are a small set of lexically specified stems. In contrast, this distinction has been generalized in Blackfoot, and nearly all TA and TI verbs have an AI+O counterpart.

[21] They worked with a speaker who allowed numeral NPs as complements to either TA/TI verbs or AI+O verbs, with consequent differences in semantic properties. This distribution is not allowed by all speakers, as discussed by Kim (2018); some speakers instead allow Numeral NPs only as complements to AI+O verbs.

Table 3.14: Internal syntax of complements to transitive verbs (Weber and Matthewson 2017)

Type of complement	TA/TI stems	AI+O stems
DP	✓	✘
‘Certain’ NP	✓	✘
Bare NP	✘	✓
Bare plural NP	✘	✓
Null complement	✘	✓
Numeral NP	✓	✓

position. She also shows that Blackfoot has a *v*P pro-form *ni'toyi* ‘same’. This pro-form replaces the verb and a following AI+O complement, but in TA and TI constructions, it only replaces the verb. This suggests that the complements to AI+O verbs remain *in situ* in the syntax, while TA/TI complements are able to move.

Table 3.15: External syntax of complements to transitive verbs (based on Bliss 2013)

	TA/TI stems	AI+O stems
Able to front before the verb?	✘	✓
Replaced by *ni'tóyi* *v*P pro-form?	✘	✓

In terms of semantics, these stem types also combine with complements of different semantic types (Weber and Matthewson 2014, 2017). TA/TI stems combine with wide-scope choice functions of type *e*, while AI+O stems combine with either predicates of type $<e,t>$ or existential quantifiers of type $<<e,t>,t>$. The evidence for these claims includes the (in)ability of complements to ‘escape’ a clause, and relative scope of the complements with respect to clause-internal quantifiers and modals (Weber and Matthewson 2014, 2017).

Table 3.16: Semantic properties of complements to transitive verbs (Weber and Matthewson 2017)

Type of complement	TA/TI stems	AI+O stems	
Choice function: e	✓	✘	
Predicate: $<e,t>$	✘	✓	(bare NPs)
Existential quantifier: $<<e,t>,t>$	✘	✓	(bare plurals, numeral NPs)

In sum, there are major differences between the syntactic and semantic properties of TA/TI complements versus AI+O complements. I focus here on the syntactic size of the complements, because this is relevant to prosodic structure. The converging evidence shows that the complements to TA/TI stems are full DPs, while the complements to AI+O stems are smaller than DPs and are either NumPs (bare plurals) or NPs (bare nouns) (Bliss 2013; Ritter and Rosen 2010; Weber and Matthewson 2014). However, this explanation cannot account for the fact that Numeral NPs are compatible with all verb stem types,[22] unless additional assumptions are made. Weber and Matthewson (2014) suggest that an optional null D could be postulated for Numeral NPs which are complements to TA/TI verbs, enabling us to retain the generalization that there is a DP/NP split between stem types. However, there is at present no independent evidence that Numeral NPs have a larger syntactic structure when they appear as complements to TA or TI verbs. I return to this idea in Section 3.3, where I show that bare NP complements prosodicize into PPh just like DP complements do and propose syntactic and prosodic solutions.

3.1.4 Interim summary: CP syntax

To re-cap the preceding section, I first showed that the clause in Blackfoot has the internal and external syntax of a CP. The final suffix of the verbal complex instantiates C^0, and the entire clause has the distribution of a CP. Those generalizations are summarized in Table 3.17. Both clause types end in the same suffix, *-i* 'DEP', which has the properties of a C^0 head.

Table 3.17: Summary of CP properties of the verbal complex

Verbal complex contains	Features of the IP	Matrix/embedded?	Clause types
C^0 = *-wa*, *-yini*, *-yi*	[+REALIS]	matrix	independent (assertive)
C^0 = *-wa*	[+REALIS]	matrix	independent (non-assertive)
C^0 = *-Ø*, *-yini*, *-yi*	[+REALIS]	*neutral*	unreal
C^0 = *-i* 'DEP'	*neutral*	embedded	conjunctive, subjunctive
C^0 = *-Ø* 'IMP'	[-REALIS]	matrix	imperative

The clause itself consists of overt or null nominal expressions plus the verbal complex. Syntactically, the verbal complex is not a constituent; it is simply the complement to the nominal expressions within the clause. In Section 3.1.3 I briefly reviewed previous research on nominal expressions in Blackfoot. I argued that all nominal expressions are compatible with a DP analysis, including complements to AI+O verbs which are morphologically simpler than other nominal expressions. In Section 3.3 I propose that all DPs are matched to a phonological phrase. This predicts that all nominal expressions should exhibit the same phonological properties, which is true.

Now that I have shown that all clause types have the syntax of a CP, in Section 3.2 I present phonological evidence of a PPh constituent in Blackfoot. After that, in Section 3.3 I discuss how the CP corresponds to a phonological phrase (PPh) constituent.

[22] At least for one person's speech. As noted in the previous footnote, some speakers do not allow Numeral NPs as complements to TA/TI stems.

3.2 Phonology of the PPh constituent

In the previous section, I used independent syntactic evidence to argue that the verbal complex is a CP with *pro* arguments. In this section I argue that the verbal complex also corresponds to a unique phonological domain. Specifically, I discuss two phonological generalizations that motivate the existence of a Phonological Phrase (PPh) prosodic constituent which corresponds to the verbal complex.

In Section 3.2.1 I argue that an edge restriction prohibits glides at the left edge of the PPh, even though glides occur at the left edge of PPh-internal morphemes. As I discuss in Section 5.1, glides also occur at the left edge of PWd constituents, showing that these are distinct from PPh constituents. In Section 3.2.2 I argue that the PPh is also the domain of stress assignment. Stress is obligatory within a PPh, and the location of pitch accent is affected by affixes within the verbal complex, but not by neighboring PPhs. As I discuss in Section 5.1, stress does not necessarily fall on a PWd constituent, showing that the PWd is distinct from the PPh.

3.2.1 Glides are prohibited at the left edge of the PPh

In this section I demonstrate that there is an edge restriction which holds of the left edge of the PPh but not of any smaller morphological or phonological constituent. In particular, the glides [w] and [j] are prohibited at the left edge of the PPh, despite the fact that they can occur as syllable onsets word-medially and also at the left edge of the PWd and other prefixes. (The distinctions between the PPh and the PWd are discussed explicitly in Section 5.1.) I discuss evidence for this constraint based on the distribution of segments (Section 3.2.1.1) and morphemic alternations (Section 3.2.1.2), before presenting an analysis (Section 3.2.1.3). This constraint can only be stated with reference to a PPh, which I take as evidence of the PPh prosodic constituent itself (following the criteria from Nespor and Vogel 2007 discussed above in (14)).

Unless otherwise noted, the source of all data in this section is the third version of the *Blackfoot dictionary of stems, roots, and affixes* (Frantz and Russell 2017). The orthographic transcriptions are copied verbatim from Frantz and Russell (2017). Free translations are verbatim from the dictionary, except when the word was extracted from a longer example sentence, in which case I modified the translation accordingly. The phonetic transcriptions are my own addition. They are derived from the orthography in a systematic manner, following rules discussed in Frantz (1978, 2009, 2017), as described in Section 1.4.2.

3.2.1.1 Data: distributional evidence

PPh-medial glides have the same distribution as all other intervocalic consonants, (206)–(207). The examples in (206) exhaustively list all the short consonants which can occur pre-vocalically.[23] These examples demonstrate that the plosives /p/, /t/, /k/, the sibilants /s/, /t͡s/, and /k͡s/, the nasals /m/ and /n/, and the glides /w/ and /j/ can all occur intervocalically after a short vowel.

(206) INTERVOCALIC CONSONANTS FOLLOWING SHORT VOWELS

[p]	⟦si.no.**p**áː.wḁ⟧	*sino**p**ááwa*	‘swift fox’
[t]	⟦ma.**t**óː.miç.kaː.t⟧	*ma**t**óómiihkaat*	‘go fishing!’
[k]	⟦ɪ^{s}t.t͡si.**k**íː.wḁ⟧	*isttsi**k**ííwa*	‘it is slippery’
[s]	⟦a.**s**o.jín.ni̥⟧	*a**s**oyínni*	‘barrel’
[t͡s]	⟦a.**t͡s**i.kí.ni̥⟧	*a**ts**ikíni*	‘shoe’
[k͡s]	⟦i.sa.**k͡s**í.wḁ⟧	*isa**ks**íwa*	‘he went out’
[m]	⟦âː.ko.**m**ɛs.sa.pi.wḁ⟧	*áako**m**aissapiwa*	‘s/he will stare’
[n]	⟦ní.**n**aː.wḁ⟧	*ní**n**aawa*	‘chief, man’
[w]	⟦a.**w**óʔ.taː.ni̥⟧	*a**w**ó’taani*	‘shield’
[j]	⟦á.**j**oʔ.kaː.wḁ⟧	*á**y**o’kaawa*	‘she is sleeping’

The examples in (207) demonstrate that the same set of consonants can all occur intervocalically after a long vowel.

[23] The glottal stop [ʔ] canonically occurs pre-consonantally, but also occurs in a small number of lexical exceptions between certain vowel combinations, as in [naʔá] ‘mother!’. I do not include examples of intervocalic glottal stops in (206) and (207), because I assume that the glottal stop does not occupy an onset position even between vowels. I follow Peterson (2004) in analyzing the glottal stop as a subsegmental [CG] feature which is prosodically licensed by a non-nuclear mora. To account for the lexical exceptions with intervocalic glottal stops, he allows the glottal stop to occupy an onset position in non-derived environments as long as it surfaces as part of an echo-vowel complex. However, his more general analysis can also account for these lexical exceptions, as long as certain vowel hiatus sequences are tolerated in Blackfoot. Then [naʔá] ‘mother’ would contain a sequence of [a] vowels in hiatus, with a [CG] feature linked to a non-nuclear mora within the first syllable. This analysis has the advantage of treating [ʔ] in a uniform fashion, but requires that some combinations of vowels are allowed to surface in hiatus, even though vowel hiatus is typically resolved within the Phonological Phrase (cf. Elfner 2006b).

(207) Intervocalic consonants following long vowels

[p]	⟦ma.tôː.**p**aː.t⟧	*matóo**p**aat*	‘go collect your winnings!’
[t]	⟦aː.**t**óː.t⟧	*aa**t**óót*	‘howl!’
[k]	⟦ko.mí.ns̩ː.t͡siː.**k**iː.ˢt͡si̥⟧	*komínsstsii**k**iistsi*	‘your sleeves’
[s]	⟦iː.tɛ́ː.síː.kaː.**s**oʔ.pi̥⟧	*iitáí**s**íikaaso’pi*	‘mat’
[t͡s]	⟦máː.**t͡s**i.ka.ki.ta.poː.wḁ⟧	*máá**ts**ikakitapoowa*	‘she did not even go’
[k͡s]	⟦saː.**k͡s**í.t⟧	*saa**ks**ít*	‘go out!’
[m]	⟦má.tôː.**m**ɛː.ta.pi.wḁ⟧	*mátóo**m**aitapiwa*	‘the first people (ancestors)’
[n]	⟦káː.nɛːs.kiː.**n**aː.wḁ⟧	*káánaisskii**n**aawa*	‘mouse’
[w]	⟦âː.k͡si.kaː.**w**oː.wḁ⟧	*áaksikaa**w**oowa*	‘she will walk’
[j]	⟦áx.ko.maː.**j**oʔ.kaː.wḁ⟧	*ááhkomaa**y**o’kaawa*	‘he is probably still sleeping’

These intervocalic consonants (including the glides) are all parsed as syllable onsets. The evidence comes from the distribution of vowel length in open and closed syllables. Vowel length is distinctive only in open syllables, and neutralized to short in closed syllables (see Section 2.4). Because all intervocalic consonants occur after short and long vowels, the simplest explanation is that these consonants are parsed to an onset position rather than a coda position, as represented in (208).

(208) Intervocalic consonants as onsets

a. After short vowel   b. After long vowel

Assuming that the left edge of the PPh coincides with the left edge of a syllable, the prediction is that any consonant which can occur in an onset position PPh-medially should also be able to occur at the left edge of the PPh, where they would be parsed as the onset of the PPh-initial syllable. This is true for most possible onsets, as shown in (209). These examples demonstrate that the plosives /p/, /t/, /k/, the sibilants /s/, /t͡s/, and /k͡s/, and the nasals /m/ and /n/ can occur PPh-initially.[24] However, the glides /w/ and /j/ are unexpectedly prohibited at the left edge of the PPh.

[24] The glottal stop [ʔ] does not occur contrastively in PPh-initial position, although Derrick (2007) reports that an epenthetic glottal stop occurs at the beginning of PPh with underlying vowel onsets. Since the presence or absence of a PPh-initial glottal stop is not contrastive, I list no examples of PPh-initial [ʔ] in (209).

(209) CONSONANTS AT THE LEFT EDGE OF THE PPH

[p]	⟦**p**íː.taː.wḁ⟧	***p****íítaawa*	‘eagle’
[t]	⟦**t**á.t͡si.kɪk.kó.na.maː.nḁ⟧	***t****átsikikkónamaana*	‘center pole of Sundance tent’
[k]	⟦**k**óː.pɪ.si̥⟧	***k****óópisi*	‘soup’
[t͡s]	⟦**t͡s**i.má⟧	***ts****imá*	‘where’
[k͡s]	⟦**k͡s**i.só.ji.wḁ⟧	***ks****isójiwa*	‘tea kettle’
[s]	⟦**s**ɪˢt.t͡sí.wḁ⟧	***s****isttsíwa*	‘small bird’
[m]	⟦**m**a.míː.wḁ⟧	***m****amííwa*	‘fish’
[n]	⟦**n**a.tá.jo.wḁ⟧	***n****atáyowa*	‘lynx’
*[w]	—	—	
*[j]	—	—	

Table 3.18 below summarizes the distribution of onsets in (206), (207), and (209). The table illustrates a gap in the list of expected PPh-initial onsets: all of the short consonants which can occur between vowels can also occur at the beginning of the PPh, *except* for glides, which cannot occur at the beginning of the PPh. I have drawn a box around the unexpected gap in the chart below.

Table 3.18: Distribution of onsets

	p	t	k	s	t͡s	k͡s	m	n	w	j
After short vowels	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
After long vowels	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PPh-initial	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗

The static distributional evidence suggests that there is a phonotactic constraint against glides in PPh-initial position. In the next section, I discuss evidence from morphemic alternations which show that this constraint is active in the grammar.

3.2.1.2 Data: root alternations

In this section I argue that there are morphemic alternations which support a phonotactic constraint against PPh-initial glides. Some roots have a glide-initial alternant which surfaces after a vowel (and sometimes in other contexts), but an alternant with no glide which surfaces PPh-initially. For example, the root *waapo'ki-* ‘inside out’ begins with a [w] after the perfect prefix *akaa-* in (210a). In the imperative, where the root is not preceded by any prefix, the [w] at the left edge of the stem does not surface, (210b). Similarly, the initial [j] in the root *yaam-* ‘twisted’ surfaces after the imperfective prefix *a-* in (211a). In the imperative, where the root is not preceded by any prefix, the [j] at the left edge of the stem does not surface, (211b).

(210) a. ⟦á.kaː.**w**aː.poʔ.kjoʔ.t͡si.mḁ⟧
ákaa**w**aapo’kio’tsima
akaa–[aapo’ki–o’t/Ø–i]–m–a
PRF–[inside.out–by.hand/*v*–TI1]–IND–3
‘S/he has turned it inside out.’

b. ⟦aː.póʔ.kjoʔ.t͡si.t⟧
aapó’kio’tsit
[aapo’ki–o’t/Ø–i]–t–Ø
[inside.out–by.hand/*v*–TI1]–2SG.IMP–CMD
‘Turn it inside out!’

(211) a. ⟦á.**j**aː.mo.jíʔ.po.ji.wḁ⟧
á**y**aamoyí’poyiwa
a–[**y**aam–oyi–i’po/yi]–Ø–wa
IPFV–[twisted–mouth–speak/AI]–IND–3
‘S/he is joking/jesting.’

b. ⟦aː.mo.jíʔ.po.ji.t⟧
aamoyí’poyit
[**y**aam–oyi–i’po/yi]–t–Ø
[twisted–mouth–speak/AI]–2SG.IMP–CMD
‘Jest!’

In other words, some roots exhibit alternations like [w] ∼ Ø and [j] ∼ Ø. There are three logical analyses of such alternations:

1. the glides not part of the underlying form of the roots and are epenthesized between vowels,
2. the glides are part of the underlying form of the root in both cases and are deleted in PPh-initial position, or
3. either [w] or [j] is epenthetic, and the other glide is part of the underlying form of roots.

The first analysis, which treats the [w] and [j] as epenthetic elements, is not parsimonious. The reason is that there is no clearly defined phonological environment which conditions the choice between epenthetic [w] and epenthetic [j]. As can be seen in (210a) and (211a), both glides can occur between the same vowel qualities, which means that the choice between the two glides is unlikely to be conditioned by phonological context. Because of this, previous research assumes the second analysis is correct, and treats these glides as part of the underlying form of the roots in question. This is implicit in Frantz and Russell (2017), since all verbs with at least one glide-initial alternant are listed in the dictionary under glides, and explicitly adopted by other Blackfoot research, such as Bliss (2013) and Elfner (2006b), among others. However, the third analysis is still logically possible, and this is ultimately the analysis that I argue for in this section.

In the following sections, I examine roots which have [w]-initial allomorphs and [j]-initial allomorphs in turn. In Section 3.2.1.2.1 I use distributional evidence to argue that root-initial [w] is not an underlying part of these roots at all, but is better analyzed as an epenthetic onset to a heavy syllable which contains a [-high] vowel. In Section 3.2.1.2.2 I turn to roots which begin in a vowel at the beginning of the PPh but have a [j]-initial realization after vowels. I argue that these roots begin in an underlying /j/ which is deleted in PPh-initial position.[25] I take this as positive confirmation that the synchronic phonology has an active constraint against glides at the left edge of the PPh.

3.2.1.2.1 No roots begin in /w/

The main goal of this section is to show that no roots begin with an underlying /w/. Instead, I argue that all roots with a [w]-initial realization begin with a vowel underlyingly, and that the [w] is epenthesized to resolve vowel hiatus sequences. As a consequence, these roots cannot be used to support an analysis with a phonological constraint against glides at the left edge of the PPh. In some ways, this section is a very long, circuitous path to get to a null result. However, there is a secondary outcome in this section which is an important step before I turn to roots with [j]-initial allomorphs. Specifically, I argue that roots can begin underlyingly in any one of the five contrastive long vowels or three contrastive short vowels. Then, once I turn to roots with [j]-initial allomorphs, it is much easier to see that they differ from vowel-initial roots in a minimal and non-predictable way. In other words, the [j] at the left edge of some allomorphs must be underlying, and root alternations which involve [j]-initial allomorph do contribute positive support for a constraint against glides at the left edge of the PPh.

Roots with [w]-initial allomorphs display several kinds of restrictions, which will be relevant to the following discussion. First, the following vowel quality is only ever [a], [ɛ], or [ɔ] (e.g. the set of [-high] vowels). Second, the [w] occurs in three clearly defined environments: (a) before a long vowel, (b) in the onset of a closed syllable, or (c) before the sequence [aj]. The following discussion is organized around these three environments. I discuss each in turn and argue that the roots which have a [w]-initial alternant begin underlyingly with a vowel. At the end of this section I present an analysis that treats [w]-epenthesis as one of several vowel hiatus resolution strategies in Blackfoot.

Roots with [w]-initial allomorphs followed by a long vowel

Consider roots which begin with a long vowel in PPh-initial position. If the vowel is a long [iː] or long [oː], then the PPh-medial allomorph also begins with long [iː] or [oː]. The evidence that the allomorph begins with a vowel is that it coalesces with a preceding vowel. (Coalescence is one of several vowel hiatus resolution strategies used in Blackfoot; see Elfner 2006b for details.) This behavior contrasts the roots that I discuss in in Section 3.2.1.2.2 which begin with a long vowel in PPh-initial position but a glide in PPh-medial position; that is, these roots do not exhibit vowel coalescence in PPh-medial

[25] In terms of root alternations, there are also roots which begin with a nasal or an obstruent in PPh-initial position. Nasal-initial roots are not addressed directly in this thesis. In Section 3.2.1.2.3 I show that some roots with a nasal at the left-edge of the PPh have a [j] in PPh-medial position; this alternation occurs before a long vowel. There are other types of alternations with nasals, however, which are not addressed here. Obstruent-initial roots are addressed in Section 4.2.2. The main point is that all roots which begin in an obstruent at the left edge of a PPh exhibit some kind of non-predictable accretion in PPh-medial position. That is, no roots begin in an obstruent in all positions of the PPh.

position. For example, *iitssk-* ‘scuffle’ begins with a long [iː] in PPh-initial position, (212a) and this long [iː] coalesces with a preceding [a] in PPh-medial position to form [ɛːi], (212b). Similarly, *ook-* ‘scuffle’ begins with a long [oː] in PPh-initial position, (213a) and this long [oː] coalesces with a preceding [a] in PPh-medial position to form [ɔːo], (213b).

(212) a. PPH-INITIAL POSITION
⟦**iː**.tṣ̩ː.káː.t⟧
iitsskáát
[iitssk–aa]–t–Ø
[scuffle–AI]–2SG.IMP–CMD
‘fight!’

b. PPH-MEDIAL POSITION
⟦ɛ́ː.soː.k**ɛ́ː.i**.tṣ̩ː.kaː.wḁ⟧
áísookáíitsskaawa
a–isooka–[iitssk–aa]–Ø–wa
IPFV–used.to–[scuffle–AI]–IND–3
‘he used to fight’

(213) a. ⟦**ôː**.ká.ta.ki.t⟧
óokátakit
[ook–at–aki]–t–Ø
[bead–*v*–AI]–2SG.IMP–CMD
‘bead!’

b. ⟦**ɔ́ː.o**.ka.ta.ki.wḁ⟧
áóokatakiwa
a–[ook–at–aki]–Ø–wa
IPFV–[bead–*v*–AI]–IND–3
‘she does beadwork’

However, if the root begins with long [aː], [ɛː], or [ɔː] in PPh-initial position, then the root has a [w]-initial allomorph following [a]. For example, *aak-* ‘argue’ begins with a long [aː] in PPh-initial position, (214a), but with [waː] after [a] in PPh-medial position, (214b).

(214) a. PPH-INITIAL POSITION
⟦**a**ː.kx̩$^{\text{w}}$.kí̩.maː.t⟧
aakohkímaat
[[aak–ohk/i]–m–aa]–t–Ø
[[argue–vocalize/AI]–*v*–AI]–2SG.IMP–CMD
‘argue!’

b. PPH-MEDIAL POSITION
⟦iç.tá.**wa**ː.kx̩$^{\text{w}}$.ki.maː.wḁ⟧
iihtá**w**aakohkimaawa
ii\oht–a–[[aak–ohk/i]–m–aa]–Ø–wa
IC\INS–IPFV–[[argue–vocalize/AI]–*v*–AI]–IND–3
‘he is arguing for that reason’

(215) a. ⟦**ɛ**ː.$^{\text{s}}$tóː.t⟧
aistóót
[aist–oo]–t–Ø
[towards–go.AI]–2SG.IMP–CMD
‘come here!’

b. ⟦á.**wɛ**ː.$^{\text{s}}$tɛç.t͡siː.wḁ⟧
á**w**aistaihtsiiwa
a–[aist–aiht/ii]–Ø–wa
IPFV–[towards–move?/II]–IND–3
‘it is coming’

(216) a. ⟦**ɔː**.níː.t⟧
aoníít
[ao–n/i–i]–t–Ø
[hole–by.needle/*v*–TI1]–2SG.IMP–CMD
'pierce it!'

b. ⟦iç.ta.**wɔ́ː**.njaː.kjoʔ.pḁ⟧
iihta**w**áóniaakio'pa
ii\oht–a–[ao–n/i–aki]–o'p–a
IC\INS–IPFV–[hole–by.needle/*v*–AI]–21.IND–3
'can opener, brad awl'

In other words, there are two relevant sets of roots which begin in long vowels at the left edge of the PPh. The first set has a single realization which occurs in PPh-initial and PPh-medial positions.

(217) a. ⟦iːtsːk-⟧ 'scuffle'
b. ⟦oːk-⟧ 'bead'

The second set has two realizations: the root begins with an initial long vowel in PPh-initial position, and with an initial glide before this vowel in PPh-medial position.

(218) a. ⟦aːk-⟧ ∼ ⟦waːk-⟧ 'argue'
b. ⟦ɛːˢt-⟧ ∼ ⟦wɛːˢt-⟧ 'towards'
c. ⟦ɔːni-⟧ ∼ ⟦wɔːni-⟧ 'pierce'

But these two sets of roots are not random. They are in complementary distribution when we consider the quality of the first vowel of the root. There are five contrastive long vowels in Blackfoot: /iː/, /oː/, /aː/, /ɛː/, and /ɔː/. (I justify this phonemic inventory in Section 2.2.) The roots with a single realization begin with either [iː] or [oː] (the set of [+high] vowels). The roots with two realizations begin with either [aː], [ɛː], [ɔː] (the set of [-high] vowels). Together, they exhaust the inventory of long vowels. This points towards a phonological analysis of the Ø ∼ [w] alternation: all of these roots begin with a long vowel underlyingly, (219), and a [w] is epenthesized before long [-high] vowels in order to resolve vowel hiatus.

(219) a. /iːtsːk-/ 'scuffle'
b. /oːk-/ 'bead'
c. /aːk-/ 'argue'
d. /ɛːˢt-/ 'towards'
e. /ɔːni-/ 'pierce'

In this case, the underlying forms of the roots happen to look like the PPh-initial realization. But the key to this analysis is to recognize that two different patterns of root realization occur for phonologically complementary sets of roots. The complementary distribution here has to do with the vowel quality of the first vowel in the root. A very similar pattern obtains when we look at roots which begin with a closed syllable, which I turn to next.

Roots with [w]-initial allomorphs where the first syllable is closed

As I discuss in Section 2.4, there are several types of closed syllables. The evidence that a syllable is closed is that vowel length is neutralized to short before coda consonants. Codas may include (a) geminate consonants, (b) a glottal stop,[26] (c) a dorsal fricative, or (d) an alveolar fricative. The alveolar fricative only occurs after a [-back] vowel. Vowels are predictably lax before geminates and a coda alveolar fricative (as discussed in Section 2.2), which is reflected in my IPA transcriptions in this section. For each vowel, I will give an example of each of these types of closed syllables.

If the first syllable of a root is closed and contains an [i] at the left edge of the PPh (e.g. in the imperative), then the PPh-medial allomorph also begins with [i]. The evidence is that it coalesces with a preceding vowel. For example, the root *ikk-* 'train' begins with a short [i] followed by a geminate [kː]. Adopting an ambisyllabic analysis of geminates (Hayes 1989a), the geminate is underlyingly moraic and is parsed to the coda of the first syllable (where moras are licensed) and the onset of the second syllable (to satisfy ONSET). This root begins with a reflex of /i/ in PPh-initial position, where it realized as lax [ɪ], (220a), and also in PPh-medial position, (220b), where it coalesces with a preceding [a] to form [ɛ]. A similar description holds for a short [i] before a glottal stop, (221), a dorsal fricative, (222), or an alveolar fricative, (223). In (221b), the mid vowel [ɛː] is pronounced as a short diphthong [ej] before glottal stop, as I describe in Section 2.2.2.1.

(220) a. PPH-INITIAL
⟦**ɪk**.kíː.s⟧
ikkíís
[ikk–i–:s]–Ø
[train–*v*–2SG:3.IMP]–CMD
'train him (e.g. a horse)!'

b. PPH-MEDIAL
⟦**ɛ́k**.kiː.wá.ji̥⟧
áíkkiiwáyi
a–[ikk–i–ii]–Ø–w=ayi
IPFV–[train–*v*–3SUB]–IND–3=OBV.SG
'he's training him'

[26] As I discuss above, I adopt Peterson's (2004) analysis of the glottal stop in Blackfoot. He discusses how several different phonetic realizations of the glottal stop in Blackfoot can be accounted for if we assume that the glottal stop is a subsegmental [CG] feature which is prosodically licensed by a non-nuclear mora. A [Vʔ] sequence is a vowel parsed to a nuclear mora followed by a [CG] feature parsed to a non-nuclear mora. In other words, although the glottal stop is subsegmental in this analysis, the sequence [Vʔ] otherwise patterns exactly like other closed syllables.

(221) a. ⟦**iʔ**.sí̹.t⟧
i'sít
[i's–Ø–i]–t–Ø
[dye–*v*–TI1]–2SG.IMP–CMD
'dye it!'

b. ⟦**éjʔ**.si.mḁ⟧
áíí'sima
a–[i's–Ø–i]–m–a
IPFV–[dye–*v*–TI1]–IND–3
'she dyes it'

(222) a. ⟦**iç**.pi.jí̹.t⟧
ihpiyít
[ihpi–yi]–t–Ø
[dance–AI]–2SG.IMP–CMD
'dance!'

b. ⟦ni.**tɛ́ç**.pi.ji̥⟧
nitáíhpiyi
nit–a–[ihpi–yi]–(hp)
1–IPFV–[dance–AI]–(IND)
'I am dancing'

(223) a. ⟦**ɪs**.pín.ni.t⟧
isspínnit
[issp–inn–i]–t–Ø
[high–by.hand.*v*–TI1]–2SG.IMP–CMD
'lift it!'

b. ⟦ni.**tɛ́s**.pɪn.niːʔ.pḁ⟧
nitáíhpiyi
nit–a–[issp–inn–i]–hp–a
1–IPFV–[high–by.hand.*v*–TI1]–IND–3
'I am lifting it'

Similarly, if the first syllable of a root is closed and contains an [o] at the left edge of the PPh (e.g. in the imperative), then the PPh-medial allomorph also begins with [o], which coalesces with a preceding [a] to form [ɔ]. This is true regardless of whether the vowel [o] is followed by a geminate, where the underlying /o/ is realized as lax [ʊ], (224), a glottal stop, (225), or a dorsal fricative, (226). In (225b), the mid vowel [ɔː] is pronounced as a short diphthong [aw] before glottal stop, as I describe in Section 2.2.2.1.

(224) a. PPH-INITIAL
⟦**ʊt**.ta.kí̹.t⟧
ottakít
[ottak–i]–t–Ø
[serve.drinks–AI]–2SG.IMP–CMD
'dip out liquid!', 'serve drinks!'

b. PPH-MEDIAL
[**ɔ́t**.ta.ki.wḁ]
áóttakiwa
a–[ottak–i]–Ø–wa
IPFV–[serve.drinks–AI]–IND–3
'he is serving drinks' (BB)

(225) a. ⟦**oʔ**.ts̩.so.po.kiː.ji.k⟧
o’tssópokiiyika
o’t–[sopok–iiyi]–k–Ø
here–[complete–AI]–2PL.IMP–CMD
‘arrive in large numbers!’

b. ⟦ni.**káwʔ**ts̩.so.po.kiː.jç.pɪ..naː.n⟧
nikáó’tssopokiiyihpinnaana
n–ikaa–o’t–[sopok–iiyi]–hp–innaan
1–PRF–here–[complete–AI]–IND–1PL
‘we have arrived in large numbers’

(226) a. ⟦**oxʷ**.ks̩ː.káː.t⟧
oohksskáát
[ohkssk–aa]–t–Ø
[hang.meat–AI]–2SG.IMP–CMD
‘hang meat to dry!’

b. ⟦i.**sɔ́xʷ**ks̩ː.kaː.wḁ⟧
isáóhksskaawa
isa–[ohkssk–aa]–Ø–wa
out–[hang.meat–AI]–IND–3
‘she hung meat out to dry’

However, if the first syllable of a root is closed and contains an [a] at the left edge of the PPh (e.g. in the imperative), then the PPh-medial allomorph begins with [w]. This is true regardless of whether the vowel [a] is followed by a geminate, where the underlying /a/ is realized as lax [ʌ], (227), a glottal stop, (228), or a dorsal fricative, (229).

(227) a. PPH-INITIAL
⟦**ʌk**.ka.jí.t͡siç.taː.t⟧
akkayítsiihtaat
akkaw–[itsiiht–aa]–t–Ø
voluminous–[state.of.mind–AI]–2SG.IMP–CMD
‘be greedy (for gain)!’

b. PPH-MEDIAL
⟦á.kaː.**wak**.ka.ji.t͡siç.taː.wḁ⟧
ákaawakkayitsiihtaawa
akaa–akkaw–[itsiiht–aa]–Ø–wa
PRF–voluminous–[state.of.mind–AI]–IND–3
‘he has been greedy (for gain)’

(228) a. ⟦**aʔ**.píː.si.t⟧
a’píísit
[a’p–iisi]–t–Ø
[around–AI]–2SG.IMP–CMD
‘wallow (e.g. in mud)!’

b. ⟦iː.tá.**waʔ**.piː.si.wḁ⟧
iitáwa’piisiwa
ii\it–a–[a’p–iisi]–Ø–wa
IC\LOC–IPFV–[around–AI]–IND–3
‘he (e.g. a pig) is wallowing’

(229) a. ⟦**ax**.t͡síː.t⟧
aahtsíít
[aht–i–i]–t–Ø
[extinguish–*v*–TI1–2SG:3.IMP]–CMD
‘extinguish it (e.g. a fire or light)!’

b. ⟦á.**wax**.t͡si.mḁ⟧
áwaahtsima
a–[aht–i–i]–m–a
IPFV–[extinguish–*v*–TI1]–IND–3
‘he is extinguishing it!’

There are not many verb stems in the dictionary which begin with a closed syllable containing [ɛ] and [ɔ], and even fewer which contain the two phonological contexts shown here (an imperative and an example of the stem after a vowel [a]). Nevertheless, the few data points that I could find show that these verbs also follow the same generalizations as [a]. For example, the root *ai’p-* ‘haul’ begins with a closed syllable containing [ej] at the left edge of the PWd, (230a), but the PPh-medial realization begins with [w], (230b).

(230) a. PPH-INITIAL

⟦**ejʔ**.px̩ʷ.tóː.s⟧
ai’pohtóósa
[[ai’p–i]–ht/o–:s]–Ø
[[haul–*v*]–CAUS/*v*–2SG:3.IMP]–CMD
‘haul for her!’

b. PPH-MEDIAL

⟦ni.tá.**wejʔ**.px̩ʷ.toː.kḁ⟧
nitáwai’pohtooka
nit–a–[[ai’p–i]–ht/o–ok]–Ø–a
1–IPFV–[[haul–*v*–INV]–IND–3
‘she is hauling my things’

Similarly, the verb stem *aoo-hk/aa* ‘cave away’ begins with a closed syllable containing [ɔ] at the left edge of the PWd, (231a), but the PPh-medial realization begins with [w], (231b). (Note that the PPh-initial form is a perfective intransitive verb instead of an imperative. Since the subject is inanimate and non-sentient, an imperative would be infelicitous.)

(231) a. PPH-INITIAL

⟦**ɔ́xʷ**.kaː.wḁ⟧
áóohkaawa
[aoo–hk/aa]–Ø–wa
[cave–GET/II]–IND–3
‘it fell away’

b. PPH-MEDIAL

⟦á.kaː.**wɔxʷ**.kaː.ji̥⟧
ákaawáóohkaayi
akaa–[aoo–hk/aa]–Ø–yi
PRF–[cave–GET/AI]–IND–3PL
‘some of the bales have fallen away from the haystack’

Once again, roots which begin in a heavy syllable divide into two sets. The first set has a single realization which occurs in PPh-initial and PPh-medial positions.

(232) a.

⟦ɪkk-⟧	‘train’
⟦iʔs-⟧	‘dye’
⟦içpi-⟧	‘dance’
⟦ɪsp-⟧	‘high’

b.

⟦ʊttak-⟧	‘serve drinks’
⟦oʔt-⟧	‘here’
⟦oxʷks̩ːk-⟧	‘hang meat to dry’

The second set has two realizations: the root begins with an initial vowel in PPh-initial position, and with an initial glide before this vowel in PPh-medial position.

(233)	a.	⟦ʌkkaw-⟧	∼	⟦wakːaw-⟧	‘voluminous’
		⟦aʔp-⟧	∼	⟦waʔp-⟧	‘around, about’
		⟦axt-⟧	∼	⟦waxt-⟧	‘extinguish’
	b.	⟦ejʔp-⟧	∼	⟦wejʔp-⟧	‘haul’
	c.	⟦ɔxʷ-⟧	∼	⟦wɔxʷ-⟧	‘cave’

Just like the roots which begin with underlying long vowels, these two sets of roots are not random. They are in complementary distribution with respect to the quality of the first vowel. The roots with a single realization begin with either [i] or [o] (the set of [+high] vowels). The roots with two realizations begin with either [a], [ɛ], or [ɔ] (the set of [-high] vowels). This exhausts the set of contrastive long vowel qualities in Blackfoot. Again, this points towards a phonological analysis of the Ø ∼ [w] alternation: all of these roots begin with a long vowel underlyingly, (234), and a [w] is epenthesized before [-high] vowels in closed syllables in order to resolve vowel hiatus.[27]

(234)	a.	/iːkk-/	‘train’
		/iːʔs-/	‘dye’
		/iːçpi-/	‘dance’
		/iːsp-/	‘high’
	b.	/oːttak-/	‘serve drinks’
		/oːʔt-/	‘here’
		/oːxʷks̩ːk-/	‘hang meat to dry’
	c.	/aːkkaw-/	‘voluminous’
		/aːʔp-/	‘around, about’
		/aːxt-/	‘extinguish’
	d.	/ɛːʔp-/	‘haul’
	e.	/ɔːxʷ-/	‘cave’

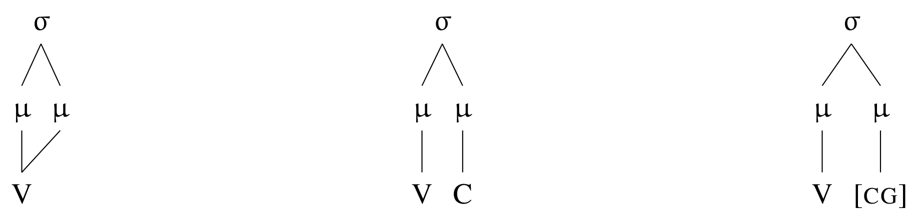
There are clear similarities between the distribution of [w] before long vowels and closed syllables. Syllables with long vowels and syllables which are closed are both bi-moraic in Blackfoot (Section 2.4),

[27] This analysis is a bit abstract in the sense that I have posited underlying long vowels at the left edge of these roots, but these vowels never actually surface as long. Because they occur before a geminate or a consonant cluster, they will always be parsed to a closed syllable where vowel length is predictably short. One alternative might be that these underlying forms reflect an earlier diachronic stage of Blackfoot, but that the distribution of contrast has been reconfigured synchronically in the following way. Perhaps the relevant distinction is not a contrast between five underlyingly long vowels versus three underlyingly short vowels, but that Blackfoot contrasts five vowel qualities *in heavy syllables* and only three vowel qualities *in short syllables*. I leave the ramifications of this proposal for future research.

as illustrated in (235). Long vowels are underlyingly bi-moraic, (235a), while closed syllables contain either a full segment, (235b), or a prosodically-licensed [CG] feature, (235c), which is parsed to a non-nuclear mora.

(235) Three types of heavy syllables

a. Long vowels b. Closed syllable c. Coda [ʔ]



Consequently, roots with a [w]-initial allomorph discussed thus far always begin with a heavy (e.g. bi-moraic) syllable, regardless of whether that syllable contains a long vowel or is closed. Under a phonological epenthesis analysis of [w], [w] is epenthesized between vowels as one of several vowel hiatus resolution strategies. Elfner (2006b) discusses several different strategies of vowel hiatus resolution used in Blackfoot, including glide formation, deletion, and vowel coalescence. Most of the examples she gives involve the resolution of hiatus between two short vowels. Here I am adding to the typology of resolution strategies by considering vowel hiatus configurations where the second syllable is heavy. As discussed above and summarized in Table 3.19, coalescence is the preferred strategy if the vowel in the heavy syllable is [+high], and [w]-epenthesis is preferred if the vowel is [-high].

Table 3.19: Allomorphy of roots with initial heavy syllables

Root-initial vowel quality		Hiatus resolution strategy
/i/	[+high]	coalescence
/o/	[+high]	coalescence
/ɛ/	[-high]	[w]-epenthesis
/ɔ/	[-high]	[w]-epenthesis
/a/	[-high]	[w]-epenthesis

There is one additional context where [w]-initial allomorphs occur, which is before an [aj] sequence followed by a vowel. I turn to this context next and argue that the sequence [aj] is not a light open syllable followed by a [j] onset. Instead, it is probably a bi-moraic diphthong, which means that [w]-epenthesis always occurs in a uniform phonological context: before heavy syllables which contain a [-high] vowel.

Roots with [w]-initial allomorphs followed by a short vowel

Some roots begin with the sequence [aj] at the left edge of the PPh (e.g. in the imperative), but [waj] after an [a]. For example, the root *ayakiit-* 'halve' begins with [aj] when it is in a PPh-initial position, (236a), but [waj] when it is in a PPh-medial position after [a], (236b). Anticipating the following analysis, I parse orthographic <ay> as a heavy diphthong [ai]. The high, front, unrounded features of the second half of the diphthong are parsed ambisyllabically to the onset of the following syllable, which I transcribe as [. . . ai.j. . .].

(236) a. PPH-INITIAL

⟦**ai**.já.kiː.toː.k⟧
ayákiitooka
[ayakiit–oo]–k–Ø
[halve–go.AI]–2PL.IMP–CMD
'separate!'

b. PPH-MEDIAL

⟦ni.káː.**wai**.já.kiː.tox^{w}.pɪn.naː.n⟧
nikááwayákiitoohpinnaana
n–ikaa–[ayakiit–oo]–hp–innaan
1–PRF–[halve–go.AI]–IND–1PL
'we have split up'

(237) a. ⟦**ai**.ja.míʔ.ta.ki.t⟧
ayamí'takit
[ayam–i't–aki]–t–Ø
[offense–by.mind.*v*–AI]–2SG.IMP–CMD
'take offense (at it)!'

b. ⟦á.kaː.**wai**.ja.miʔ.ta.ki.wḁ⟧
ákaawayami'takiwa
akaa–[ayam–i't–aki]–Ø–wa
PRF–[offense–by.mind.*v*–AI]–IND–3
'she has taken offense'

(238) a. ⟦**ai**.ji.kí.naː.t⟧
ayikínaat
[ayikin–aa]–t–Ø
[paranormal–AI]–2SG.IMP–CMD
'communicate with a paranormal force!'

b. ⟦á.kaː.**wai**.ja.miʔ.ta.ki.wḁ⟧
áwayikinaawa
a–[ayikin–aa]–Ø–wa
IPFV–[paranormal–AI]–IND–3
'she communicates with paranormal forces'

The root alternations above are as follows.

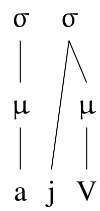
(239) a.

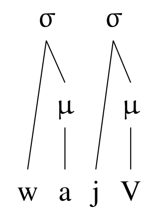
⟦ajak-⟧	∼	⟦wajak-⟧	'both'
⟦ajam-⟧	∼	⟦wajam-⟧	'offense'
⟦ajikin-⟧	∼	⟦wajikin-⟧	'paranormal'

As I showed in Section 3.2.1.1, intervocalic glides typically have the same distribution as onsets. Therefore, at first glance these roots look like they begin with a light open syllable followed by a [j] onset. But if the [j] glides in these roots are parsed to an onset position, then these roots would exhibit [w]-epenthesis *before an initial light syllable*. The expected internal syllable structure for both positional realizations is shown in (240). Because [j] is an onset, the initial syllable of the root contains only the short vowel [a], which is monomoraic. When [w] is epenthesized, it occurs as an onset to that light syllable.

(240) INTERVOCALIC [j] AS ONSET (TO BE REJECTED)

a. PPH-INITIAL ∼ b. PPH-MEDIAL





Considering that all other cases of [w]-epenthesis occur before heavy syllables, this would be unexpected. However, there is other evidence that suggests this is the wrong analysis. If [w] is epenthesized before short [a], then it should not matter what the following onset is. We would expect [w]-epenthesis to occur before a short [a] followed by [t] or [k] or any other onset. But this is not the case; [w]-epenthesis only occurs before a short [a] followed by [j]. Furthermore, stems which do begin with a short [a] exhibit a different pattern of allomorphy entirely, suggesting that the [aj] sequences in these roots does not have the same type of syllable structure. I describe these types of roots next.

Some roots begin with a short vowel when they occur at the left edge of the PPh. In PPh-medial position, the short vowel coalesces with a preceding vowel. If a root begins in a short [i] or [o] in PPh-initial position (e.g. in the imperative), then it also begins with an [i] or [o] in a PPh-medial position. For example, the root *itsin-* ‘among’ begins with a short [i] in PPh-initial position, (241a), and this short [i] coalesces with a preceding [a] in PPh-medial position to form [ɛː], (241b). Similarly, the root *ok-* ‘snare’ begins with a short [o] in PPh-initial position, (242a), and this short [o] coalesces with a preceding [a] in PPh-medial position to form [ɔː], (242b).

(241) a. PPH-INITIAL

⟦**i**.t͡sí.nx̩ʷ.toː.t⟧
itsínohtoot
[**i**tsin–oht–oo]–t–Ø
[among–put.*v*–TI2]–2SG.IMP–CMD
‘place it among the rest!’

b. PPH-MEDIAL

⟦**ɛ́ː**.t͡si.nx̩ʷ.toː.má.ji̥⟧
áítsinohtoomáyi
a–[**i**tsin–oht–oo]–m–Ø=ayi
IPFV–[among–put.*v*–TI2]–IND–3=OBV.SG
‘he is placing it among the rest’

(242) a. ⟦**o**.káː.t⟧
okáát
[**o**k–aa]–t–Ø
[snare–AI]–2SG.IMP–CMD
‘rope!’

b. [**ɔ́ː**.kaː]
áókaawa
a–[**o**k–aa]–Ø–wa
IPFV–[snare–AI]–IND–3
‘he is roping’ (BB)

Roots that begin with a short [a] in PPh-initial position exhibit two subpatterns.[28] For roots like *atsinik-* ‘relate a story’ in (654), the PPh-medial allomorph begins in [i], which coalesces with a preceding [a] to form [ɛː]. For other roots like *ok-* ‘count’, (244), the PPh-medial allomorph begins in [o], which coalesces with a preceding [a] to form [ɔː].

(243) a. [**a**.t͡si.ní.ki.t]
atsinikit
[**a**tsinik–i]–t–Ø
[relate.story–AI]–2SG.IMP–CMD
‘relate a story!’ (BB)

b. ⟦**ɛ́ː**.t͡si.ni.ki.w̥a⟧
áítsinikiwa
a–[**i**tsinik–i]–Ø–wa
IPFV–[tell.story–AI]–IND–3
‘s/he is relating a story’

(244) a. [**a**.ks̩.tá.ki.t]
akstákit
[**a**k–st–aki]–t–Ø
[count–*v*–AI]–2SG.IMP–CMD
‘read!’ (BB)

b. ⟦**ɔ́ː**.ks̩.ta.ki.w̥a⟧
áókstakiwa
a–[**o**k–st–aki]–Ø–wa
IPFV–[read–*v*–AI]–IND–3
‘s/he is reading/counting’

The allomorphy patterns of roots which begin in short vowels looks like the following. Roots which begin in short [i] or [o] do so in all positions of the word. Roots that begin with [a] at the left edge of the PPh begin in either [i] or [o] in PPh-medial position. There are no roots which begin in short [a] in both positions, *except* when that short [a] is followed by [j].

(245)	a.	⟦itsin-⟧			‘among’
	b.	⟦ok-⟧			‘snare’
	c.	⟦atsinik-⟧	∼	⟦itsinik-⟧	‘relate a story’
	d.	⟦ak-⟧	∼	⟦ok-⟧	‘count’
	e.	*[aC]	∼	[aC]	(where C = [+cons])

A relevant question is whether the two subpatterns of alternation for [a]-initial roots occur in complementary environments or not. The [a] ∼ [i] subpattern is relatively minor and as far as I can tell only occurs when the following consonant is [s], [t], [t͡s], or [ˢt] (e.g. before voiceless alveolar consonants).

[28] Within the stem, some suffixes begin with a short [a]. When those suffixes follow a vowel-final morpheme, vowel hiatus is resolved either via deletion or coalescence. See Section 4.2.1.1.1 for details.

The [a] ∼ [o] pattern is much more common and occurs before many different consonants, including [t]. For example, the root *atsimot-* 'escape, flee' is shown in (246). It begins with [a] in PPh-initial position, but with [o] in PPh-medial position. There are no examples in the dictionary of this root or other [at͡s...] roots after a vowel, which is why the PPh-medial example shows the root after the final consonant of the future prefix.

(246) a. PPH-INITIAL
⟦**a**.t͡si.mo.tá:.t⟧
atsimotáát
[**a**tsimot–aa]–t–Ø
[escape–AI]–2SG.IMP–CMD
'escape!'

b. PPH-MEDIAL
⟦â:.k**o**.t͡si.mo.ta:.wḁ⟧
áak**o**tsimotaawa
aak–[**o**tsimot–aa]–Ø–wa
FUT–[escape–AI]–IND–3
'she will flee'

For comparison, example (654b) repeats the PPh-initial example for the root *atsinik-* 'relate a story' from above, and also gives a PPh-medial context where the root occurs directly after a consonant.

(247) a. [**a**.t͡si.ní.ki.t]
atsinikit
[**a**tsinik–i]–t–Ø
[relate.story–AI]–2SG.IMP–CMD
'relate a story!' (BB)

b. ⟦â:.k**i**.t͡si.ni.ki.wḁ⟧
áak**i**tsinikiwa
aak–[**i**tsinik–i]–Ø–wa
FUT–[tell.story–AI]–IND–3
'she will relate a story'

These examples show that the [a] ∼ [i] and [a] ∼ [o] subpatterns can occur in partially overlapping environments; namely, at the beginning of a root before [t͡si...]. For that reason, I will assume that both allomorphs must be listed in the lexicon for these roots.

The presumed underlying forms of roots which begin in short vowels are given in (248). The full set of contrastive short vowels in Blackfoot is /i/, /o/, and /a/. Taken together, these patterns of alternation exhaust the full set of short vowels. That is, roots can begin with an underlying /i/ or /o/, which surfaces in all environments. There is also a set of roots which have underlying /a/ in one of the two allomorphs. These roots divide into two subpatterns: either the second listed allomorph has an underlying /i/ or an underlying /o/. But taken together, these two subpatterns essentially fill the slot for roots that begin with underlying short [a].

(248) a. /itsin-/ 'among'
b. /ok-/ 'snare'
c. {/atsinik-/, /itsinik-/} 'relate a story'
d. {/ak-/, /ok-/} 'count'

If the [aj] ∼ [waj] alternations really did involve an initial light syllable with a short [a], then we would expect roots to conform to one of these two subpatterns. That is, roots that begin with short [aj] in PPh-initial position should alternate with [ij] or [oj] in PPh-medial position. This is never the case. These sequences always alternate with a [w]-initial allomorph in PPh-medial position.

(249) a. ⟦aj. . .⟧ ∼ ⟦waj. . .⟧
b. *⟦aj. . .⟧ ∼ ⟦ij. . .⟧
c. *⟦aj. . .⟧ ∼ ⟦oj. . .⟧

To summarize this discussion, there are two reasons to believe that the [aj] ∼ [waj] alternations do not involve a light syllable containing a short [a] followed by a [j] onset. Both of these reasons essentially point out that there is no natural connection between [w]-epenthesis and the onset of the following syllable.

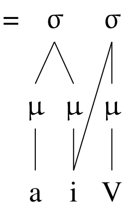
1. Under this analysis, [w]-epenthesis occurs before a short [a] only when the following segment is [j]. If [w]-epenthesis typically happens before heavy syllables regardless of the following syllable onset, it's not clear why the [a] ∼ [wa] alternation should occur only before a particular onset.
2. Roots which have an allomorph beginning in /a/ before a consonant other than /j/ exhibit a different pattern of alternation entirely: either the PPh-medial allomorph begins with /i/ or the PPh-medial allomorph begins in /o/. If these patterns of allomorphy typically occur regardless of the following syllable onset, it's not clear why the exceptional [a] ∼ [wa] alternation should only occur before a particular onset.

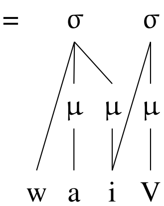
Instead, I adopt an alternative analysis, where the [aj] sequence is a bi-moraic diphthong, (250). Because the next segment is a vowel, I will assume that the moraic [i] which forms the second half of the diphthong is also parsed to the following syllable in order to satisfy ONSET.[29]

[29] It is interesting that the [j] is not long in this context. It has essentially the same representation as a geminate consonant (e.g. it is dominated by both the final mora of one syllable as well as by the following syllable node). I will assume the difference in length is because [j] differs from other consonants by being [-cons]. All ambisyllabic [+cons] segments are phonetically long, but ambisyllabic [-cons] segments are not.

(250) ROOT-INITIAL [aj] AS BI-MORAIC DIPHTHONG

a. PPH-INITIAL ~ b. PPH-MEDIAL

[ai.jV] = 

[wai.jV] = 

This analysis allows us to preserve generalization that [w]-epenthesis only occurs in the onset of heavy syllables. It also explains why this type of alternation occurs before [aj] but no other [aC] sequence: [aj] is actually a bi-moraic diphthong, whereas any other [aC] sequence is a light syllable followed by an onset. I will assume that the underlying forms of the roots up above contain a sequence of three monomoraic vowels. The phonological grammar parses the first two vowels into a bi-moraic diphthong in order to preserve faithfulness to underlying moras.

(251) a. /aiak-/ 'both'
/aiam-/ 'offense'
/aiikin-/ 'paranormal'

I have established that no roots begin in an underlying /w/ and that [w] is epenthesized in some contexts (e.g. after [a]) as an onset to a heavy syllable. In the next section I discuss the contexts for [w]-epenthesis in more detail. As I will show, [w]-epenthesis occurs in very few contexts (which is itself another argument in favor of an epenthesis analysis) and epenthesis competes with glide formation as a strategy to resolve vowel hiatus.

Roots with [w]-initial allomorphs occur in few phonological environments

To establish the patterns of alternation in the preceding sections, I considered two phonological contexts: (a) the left edge of the PPh, and (b) PPh-medially, after an [a] or [aː]. In this section I consider other phonological contexts and show that [w]-initial realizations occur in very few contexts, while vowel-initial realizations occur more broadly. This supports my analysis of root-initial [w] as an epenthetic segment.

As an example I will use the stem *aanist* 'tell s.o.', which begins with the morpheme *aan-* 'tell, say'. This root happens to occur in Frantz and Russell (2017) in many phonological contexts, so it is a useful illustration of the patterns. In PPh-initial position the root /aan-/ 'tell, say' surfaces faithfully. This is true in the imperative clause, (252), as well as in indicative clauses with third person arguments, (253). A [w]-initial allomorph never occurs in PPh-initial position, as indicated by the unattested (b) examples.

(252) NO [w] IN PPH-INITIAL POSITION: IMPERATIVE CLAUSE

a. ⟦aː.ni.ˢt͡si.́s⟧
aanistsísa
[aan–ist–:s]–Ø
[tell–*v*–2SG:3.IMP]–CMD
'tell her!'

b. * ⟦**w**aː.ni.ˢt͡si.́s⟧
waanistsísa
[aan–ist–:s]–Ø
[tell–*v*–2SG:3.IMP]–CMD
'tell her!'

(253) NO [w] IN PPH-INITIAL POSITION: INDICATIVE CLAUSE

a. ⟦áː.ni.ˢt͡siː.wa.ji̥⟧
áánistsiiwayi
[aan–ist–ii]–Ø–w=ayi
[tell–*v*–3SUB]–IND–3=OBV.SG
'he told him'

b. * ⟦**w**áː.ni.ˢt͡siː.wa.ji̥⟧
wáánistsiiwayi
[aan–ist–ii]–Ø–w=ayi
[tell–*v*–3SUB]–IND–3=OBV.SG
'he told him'

After a consonant the first vowel of /aan-/ 'tell, say' is short, which is irrelevant to the point here about the distribution of [w]-initial realizations.[30] The examples in (254)–(256) show this is true after [p], [t], and [k]. The [w]-initial allomorph never occurs after a consonant, as indicated by the unattested (b) examples. This is unsurprising, because [Cw] clusters are prohibited in Blackfoot.

(254) SHORT VOWEL AFTER [p]

a. ⟦sa.pa.ní.ˢt͡sí.s⟧
sapanístsísa
sap–[an–ist–:s]–Ø
correct–[tell–*v*–2SG:3.IMP]–CMD
'respond correctly to him!'

b. * ⟦sa.p**w**a.ní.ˢt͡sí.s⟧
sap**w**anístsísa
sap–[an–ist–:s]–Ø
correct–[tell–*v*–2SG:3.IMP]–CMD
'respond correctly to him!'

[30]The initial vowel for *all* roots with a [w]-initial allomorph is short after consonants, which is reflected in the orthographic and phonetic transcriptions for these examples. Frantz (2009: 79) calls these 'variable-length vowels'. An analysis of vowel length variation is beyond the scope of this thesis, but point it out as a relevant related fact for future research.

(255) SHORT VOWEL AFTER [t]

a. ⟦ni.tâː.ki.ta.ni.^{s}ta.wḁ⟧
nitáakitanistawa
nit–aak–it–[an–ist–a]–Ø–wa
1–FUT–TIME–[tell–*v*–3OBJ]–IND–3
'that's when I will tell him'

b. * ⟦ni.tâː.ki.t**w**a.ni.^{s}ta.wḁ⟧
nitáakit**w**anistawa
nit–aak–it–[an–ist–a]–Ø–wa
1–FUT–TIME–[tell–*v*–3OBJ]–IND–3
'that's when I will tell him'

(256) SHORT VOWEL AFTER [k]

a. ⟦ni.tâː.ki.ta.ni.^{s}ta.wḁ⟧
nitáakssokanistawa
nit–aak–sok–[an–ist–a]–Ø–wa
1–FUT–good–[tell–*v*–3OBJ]–IND–3
'I will speak well to him'

b. * ⟦ni.tâː.ks̩.so.k**w**a.ni.^{s}ta.wḁ⟧
nitáakssok**w**anistawa
nit–aak–sok–[an–ist–a]–Ø–wa
1–FUT–good–[tell–*v*–3OBJ]–IND–3
'I will speak well to him'

Finally, after a vowel the [w]-initial realization only occurs after [a], (257), and [o], (258). After an [i] there is no [w] at all, and in fact the [i] becomes a glide. Therefore, [w] is only epenthesized after certain vowels.

(257) [w] OCCURS AFTER [a]

a. * ⟦i.ts̩ː.t͡sáː.ni.^{s}t͡sí̥.s⟧
itsstsáánistsisa
itsstsaa–[aan–ist–:s]–Ø
callous–[tell–*v*–2SG:3.IMP]–CMD
'be blunt, callous with her!'

b. ⟦i.ts̩ː.t͡sáː.**w**aː.ni.^{s}t͡sí̥.s⟧
itsstsáá**w**aanistsisa
itsstsaa–[aan–ist–:s]–Ø
callous–[tell–*v*–2SG:3.IMP]–CMD
'be blunt, callous with her!'

(258) [w] OCCURS AFTER [o]

a. * ⟦iʔ.kj**áː**.ni.^{s}ta.wḁ⟧
ii'kiáánistawa
ii\o'ko–[aan–ist–a]–Ø–wa
IC\all.at.once–[tell–*v*–3OBJ]–IND–3
'everyone told him'

b. ⟦iʔ.kjo.**w**áː.ni.^{s}ta.wḁ⟧
ii'kio**w**áánistawa
ii\o'ko–[aan–ist–a]–Ø–wa
IC\all.at.once–[tell–*v*–3OBJ]–IND–3
'everyone told him'

(259) NO [w] AFTER [i]

a. ⟦âː.ko.ka.kjaː.ni.ˢt͡siː.wa.ji̥⟧
áakokakiaanistsiiwáyi
aak–okaki–[aan–ist–ii]–Ø–w=ayi
FUT–wise–[tell–*v*–3SUB]–IND–3=OBV.SG
'he will advise him'

b. * ⟦âː.ko.ka.ki.**w**aː.ni.ˢt͡siː.wa.ji̥⟧
áakokaki**w**aanistsiiwáyi
aak–okaki–[aan–ist–ii]–Ø–w=ayi
FUT–wise–[tell–*v*–3SUB]–IND–3=OBV.SG
'he will advise him'

As the examples above demonstrate, the contexts where [w] is epenthesized are quite narrow. In particular, the fact that [w] does not occur after [i] is another argument that the [w] is not underlying. There is no obvious reason why [w] would be deleted in such contexts, because [iw] sequences are either tolerated or resolved in a different way elsewhere in the word. A glide [w] is tolerated after [i] when the glide forms the onset to a DP enclitic, (260).

(260) ⟦máː.t͡sɪk.ka.kș.s**i.w**aː.t͡si.k͡si̥⟧
máátsikkakss**iw**aatsiksi
maat–[ikkak–ss**i**]–Ø–**w**=aatsiksi
NEG–[short–AI]–IND–3=NONAFF.3SG
'he was not short'

Elsewhere in the word, some speakers tolerate an [iw] sequence while others have [ow]. For example, the prefix *ksiw-* 'at ground level' ends in an [iw] sequence. Morpheme-final glides are predictably realized as [j] before an [i] and as [w] elsewhere. Before the vowel [a], (261), some speakers tolerate the [iw] sequence, while others round the vowel to [o]. The glide [w] does not delete for either pronunciation.

(261) % ⟦k͡s**i.w**á.wá.kaː.si.wḁ]⟧ ∼ % ⟦k͡s**o.w**á.wá.kaː.si.wḁ⟧
ks**iw**áwákaasiwa
ks**iw**–[awa–ka–asi]–Ø–wa
ground.level–[meander–leg–AI]–IND–3
'spider' (lit. 'ground or low deer'

However, before the vowel [i], (262), the glide is realized as [j], and the preceding vowel remains [i] for all speakers.

(262) ⟦iː.k͡s**í.j**ç̩.pi.ji̥⟧
iiks**íy**ihpiyiwa
ii\iks**iw**–[ihpi–yi]–Ø–wa
IC\ground.level–[dance–AI]–IND–3
'he danced low'

These examples show that [w] is not typically deleted after an [i]. Therefore, an analysis that treats /w/ as part of the underlying form of *aan-* 'tell' must resort to ad-hoc deletion after [i] for examples like (259). An epenthesis analysis is more parsimonious than treating the [w] as underlying.

Under this analysis, [w]-epenthesis emerges as one of several competing strategies to resolve vowel hiatus. Specifically, [w]-epenthesis only occurs to form an onset before a vowel which is [-high] and parsed to a heavy syllable. Glide epenthesis competes with glide formation (of a high front vowel [i]) to resolve hiatus. The preferred strategy after an [a] or [o] is [w]-epenthesis, but the preferred strategy after an [i] is glide formation. Those strategies are summarized in Table 3.20. In this table, if V2 is long, then the final resulting vowel will be long. If V2 is in a closed syllable or part of an [aj] diphthong, V2 will be short.

Table 3.20: Vowel hiatus resolution strategies: V_2 is [-high] and parsed to a heavy syllable

V1	+ V2			
	a	ɛ	ɔ	
a	awa	awɛ	awɔ	([w]-epenthesis)
o	owa	owɛ	owɔ	([w]-epenthesis)
i	ja	jɛ	jɔ	(glide formation)

Because [w] at the left edge of a root is always epenthetic, these roots unfortunately give no evidence in support of a constraint against glides at the left edge of the PPh. In the next section I turn to roots which have a [j]-initial allomorph, and show that these roots do provide support for a constraint against glides at the left edge of the PPh.

3.2.1.2.2 Some roots begin in /j/

In this section I argue that some roots begin with an underlying /j/, and that these roots support a constraint against glides in PPh-initial position. These roots begin in a vowel at the left edge of the PPh, but a [j] in PPh-medial position. In other words, they exhibit a Ø ∼ [j] alternation at the left edge. There are co-occurrence restrictions between the [j] and the following segments: either the [j] occurs before a long vowel, or it occurs before a vowel in a closed syllable. I discuss each case in turn.

Some roots begin in long [iː], [oː], or [aː] in PPh-initial position, but [jiː], [joː], and [jaː] in PPh-medial position after a vowel, (263)–(104). No roots with a Ø ∼ [j] alternation begin with [ɛː] or [ɔː] at the left edge of the PPh. As I discuss in Appendix A.2.3, these two vowels are less common than the other long vowels in morpheme-internal position. For each example below, (a) shows the root in PPh-initial position (e.g. in the imperative) and (b) shows the root in a PPh-medial position after a vowel.

(263) a. PPH-INITIAL

⟦iː.pí.ˢto.t͡si.t⟧
iipístotsit
[**y**iip–istot/Ø–i]–t–Ø
[decrease–CAUS/*v*–TI1]–2SG.IMP–CMD

‘decrease the volume of it (e.g. of your load of ironing)!’

b. PPH-MEDIAL

⟦ni.tá.**j**iː.pi.ˢto.t͡siːʔ.pḁ⟧
nitá**y**iipistotsii’pa
nit–a–[**y**iip–istot/Ø–i]–hp–a
1–IPFV–[decrease–CAUS/*v*–TI1]–IND–3

‘I am decreasing the amount’

(264) a. ⟦iː.ˢt͡si.pʊ́m.ma.toː.t⟧
iistsipómmatoot
yiist–[ipomm–at–oo]–t–Ø
on.back–[transfer–*v*–TI2]–2SG.IMP–CMD

‘unload it from your back!’

b. ⟦niː.táʔ.pa.**j**iː.ˢt͡si.pʊm.ma.toː.mḁ⟧
niitá’pa**y**iistsipommatooma
niita’p–a–**y**iist–[ipomm–at–oo]–m–a
really–IPFV–on.back–[transfer–*v*–TI2]–IND–3

‘he started to take it off his back/body’

(265) a. ⟦iː.ˢtó.ms̩ː.koxʷ.si.t⟧
iistómsskoohsit
[**y**iistom–ssk/o–ohs/i]–t–Ø
[body–by.body/*v*–REFL/AI]–2SG.IMP–CMD

‘exercise!’

b. ⟦á.**j**iː.ˢto.ms̩ː.koxʷ.si.wḁ⟧
á**y**iistomsskoohsiwa
a–[**y**iistom–ssk/o–ohs/i]–Ø–wa
IPFV–[body–by.body/*v*–REFL/AI]–IND–3

‘she is exercising’

(266) a. ⟦iː.t͡si.max.kaː.t⟧
iitsimaahkaat
[[**y**iit–im–aa]–hk/aa]–t–Ø
[[storage–*v*–AI]]–GET/AI]–2SG.IMP–CMD

‘store food for the winter!’

b. ⟦iː.tá.**j**iː.t͡si.max.kɔʔ.pi̥⟧
iitá**y**iitsimaahkao’pi
ii\it–a–[[[**y**iit–im–aa]–hk/aa]–o’p–i
IC\LOC–IPFV–[[[storage–*v*–AI]]–GET/AI]–21.IND–IN.SG

‘August (lit. when we prepare food for storage)’

(267) a. ⟦ôː.mi.t⟧
óomit
[**y**oom–i]–t–Ø
[husband–AI]–2SG.IMP–CMD

‘marry!’

b. ⟦á.kaː.**j**ôː.mi.wḁ⟧
ákaa**y**óomiwa
akaa–[**y**oom–i]–Ø–wa
PRF–[husband–AI]–IND–3

‘she’s married’

(268) a. ⟦aː.mo.jîː.ʔ.po.ji.t⟧
aamoyíi'poyit
[**y**aam–oyi–i'po/yi]–t–Ø
[twisted–mouth–speak/AI]–2SG.IMP–CMD
'joke/jest from a twisted mouth!'

b. ⟦á.**j**aː.mo.jîː.ʔ.po.ji.wḁ⟧
á**y**aamoyíi'poyiwa
a–[**y**aam–oyi–i'po/yi]–Ø–wa
IPFV–[twisted–mouth–speak/AI]–IND–3
'he is joking'

(269) a. ⟦aː.tóː.t⟧
aatóót
[**y**aat–oo]–t–Ø
[growl–AI]–2SG.IMP–CMD
'howl (as a dog)!'

b. ⟦á.**j**aː.ts̩ː.ki.naː.wḁ⟧
á**y**aatsskinaawa
a–[**y**aat–sskin–aa]–Ø–wa
IPFV–[growl–throat–AI]–IND–3
'she is growling'

The pattern of alternation for each of these roots is summarized below. Each root begins with a long vowel in PPh-initial position, but with a [j] after a vowel.

(270) ROOTS WITH INITIAL [j] BEFORE LONG VOWELS

	PPh-initial		*PPh-medial*	
a.	⟦iːp-⟧	∼	⟦**j**iːp-⟧	'decrease'
	⟦iːˢt-⟧	∼	⟦**j**iːˢt-⟧	'on back'
	⟦iːˢtom-⟧	∼	⟦**j**iːˢtom-⟧	'body'
	⟦iːt-⟧	∼	⟦**j**iːt-⟧	'food storage'
b.	⟦oːm-⟧	∼	⟦**j**oːm-⟧	'husband'
c.	⟦aːm-⟧	∼	⟦**j**aːm-⟧	'twisted'
	⟦aːt-⟧	∼	⟦**j**aːt-⟧	'howl'
d.	*⟦ɛː...⟧	∼	⟦**j**ɛː...⟧	
e.	*⟦ɔː...⟧	∼	⟦**j**ɔː...⟧	

The roots in (270) are logically compatible with either an epenthesis or deletion analysis. However, when other patterns of root alternation are taken into consideration, the deletion analysis must be correct. In the previous section, I discussed another set of roots which begin with long vowels in PPh-initial position but which do not begin with [j] in PPh-medial position. Those alternations are repeated in (271) below for comparison.

(271) ROOTS WITH INITIAL LONG VOWELS

	PPh-initial		*PPh-medial*	
a.	⟦iːtʂ̩ːk-⟧	∼	⟦iːtʂ̩ːk-⟧	'scuffle'
b.	⟦oːk-⟧	∼	⟦oːk-⟧	'bead'
c.	⟦aːk-⟧	∼	⟦waːk-⟧	'argue'
d.	⟦ɛːˢt-⟧	∼	⟦wɛːˢt-⟧	'towards'
e.	⟦ɔːni-⟧	∼	⟦wɔːni-⟧	'pierce'

The two classes of roots must differ in some manner. If the roots with a Ø ∼ [j] alternation pattern were vowel-initial with an epenthetic [j] between vowels, then it is impossible to explain why the roots that begin with [iː] and [oː] in (271) *fail* to epenthesize [j] after a vowel. An epenthesis analysis also does not explain the gap in (271). If these roots begin with long vowels underlyingly, then why do roots only begin with three of the five contrastive long vowels? Additionally, I argued in Section 3.2.1.3.2 on independent grounds that the roots in (271) begin with long vowels, which means that the roots in (270) must differ minimally. For all these reasons, a deletion analysis is more parsimonious. I assume that all roots with a Ø ∼ [j] alternation begin with underlying glides. The underlying forms for the roots above are given in (272).

(272) ROOTS WITH INITIAL /j/ BEFORE LONG VOWELS

a.	/jiːp-/	'decrease'
	/jiːˢt-/	'on back'
	/jiːˢtom-/	'body'
	/jiːt-/	'food storage'
b.	/joːm-/	'husband'
c.	/jaːm-/	'twisted'
	/jaːt-/	'howl'
d.	*/jɛː.../	
e.	*/jɔː.../	

Some roots with an Ø ∼ [j] alternation begin with an initial closed syllable. Again, these roots begin with only three vowel qualities ([i], [o], or [a]) in PPh-initial position. For each example below, (a) shows the root in PPh-initial position (e.g. in the imperative) and (b) shows the root in a PPh-medial position after a vowel. Unfortunately I cannot include as many examples as above, because not as many of these entries include an example of the root after a vowel.

(273) a. PPH-INITIAL

⟦ɪs.t͡síː.ji.t⟧
isstsííyit
[**y**isst–iiyi]–t–Ø
[listen–AI]–2SG.IMP–CMD
'listen!'

b. PPH-MEDIAL

⟦á.**j**ɪs.t͡siː.ji.wḁ⟧
á**y**isstsiiyiwa
a–[**y**isst–iiyi]–Ø–wa
IPFV–[listen–AI]–IND–3
'she is listening'

(274) a. ⟦oʔ.káː.t⟧
o'káát
[**y**o'k–aa]–t–Ø
[sleep–AI]–2SG.IMP–CMD
'sleep!'

b. ⟦á.**j**oʔ.kaːwḁ⟧
á**y**o'kaawa
a–[**y**o'k–aa]–Ø–wa
IPFV–[sleep–AI]–IND–3
'she is sleeping'

(275) a. ⟦óxʷ.ka.nín.ni.t⟧
óóhkanínnit
[**y**oohk–an–inn–i]–t–Ø
[shut–SHEET–by.hand.*v*–TI1]–2SG.IMP–CMD
'shut it! (e.g. a window)'

b. ⟦á.kaː.**j**óxʷ.ka.nɪn.ni.mḁ⟧
ákaa**y**óóhkaninnima
akaa–[**y**oohk–an–inn–i]–m–a
PRF–[shut–SHEET–by.hand.*v*–TI1]–IND–3
'he has shut it'

(276) a. ⟦áx.síʔ.ta.ki.t⟧
ááhsí'takit
[**y**aahs–i't–aki]–t–Ø
[pleased–by.mind.*v*–AI]–2SG.IMP–CMD
'agree!'

b. ⟦iː.ká.**j**ax.siʔ.t͡si.mḁ
iiká**y**aahsi'tsima
ii\ik–a–[**y**aahs–i't–i]–m–a
IC\DEG–IPFV–[pleased–by.mind.*v*–TI1]–IND–3
sa.jíp.po.maʔ.piː.ˢt͡si̥s⟧
sayíppoma'piistsi
[saw–[ippom–a'p/ii]–Ø]–istsi
[NEG–[adequate–be/II]–IND]–IN.PL
'he likes things which are not acceptable (e.g. squabbles)'

The pattern of alternation for each of these roots is summarized below. Each root begins with a vowel in PPh-initial position, but with a [j] after a vowel.

(277) ROOTS WITH INITIAL [j] BEFORE CLOSED SYLLABLES

	PPh-initial		*PPh-medial*	
a.	⟦ɪst-⟧	∼	⟦**j**ɪst-⟧	'listen'
b.	⟦oʔk-⟧	∼	⟦**j**oʔk-⟧	'sleep'
	⟦oxʷk-⟧	∼	⟦**j**oxʷk-⟧	'shut'
c.	⟦axs-⟧	∼	⟦**j**axs-⟧	'pleased'
d.	*⟦ɛʔ...⟧	∼	⟦**j**ɛʔ...⟧	
e.	*⟦ɔxʷ...⟧	∼	⟦**j**ɔxʷ...⟧	

Again, the roots in (277) are logically compatible with either an epenthesis or deletion analysis. However, the deletion analysis must be correct. The vowel-initial roots I discussed in the previous section which begin with a heavy syllable are shown again in (278) below for comparison.

(278) ROOTS WITH INITIAL VOWELS BEFORE CLOSED SYLLABLES

	PPh-initial		*PPh-medial*	
a.	⟦ɪsp-⟧	∼	⟦ɪsp-⟧	'high'
b.	⟦oʔt-⟧	∼	⟦oʔt-⟧	'here'
	⟦oxʷkʂ̩ːk-⟧	∼	⟦oxʷkʂ̩ːk-⟧	'hang meat to dry'
c.	⟦axt-⟧	∼	⟦waxt-⟧	'extinguish'
d.	⟦ɛʔp-⟧	∼	⟦wɛʔp-⟧	'haul'
e.	⟦ɔxʷ-⟧	∼	⟦wɔxʷ-⟧	'cave'

The same arguments hold as before, which is that the two sets of roots must differ in their underlying forms because they exhibit different patterns of alternation. Since the roots in (278) begin with a vowel, the roots in (277) must begin with a /j/.

To summarize the restrictions on /j/-initial glides: the first syllable of these roots is always heavy (e.g. it contains a long vowel or it is closed). There are also co-occurrence restrictions between root-initial /j/ and a following vowel. These are summarized in Table 3.21 and compared against the vowel-initial roots that I established in the previous section. Roots that begin in a vowel with an initial heavy syllable can begin with any one of the five contrastive long vowel qualities. However, roots that begin with /j/ are only ever followed by /i/, /o/, or /a/.

The initial /j/ of all the roots in this section never surfaces in PPh-initial position. This means that the group of roots with Ø ∼ [j] alternations provides support for a synchronic constraint in the grammar

Table 3.21: Co-occurrence restrictions between root-initial /j/ and a following vowel; first syllable must be heavy

Onset	[i]	[o]	[ɛ]	[ɔ]	[a]	
Ø	✓	✓	✓	✓	✓	(vowel-initial)
[j]	✓	✓	✘	✘	✓	

prohibiting PPh-initial glides. Before I present an analysis in Section 3.2.1.3.2, I discuss a few other phonologically unpredictable root alternations with [j].

3.2.1.2.3 Other patterns with [j]-initial allomorphs

There are other roots which have a [j]-initial allomorph after vowels, but which do not exhibit deletion at the left edge. One group of roots has a nasal [n] or [m] in PPh-initial position and a [j] after vowels, (279)–(281). This group of roots is irregular and differs from other nasal-initial roots which do not alternate with [j].

(279) a. PPh-initial

⟦**m**âː.kx̩ʷ.toː.t⟧
máakohtoot
[**m**aak–oht–oo]–t–Ø
[arrange–put.*v*–TI2]–2SG.IMP–CMD
'arrange it (e.g. the contents of a letter)!'

b. PPh-medial

⟦á.**j**âː.kx̩ʷ.toː.mḁ⟧
á**y**áakohtooma
a–[**y**aak–oht–oo]–m–a
IPFV–[arrange–put.*v*–TI2]–IND–3
'she is arranging it'

(280) a. ⟦**m**íː.ˢta.poː.t⟧
míístapoot
[**m**iistap–oo]–t–Ø
[away–go.AI]–2SG.IMP–CMD
'go away!'

b. [á.**j**íː.ˢta.poː]
á**y**iistapoowa
a–[**y**iistap–oo]–Ø–wa
IPFV–[away–go.AI]–IND–3
'she is going away' (BB)

(281) a. ⟦**n**aː.mi.tá.piː.wḁ⟧
náámitapiiwa
[**n**aam–itap/ii]–Ø–wa
[alone–person/AI]–IND–3
'he is on his own'

b. ⟦á.kaː.**j**âː.mi.tá.piː.wḁ⟧
ákaa**j**áamitapiiwa
akaa–[**j**aam–itap/ii]–Ø–wa
PRF–[alone–person/AI]–IND–3
'he is completely on his own'

(282) a. ⟦**n**iː.pó.wḁ⟧
niipówa
[**n**iip–o]–Ø–wa
[leaf–II]–IND–3
'it was summer'

b. ⟦á.kaː.**j**iː.po.wḁ⟧
ákaa**j**iipowa
akaa–[**j**iip–o]–Ø–wa
PRF–[leaf–II]–IND–3
'it has become summer'

A second group of roots has [i] before the glide in PPh-initial position, but no [i] in PPh-medial position, (283)–(111). It is possible that these roots begin with an underlying /i/, but if so, they do not exhibit the normal pattern of vowel coalescence after [a].

(283) a. PPH-INITIAL
⟦i**j**âːpit⟧
i**y**áapit
[i**y**aap–i]–t–Ø
[see–AI]–2SG.IMP–CMD
'see!'

b. PPH-MEDIAL
[içkanáː**j**âːpiːja]
iihkanáá**y**aapiiya
ii\ohkana–[**y**aap–i]–Ø–yi=aawa
IC\all–[see–AI]–IND–3PL=PRX.PL
'they all saw eagles' (BB)

(284) a. ⟦i**j**íːˢt͡sinit⟧
i**y**íístsinit
[i**y**iist–in/i–Ø]–t–Ø
[cut–by.blade/*v*–TI3]–2SG.IMP–CMD
'cut it!'

b. ⟦nitá**j**iːˢt͡siniːʔpḁ⟧
nitá**y**iistsinii'pa
nit–a–[**y**iist–in/i–Ø]–hp–a
1–IPFV–[cut–by.blade/*v*–TI3]–IND–3
'I am cutting it'

(285) a. ⟦i**j**ít͡sɪt͡ːsimaːt⟧
iyítsittsimaat
[[**y**iit–itt–i]–m–aa]–t–Ø
[[storage–by.blade.*v*–TI1]–*v*–AI]–2SG.IMP–CMD
'cut meat!' (to dry for storage)

b. ⟦á**j**iːt͡sɪt͡ːsimaːwḁ⟧
á**y**iitsittsimaawa
a–[[**y**iit–itt–i]–m–aa]–Ø–wa
IPFV–[storage–by.blade.*v*–TI1]–*v*–AI]–IND–3
'he slices meat'

Both patterns of alternation are phonologically irregular in the sense that neither allomorph can be straightforwardly derived from the other. The patterns partially overlap the Ø ∼ [j] pattern of alternation. It would not be surprising then if speakers reanalyzed the roots into the more regular Ø ∼ [j] pattern. Indeed, some words have multiple attested strategies within Frantz and Russell (2017), suggesting that this area of the grammar is undergoing restructuring. The examples in (286) and (287) either have an imperative that begins with a nasal or not. This suggests that some speakers have [m] ∼ [j] alternations for these roots, while others have reanalyzed these as Ø ∼ [j]; that is, as the regular /j/-initial roots.

(286) ⟦(**m**)âː.k͡si.ni.t͡si.s⟧
(**m**)áaksinitsis
[**m**aak–in/it–:s]–Ø
[arrange–by.blade/*v*–2SG:3.IMP]–CMD
'cut it to size!'

(287) ⟦(**n**)áː.ps̩.t͡saː.ki.t⟧
(**n**)áápstsaakit
[**n**aap–st?/i–aki]–t–Ø
[see–close?/*v*–AI]–2SG.IMP–CMD
'close your eyes!' (cf. (283))

The examples in (288) and (289) either have an imperative that begins with [ij] or not. This suggests that some speakers have [ij] ∼ [j] alternations for these roots, while others have reanalyzed these as regular /j/-initial roots.

(288) ⟦(**i.j**)ís.sá.aː.t͡si.s⟧
(**iy**)íssáaatsis
[[**y**iss–oo]–at–:s]–Ø
[[forward–go.AI]–*v*–2SG:3.IMP]–CMD
'go in front of him!'

(289) ⟦(**i.j**)óx^{w}.koː.s⟧
(**iy**)óóhkoos
[**y**oohk–o–:s]–Ø
[wait–*v*–2SG:3.IMP]–CMD
'wait for her!'

To summarize, there are at least three classes of roots which have a [j]-initial allomorph in PPh-medial position: (a) some exhibit truncation (e.g. deletion of the [j]), (b) some substitute a nasal [n] or [m], and (c) some exhibit an accretion (e.g. epenthesis of a vowel [i]). These are summarized in (290).

(290)

	PPh-initial	*After vowels*	*Description*
a.	Ø	j	(truncation in PPh-initial position)
b.	{n, m}	j	(nasal substitution in PPh-initial position)
c.	ij	j	(accretion in PPh-initial postion)

I have argued that the first class of roots begin in /j/, while the other two are lexically-specified exceptions. Still, these patterns of alternation indirectly support a constraint against glides at the left edge of the PPh, because they represent a conspiracy of alternation patterns which together serve to avoid glides at the left edge of the PPh. I return to this idea in Section 4.2.2, where I argue that lexically listed allomorphs are phonologically optimizing in Blackfoot.

3.2.1.3 Analysis

I now present an analysis of the data from the preceding sections. In Section 3.2.1.3.1 I analyze the pattern of [w]-epenthesis and coalescence at the left edge of stems which begin with long vowels and diphthongs (described in Section 3.2.1.2.1). Then in Section 3.2.1.3.2 I analysis the pattern of [j]-deletion at the left edge of the PPh (discussed in Section 3.2.1.3.2). Glide deletion provides evidence for the left edge of the PPh as distinct from the left edge of the PWd or any smaller constituent.

3.2.1.3.1 [w]-epenthesis and coalescence within the PPh

As shown in Section 3.2.1.2.1, stems can begin in any one of the five contrastive long vowels /iː oː ɛː ɔː aː/, the three short vowels /i o a/, or in a heavy diphthong /ai/. Vowel hiatus is resolved by coalescence, diphthong preservation, and glide-epenthesis. In this section, I show that a single constraint ranking generates all three processes. The following constraints are relevant for the following analysis.

(291) *HIATUS

Abbreviation: *HIAT

*σ σ
| |
μ μ
| |
V V

(Orie and Pulleyblank 2002)

(292) *DIPHTHONG

Abbreviation: *DIPH

(Rosenthall 1997: 142)

* σ
/ \
μ μ
| |
V_i V_j where $i \neq j$

(293) UNIFORMITY

Abbreviation: UNIF

No element of the output has multiple correspondents in the input.

If S_1 is the input and S_2 is the output: for $x, y \in S_1$ and $z \in S_2$, if $x\mathfrak{R}z$ and $y\mathfrak{R}z$, then $x = y$.

(McCarthy and Prince 1995)

Some of the optimal candidates I propose below include [-high, -low] glides (e.g. mid vowels parsed to a syllable node as an onset), but no optimal candidates include [-high, +low] glides (e.g. low vowels parsed to a syllable node as an onset). Non-high glides are marked cross-linguistically: many languages prohibit them outright; some languages create high glides from non-moraic vowels (Baković 2006); in others, other segments substitute for non-high glides, such as [ʔ] for /a/ in Ilokano (Rosenthall 1994). I conceive of the constraints against non-high glides as a family of Stringent Markedness constraints, (294)–(296). These prohibit classes of vowels which are ordered in terms of a subset relation to each other.[31]

(294) *[ă]

Assign a violation mark for every [-cons, +low] segment which is immediately dominated by a syllable. (“Assign a violation mark for every low glide.”)

e.g. * $\begin{array}{c}\sigma\\ |\\ \begin{bmatrix}\text{-cons}\\ \text{+low}\end{bmatrix}\end{array}$

(295) *[ɛ̆, ɔ̆, ă]

Assign a violation mark for every [-cons, -high] segment which is immediately dominated by a syllable. (“Assign a violation mark for every low or mid glide.”)

e.g. * $\begin{array}{c}\sigma\\ |\\ \begin{bmatrix}\text{-cons}\\ \text{-high}\end{bmatrix}\end{array}$

[31] Stringent markedness constraints have the advantage of duplicating sonority hierarchies without stipulating a universal sub-ranking; see de Lacy 2002, 2006. These constraints are essentially the *non-HD/X family of constraints from de Lacy (2002), which were originally developed to account for sonority-driven stress (de Lacy 2002). However, my definitions do not rely on a definition of ‘headedness’ and are defined solely in terms of prosodic categories and dominance relations.

(296) *G

Assign a violation mark for every [-cons] segment which is immediately dominated by a syllable. ("Assign a violation mark for every low, mid, or high glide.")

e.g. * σ
|
[-cons]

The ranking in (297) ensures that coalescence is the least marked strategy to resolve vowel hiatus. If coalescence does not avoid hiatus contexts, then diphthongs are preserved. If coalescence would cause deletion of an underlying mora, and parsing a vowel to the following syllable as an onset would violate *[ă], then [w]-epenthesis is the best strategy.

(297) {*Hiat, Max(μ), *[ă]} ≫ Dep ≫ *[ɛ̆, ɔ̆, ă] ≫ {*Diph, *G} ≫ {Unif, *Vː}

Consider the different resolutions of an underlying diphthong /ai/ and derived /a+i/ sequences across a morpheme boundary. Underlying heavy diphthongs are maintained on the surface, (298). This is surprising because when an /a+i/ sequence arises across a morpheme boundary, it coalesces to long [ɛː], (299). The difference between the two is the following phonological environment: /ai/ in (298) occurs before a vowel, while /ai/ → [ɛː] occurs before a consonant. I use this fact in the analysis below.

(298) Underlying /ai/ diphthong

⟦**ai**.já.kiː.toː.k⟧
ayákiitooka
[ayakiit–oo]–k–Ø
[halve–go.ai]–2pl.imp–imp
'separate!' (=236a)

(299) Derived /ai/→[ɛː] sequence

⟦i.mi.t**ɛ́**ː.ko.wʌ.n⟧
imit**áí**koana
[[imit**aa**]–**i**koan]]–a
[[dog]–young.being]–prx
'puppy'

The tableau below shows how an /ai/ sequence before a consonant is resolved via coalescence. To save space, I have given schematic inputs and outputs in the following tableaux. The final C of each output candidate represents an onset before a vowel in PPh-medial position or in a PPh-final degenerate syllable. A faithful candidate would either violate *Hiatus (candidate (a)) or *Diphthong (candidate (c)). The optimal candidate violates Uniformity, which is ranked low. (In all tableaux, [i] represents a high, front vocoid parsed to a mora and [j] represents a non-moraic high, front vocoid parsed to a syllable.)

(300)

/Ca+iC/	*HIAT	MAX(μ)	DEP	*DIPH	UNIF	*Vː
a. Ca.i.C	∗!					
b. Ca.C		∗!				
c. Ca.ji.C			∗!			
d. Cai.C				∗!		
☞ e. Cɛː.C					∗	∗

Crucial rankings: {*HIAT, MAX-IO(μ), DEP-IO(Seg), *DIPH} ≫ {UNIF, *Vː}

If /ai/ occurs before a vowel, then violations of UNIFORMITY do not avoid violations of *HIATUS (candidate (b) below). Instead, the optimal candidate (d) violates *DIPHTHONG, allowing a diphthong to surface and the [i] to be parsed as the onset to the following syllable. Candidate (c) is harmonically bound by (d) because it contains a diphthong (which violates *DIPHTHONG), but also violates DEP-IO because the onset to the next syllable does not have a correspondent in the input.[32]

(301)

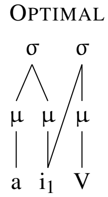
/Cai$_1$a/	*HIAT	MAX(μ)	DEP	*DIPH	UNIF	*Vː
a. Cai.a	∗!			∗		
b. Cɛː.a	∗!				∗	∗
c. Cai$_1$.j$_2$a			∗!	∗		
☞ d. Cai.ja				∗		
e. Ca.j$_1$a		∗!				

Crucial rankings: {*HIAT, MAX-IO(μ), DEPSeg} ≫ *DIPH

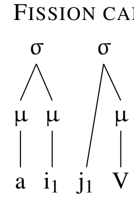
Now consider the different vowel hiatus resolution strategies when V2 is long. When V2 is [-high] and V1 is not [i], then [w] is epenthesized between the two vowels. To see this, consider the tableaux

[32] Anne-Michelle Tessier points out that there is another candidate which is similar to the optimal candidate (d) but which arises via fission. Instead of a single segment being parsed ambisyllabically, (1), this candidate would involve two high, front vocoids (one parsed to a mora, and one parsed to a syllable onset) which are both in correspondence with the input /i$_1$/, (2). This candidate is harmonically bound by the optimal candidate, because it violates *DIPHTHONG as well as INTEGRITY (McCarthy and Prince 1995).

(i) OPTIMAL CANDIDATE (d)



(ii) FISSION CANDIDATE (NOT SHOWN IN TABLEAU)



below, where V1 = [a] and V2 = [aː]. Vowel hiatus is resolved via diphthongization in candidate (b) and coalescence in candidate (d). Both strategies involve deletion of a mora, violating MAX-IO(μ). To generate [w]-epenthesis, MAX-IO(μ) must be ranked higher than DEP-IO. In other words, epenthesis before long vowels avoids violations of MAX-IO(μ).

(302)

/Ca+aːC/	*HIAT	MAX(μ)	DEP	*DIPH	UNIF	*Vː
a. Ca.aː.C	*!					*
b. Caa.C		*		*!		
☞ c. Ca.waː.C			*			*
d. Caː.C		*			*	*

Crucial rankings: {*HIAT, MAX-IO(μ)} ≫ DEP-IO(Seg)

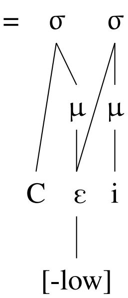
This ranking means that epenthesis is the optimal strategy for all combinations of vowels when V2 is long. That means that this ranking chooses an incorrect optimal output when V2 is [+high], as shown in (303). The actual output is something closer to candidate (b), which I have marked with a ☹ symbol.

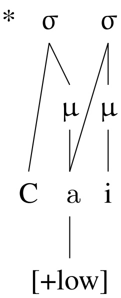
(303)

/Ca+iːC/	*HIAT	MAX(μ)	DEP	*DIPH	UNIF	*Vː
a. Ca.iː.C	*!					*
☹ b. Cɛː.i.C	*!				*	*
☞ c. Ca.jiː.C			*			
d. Cai.C		*!		*!		
e. Cɛː.C		*!			*	*

In tableau (301) I showed that when coalescence fails to avoid violations of *HIATUS, then diphthongs are the most optimal choice. The actual output for an input like /Ca+iːC/ (e.g. candidate (b) above) clearly involves coalescence because the output vowel quality is intermediate between the two input vowel qualities, and yet this coalescence seems to cause violations of *HIATUS. If so, it seems odd that the optimal candidate would involve this strategy. I hypothesize that [-low] vowels can be parsed ambisyllabically as syllable onsets; that is, [-low] vowels can be parsed directly to a following syllable node but [+low] vowels cannot.[33] In other words, representations like (304) are tolerated in Blackfoot, while representations like (305) are not. (I use [V̆] to represent a non-moraic non-high vowel.)

[33]This solution was suggested to me by Doug Pulleyblank.

(304) [Cɛ.ɛ̆i] = 

(305) *[Ca.ăi] = * 

Now coalescence makes sense because it creates a syllable-final [-low] vowel which can be parsed as an onset to the next syllable, avoiding violations of *HIATUS. The tableau from (303) is repeated below with additional candidates; candidate (d) parses the [-low] vowel [ɛ] to the onset of a following syllable. This candidate is optimal, because it does not violate *HIATUS.

(306)

/Ca+iːC/	*HIAT	MAX(μ)	*[ă]	DEP	*[ɛ̆, ɔ̆, ă]	*DIPH	*G	UNIF	*Vː
a. Ca.iː.C	∗!								∗
b. Cɛː.i.C	∗!							∗	∗
c. Ca.ăiː.C			∗!		∗		∗		∗
☞ d. Cɛː.ɛ̆i.C					∗		∗	∗	∗
e. Ca.jiː.C				∗!			∗		
f. Cai.C		∗!				∗!			
g. Cɛː.C		∗!						∗	∗

Crucial rankings: {*[ă], DEP-IO(Seg)} ≫ {*[ɛ̆, ɔ̆, ă], *G}

For underlying diphthongs /ai/, the optimal candidate parses a high vowel ambisyllabically as an onset. This means that *[ɛ̆, ɔ̆, ă] dominates *DIPHTHONG.

(307)

/Cai$_1$a/	*HIAT	MAX(μ)	*[ă]	DEP	*[ɛ̆, ɔ̆, ă]	*DIPH	*G	UNIF	*Vː
a. Cɛː.a	∗!							∗	∗
b. Cɛː.ɛ̆a					∗!		∗	∗	∗
☞ c. Cai.ja						∗	∗		

Crucial rankings: {*[ɛ̆, ɔ̆, ă] ≫ *DIPH

As long as *[ă] dominates DEP, this ranking means that the optimal candidate will avoid violations of MAX-IO(μ) by epenthesizing [w] before a long vowel, (308), in a closed syllable, (309), or an underlying diphthong ,(310).

(308)

/Ca+aːC/	*HIAT	MAX(μ)	*[ă]	DEP	*[ɛ̆, ɔ̆, ă]	*DIPH	*G	UNIF	*Vː
a. Ca.aː.C	*!								*
b. Ca.ăaːC			*!		*		*		*
☞ c. Ca.waː.C				*			*		
d. Caa.C		*!				*!			
e. Caː.C		*!						*	*

Crucial rankings: *[ă] ≫ DEP-IO(Seg)

(309)

/Ca+aCC/	*HIAT	MAX(μ)	*[ă]	DEP	*[ɛ̆, ɔ̆, ă]	*DIPH	*G	UNIF	*Vː
a. Ca.aC.C	*!								
b. Ca.ăaC.C			*!						
c. CaC.C		*!						*	
d. CaC.C		*!							
☞ e. Ca.waC.C				*					

Crucial rankings: *[ă] ≫ DEP-IO(Seg)

(310)

/Ca+aiV/	*HIAT	MAX(μ)	*[ă]	DEP	*[ɛ̆, ɔ̆, ă]	*DIPH	*G	UNIF	*Vː
a. Ca.ai.V	*!*					*			
b. Ca.ăai.jV			*!			*			
c. Ca.ɛː.V	*!*							*	*
d. Ca.ăɛː.ɛ̆V			*!					*	*
e. Cai.jV		*!				*			
☞ f. Ca.wai$_1$.j$_1$V				*	*				

Crucial rankings: *[ă] ≫ DEP-IO(Seg)

Note that there is less data on what happens when a morpheme ending in [i] concatenates with another non-[i] vowel, but this ranking predicts that glide formation should be the preferred strategy. This is true, as I noted in Table 3.20.

To summarize, there are many roots which exhibit an alternation Ø ∼ [w] at the left edge. However, this alternation is compatible with an epenthesis analysis, as shown in this section. That means that these roots offer no support for a prohibition against glides at the left edge of the PPh. In the next section I turn to an analysis of [j]-initial roots.

3.2.1.3.2 Glide deletion at the left edge of the PPh

In this section I provide an analysis of glide deletion at the left edge of the PPh. A similar analysis is proposed in Elfner (2006b). There is a positional markedness constraint which prohibits glides, and only glides, at the left edge of the PPh. Glides differ from high vowels in that the latter are moraic (e.g. dominated by a mora) while the former are non-moraic (e.g. dominated immediately by a syllable node). Glides differ from other consonants in that glides are [-cons] whereas all other consonants are [+cons] (except for [ʔ], which is simply a [CG] feature in Blackfoot). Therefore, the positional markedness constraint in (311) refers specifically to [-cons] segments which are not dominated by a mora and which are leftmost within the PPh. The positional markedness constraint in (311) is a more specific version of a general markedness constraint against glides, which was defined in (296).

(311) *#G

Assign a violation mark for every [-cons] segment which is immediately dominated by a syllable and occurs leftmost within the PPh. (“Assign a violation mark for every glide which occurs leftmost within the PPh.”)

e.g. * $_{\text{PPh}}\left[\begin{array}{c}\sigma \\ | \\ \text{[-cons]}\end{array}\right.$

These markedness constraints have typological and perceptual motivation. Typologically, languages tend to prefer onsets with low sonority. For example, onset clusters simplify in Sanskrit reduplication by preserving the less sonorous member of a cluster; e.g. by preserving [p] and [t] over [r] in *__p__a-__pr__ach* and *a-__t__i-__tr__asam* (Gnanadesikan 2004; Kiparsky 1979; Steriade 1988; Whitney 1889). Onset clusters in children’s speech likewise tend to simplify to low-sonority segments (Gnanadesikan 2004; Goad and Rose 2004; Pater and Barlow 2003). Focusing on word-initial position, Flack (2007) includes a survey of other languages which ban high-sonority segments at the left edge of the word, even though those same high-sonority segments are allowed as word-medial onsets. The perceptual explanation for this is that low-sonority onsets are more prominent than high-sonority onsets, and that the optimal syllable type has a high contrast between a low-sonority onset and a high-sonority nucleus. These markedness constraints could be reformulated as a family of constraints which bans individual classes of sonority (see Smith 2002 for one such proposal). The simpler versions I give here are good enough for our purpose; all that is necessary is some constraint that references the PPh.

Underlying glides are tolerated in PPh-medial position but do not occur in PPh-initial position. An example would be the root *yaat-* ‘growl’ in (104), repeated in (312) for convenience.

(312) a. ⟦aː.tóː.t⟧
aatóót
[**y**aat–oo]–t–Ø
[growl–AI]–2SG.IMP–IMP
'howl (as a dog)!'

b. ⟦á.**j**aː.ts̩ː.ki.naː.wḁ⟧
á**y**aatsskinaawa
a–[**y**aat–sskin–aa]–Ø–wa
IPFV–[growl–throat–AI]–IND–2SG.IMP–CMD
'she is growling' (=104)

Since PPh-initial glides do not occur in outputs, the positional markedness constraint *#G must dominate MAX-IO(Seg). This is demonstrated in the tableau for the imperative [aːtóːt] 'howl!' in (313). Candidate (a) is faithful to the input, and incurs a violation of *#G. The optimal candidate (b) satisfies this constraint by incurring a violation of MAX-IO(Seg) (and ONSET, which plays little role here). This demonstrates that *#G dominates MAX-IO(Seg) and DEP-IO(Seg). However, recall that tableau (117) demonstrated that MAX-IO(Seg) crucially dominates DEP-IO(μ), and tableaux (127)–(130) demonstrated that MAX-IO(Seg) crucially dominates DEP-IO(Seg) in order to derive PPh-internal epenthesis. This means that the current ranking incorrectly chooses candidate (c), which satisfies *#G by incurring violations of DEP-IO(Seg) and DEP-IO(μ) (and ONSET).

(313)

/jaːt-oː-t/	*#G	MAX	DEP	DEP(μ)	*G	ONS
a. jaː.toː.t	*!				*	
☹ b. aː.toː.t		*!	*			*
☞ c. i.jaː.toː.t			*	*	*	*

From this I conclude that epenthesis at the left edge is penalized more strongly than epenthesis in PPh-medial position. The ANCHOR family of constraints (McCarthy 2003; McCarthy and Prince 1995) prohibit peripheral deletion and epenthesis and are construed as contextually restricted versions of MAX-IO and DEP-IO. The relevant constraint here is ANCHOR-L[OI], defined in (314), which prohibits epenthesis at the left edge of the PPh.

(314) ANCHOR-L[OI]
Abbreviation: ANCH-L
Any element at the left edge of a PPh in the output has a correspondent at the left edge of the input.

Ranking ANCHOR-L[OI] above MAX(Seg) generates the correct result.

(315)

/jaːt-oː-t/	*#G	ANCH-L	MAX	DEP	DEP(μ)	*G	ONS
a. jaː.toː.t	*!					*	
☞ b. aː.toː.t			*	*			*
c. i.jaː.toː.t		*!		*	*	*	*

Crucial rankings: {*#G, ANCHOR-L[OI]} ≫ MAX-IO(Seg)

PPh-medial glides are tolerated, which means that MAX-IO(Seg) must itself dominate the general markedness constraint *G. This is demonstrated in (316) for [ájaːtsːkinaːwḁ] 'she is growling', where the root *yaat-* occurs in PPh-medial position. The faithful candidate (a) violates the low-ranking constraint *G, but satisfies the high-ranking positional markedness constraint *#G. Candidate (b) has one fewer violation of *G than candidate (a), but it also incurs a violation of MAX-IO(Seg).[34] Because *G is ranked lower than MAX-IO(Seg), candidate (a) is optimal.

(316)

/a-jaːt-skin-aː-wa/	*#G	ANCH-L	MAX	DEP	DEP(μ)	*G	ONS
☞ a. á.jaː.tsːː.ki.naː.wḁ						**	**
b. á.aː.tsː.ki.naː.wḁ			*!			*	*

Crucial rankings: MAX-IO(Seg) ≫ {*G, ONSET}

The partial ranking {*#G, ANCHOR-L[OI]} ≫ MAX-IO(Seg) ≫ DEP-IO(Seg) ≫ {DEP-IO(μ), *G} results in positional neutralization at the left edge of the PPh. Roots that begin in underlying vowels and roots that begin with underlying /j/ will both have vowel-initial realizations at the left edge of the PPh.

To summarize this section, evidence from the distribution of glides as well as from root alternations support a constraint against glides that holds specifically at the left edge of the PPh. I have formulated this via a positional markedness constraint, *#G. Following Nespor and Vogel (2007), I take the fact that the constraint must refer to a PPh constituent as evidence for the PPh constituent itself. In the next section I discuss a second phonological property that also serves as evidence for a PPh constituent; namely, the location of primary stress.

[34]This candidate also incurs a violation of *HIATUS, which is not shown here because it is besides the point. No matter where *HIATUS is ranked, candidate (b) is suboptimal compared to candidate (a). The constraint *HIATUS is relevant for PPh-internal vowel hiatus sequences, which are not resolved via deletion (see Elfner 2006b). *HIATUS has also been argued to be the relevant for vowel hiatus resolution in other languages (see Orie and Pulleyblank 2002).

3.2.2 Primary stress

In the previous section I showed that there is an edge restriction at the left edge of the phonological phrase that does not hold of smaller units. In this section I argue that there is also a domain-span rule which takes the PPh as its domain, and not any smaller domain, such as the PWd. Together, these two phonological generalizations define the PPh as a distinct prosodic constituent.

In Section 3.2.2.1 I discuss the location of prominent syllables in Blackfoot, which are realized with a high pitch peak (see Section 2.3). In the default case, prominence falls on the second syllable if it is heavy and the third syllable otherwise. In Section 3.2.2.2 I summarize the generalizations and note that prominent syllables exhibit properties of metrical stress, such as obligatoriness, culminativity, weight-sensitivity, and orientation towards an edge (cf. Hayes 1995). I use this fact to argue that pitch peaks in Blackfoot are the instantiation of primary stress (similar analyses exist in Weber 2016a,b). This entails a separation between the analytical model which determines stress location and the phonetic interpretation of stress. Then in Section 3.2.2.3 I present an analysis of default prominence within the Optimality Theory framework (McCarthy and Prince 1993b; Prince and Smolensky 1993).

3.2.2.1 Data

This description focuses on the phonological characteristics of stress. (See Section 2.3 for a phonetic description.) Stress is affected by the morphological composition of the word (for example, see Dunham 2009; Stacy 2004; Weber and Allen 2012 for the interaction of stress and prefixes). In order to minimize morphological factors, I only consider words where the verb stem occurs at the left edge of the PPh. The stems are 'minimal' in the sense that they are the smallest grammatical unit which can take inflectional suffixes; they do not include any other modifier prefixes.

There are three syntactic conditions which allow a verb stem to occur at the left edge: (a) perfective verbs in the independent clause type with third person arguments (most other persons require proclitics, as I discussed in Section 3.1.1), (318), (b) imperatives, (317), and (c) event nominalizations, (319). Event nominalizations are derived from intransitive verbs via a suffix which is [-n] after [a], [-x^{w}sɪn] after [o], and [-ssɪn] after [i] (Bliss, Ritter and Wiltschko 2016; Frantz 2009).[35]

[35] There are a few exceptions to this generalization, where *-hsin* occurs after [a]. The stem *i'poyi-* 'speak' has a nominalization *i'pówahsin* 'language, talk, speech' instead of expected **i'póyissin*; the stem *ooyi-* 'eat' has *aoówahsin* 'food' instead of expected **aoóyissin*.

(317) Imperative
[iç.kíː.taː.t]
iihkíítaat
[iihki–it/aa]–t–Ø
[dry–by.heat/II]–IMP.2SG–IMP
'bake!' (BB)

(318) Independent
[iç.kíː.ta]
iihkíítaawa
[iihki–it/aa]–Ø–wa
[dry–by.heat/II]–IND–3
's/he baked.' (BB)

(319) Nominalization
[iç.kíː.taː.n]
iihkíítaan
[[iihki–it/aa]–n]
[[dry–by.heat/II]–NMLZ]
'(the) baking' (BB)

The data in this section are from original fieldwork by the author with the late Beatrice Bullshields (BB), a speaker of Káínai (Blood) dialect who was in her late 60s at the time. She was born in Alberta but lived in various places in North America as an adult, and in Vancouver for many years. Tokens were prompted by an English translation and elicited across several elicitation sessions to confirm that the location of accent was consistent. For most verb stems, I elicited at least two of the three types of words (independent, imperative, nominalization).

For this speaker, a glottal stop occurs between sonorants and syllabic fricatives, (320).[36] The vowel length before the sonorant is predictably short, which I take to mean that the glottal stop is parsed as the onset to the voiceless nucleus, while the sonorant is parsed to the coda of the preceding syllable. This means that the syllable preceding a devoiced vowel will always be heavy if the devoiced vowel is immediately preceded by a sonorant.

(320)	[i.k͡sím.**ʔ**s̩.ta]	*iksimsstaawa*	's/he thought'
	[in.**ʔ**ç̩.kí]	*inihkíwa*	's/he sang'
	[áw.**ʔ**x̩.ka]	*áwahkaawa*	's/he played'
	[i.sɪ.mím.**ʔ**x̩ʷ.ki]	*isimímmohkiwa*	's/he gossiped'

A stressed [o] is often high ([ú]) for Beatrice. Some short vowels are lax in open syllables, which I have transcribed. However, there is no contrast between tense and lax short vowels. Finally, vowel length at either edge of the word can be hard to distinguish. Word-finally, vowel length neutralizes to short *unless* that final syllable is stressed. If the final syllable is stressed, vowel length remains contrastive.

This speaker also has no auditory or articulatory reflexes of third person -*wa* on verbs or the proximate animate singular suffix -*wa* on nouns (Bliss and Gick 2009; Bliss and Glougie 2010). The speaker's intuition is that these forms do not include such a suffix at all. Despite this, Bliss and Glougie (2010) shows how final devoicing is blocked for this speaker on exactly those words that have a final -*wa* in other dialects. I include this suffix in the orthographic transcriptions to match the dictionary entries in Frantz and Russell (2017).

[36]This also occurs for other speakers. Frantz (1978: 309) notes that the glottal stop in [iˑyimˈsˑini] 'smiling' is predictable, and he does not mark it in the orthography.

3.2.2.1.1 Stress determined by syllable count and weight

PPhs are minimally bimoraic and bisyllabic; there are no lexical PPhs which have the shape CV or CVV or CVC. That means that the smallest PPhs consist of a heavy syllable followed by a degenerate syllable. (See Section 2.4.4 for degenerate syllables.) All minimal words have stress on the single full syllable, (321). In this and the following datasets, the rightmost column represents the stress pattern in the word; I have used H to represent a heavy syllable, L to represent a light syllable, and L̥ to represent a light syllable which contains a voiceless syllable nucleus. Degenerate syllables are not designated by any symbol, because they do not affect the location of stress.

(321) MONOSYLLABIC WORDS: STRESS FALLS ON SINGLE HEAVY SYLLABLE

‘enter!’	[píː.t]	*píít*	**H́**
‘it (anim.) is six’	[néː.j] ∼ [néː.i]	*nááiwa*	**H́**
‘it (inan.) is six’	[nɔ́ː.w] ∼ [nɔ́.o]	*nááowa*	**H́**

Disyllabic (with or without a final degenerate syllable) have stress on the second syllable, regardless of the weight of the two syllables.

(322) DISYLLABIC WORDS: STRESS FALLS ON SECOND SYLLABLE

a.	‘drink!’	[sɪ.mí.t]	*simít*	L **Ĺ**
b.	‘sit!’	[a.píː.t]	*apíít*	L **H́**
	‘say!’	[a.níː.t]	*aníít*	L **H́**
	‘rope!’	[o.káː.t]	*okáát*	L **H́**
	‘roping’	[o.káː.n]	*okáán*	L **H́**
	‘possession’	[i.náː.n]	*ináán*	L **H́**
	‘s/he entered’	[i.píː.m]	*ipííma*	L **H́**
c.	‘s/he ate’	[iː.jí]	*iiyíwa*	H **Ĺ**
	‘s/he barked’	[iç.kí]	*iihkíwa*	H **Ĺ**
	‘eat!’	[oː.jí.t]	*ooyít*	H **Ĺ**
	‘take it!’	[maʔ.t͡sí.t]	*ma’tsít*	H **Ĺ**
	‘bark!’	[oxʷ.kí.t]	*ohkít*	H **Ĺ**
d.	‘s/he roped’	[iː.káː]	*iikááwa*	H **H́**
	‘sleep!’	[oʔ.káː.t]	*o’káát*	H **H́**
	‘Sundance lodge’	[oː.káː.n]	*ookáán*	H **H́**

Longer words (with or without a final degenerate syllable) with a heavy second syllable have accent on the second syllable, regardless of whether the first syllable is light or heavy. The weight or number of following syllables does not affect this generalization.

(323) POLYSYLLABIC WORDS: STRESS FALLS ON A HEAVY SECOND SYLLABLE

a. LIGHT FIRST SYLLABLE

'speech, talk'	[a.nís.sɪ.n]	*aníssin*	L **H́** L
's/he danced'	[i.pʌ́s.ka]	*ipásskaawa*	L **H́** L
's/he chopped wood'	[i.kâʔ.kjaː.ki]	*iká'kiaakiwa*	L **H́** H L
's/he sliced meat thinly'	[i.jíː.t͡sɪt.t͡sɪ.ma]	*iyíítsittsimaawa*	L **H́** H L L

b. HEAVY FIRST SYLLABLE

'travelling'	[aʔ.póxʷ.sɪ.n]	*a'póóhsin*	H **H́** L
'work'	[aʔ.púʔ.ta.ks̩.sɪ.n]	*a'pó'takssin*	H **H́** L
's/he was thirsty'	[iʔ.náː.ki]	*i'náákiwa*	H **H́** L
's/he baked'	[iç.kíː.ta]	*iihkíítaawa*	H **H́** L
'baking'	[iç.kíː.taː.n]	*iihkíítaana*	H **H́** H
's/he bought'	[iç.pʊ́m.ma]	*iihpómmaawa*	H **H́** L
's/he bought him/her'	[iç.pʊ́m.ma.t͡si]	*iihpómmatsiiwa*	H **H́** L L
'hitchhike'	[pɪç.kóxʷ.sɪ.n]	*piihkóóhsin*	H **H́** L

Longer words (with or without a final degenerate syllable) with a light second syllable have accent on the third syllable, regardless of whether the first syllable is light or heavy. The weight and number of following syllables does not affect this generalization.

(324) POLYSYLLABIC WORDS: STRESS FALLS ON THE THIRD SYLLABLE IF THE SECOND IS LIGHT

a. LIGHT FIRST SYLLABLE

's/he hit'	[i.pi.k͡sî]	*ipiksíwa*	L L **Ĺ**
's/he got up'	[i.po.wáː]	*ipowááwa*[37]	L L **H́**
's/he hit him/her'	[a.wa.já.ki]	*awayákiyiiwa*	L L **Ĺ** L
'story'	[a.tˢɪ.ní.ks̩.sɪ.n]	*atsiníkssin*	L L **Ĺ** L̥ H
's/he gossiped'	[i.sɪ.mím.ʔx̩ʷ.ki]	*isimímmohkiwa*	L L **H́** L̥ L
'gossip'	[a.sɪ.mím.ʔx̩ʷ.ks̩.sɪ.n]	*asimímmohkssin*	L L **H́** L̥ L̥ L

[37] This verb stem is listed under *ipowaoo-* in Frantz and Russell (2017), so evidently there are other pronunciations possible.

b. HEAVY FIRST SYLLABLE

's/he told a story'	[iː.t͡sɪ.ní.ki]	*iitsiníkiwa*	H L **Ĺ** L
's/he dove'	[ɪˢt.ta.jí]	*isttayíwa*	H L **Ĺ**
'baby'	[ɪs.sɪ.t͡sí.maː.n]	*issitsímaan*	H L **Ĺ** H
'take!'	[maʔ.ta.kí.t]	*ma'takít*	H L **Ĺ**
's/he took'	[iʔ.ta.kí]	*i'takíwa*	H L **Ĺ**
's/he wet it'	[iʔ.pɪ.ˢtó.t͡sɪm.ʔḁ]	*i'pistótsima*	H L **Ĺ** H L̥

The data above can be summarized as follows.

(325) a. If the word is monosyllabic, stress falls on the single (non-degenerate) syllable;

b. If the word is disyllabic, stress falls on the second syllable;

c. If the word is longer that two syllables, then stress falls on the second syllable if it is heavy and the third syllable otherwise.

3.2.2.1.2 Stress determined by initial syllable and clause type

Some words have first syllable accent, (326). This only occurs when three conditions are met: (1) the first syllable of the word is heavy, (2) the first syllable of the word contains a [-high] vowel, and (3) it is in the independent clause type.

(326) POLYSYLLABIC WORDS: FIRST SYLLABLE STRESS

's/he said'	[áː.niː]	*áániiwa*	**Ḱ** H
's/he cried'	[áː.seʔ.ni]	*áásai'niwa*	**Ḱ** H L
's/he boiled it'	[áː.kx̩ʷ.sɪ.m]	*áákohsima*	**Ḱ** L̥ L
's/he played'	[áw.ʔx̩.ka]	*áwahkaawa*	**Ḱ** L̥ L
's/he sold it'	[áʔ.pç̩.kx̩.tuː.m]	*á'pihkahtooma*	**Ḱ** L̥ L̥ L
's/he worked'	[áʔ.puʔ.ta.ki]	*á'po'takiwa*	**Ḱ** H L L
's/he took'	[máʔ.ta.ki]	*má'takiwa*	**Ḱ** L L
's/he took it'	[máʔ.t͡sɪ.m]	*má'tsima*	**Ḱ** H
'it (anim) is red'	[mɔ́xʷ.k͡sɪ.nʌm.m]	*máóhksinamma*	**Ḱ** L H

Regarding the claim that the syllable must be heavy, consider the following verbs (repeated from above). These begin with a light syllable vowel in the indicative clause type.[38]

[38] There is massive neutralization at the left edge of vowel-initial indicative clauses, as I show in Appendix C. All verbs begin with either [i], [iː], or a heavy, stressed [-high] vowel.

(327)	‘s/he hit him/her’	[a.wa.já.ki]	*awayákiyiiwa*[39]	L L **Ĺ** L
	‘s/he hit’	[i.pi.k͡sî]	*ipiksíwa*	L L **Ĺ**
	‘s/he got up’	[i.po.wáː]	*ipowááwa*	L L **H́**
	‘s/he gossiped’	[i.sɪ.mím.ʔx̥ʷ.ki]	*isimímmohkiwa*	L L **H́** L̥ L
	‘s/he entered’	[i.pí̆ː.m]	*ipííma*	L **H́**
	‘s/he danced’	[i.pʌ́s.ka]	*ipásskaawa*	L **H́** L
	‘s/he chopped wood’	[i.kâʔ.kjaː.ki]	*ikáʼkiaakiwa*	L **H́** H L
	‘s/he sliced meat thinly’	[i.jí̆ː.t͡sɪt.t͡sɪ.ma]	*iyíítsittsimaawa*	L **H́** H L L

Regarding the claim that the syllable must contain a [-high] vowel, consider the following verbs (repeated from above). These begin with a heavy syllable in the independent clause type, but the vowel is [+high]. None of these have first syllable stress.

(328)	‘s/he ate’	[iː.jí]	*iiyíwa*	H **Ĺ**
	‘s/he roped’	[iː.káː]	*iikááwa*	H **H́**
	‘s/he told a story’	[iː.t͡sɪ.ní̆.ki]	*iitsiníkiwa*	H L **Ĺ** L
	‘s/he dove’	[ɪˢt.ta.jí]	*isttayíwa*	H L **Ĺ**
	‘s/he was thirsty’	[iʔ.náː.ki]	*iʼnáákiwa*	H **H́** L
	‘s/he took’	[iʔ.ta.kí̆]	*iʼtakíwa*	H L **Ĺ**
	‘s/he wet it’	[iʔ.pɪ.ˢtó.t͡sɪm.ʔḁ]	*iʼpistótsima*	H L **Ĺ** H L̥
	‘s/he baked’	[iç.kí̆ː.ta]	*iihkíítaawa*	H **H́** L
	‘s/he bought him/her’	[iç.pʊ́m.ma.t͡si]	*iihpómmatsiiwa*	H **H́** L L

Regarding the claim that first syllable stress only obtains in the independent clause type, I have included the imperative and independent clause types for several verbs below. If the verb is intransitive (AI) and if I elicited an event nominalization, I included those as well. All have initial stress in the independent clause type, but not in the imperative or event nominalization. If the verb begins with an open syllable, then the initial vowel is short in the imperative and nominalization, but long in the independent.

[39]This verb is exceptional because it is in the independent clause type and begins with a [-high] vowel, but the first syllable is not heavy. This verb is listed in the dictionary with a long initial [aː], but BB typically pronounces this with a short initial vowel, sometimes with a secondary stress on the initial syllable.

(329)	*Stem gloss*	*Imperative*	*Independent*	*Event nominalization*
	‘say’ (AI)	[a.nı́ː.t]	[áː.niː]	[a.nís.sɪ.n]
	‘cry’ (AI)	[a.séʔ.nɪ.t]	[áː.seʔ.ni]	[a.sén.ʔs̥.s.n] (‘cry-baby’)
	‘boil’ (TI)	[a.kx̥ʷ.sı́.t]	[áː.kx̥ʷ.sɪ.m]	—
	‘walk, play’ (AI)	[aw.ʔx̥.káː.t]	[áw.ʔx̥.ka]	[aw.ʔx̥.káː.n]
	‘sell’ (TI)	[aʔ.pç̥.kx̥.tóː.t]	[áʔ.pç̥.kx̥.tuː.m]	[aʔ.pç̥.kx̥.táː.n]
	‘take’ (TI)	[maʔ.t͡sí.t]	[máʔ.t͡sɪ.m]	—
	‘work’ (AI)	[aʔ.púʔ.ta.ki]	[áʔ.puʔ.ta.ki]	[aʔ.púʔ.ta.ks̥.sɪ.n]

There is pervasive left-edge allomorphy within the independent clause type, but for other verbs it typically involves a different vowel quality, not a different stress pattern (Frantz 2009; Taylor 1969). Some examples from BB are given below. If the verb begins with a short [a] or a short or long [o] in the imperative, then this vowel ablauts to either [i] or [iː] in the independent clause type. Verbs that begin with a consonant in the imperative typically append an initial [i] in the independent, and stems that begin with long vowels sometimes append an initial [ij]. I discuss these left-edge mutations further in Appendix C.

(330)	*Stem gloss*	*Imperative*	*Independent*	*Event nominalization*
	‘relate story’	[a.t͡sɪ.nı́.ki.t]	[iː.t͡sɪ.nı́.ki]	[a.tˢɪ.ní.ks̥.sɪ.n] (‘story’)
	‘gossip’	[a.sɪ.mím.ʔx̥ʷ.ki.t]	[i.sɪ.mím.ʔx̥ʷ.ki]	[a.sɪ.mím.ʔx̥ʷ.ks̥.sɪ.n]
	‘read’	[a.ks̥.tá.kɪ.t]	[iː.ks̥tá.ki]	—
	‘rope’	[o.káː.t]	[iː.káː]	[o.káː.n]
	‘eat’	[oː.jít]	[iː.jı́]	[ɔːów.ʔx̥.sɪ.n] (‘food’)
	‘bark’	[oxʷ.kí.t]	[iç.kí]	[oxʷ.ks̥.sí.n]
	‘bite’	[sɪ.ks̥.tá.kɪ.t]	[i.sí.ks̥.ta.ki]	[sɪ.ks̥.tá.ks̥.sɪ.n]
	‘pack’	[aː.kç̥.táː.t]	[i.jáː.kç̥.ta]	[aː.kç̥.táː.n]

The data above can be summarized as follows.

(331) a. If the word begins with a heavy syllable containing a [-high] vowel in the independent clause type, then stress falls on the first syllable.

b. For BB, the stems which begin with a long [-high] vowel neutralize to short in the imperative and event nominalizations.

3.2.2.1.3 Interaction of stress with voiceless syllable nuclei

If the third syllable contains a voiceless nucleus, then stress falls on the second syllable, regardless of whether the second syllable is light or heavy. For example, in [i.sí.kṣ̩.ta.ki] 'ṣ/he bit', since the second syllable is light we expect stress to fall on the third syllable. The third syllable in this case is [kṣ̩], which contains a voiceless nucleus. A voiceless nucleus has no vibration of the vocal folds and therefore no F_0 which could carry pitch, the main correlate of Blackfoot stress. In these cases, pitch accent occurs one syllable to the left. When the second syllable is heavy, as for [i.jáː.kç̩.ta] 's/he packed' and [ɪs.pʊ́m.ʔç̩.ta] 's/he helped out', second syllable stress is already predicted by the generalizations from above.

(332) VOICELESS THIRD SYLLABLE: STRESS FALLS ON THE SECOND SYLLABLE

's/he bit'	[i.sí.kṣ̩.ta.ki]	*isikstakiwa*	L **Ĺ** L̥ L L
's/he packed'	[i.jáː.kç̩.ta]	*iyaakihtaawa*	L **H́** L̥ L
's/he helped out'	[ɪs.pʊ́m.ʔç̩.ta]	*isspómmihtaawa*	H **H́** L̥ L

If the second syllable is light and voiceless, then stress falls either on the first syllable or the third syllable. It falls on the first syllable under the same conditions as above (first syllable must be heavy and contain a [-high] vowel; must be an independent clause). Otherwise it falls on the third syllable, as expected.

(333) VOICELESS SECOND SYLLABLE

a. STRESS FALLS ON THE FIRST SYLLABLE

's/he boiled it'	[áː.kx̣̩ʷ.sɪ.m]	*áákohsima*	**H́** L̥ L
's/he played'	[áw.ʔx̣̩.ka]	*áwahkaawa*	**H́** L̥ L

b. STRESS FALLS ON THE THIRD SYLLABLE

's/he hunted'	[i.kṣ̩.kí.ma]	*ikskímaawa*	L L̥ **Ĺ** L
'boil it!'	[a.kx̣̩ʷ.sí.maː.t]	*akohsímaat*	L L̥ **Ĺ** H
'play!'	[aw.ʔx̣̩.káː.t]	*awahkáát*	L L̥ **H́**
'playing'	[aw.ʔx̣̩.káː.n]	*awahkáán*	H L̥ **H́**
'barking'	[oxʷ.kṣ̩.sí.n]	*ohkssín*	H L̥ **Ĺ**
'read!'	[o.kṣ̩.tá.kɪ.t]	*okstákit*	L L̥ **Ĺ** L
's/he read'	[iː.kṣ̩.tá.ki]	*iikstákiwa*	H L̥ **Ĺ** L
's/he sang'	[in.ʔç.kí]	*inihkíwa*	H L̥ **Ĺ**

If both the second and third syllables are light and voiceless, then stress falls either on the first syllable or the fourth syllable. It falls on the first syllable under the same conditions as above (first syllable must be heavy and contain a [-high] vowel; must be an independent clause). Otherwise it falls on the fourth syllable.

(334) VOICELESS SECOND AND THIRD SYLLABLES

a. FIRST SYLLABLE STRESS

‘s/he sold it’	[áʔ.pç̩.kx̩.tuː.m]	*á’pihkahtooma*	**H́** L̥ L̥ L

b. FOURTH SYLLABLE STRESS

‘song’	[nin.ʔç.ks̩.sí.n]	*ninihkssín*	H L̥ L̥ **Ĺ**
‘sell it!’	[aʔ.pç̩.kx̩.tóː.t]	*a’pihkahtóót*	H L̥ L̥ **H́**
‘purchase’	[aʔ.pç̩.kx̩.táː.n]	*a’pihkahtáán*	H L̥ L̥ **H́**

3.2.2.1.4 Idiosyncratic stress

I have also found several stems which have unexpected stress location. The examples in (a) below have second syllable stress, even though the second syllable is light and stress normally falls on the third syllable in that case, (b).

(335)	a.	‘s/he danced’	[iç.pí.jɪ]	*ihpíyiwa*	H **Ĺ** L
		‘s/he spoke’	[iʔ.pó.jɪ]	*i’póyiwa*	H **Ĺ** L
	b.	cf. ‘s/he dove’	[ɪ^{s}t.ta.jí]	*isttayíwa*	H L **Ĺ**

One stem consistently has second syllable stress on a light syllable in independent clauses, (a). Normally if the second syllable is light, then stress falls on the third syllable. This stem has expected second syllable stress in the imperative and event nominalization, (b), where the second syllable is heavy.

(336)	a.	‘s/he drew’	[i.sí.naː.ki]	*isínaakiwa*	L **Ĺ** H L
		cf. ‘s/he got up’	[i.po.wáː]	*ipowááwa*	L L **H́**
	b.	‘draw!’	[sɪ.náː.kɪ.t]	*sinóákit*	L **H́** L
		‘writing’	[sɪ.náː.ks̩.sɪ.n]	*sinóáksin*	L **H́** L̥ L

Finally, some stems have (expected) stress on a heavy second syllable in independent clauses, (337), but unexpected stress on an initial syllable in nominalizations, (338). Stress falls on the same syllable of the stem in both cases (e.g. always on [pʌ́s] in the two forms of ‘dance’), so this might be due to some pressure from paradigm uniformity.

(337)	a.	‘s/he danced’	[i.pʌ́s.ka]	*ipásskaawa*	L **H́** L
	b.	‘s/he bought (s.t.)’	[iç.pʊ́m.ma]	*iihpómmaawa*	H **H́** L
	c.	‘s/he found (s.t.)’	[iç.kóː.ni.ma]	*iihpómmaawa*	H **H́** L L

(338)	a.	‘(a) dance’	[pʌ́s.kaː.n]	*pásskaan*	**H́** H
	b.	‘(a) purchase’	[pʊ́m.maː.ni]	*pómmaani*	**H́** H L
	c.	‘s/he got found’ (name)	[kóːni.maː.n]	*kóónimaan*	**H́** L H

Next, I summarize the generalizations for non-idiosyncratic stress, and preview my analysis.

3.2.2.2 Generalizations

In all cases, idiosyncratic or otherwise, prominence in Blackfoot has the hallmarks of primary metrical stress (Hayes 1995): it is obligatory, culminative over these minimal PPhs, weight sensitive, and oriented towards the left edge of the PPh (see also Kaneko 1999; Stacy 2004 on that last point). I take these facts as evidence of the metrical nature of Blackfoot accent. Accordingly, I take the relatively higher pitch on prominent syllables to be the acoustic correlate of primary stress in Blackfoot, and I will analyze it using metrical constraints in the next section.

I focus here on an analysis of the default second and third syllable stress, because initial syllable stress is conditioned by both syntactic and phonological factors; namely, the PPh must contain and independent clause type and contain a [-high] vowel. Setting those cases aside, the location of primary stress is determined phonologically. For PPhs longer than two syllables, stress falls on the second syllable if it heavy, and the third syllable otherwise. For PPhs which are exactly two syllables, stress falls on the second syllable, regardless of whether the first syllable is light or heavy. This pattern occurs regardless of whether the first syllable is light or heavy.

A unified analysis of second and third syllable accent is possible if we assume that Blackfoot stress uses quantity-sensitive iambs and that the first syllable remains unparsed. For a PPh longer than two syllables, a heavy second syllable or else the second and third syllable, are both parsed into a quantity-sensitive iamb, (339). For a PPh with exactly two syllables, the second syllable is parsed into a binary or degenerate iamb, (340). This makes Blackfoot look like the mirror image of Latin and other quantity-sensitive antepenultimate stress systems (Mester 1994).

(339) THREE OR MORE SYLLABLES

	1	2	3	…	
a.	$\sigma_{\mu(\mu)}$	$(\acute{}\sigma_{\mu\mu})$		…	heavy second syllable stress
b.	$\sigma_{\mu(\mu)}$	$(\sigma_{\mu}$	$\acute{}\sigma_{\mu(\mu)})$	…	third syllable stress

(340) TWO SYLLABLES

	1	2	
a.	$\sigma_{\mu(\mu)}$	$(\acute{}\sigma_{\mu(\mu)})$	second syllable stress (binary foot)
b.	$\sigma_{\mu(\mu)}$	$(\acute{}\sigma_{\mu(\mu)})$	second syllable stress (degenerate foot)

In (339) and (340), the first syllable is not parsed into a foot at all. There are two pieces of evidence which support this parse. First, the only way to account for default third syllable stress using strictly binary feet is for the first syllable to be 'invisible' to stress (Elenbaas and Kager 2008). Second, the first syllable never attracts stress, regardless of whether it is light or heavy, and regardless of whether it contains an onset or not. Unlike the prosodic misalignment described in Downing (1998), which occurs in order to satisfy prosodic wellformedness constraints, the 'invisibility' of the first syllable in Blackfoot is invariant.

In the analysis below, underparsing is induced by a NONINITIALITY constraint (Buckley 2014; Bye and de Lacy 2000). This constraint is violable, because the initial syllable is parsed in cases where the PPh only contains a single non-degenerate syllable, and also in the cases discussed above, which are conditioned by a mix of syntactic and phonological properties.[40] This constraint has implications for stress typology more broadly, because proposed cases of initial extrametricality are so rare that phonological rules and constraints often explicitly ban left-edge extrametricality (cf. Gordon 2002; Hayes 1995). Despite this, there are several langauges which have been described as having default third syllable stress: Azkoitia Basque (Hualde 1998) has default third syllable accent in words longer than two syllables; Winnebago (Siouan; Hale and Eagle 1980) is analyzed with consistent third mora stress; Choguita Rarámuri (Uto-Aztecan; Caballero 2008, 2011), has a pattern of third-syllable stress conditioned by particular suffixes; and Kashaya (Hokan; Buckley 1994, 1997, 2014) has third syllable stress under certain conditions that are partly morphological and partly related to syllable shape.. Taken together with Blackfoot, the data from these languages shows that initial extrametricality is possible, which in turn suggests that the current sampling of languages in stress databases does not accurately reflect the stress typology.

In the next section, I turn to an analysis of non-idiosyncratic stress in Blackfoot.

3.2.2.3 Analysis

This section formalizes aspects of the above description using ranked and violable constraints in Optimality Theory (McCarthy and Prince 1993b; Prince and Smolensky 1993). I use categorical constraints,

[40] Many researchers have argued in favor of weakly-layered feet, which are minimally recursive, and which allow a single foot to consist of a foot and an adjunct syllable (Itô and Mester 2003; Kager 2012; Martnez-Paricio and Kager 2015). If so, third syllable stress is obtainable by aligning a single weakly-layered foot with the left edge of the PPh. However, note that Buckley (2014) finds that an analysis of default stress in Kashaya (Pomoan), a quantity-sensitive language like Blackfoot, requires a type of initial extrametricality even when using weakly-layered feet.

which require that each element under evaluation receives at most one violation (McCarthy 2003).[41] In tableaux I underline the head syllable of each foot, and the head syllable of the head foot is additionally marked via an acute accent. This is meant to signal that only primary stress has obvious phonetic correlates, while secondary stresses are covert. I begin with some relevant constraint definitions.

3.2.2.3.1 Constraint definitions

The foot type constraints in (341) and (342) require feet to be iambic and trochaic, respectively. The head of the foot is a syllable, so both constraints are trivially satisfied by monosyllabic feet.

(341) ALIGN(Ft, R, Hd(FT), R)

Abbreviation: FTTYPE=I or FTT=I

For every foot, there is a head of the foot such that the right edge of the head of the foot aligns with the right edge of the foot. ("Feet are iambic.")

(McCarthy 2003; McCarthy and Prince 1993a)

(342) ALIGN(Ft, L, Hd(FT), L)

Abbreviation: FTTYPE=T or FTT=T

For every foot, there is a head of the foot such that the left edge of the head of the foot aligns with the left edge of the foot. ("Feet are trochaic.")

(McCarthy 2003; McCarthy and Prince 1993a)

The ENDRULE-L (343) (and analogous ENDRULE-R constraints, not shown here) require the head foot to be the leftmost or rightmost foot in the PWd, the PPh, or the IPh, respectively. These are modeled on McCarthy's (2003) ENDRULE-L constraint (itself a reformulation of the End Rule in Prince 1983). The rule in McCarthy (2003) specifically refers to the prosodic word, so I have reconceived these as a family of constraints, one at each level of the prosodic hierarchy.

(343) a. ENDRULE-L(PWd)

PWd — i.e. the head foot is not preceded by another foot in the PWd

*Hd(PWd) / Ft __

[41]This prohibits some alignment constraints which assign gradient violations, such as Align(Ft, Edge_1, Wd, Edge_2), where a foot incurs a violation for every syllable that separates the foot Edge_1 from the word Edge_2 (McCarthy and Prince 1993a; Prince and Smolensky 1993). As explained in McCarthy (2003), gradient alignment constraints overgenerate the metrical typology and predict certain unattested patterns, such as right-to-left iambic parsing. The effects of gradient alignment constraints can instead be replaced by the rhythmic constraints, *LAPSE and *CLASH (Kager 2001; McCarthy 2003).

b. ENDRULE-L(PPh)

$$*\mathrm{Hd(PPh)} / \begin{array}{c} \mathrm{PPh} \\ \wedge \\ \mathrm{Ft}\ \_\_ \end{array}$$

i.e. the head foot is not preceded by another foot in the PPh

c. ENDRULE-L(IPh)

$$*\mathrm{Hd(IPh)} / \begin{array}{c} \mathrm{IPh} \\ \wedge \\ \mathrm{Ft}\ \_\_ \end{array}$$

i.e. the head foot is not preceded by another foot in the IPh

(Based on ENDRULE-L in McCarthy 2003)

In Chapter 5 I hypothesize that feet align to PPh boundaries but not PWd boundaries in Blackfoot. An alignment constraint that aligns the left edge of a PPh to the left edge of a foot must dominate an alignment constraint that requires the left edge of a PWd to align to the left edge of a foot.

(344) ALIGN(PPh,L;Ft,L) $\gg$ ALIGN(PWd,L;Ft,L)

As discussed above, the first syllable in Blackfoot must be extrametrical in order to generate default third syllable stress. Following Buckley (2014) & Bye and de Lacy (2000), I propose that a positional markedness constraint, NONINITIALITY (NONINIT), is active in the Blackfoot grammar. This is one of a family of NONINIT constraints defined at each prosodic level. The definition in (345) is modelled on the NONFINALITY constraint in McCarthy (2003). NONINIT requires the initial syllable of the PPh to not be parsed to a foot; or equivalently, that no foot stand at the left edge of the PPh.

(345) NONINITIALITY (NONINIT)

$*\mathrm{Ft} / [_{\mathrm{PPh}}\ \_\_$

'PPh-initial feet are prohibited within the PPh.'

(Buckley 2014; Bye and de Lacy 2000; McCarthy 2003)

The following constraints deal with foot wellformedness. FTBIN in (346) is satisfied if feet either contain two syllables or two moras. I will assume the feet are typically binary under a syllabic or moraic analysis (but see Itô and Mester 2003; Kager 2012; Martnez-Paricio and Kager 2015 for arguments that feet may be recursive). WSP in (347) is based on the Weight-to-Stress Principle in Prince (1990) and ensures that heavy syllables are stressed. As I discussed in Section 1.2, I take stress to be a relational property obtaining between heads and non-heads within a metrical structure. Therefore, I interpret "stress" to mean the head of a foot, regardless of whether that stress has any acoustic manifestation.

(346) FOOT BINARITY (FTBIN)

Feet must be binary under a moraic or syllabic analysis.

(Broselow 1982; McCarthy and Prince 1993b; Prince 1980)

(347) WEIGHT-TO-STRESS PRINCIPLE (WSP)

Assign a violation for every heavy syllable which is not the head of a foot.

(Prince 1990; Prince and Smolensky 1993)

Stress tends to have a rhythmic pattern. This is governed by the constraints *LAPSE and *CLASH,[42] which require stressed syllables to be separated by no more and no less than one unstressed syllable, respectively (Gordon 2002; Kager 2005; McCarthy 2003). When no other constraints are involved, these together ensure a binary alternating rhythm of stressed/unstressed syllables. I interpret the *CLASH, (348), and *LAPSE, (349), constraints as applying to stressed syllables (i.e. foot heads). In this way, *CLASH and *LAPSE still regulate covert secondary feet in Blackfoot. A syllable which is not a foot head may be (a) completely unfooted or (b) a non-head syllable within a foot; *LAPSE is violated for each sequence of two syllables drawn from either of these two categories.

(348) *CLASH

Assign one violation-mark for each pair of adjacent syllables which are foot heads.

(349) *LAPSE

Assign one violation-mark for each pair of adjacent syllables which are not foot heads.

Any syllable which is not parsed into a foot will be 'invisible' to stress. I will assume these syllables are parsed directly to the ω constituent, violating a PARSE SYLLABLE (PARSE-σ) constraint (Itô and Mester 2003; McCarthy 2003; Selkirk 1996). This constraint assigns a violation for each syllable that is immediately dominated by a phonological phrase. Following McCarthy (2003), PARSE-σ is conceived of as a family of PARSE-X constraints, where X may stand for any prosodic category. If each level of the prosodic hierarchy is associated with a number (i.e. $\sigma = 1$, $\text{FT} = 2$, etc.), then the PARSE-X constraints prohibit any prosodic constituent X_i from dominating a constituent X_{i-2}.[43]

(350) PARSE SYLLABLE (PARSE-σ)

A σ must be dominated by a Foot. (McCarthy 2003, among others)

[42] Because secondary stresses are covert, the forms in the above section do not tell us how *CLASH is ranked relative to the other constraints. In the wider lexicon, *CLASH is sometimes violated in surface forms, as in the noun [ɛ́m.mó.niː.si] 'otter'. I leave this constraint for further research and I do not include it in the tableaux below.

[43] The PARSE-X family of constraints captures the Exhaustivity parameter in the Strict Layer Hypothesis (Nespor and Vogel 2007; Selkirk 1984).

Next I will demonstrate the crucial rankings between these constraints in order to generate the default second and third syllable stress patterns. After that, I address cases of initial stress and then interactions with voiceless syllable nuclei.

3.2.2.3.2 Default stress pattern: second and third syllable stress

To generate iambs in Blackfoot, FtType=I dominates FtType=T, as in (351). The optimal candidate also violates *Lapse, because it contains two syllables in a row which are not heads of feet.

(351) FtType=I ≫ {FtType=T, *Lapse}

(352) [i.pi.k͡sî] *ipiksíwa* ‘s/he hit’

/ipiksi-wa/	FtType=I	FtType=T	*Lapse
☞ a. [i.(pi.k͡sî)]		*	*
b. [i.(pí.k͡si)]	*!		

Crucial rankings: FtType=I ≫ {FtType=T, *Lapse}

Stress falls on a syllable towards the left edge of the PPh. The EndRule-L(PPh) constraint must dominate EndRule-R(PPh), (353). This ranking ensures that the head foot is near the left edge.

(353) EndRule-L(PPh) ≫ EndRule-R(PPh)

(354) [iʔpɪˢtót͡sɪmʔḁ] *i’pistótsima* ‘s/he wet it’

/iʔpiˢtot͡sim-wa/	EndRule-L(PPh)	EndRule-R(PPh)
☞ a. [iʔ.(pɪ.ˢtó).(t͡sɪm).ʔḁ]		*
b. [iʔ.(pɪ.ˢto).(t͡sím).ʔḁ]	*!	

Crucial rankings: EndRule-L(PPh) ≫ EndRule-R(PPh)

Setting aside for a moment the cases of first and fourth syllable stress, the regular stress pattern on second and third syllables is generated by the ranking in (355).

(355) Dep-IO(μ) NonInit Max-IO(μ)

FtType=I FtBin WSP

FtType=T *Lapse Parse-σ

FTBIN must dominate *LAPSE and PARSE-σ because lapses and unparsed syllables are preferred over creating degenerate feet. Candidates (a) and (b) in (356) are both compatible with the actual surface pronunciation, which has third syllable stress. In both candidates, the head of the head foot is the third syllable. They differ only in whether the fourth syllable is parsed to a degenerate foot or left unparsed. Candidate (b) is harmonically bound: it incurs the same violations as candidate (c) plus a violation of *LAPSE (and *CLASH, not shown here because it does not affect the constraint ranking). Therefore the optimal candidate must be (a). The crucial rankings in (356) are evident by comparing the optimal candidate (a) to (c). Candidate (a) violates *LAPSE and PARSE-σ but satisfies FTBIN. Candidate (c) incurs one fewer violation each of *LAPSE and PARSE-σ by making the leftmost foot degenerate, violating FTBIN. If candidate (c) were optimal, then stress would fall on the second syllable rather than the third. It does not, which shows that this candidate is suboptimal.

(356) [at͡sinı́kɪt] *atsiníkit* 'tell a story!'

/at͡siniki-t/	NONINIT	FTBIN	*LAPSE	PARSE-σ
☞ a. [a.(t͡si.<u>ní</u>).kɪ.t]			*	**
b. [a.(t͡si.<u>ní</u>).(<u>kɪ</u>).t]		*!	*	*
c. [a.(<u>t͡sí</u>).(nɪ.<u>kɪ</u>).t]		*!		*

Crucial rankings: FTBIN ≫ {*LAPSE, PARSE-σ}

Because feet are right-headed, lapses occur more easily at the left edge. The two candidates below parse the same number of syllables into wellformed iambs. They only differ in how many non-head syllables occur in a sequence at the left edge of the PPh. In this way, the *LAPSE constraint ensures that iambs are as near to the left edge as possible, but is not crucially ranked against PARSE-σ.

(357) [at͡sinı́kɪt] *atsiníkit* 'tell a story!'

/at͡siniki-t/	NONINIT	FTBIN	*LAPSE	PARSE-σ
☞ a. [a.(t͡si.<u>ní</u>).kɪ.t]			*	**
b. [a.t͡si.(nɪ.<u>kí</u>).t]			**!	**

Ranking NONINIT above *LAPSE and PARSE-σ derives initial extrametricality, because allowing the initial syllable to be immediately dominated by the phonological phrase is preferential to parsing it to a foot. This ranking is illustrated below in (358). The winning candidate (a) leaves the initial syllable unparsed to a foot in order to satisfy NONINIT, but violates *LAPSE and PARSE-σ. Candidate (b) satisfies *LAPSE and PARSE-σ by parsing all syllables into feet, but it fatally violates NONINIT, because the first foot stands at the left edge of the PPh.

(358) [at͡sɪníkit] *atsiníkit* ‘tell a story!’

/at͡siniki-t/	NONINIT	FTBIN	*LAPSE	PARSE-σ
☞ a. [a.(t͡si.ní).kɪ.t]			∗	∗∗
b. [(a.t͡sí).(nɪ.kɪ).t]	∗!			

Crucial rankings: NONINIT ≫ {*LAPSE, PARSE-σ}

Finally, NONINIT dominates FTBIN. The crucial cases are disyllables with an initial heavy syllable followed by a light syllable. Candidate (a) below parses both syllables into a single foot, satisfying all constraints except for NONINIT and WSP. Candidate (b) parses only the second syllable into a degenerate foot, satisfying NONINIT but violating WSP, FTBIN and PARSE-σ. Both candidates violate WSP an equal number of times and FTBIN is crucially ranked above PARSE-σ; therefore, the crucial ranking is NONINIT ≫ FTBIN.

(359) [oːjít] *ooyít* ‘eat!’

/oːji-t/	NONINIT	WSP	FTBIN	*LAPSE	PARSE-σ
a. [(oː.jí).t]	∗!	∗			
☞ b. [oː.(jí).t]		∗	∗		∗
c. [(óː).jɪ.t]	∗!				∗
d. [(óː).(jɪ).t]	∗!		∗		

Crucial rankings: NONINIT ≫ {FTBIN, PARSE-σ}

As shown in the next tableaux, DEP-IO(μ) also dominates FTBIN or else the optimal candidate would allow mora epenthesis in order to avoid violations of FTBIN.

(360) [sɪmít] *simít* ‘drink!’

/simi-t/	DEP(μ)	FTBIN	*LAPSE	PARSE-σ
a. [sɪ.(míː).t]	∗!			∗
☞ b. [sɪ.(mí).t]		∗		∗

Crucial rankings: DEP-IO(μ) ≫ FTBIN

In the tableau below, candidates (a) and (b) are both compatible with the actual pronunciation of this form, because stress falls on the second syllable in both candidates. Because secondary feet are covert in Blackfoot, it is unclear whether the final syllable is left unparsed, as in (a), or is parsed into a degenerate foot, as in (b). Given the constraint ranking, where FtBin dominates Parse-σ, candidate (a) is optimal. Candidate (c) has one fewer violation of Parse-σ than the optimal candidate, but incurs one more violation each of WSP and *Lapse. I hypothesize that the crucial ranking is WSP ≫ Parse-σ, in order to derive quantity sensitivity parsing.[44]

(361) [içkíːta] *iihkíítaawa* ‘s/he baked’

/içkiːta/	NonInit	WSP	FtBin	*Lapse	Parse-σ
☞ a. [iç.(kíː).ta]		*			**
b. [iç.(kíː).(ta)]		*	*!		*
c. [iç.(kiː.tá)]		**!		*	*

Crucial rankings: {WSP, FtBin} ≫ Parse-σ

The next tableau illustrates that NonInit and Max-IO(μ) both dominate WSP. This input contains a long vowel in the initial syllable. The optimal candidate leaves this syllable unparsed, satisfying NonInit but violating WSP because a heavy syllable is not the head of a foot. However, WSP is not crucially ranked against Parse-σ.

(362) [iːkáː] *iikááwa* ‘s/he roped’

/iːkaː-wa/	Max(μ)	NonInit	WSP	FtBin	*Lapse	Parse-σ
a. [(íː).(kaː)]		*!				
b. [i.(káː)]	*!					*!
☞ c. [iː.(káː)]			*			*

Crucial rankings: Max-IO(μ) ≫ WSP; NonInit ≫ {WSP, Parse-σ}

Finally, the following summary tableaux for each type of PPh (in terms of the number and weight of syllables) demonstrate that this ranking is correct. The next four tableaux show that disyllabic PPhs have second syllable stress[45] regardless of whether they are L Ĺ, (363), L H́, (364), H Ĺ, (365), H H́, (366).

[44] Interestingly, the correct candidate would be choses as well if the crucial ranking were *Lapse ≫ Parse-σ.

[45] One way to avoid violations of FtBin would be to leave all syllables unparsed to feet. I assume that candidates like this are ruled out by an inviolable constraint which requires each level of the prosodic/metrical hierarchy to include at least one constituent of the next-lower category (cf. Headedness in Selkirk 1996 or Proper Headedness in Itô and Mester 2003).

(363) [sɪmít] *simít* ‘drink!’

/simi-t/	Max(μ)	Dep(μ)	NonInit	WSP	FtB	*Lapse	Par-σ
a. [(sɪ.mí).t]			∗!				
b. [(sí).mɪ.t]			∗!		∗		∗
☞ c. [sɪ.(mí).t]					∗		∗
d. [sɪ.(míː).t]		∗!					∗
e. [(sɪ.míː).t]		∗!	∗				

(364) [apíːt] *apíít* ‘sit!’

/apiː-t/	Max(μ)	Dep(μ)	NonInit	WSP	FtB	*Lapse	Par-σ
a. [(a.píː).t]			∗!		∗		
☞ b. [a.(píː).t]							∗

(365) [oːjít] *ooyít* ‘eat!’

/oːji-t/	Max(μ)	Dep(μ)	NonInit	WSP	FtB	*Lapse	Par-σ
a. [o.(jí).t]	∗!				∗		∗
b. [oː.(jíː).t]		∗!		∗			∗
c. [o.(jíː).t]	∗!	∗!					∗
d. [(oː.jí).t]			∗!	∗			
e. [(óː).jɪ.t]			∗!				∗
f. [(óː).(jɪ).t]			∗!		∗		
☞ g. [oː.(jí).t]				∗	∗		∗

(366) [iːkáː] *iikááwa* ‘s/he roped’

/iːkaː-wa/	Max(μ)	Dep(μ)	NonInit	WSP	FtB	*Lapse	Par-σ
a. [(íː).(kaː)]			∗!				
b. [i.(káː)]	∗!						∗
☞ c. [iː.(káː)]				∗			∗

The next two tableaux show that PPhs with three or more syllables have stress on the third syllable if the second is light, regardless of whether the first syllable is light, (367), or heavy, (368).

(367) [at͡sɪnɪ́kit] *atsiníkit* ‘tell a story!’

/at͡siniki-t/	MAX(μ)	DEP(μ)	NONINIT	WSP	FTB	*LAPSE	PAR-σ
☞ a. [a.(t͡si.ní).kɪ.t]						∗	∗∗
b. [a.t͡sí.(nɪ.kí).t]						∗∗!	∗∗
c. [a.(t͡si.ní).(kɪ).t]					∗!	∗	∗
d. [a.(t͡sí).(nɪ.kɪ).t]					∗!		∗
e. [(a.t͡sí).(nɪ.kɪ).t]			∗!				
f. [a.(t͡síː).(nɪ.kɪ).t]		∗!					∗

(368) [iːt͡sɪnɪ́ki] *iitsiníkiwa* ‘s/he told a story’

/iːt͡siniki-wa/	MAX(μ)	DEP(μ)	NONINIT	WSP	FTB	*LAPSE	PAR-σ
☞ a. [iː.(t^{s}ɪ.ní).ki]				∗		∗	∗∗
b. [iː.t^{s}ɪ.(ni.kí)]				∗		∗∗!	∗∗
c. [iː.(t^{s}ɪ.ní).(ki)]				∗	∗!	∗	∗
d. [iː.(t^{s}í).(ni.kí)]				∗	∗!		∗
e. [(iː.t^{s}í).(ni.kí)]			∗!	∗			
f. [(íː).(t^{s}ɪ.ní).ki]			∗!				∗
g. [(íː).t^{s}ɪ.(ni.kí)]			∗!			∗	∗
h. [iː.(t^{s}íː).(ni.kí)]		∗!		∗			∗

The next two tableaux show that PPhs with three or more syllables have stress on the second syllable if heavy, regardless of whether the first syllable is light, (369), or heavy, (370).

(369) [ipʌ́ska] *ipásskaawa* ‘s/he danced’

/ipaska/	MAX(μ)	DEP(μ)	NONINIT	WSP	FTB	*LAPSE	PAR-σ
☞ a. [i.(pʌ́s).ka]							∗∗
b. [i.(pʌ́s).(ka)]					∗!		∗
c. [i.(pʌs.ká)]				∗!		∗	∗
d. [i.(pʌ́s).(kaː)]		∗!					∗
e. [(i.pʌ́s).ka]			∗!				∗

(370) [içkíːta] *iihkíítaawa* ‘s/he baked’

/içkiːta/	MAX(μ)	DEP(μ)	NONINIT	WSP	FTB	*LAPSE	PAR-σ
☞ a. [iç.(kíː).ta]				∗			∗∗
b. [iç.(kíː).(ta)]				∗	∗!		∗
c. [iç.(kiː.tá)]				∗∗!		∗	∗
d. [iç.(ki.tá)]	∗!			∗		∗	∗
e. [iç.(kíː).(taː)]		∗!		∗			∗
f. [(íç).(kiː).ta]			∗!				

The next two tableaux show that PPhs with three or more syllables, where the second and third syllables are heavy, have stress on the second syllable. This is true regardless of whether the first syllable is light, (371), or heavy, (372).

(371) [i.jíːt͡sɪt͡ːst͡sɪma] *ijíítsittsimaawa* ‘s/he sliced meat thinly’

/iyiitsittsimaa-wa/	MAX(μ)	DEP(μ)	NONINIT	WSP	FTB	*LAPSE	PAR-σ
☞ a. [i.(jíː).(t͡sɪt).(t͡sɪ.ma)]							∗
b. [(i.jíː).(t͡sɪt).(t͡sɪ.ma)]			∗!				
c. [i.(jiː.t͡sít).(t͡sɪ.ma)]				∗!		∗	∗
d. [i.(ji.t͡sɪt).(t͡sɪ.ma)]	∗!						∗

(372) [iç.kíː.taː.n] *iihkíítaan* ‘baking’

/içkiːtaː-n/	MAX(μ)	DEP(μ)	NONINIT	WSP	FTB	*LAPSE	PAR-σ
a. [iç.(kíː).taː.n]				∗∗!			∗∗!
☞ b. [iç.(kíː).(taː).n]				∗			∗
c. [iç.(ki.táː).n]	∗!			∗		∗	∗
d. [iç.(kiː.táː)].n				∗∗!		∗	∗
e. [(íç).(kiː).(taː).n]			∗!				

To summarize this section, non-idiosyncratic stress in Blackfoot can be analyzed using quantity-sensitive iambs and a NONINIT constraint that prohibits the first syllable from being parsed into a foot. All of the properties of Blackfoot stress deal with the PPh: stress is culminative and obligatory within a PPh, and stress tends to fall near the left edge of the PPh. I discuss how stress is a diagnostic of the PPh but not of the PWd more in Section 5.1.

I have only offered an analysis of the highest or most prominent pitch accent in a PPh, although PPhs do sometimes have more than one pitch accent (Frantz 2009). This analysis suggests that the less prominent pitch accents could be analyzed as secondary stresses. Since most of the work on pitch accent to date has been done on small PPhs, future research should investigate longer and more complicated words, in order to see if secondary stresses also have properties of metrical stress (that is, rhythmic properties, attraction to heavy syllables, etc.).

3.2.3 Interim summary: PPh phonology

To summarize this section, I discussed two phonological generalizations which specifically refer to the PPh, which is the prosodic constituent that corresponds to a verbal complex or a nominal DP. First, an edge restriction picks out the left edge of the PPh: glides are prohibited in this position but not at the left edge of any smaller phonological or syntactic constituent. The constraint against glides must refer precisely to the PPh, as I showed in (311), repeated in (373) below.

(373) *#G

Assign a violation mark for every [-cons] segment which is immediately dominated by a syllable and occurs leftmost within the PPh. ("Assign a violation mark for every glide which occurs leftmost within the PPh.")

e.g. * $_{\text{PPh}}\left[\begin{array}{c}\sigma\\ | \\ [\text{-cons}]\end{array}\right.$ (=311)

Second, the PPh is the constituent which delimits stress assignment and metrical structure. This is evident because the pattern of stress assignment must be described with reference to the PPh, e.g. "stress falls on the second syllable of the PPh if heavy, and otherwise falls on the third syllable of the PPh". Consequently, some constraints for stress assignment must refer specifically to the PPh. Furthermore, prefixes within a PPh may affect stress location, but neighboring PPhs within the same utterance do not cause stress to shift. I take this to mean that metrical constituents align with the edges of the PPh, but not necessarily with the PWd.

(374) ALIGN(PPh,L;Ft,L) $\gg$ ALIGN(PWd,L;Ft,L)

Both phonological generalizations cannot be stated without reference to the PPh. Following Nespor and Vogel (2007: 58*ff*), I take this as evidence for the phonological constituent itself (see discussion in Section 1.2.3.1). I have labeled it the PPh because it corresponds to a phrasal unit which is roughly the size of a CP. (I discuss this correspondence relation more in the next section.)

The PPh can be defined by still more generalizations, which have been discussed elsewhere. The left edge of the PPh is the only boundary where onsetless syllables occur freely The right edge of the PPh is the only boundary where degenerate syllables (discussed in Section 2.4.4) occur, as well as a process of final devoicing (Bliss 2013; Windsor 2017b). The PPh is also the domain for [t]-assibilation and vowel coalescence (the latter is discussed in Bliss 2013; Elfner 2006b; Peter 2014). Taken together, these generalizations provide robust evidence for a PPh domain which corresponds to the verbal complex. In the next section I show how the MATCH and MATCH-∃ constraints discussed in Section 1.2.4.1 account for this correspondence.

3.3 Mapping the CP to prosodic structure

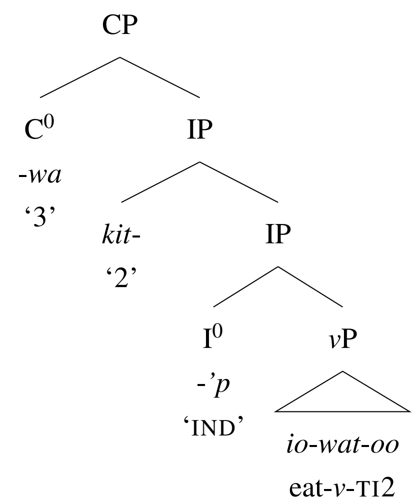
In Section 3.1 I used independent syntactic evidence to argue that the verbal complex in Blackfoot has the syntax of a CP phrase. In Section 3.2 I used independent phonological evidence to argue that the verbal complex forms a single prosodic unit. I name this unit the PPh because it corresponds in systematic ways to CP and DP phases. In this section I show how the MATCH constraints and prosodic wellformedness constraints from Section 1.2.4.1 account for the correspondence between CPs and DPs (in the syntactic structure) and PPhs (in the prosodic structure). I first discuss matrix and embedded CP clauses where all arguments are *pro*. Then I turn to clauses which contain overt nominal expressions.

Consider an utterance with a single matrix CP clause, such as the independent clause below, repeated from (165a).

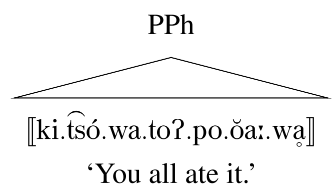
(375) *Kitsówatoo'poaawa*
kit–[io–wat–oo]–'p–oaa–wa
2–[eat–*v*–TI2]–IND–2PL–3
'You all ate it.'

The syntactic structure of this verbal complex, (376), follows from the argumentation in Section 3.1 as well as previous arguments that the clause-typing suffixes instantiate I^0 and that the person prefix is a sister to I^{MIN} Déchaine and Wiltschko (2010) & Ritter and Wiltschko (2014). The prosodic structure is given in (376).

(376) MATCHRIX CP CONTEXT: SYNTAX



(377) MATRIX CP CONTEXT: PROSODY



Setting aside the question of morpheme linearization within the PPh,[46] the entire CP phase is mapped to a PPh; smaller constituents in the syntactic structure are ignored when creating phonological phrases. This motivates my definitions of MATCH-∃ and MATCH constraints in (1.2.4.1), repeated below. MATCH-∃(CP→PPh) and MATCH-∃(PPh→CP) prohibit CPs in the syntactic representation that do not have a correspondent PPh in the prosodic structure, and vice versa.

(378) MATCH-∃(CP→PPH)

Abbreviation: MATCH-∃ (CP) or M-∃ (CP)

Given an input syntactic representation *S* and an output phonological representation *P*, such that $S\mathfrak{R}P$, assign a violation mark for every CP phase in *S* which does not have a correspondent PPh constituent in *P*.

(379) MATCH-∃(PPH→CP)

Abbreviation: MATCH-∃ (PPh) or M-∃ (PPh)

Given an input syntactic representation *S* and an output phonological representation *P*, such that $S\mathfrak{R}P$, assign a violation mark for every PPh constituent in *P* which does not have a correspondent CP phase in *S*.

[46] As a general rule, syntactic heads are linearized as suffixes and other morphemes are linearized as prefixes with a linear order that matches the Merge order. This is compatible syntactic or phonological linearization strategies. For a syntactic solution, the morphemes could be base generated in the correct order if the phrases above the *v*P are head-final. Even with a consistently right-branching tree, phrasal "snowball" movement (Aboh 2004) can derive the correct order: after I^0 Merges, (1) the *v*P Moves to adjoin to I^0, (2) the person prefix Merges, (3) C^0 Merges, (4) I^{MAX} Moves to adjoin to CP. For a phonological solution, perhaps the heads a phonologically deficient and encliticize (cf. Bennett, Elfner and McCloskey 2016; Elfner 2012; Werle 2009). One confound for linearization is the two plural agreement suffixes, such as *-oaa* '2PL' in (375), which occur between I^0 and C^0. These cannot instantiate some FP projection between C^0 and I^0, because if they did they would block the local selection between C^0 and its complement IP. (See Bliss 2013: 224 for one possible analysis.)

The two MATCH(CP) constraints below prohibit mismatches between corresponding CP and PPh constituents and are defined based on dominance of terminal elements. The first MATCH(CP) (All) constraint requires that a PPh dominate *all* of the segments in the output which correspond to segments in the input associated with the terminal nodes in the CP, (380). The second MATCH(CP) (Only) constraint requires that a PPh dominate *no* segments in the output which correspond to segments in the input associated with some terminal node outside of the CP, (381).

(380) MATCH(CP) (ALL)
Abbreviation: MATCH(CP) (All) or M_A(CP)

Let S be an input syntactic representation and P be an output phonological representation. Suppose there is a CP constituent in S that exhaustively dominates a set of one or more terminal nodes $\alpha \in S$, and there is PPh constituent in P and CP $\mathfrak{R}$ PPh. Let S_2 be the output string in P.

Assign a violation mark for every element that (1) is an exponent of a morpheme in α and (2) has a correspondent in S_2 which is not dominated by the PPh.

(381) MATCH(CP) (ONLY)
Abbreviation: MATCH(CP) (Only) or M_O(CP)

Let S be an input syntactic representation and P be an output phonological representation. Suppose there is a CP constituent in S that exhaustively dominates a set of one or more terminal nodes $\alpha \in S$, and there is PPh constituent in P and CP $\mathfrak{R}$ PPh. Let S_2 be the output string in P.

Assign a violation mark for every element that (1) is an exponent of a morpheme that is not in α and (2) has a correspondent in S_2 which is dominated by the PPh.

For the monoclausal contexts I examined, all four constraints are perfectly satisfied by the prosodic structure in (377).[47] Consider now the two embedded CP contexts: biclausal utterances with a complement or adjunct CP. One example of a complement clause is repeated below from (197). The embedded clause is rightmost within the utterance.

[47] It is likely that more complicated CP structures might involve phrasal clitics which disrupt this perfect match. I leave this question for future research.

(382) COMPLEMENT CP CONTEXT: SYNTAX

[*Nítssksinii'pa* [*kitsówatoohsoaayi* $]_{CP}]_{CP}$

Nit–[ssk–in/Ø–i]–'p–a kit–[io–wat–oo]–hs–oaa–yi

1–[return–see/*v*–TI1]–IND–3 2–[eat–*v*–TI2]–CNJ–2PL–DEP

'I know you ate it.' (Frantz 2009: 109, (f); re-glossed)

I have listed five possible prosodifications below. Only some of these are compatible with the data. The prosodic structure in (a) perfectly matches the syntactic structure in (197), but cannot be correct. The right edge of the first verbal complex is not at the right edge of a PPh, and yet verbal complexes in this position exhibit the right edge effects of a PPh (e.g. final devoicing, final degenerate syllable). For similar reasons, prosodification (d) can be ruled out. The left edge of the second verbal complex is not at the left edge of a PPh, and yet verbal complexes in this position exhibit the left edge effects of a PPh (e.g. glides are prohibited, primary stress falls on the first, second, or third syllable). prosodification (e) can be ruled out for both of these reasons, as well as the fact that each verbal complex has a separate primary stress. That leaves either (b) or (c) as structures which are compatible with the empirical facts. Both of these structures parse the two verbal complexes into separate PPhs instead of matching the embedded structure of the two CPs.

(383) COMPLEMENT CP CONTEXT: PROSODY

a. *(ní.ts̩ː.k͡si.niʔ.pa (ki.t͡só.wa.toxʷ.so.ŏaː.ji̥ $)_{PPh}$ $)_{PPh}$

b. ((ní.ts̩ː.k͡si.niʔ.pḁ $)_{PPh}$ (ki.t͡só.wa.toxʷ.so.ŏaː.ji̥ $)_{PPh}$ $)_{PPh}$

c. (ní.ts̩ː.k͡si.niʔ.pḁ $)_{PPh}$ (ki.t͡só.wa.toxʷ.so.ŏaː.ji̥ $)_{PPh}$

d. *((ní.ts̩ː.k͡si.niʔ.pḁ $)_{PPh}$ ki.t͡só.wa.toxʷ.so.ŏaː.ji̥ $)_{PPh}$

e. *(ní.ts̩ː.k͡si.niʔ.pa.ki.t͡só.wa.toxʷ.so.ŏaː.ji̥ $)_{PPh}$

An example of an adjunct CP clause is given below, repeated from (199). The embedded clause is leftmost within the utterance, although as I will show, this linear precedence does not affect prosodification.

(384) ADJUNCT CP CONTEXT: SYNTAX

[[*Áó'tooyiniki,* $]_{CP}$ *áakitsoyo'pa.* $]_{CP}$

a–[o't–oo]–yin–ik–i aak–it–[io–yi]–o'p–a

IPFV–[at–go.AI]–SBJ–MOOD–DEP FUT–LOC–[eat–AI]–21.IND–3

'When you/I arrive, (then) we'll eat.' (Frantz 2009: 111, (o); re-glossed)

I have listed five possible prosodifications below. For the same reasons as above, only some of these are compatible with the data. The left and right edges of both verbal complexes have the phonological properties of the left and right edges of a PPh. Therefore, only the structures in (b) and (c) are compatible with the empirical facts. Both of these structures parse the two verbal complexes into separate PPhs instead of matching the embedded structure of the two CPs.

(385) ADJUNCT CP CONTEXT: PROSODY

a. *(áwʔ.toː.ji.ni.ki (âː.ki.t͡so.joʔ.pḁ $)_{\text{PPh}}$ $)_{\text{PPh}}$

b. ((áwʔ.toː.ji.ni.ki $)_{\text{PPh}}$ (âː.ki.t͡so.joʔ.pḁ $)_{\text{PPh}}$ $)_{\text{PPh}}$

c. (áwʔ.toː.ji.ni.ki $)_{\text{PPh}}$ (âː.ki.t͡so.joʔ.pḁ $)_{\text{PPh}}$

d. *((áwʔ.toː.ji.ni.ki $)_{\text{PPh}}$ âː.ki.t͡so.joʔ.pḁ $)_{\text{PPh}}$

e. *(áwʔ.toː.ji.ni.kj.aː.ki.t͡so.joʔ.pḁ $)_{\text{PPh}}$

In order to account for both of these types of mismatches, EQUALSISTERS and MATCH-∃(CP→PPh) must both dominate BINMIN and MATCH-∃(PPh→CP).[48] I show how this works in the two tableaux below, where {x, y} = verbal complexes, [ ] = CP constituents, and ( ) = PPh constituents. Subscripts indicate correspondence relations. For the purposes of calculating BINMIN, I assume that each PPh contains no more than one PWd. In Chapter 4 I confirm this: there is no evidence for multiple PWd constituents within a Blackfoot PPh. (By Proper Headedness, a PPh must contain at least one PWd.)

(386)

$[\ x\ [\ y\ ]_1\ ]_2$	M_A(CP)	M_O(CP)	EQSIS	M-∃ (CP)	BIN	M-∃ (PPH)
a. $(\ x\ (\ y\ )_1\ )_2$			∗!		∗	
☞ b. $((\ x\ )_3\ (\ y\ )_1)_2$					∗∗	∗
c. $(\ x\ )_2\ (\ y\ )_1$	∗y!				∗∗	
d. $(\ (\ x\ )_1\ y\ )_2$	∗y!	∗x!	∗!		∗	
e. $(\ x\ y\ )_2$				∗!		

Crucial rankings: {MATCH(CP) (All), EQUALSISTERS, MATCH-∃(CP→PPh) } ≫ {BINMIN, M-∃(PPh) }

[48]Candidate (c) is optimal if MATCH(CP) (All) ranks below MATCH-∃(PPhh) instead. I assume this is not the most relevant constraint, because it is assigned gradiently and will quickly incur many violations.

(387)

$[\ [\ \text{x}\ ]_1\ \text{y}\ ]_2$	M_A(CP)	M_O(CP)	EqSis	M-∃ (CP)	Bin	M-∃ (PPh)
a. $(\ \text{x}\ (\ \text{y}\ )_1\ )_2$	∗x!	∗y!	∗!		∗	
☞ b. $((\ \text{x}\ )_1\ (\ \text{y}\ )_3)_2$					∗∗	∗
c. $(\ \text{x}\ )_1\ (\ \text{y}\ )_2$	∗x!				∗∗	
d. $(\ (\ \text{x}\ )_1\ \text{y}\ )_2$			∗!		∗	
e. $(\ \text{x}\,\text{y}\ )_2$				∗!		

Crucial rankings: {MATCH(CP) (All), EQUALSISTERS, MATCH-∃(CP→PPh) } ≫ {BINMIN, M-∃(PPh) }

In Section 3.1 I argued that the verbal complex has a *negative* syntactic definition. When all arguments are *pro*, the verbal complex is exactly as large as a CP. When nominal arguments are overt, they have the same phonological generalizations as the verbal complex. I take this to mean that the nominal arguments and the verbal complex are prosodified into the same type of prosodic constituent. In essence, the verbal complex cannot be defined as a syntactic constituent, but can be defined prosodically as a PPh.

As I discussed in Section 3.1.3, subjects and complements to TA/TI verb stems have the internal and external syntax of a DP. The analysis of embedded CPs above extends straightforwardly to account for CPs that contain a verbal complex and one or more DP arguments. For example, a complement CP and a complement DP create the same embedded structure: [x [y]]. The embedded CP or DP MATCH-es to a PPh, and then the effect of EQUALSISTERS is to "promote" the remainder of the CP to a PPh.

The delimiting case are NP complements. These too are parsed to a PPh (e.g. they never begin in glides, etc.), but the MATCH constraints as formulated cannot account for this, because the NP is not a DP, as shown below.

(389)

$[\ \text{x}\,\text{y}\ ]_2$	M_A(CP)	M_O(CP)	EqSis	M-∃ (CP)	Bin	M-∃ (PPh)
a. $(\ \text{x}\ (\ \text{y}\ )_1\ )_2$			∗!		∗	∗
☹ b. $((\ \text{x}\ )_1\ (\ \text{y}\ )_3)_2$					∗!∗	∗
c. $(\ \text{x}\ )_1\ (\ \text{y}\ )_2$	∗x!				∗∗	∗
d. $(\ (\ \text{x}\ )_1\ \text{y}\ )_2$			∗!		∗	∗
☞ e. $(\ \text{x}\,\text{y}\ )_2$						

It's possible that all NPs are associated with a null, semantically deficient D, although there is no empirical evidence for this. An alternative solution is to propose a WRAP-*n*P constraint which requires all *n*Ps to be WRAP'd in a PPh.

(390)

$[\ x\ y\ ]_2$	WR(n^{MAX})	M_A(CP)	M_O(CP)	EQSIS	M-∃ (CP)	BIN	M-∃ (PPH)
a. $(\ x\ (\ y\ )_1\ )_2$				∗!		∗	∗
☞ b. $((\ x\ )_1\ (\ y\ )_3\ )_2$						∗∗	∗
c. $(\ x\ )_1\ (\ y\ )_2$		∗x!				∗∗	∗
d. $(\ (\ x\ )_1\ y\ )_2$	∗!			∗		∗	∗
e. $(\ x\ y\ )_2$	∗!						

In the next chapter, I turn to discuss smaller constituents within the CP and show how they map to prosody.

Chapter 4

Correspondence of *v*P/VP phrases and prosodic words

This chapter discusses the correspondence between *v*P/VP phrases and prosodic constituents. Syntactically, a transitive verb stem contains a *v*P/VP shell (Larson 1988) and therefore is a more complex unit than an intransitive VP. I adopt the proposal in Déchaine (2002) & Déchaine and Weber (2015, 2018) that an a-categorical √ROOT may merge as a *v*P or VP adjunct without first combining with a categorizing head, *contra* many other theories such as Distributed Morphology (Marantz 1997; Siddiqi 2009) and Asymmetric Morphology (Di Sciullo 2005). I argue that a √ROOT may be syntacticized in two different ways: as an adjunct to the transitive *v*P or intransitive VP, or as an adjunct to a v^0 or V^0 head. This is similar to an analysis of Dutch primary compounds in De Belder (2017): the non-head of the compound is a bare root, which supports my view here that the root does not need to be licensed by superstructure in order to be interpretable or realizable (see also Alexiadou and Lohndal 2017; Arad 2005; Marantz 2007; Ramchand 2008; Starke 2009).

(391) ROOT ADJUNCTION TO XP OR X

a. XP

√ROOT XP

b. XP

√ROOT X^0

These two types of merge strategies have several correlates. Syntactic heads in Blackfoot are dependent or bound, and require a morpheme at the left edge before the stem can be inflected. Following Déchaine and Weber (2015) & Slavin (2012), I hypothesize this syntactic dependency is because a verbal head in Blackfoot is a light verb construction, which is semantically deficient. I hypothesize that such verbs have a *gap*—the predicate which takes an event as its argument. This predicate is supplied by an XP-adjoined root or any other phrasal adjunct which contributes lexical semantics. I adopt a version of first phase syntax (Ramchand 2008) and assume that the first phase is the domain of event structure. I propose that the phase boundary occurs at the point where all semantic predicates are filled, yielding a complete predicate. This hypothesis leads to a prediction, which is that some XP-adjoined roots do not have the right kind of lexical semantics to complete the phase of events. This class of roots is instantiated by a special class of XP-adjoined roots known as medials, which restrict the denotation of a nominal argument in the clause but do not add an event predicate and therefore do not complete the phase. For most languages, this first phase is contiguous with the first *v*P, and indeed, many people take the first phase to be equivalent to the first *v*P. For Blackfoot and other Algonquian languages, it must be equivalent to a recursive *v*P, because the main lexical predicate is an XP-adjoined $\sqrt{\text{ROOT}}$ which mergest *outside* the first *v*P.

Consider first a stem which contains only an XP-adjoined $\sqrt{\text{ROOT}}$ adjoined to the *v*P, (392), or VP, (393). Root adjunction creates a recursive *v*P or VP, as shown in the (a) examples below. The phase is not complete until the root adjoins, so it is the entire recursive *v*P/VP which corresponds to a Prosodic Word (PWd) constituent, as shown in the (b) examples. The PWd is contained inside the PPh, which also includes the inflectional suffixes to the *v*P/VP phrase. As I discuss in Section 3.1.1, the person prefix occurs in certain clause types and agrees with one of the nominal arguments of the clause, which is why it is in parentheses.

(392) TRANSITIVE VERBS: XP-ADJOINED ROOTS ONLY

a. [[(per–*) [$\sqrt{}$**ROOT** [**–*v*–V**]$_{vP}$]$_{vP}$ –I^0 –AGR –C^0]$_{CP}$ (syntax)

b. ((per–*) ($\sqrt{}$**ROOT–*v*–V**)$_{PWd}$ –I^0 –AGR –C^0)$_{PPh}$ (prosody)

(393) INTRANSITIVE VERBS: XP-ADJOINED ROOTS ONLY

a. [[(per–*) [$\sqrt{}$**ROOT** [**–V**]$_{vP}$]$_{vP}$ –I^0 –AGR –C^0]$_{CP}$ (syntax)

b. ((per–*) ($\sqrt{}$**ROOT–V**)$_{PWd}$ –I^0 –AGR –C^0)$_{PPh}$ (prosody)

Now consider stems which contain an XP-adjoined $\sqrt{\text{ROOT}}$ adjoined to the *v*P/VP as well as a X^0-adjoined $\sqrt{\text{ROOT}}$ adjoined to the highest verbal head. A schema for transitive stems is shown in (394) and a schema for intransitive stems is shown in (395). The X^0-adjoined $\sqrt{\text{ROOT}}$ is underlined. X^0-adjoined roots always occur within the innermost *v*P or VP phrase, as shown in the (a) examples. Only the outer *v*P/VP is a phase, so only the outer *v*P/VP corresponds to a PWd. This means that X^0-adjoined and XP-adjoined roots are prosodified differently, as in (b): XP-adjoined roots always occur at the left edge of a PWd, while X^0-adjoined roots (underlined) do not.

(394) TRANSITIVE VERBS: XP-ADJOINED AND X^0-ADJOINED ROOTS

a. [[(per–*) [$\sqrt{}$**ROOT** [$\sqrt{}$**<u>ROOT</u>–*v*–V** $]_{vP}$ $]_{vP}$ –I^0 –AGR –C^0 $]_{CP}$ (syntax)

b. ((per–*) ($\sqrt{}$**ROOT–**$\sqrt{}$**<u>ROOT</u>–*v*–V** $)_{PWd}$ –I^0 –AGR –C^0 $)_{PPh}$ (prosody)

(395) INTRANSITIVE VERBS: XP-ADJOINED AND X^0-ADJOINED ROOTS

a. [[(per–*) [$\sqrt{}$**ROOT** [$\sqrt{}$**<u>ROOT</u>–V** $]_{vP}$ $]_{vP}$ –I^0 –AGR –C^0 $]_{CP}$ (syntax)

b. ((per–*) ($\sqrt{}$**ROOT–**$\sqrt{}$**<u>ROOT</u>–V** $)_{PWd}$ –I^0 –AGR –C^0 $)_{PPh}$ (prosody)

The remainder of the chapter proceeds as follows. In Section 4.1 I discuss the internal syntax of the *v*P/VP phrase and show that transitive verbs contain a *v*P/VP shell while intransitive verbs contain a VP. The evidence comes from the *v*P/VP-internal suffixes, which have the distribution of v^0 and V^0 heads. I show that there are subclasses of roots which exhibit properties that follow from two different Merge strategies: roots can Merge as (1) as adjuncts to a *v*P/VP phrase, or (2) as adjuncts to a v^0/V^0 head. As a result, a stem in Blackfoot can contain one X^0-adjoined root and multiple XP-adjoined roots. I hypothesize that the Blackfoot stem is a phase of events, and that the verbal suffixes and X^0-adjoined roots essentially light verbal elements which are unable to provide a lexical predicate with event-compatible semantics. The phase completes once a root with compatible semantics adjoins to the *v*P/VP. Finally, I briefly compare my analysis with the traditional Algonquian template and conclude.

Then, in Section 4.2 I discuss the phonological correlates of the PWd constituent. There is a process of epenthesis which satisfies syllable structure constraints in Blackfoot by breaking up illicit consonant clusters within the PPh domain. This process can be determined by comparing patterns of low root allomorphy inside of the PWd, away from prosodic boundaries. The left edge of the PWd prohibits [-cont] segments. There is also evidence that [-cont] segments are prohibited at the left edge of the PWd, but tolerated when the left edge of the PWd and PPh coincide. The evidence is that XP-adjoined roots exhibit phonologically optimizing allomorphy and a process of epenthesis at the left edge which are both conditioned by the constraint against [-cont] segments. The patterns of alternation conspire to create PWds which always begin with a vowel or glide. Finally, neither process of epenthesis occurs within the suffixal domain, suggesting that the inflectional suffixes are outside of some prosodic domain, which I take to be the PWd.

Finally, in Section 4.3 I discuss the mapping from syntax to phonology. The smallest syntactic constituent which is relevant for MATCH is what I take to be the phase of events. This motivates the modified MATCH constraints I defined in Section 1.2.4.1. I show that the prosodic structure in Blackfoot at the PWd level is compatible with the constraint ranking that was developed for the CP/PPh level.

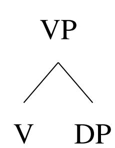
4.1 Syntax of the *v*P/VP phrase

In this section I discuss the internal syntax of the verb stem. I pay particular attention to determining the Merge site of √ROOTs, because a √ROOT which adjoins to a *v*P or VP phrase has different phonological correlates than a √ROOT which adjoins to a v^0 or V^0 head, which I discuss in Section 4.2. In Section 4.1.1 I lay out my assumptions about the internal syntax of transitive and intransitive verbs and discuss the syntactic diagnostics for determining the Merge site of the √ROOT. After that in sections Section 4.1.2 and Section 4.1.3 I discuss both types of √ROOT in turn. For each type of √ROOT, I argue that intransitive stems contain a V^0, while transitive stems contain a -v^0-V^0 sequence. In Section 4.1.4 I use the diagnostics developed earlier in the section to argue for the Merge site of the √ROOT. Because all stems contain at least one XP-adjoined √ROOT, the stem is necessarily recursive in Blackfoot. However, I argue in Section 4.1.5 that the external *v*P and VP have a unified syntactic definition as the first phase of events. In Section 4.1.6 I briefly compare my analysis with the traditional Algonquian templatic stem, and in Section 4.1.7 I conclude the section.

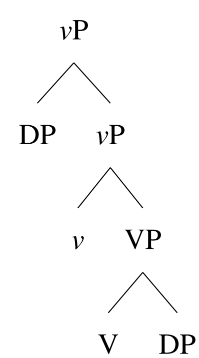
4.1.1 Theoretical assumptions

Many recent works decompose verbal meaning into multiple structural layers, each headed by a functional head (Borer 2013; Hale and Keyser 2002; Hale and Keyser 1993; Lohndal 2014; Marantz 1997, 2001, 2007; Ramchand 2008). Following these works and others, I assume that each verbal argument is introduced by a separate verbal head. Intransitive verbs contain a head (V^0) that selects one DP, (396). Transitive verbs contain two heads (little v^0 and big V^0), much like a Larsonian shell (Larson 1988). The v^0 head introduces the external argument DP,[1] and V^0 selects the internal argument DP, (397). (For arguments in favor of decomposing transitive verbs into two heads, see Hale and Keyser 1993; Kratzer 1996; Marantz 1997.) In Blackfoot, each of these heads is instantiated by a morpheme which is typically overt. This means that a transitive *v*P is morphologically more complex than an intransitive VP.

(396) INTRANSITIVE VERBS



(397) TRANSITIVE VERBS



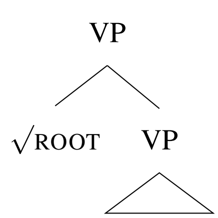
[1] This projection is equivalent to the VoiceP in Kratzer (1996), and is not the same as the categorizing head *v* in Distributed Morphology accounts like Marantz (2001). For discussion of the connection of v^0 to Voice, see Crippen and Déchaine (2015), Folli, Harley and Karimi (2005), & Harley (2013).

The structures above lead to several diagnostics for determining whether morphemes within the stem are V^0 or v^0 heads; namely, the *v*P/VP shell is the locus of argument structure and event structure. Regarding argument structure, both verbal heads in (396) and (397) are able to restrict the features of their local DP argument. I model this with Agree, where a head probes for a matching feature (Chomsky 2000, 2001). Big V^0 may restrict its sister DP argument, while v^0 may restrict the nearest adjoined DP argument. Regarding event structure (e.g. *Aktionsart*; Dowty 1979; Vendler 1967), I adopt a version of first phase syntax (Ramchand 2008), where *v*P/VP is the locus of event structure. The locus of event typing is V^0 for intransitive verbs and distributed across both verbal heads in transitive verbs. I leave open the possibility that either or both verbal heads could be further decomposed into multiple event structure heads, such as the $init^0$, $proc^0$, and res^0 heads in Ramchand (2008). Should that be the case, then event typing would be distributed across all heads.

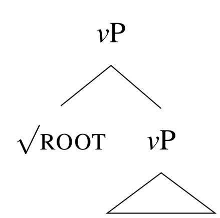
All verb stems also contain at least one lexical $\sqrt{\text{ROOT}}$ morpheme (Borer 2005a,b, 2013; Halle and Marantz 1993). I take the $\sqrt{\text{ROOT}}$ to be a combination of phonological and semantic information, with the phonological information inserted relatively "late". Crucially, I assume the $\sqrt{\text{ROOT}}$ is a-categorical in Blackfoot (*contra* Armoskaite 2011), a view which is adopted in some form by many others (Borer 2013; Di Sciullo 2005; Marantz 1997; Siddiqi 2009). Roots in Blackfoot do not have uniform morphosyntactic properties. To account for this, I follow a proposal in Déchaine (2002) & Déchaine and Weber (2015, 2018) that a-categorial $\sqrt{\text{ROOT}}$s merge with the syntactic spine in different ways: roots adjoin to an XP phrase or X^0 head, with the latter precompiled "offline" (and stored) or computed "online" in the syntax. Given the syntactic trees in (396) and (397) above, adjunction to XP yields two outputs: adjunction to VP or *v*P, (398). Likewise, adjunction to X^0 yields two outputs—adjunction to V^0 or v^0—and is further distinguished according to whether the tree is computed online, (399), or precompiled offline, (400). Offline precompilation results in a precategorized monomorphemic ("bare") root, which I label $\sqrt{\text{ROOT}}_V$ or $\sqrt{\text{ROOT}}_v$. These strategies predict a total of six outputs, shown below.

(398) ADJUNCTION TO XP

a.



b.



(399) ADJUNCTION TO X^0 VIA ONLINE COMPUTATION

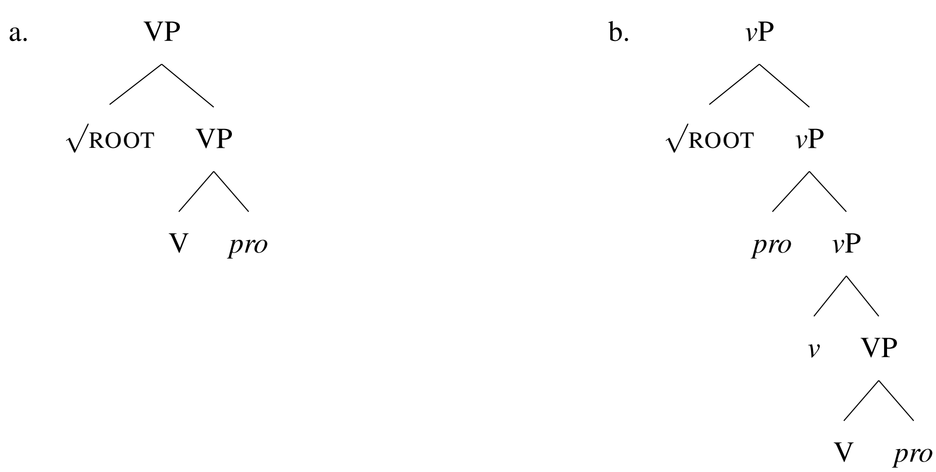
(400) ADJUNCTION TO X^0 VIA OFFLINE PRECOMPILATION

Inasmuch as morphology mirrors syntax, this predicts that roots pattern differently depending on where and how they merge with the verb spine. I discuss each type of root and their syntactic correlates in turn.

4.1.1.1 Adjunction to XP

A √ROOT can adjoin to intransitive VP (401a) or transitive *v*P (401b). (To simplify the trees, I have shown all arguments as *pro*.)

(401) STEMS CONTAINING XP-ADJOINED ROOTS ONLY

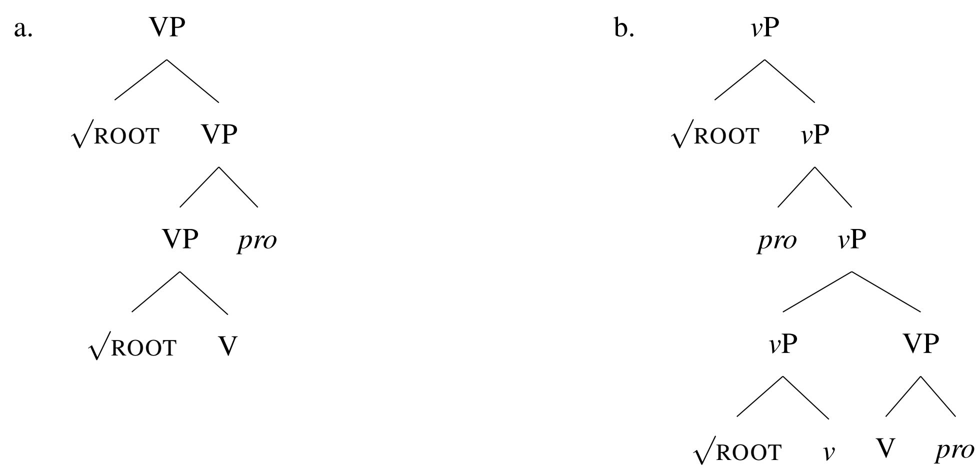


Because the verbal heads in Blackfoot are typically overt, an XP-adjoined root derives bimorphemic intransitive $[\sqrt{\text{ROOT}}+\text{V}]_{\text{VP}}$ stems and trimorphemic transitive $[\sqrt{\text{ROOT}}+v+\text{V}]_{v\text{P}}$ stems. These XP-adjoined roots ‘complete’ the stem in the sense that the stem can immediately combine with inflectional affixes. As adjuncts, these roots impose no selectional restrictions on the constituent they merge with. Therefore, this $\sqrt{\text{ROOT}}$ class is category-neutral, and not restricted to verb contexts. It is a-valent, and freely combines with *v*P/VP shells, with the latter determining valency. It is also neutral with respect to event type and DP features, because these also are properties of the *v*P/VP shells.

4.1.1.2 Adjunction to X^0

A $\sqrt{\text{ROOT}}$ can adjoin to an intransitive head V^0 (402a) or transitive head v^0 (402b). These roots do not form a complete stem on their own, but are bound at the left edge. In the simplest case these stems combine with an XP-adjoined root, as shown in (402). In more complex cases they may combine with larger adjoined syntactic phrases. (To simplify the tree, I have shown all arguments as *pro*.)

(402) STEMS CONTAINING X^0-ADJOINED ROOTS VIA ONLINE COMPUTATION



As a consequence of containing two roots, stems which contain X-adjoined roots are more complex than stems with only XP-adjoined roots: an X-adjoined root derives trimorphemic intransitive $[\sqrt{\text{ROOT}}+[\sqrt{\text{ROOT}}+\text{V}]_{\text{VP}}]_{\text{VP}}$ stems and quadrimorphemic transitive $[\sqrt{\text{ROOT}}+[\sqrt{\text{ROOT}}+v+\text{V}]_{v\text{P}}]_{v\text{P}}$ stems. These X-adjoined $\sqrt{\text{ROOT}}$s mirror the category and valency of the heads they adjoin to. For this type of adjunction, it is the heads V^0/v^0 which condition category, valency, event type, and DP type, which can be determined by considering derivational paradigms (Bauer 1997); the $\sqrt{\text{ROOT}}$ is not specified for any of these properties.

Finally, a $\sqrt{\text{ROOT}}$ can be prebundled with a covert head. Following Déchaine and Weber (2018), I assume that prebundling is a special case of adjunction to a null intransitive head V^0, (403a), or transitive head v^0, (403b), which is precompiled offline and stored as a precategorized unit. The claim that categorizing features are prebundled with some lexical items but project as independent heads elsewhere has a long pedigree in inflectional morphology; I apply this idea to derivational morphology to account for the behavior of precategorized roots.[2] This creates stems with "bare roots" which have the formal properties of a verbal head. I label precategorized intransitive roots as $\sqrt{\text{ROOT}}_{\text{V}}$, and precategorized transitive roots as $\sqrt{\text{ROOT}}_{v}$.

(403) ADJUNCTION TO X^0 VIA OFFLINE PRECOMPILATION

a. [$_{\text{VP}}$ $\sqrt{\text{ROOT}}$ V^0 Ø] $\rightarrow \sqrt{\text{ROOT}}_{\text{V}}$

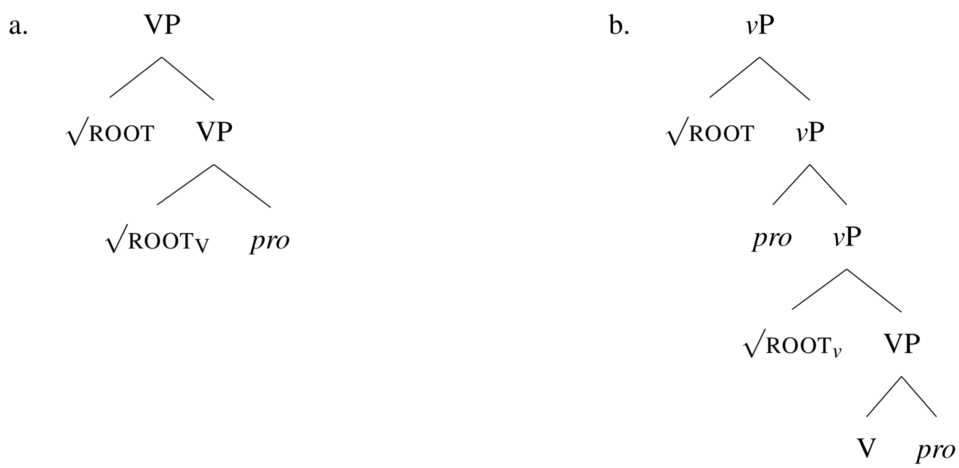
b. [$_{v\text{P}}$ $\sqrt{\text{ROOT}}$ v^0 Ø] $\rightarrow \sqrt{\text{ROOT}}_{v}$

(=400)

Just like other X-adjoined roots, precategorized roots do not form a complete stem on their own, but are bound at the left edge. The trees in (404) reflect the simplest case, in which the stems combine with an XP-adjoined root. (To simplify the tree, I have shown all arguments as *pro*.)

[2] Déchaine and Weber (2015) analyze precategorized roots as insertion of a root into V^0 or v^0. A precedent for this is found in Rizzi and Roberts (1989: 107), who argue that, in French, Infl can be inserted into C in main clauses. Instead, I follow Déchaine and Weber (2018) and present "insertion of a root into V or v" in terms of precompiled verb roots.

(404) STEMS CONTAINING PRECATEGORIZED ROOTS



As a consequence of prebundling, stems which contain precategorized roots are less complex than other stems with X-adjoined roots: a precategorized root derives bimorphemic intransitive $[\sqrt{\text{ROOT}}+[\sqrt{\text{ROOT}}_{\text{V}}]_{\text{VP}}]_{\text{VP}}$ stems and trimorphemic transitive $[\sqrt{\text{ROOT}}+[\sqrt{\text{ROOT}}_{v}+\text{V}]_{v\text{P}}]_{v\text{P}}$ stems. Just like syntactic heads, precategorized roots are restricted to a particular category (verb, noun), valency (intransitive, transitive), event type (state, event, process), and DP type (animate, inanimate).

In (403) a $\sqrt{\text{ROOT}}$ adjoins to a phonologically null head, deriving a bare root with an abstract bimorphemic structure. Analyses like this have been proposed in Distributed Morphology (Embick and Noyer 2007, among others) for English roots, where a null verbalizer (v) merges with *fall*, *laugh*, or *eat*. A crucial difference is that morphological exponence in Blackfoot almost always maps transparently to syntax, and bare roots arise only with precompiled adjunction to X^0. I take this to indicate that a transparent morphology-syntax mapping is optimal as it is more learnable. Accordingly, I only posit covert heads if they occur in a paradigm with phonologically overt heads.

4.1.1.3 Summary of diagnostics

The two merge strategies (adjunction to XP or X), together with the possibility of online computation versus offline precompilation, correlate with the diagnostics in Table 4.1, which I explain below.

Diagnostic 1, which counts morphemes, assumes that roots do not generally adjoin to phonologically null heads in syntactic derivation. Accordingly, XP-adjoined roots derive bimorphemic intransitive $[\sqrt{\text{ROOT}}+[\text{V}]_{\text{VP}}]_{\text{VP}}$ stems and trimorphemic transitive $[\sqrt{\text{ROOT}}+[v+\text{V}]_{v\text{P}}]_{v\text{P}}$ stems. In contrast, X-adjoined roots which are computed online in the syntax derive larger stems than stems with only XP-adjoined roots; the smallest are trimorphemic intransitive $[\sqrt{\text{ROOT}}+[\sqrt{\text{ROOT}}+\text{V}]_{\text{VP}}]_{\text{VP}}$ stems and

Table 4.1: Diagnostic properties for the Merge strategies of roots

		XP-ADJOINED	X-ADJOINED	
	DIAGNOSTIC	COMPUTED	COMPUTED	PRECOMPILED
1.	*Morpheme count* (e.g. minimal stem)			
	(a) bi-morphemic intransitive stem	✓	✘	✓
	(b) tri-morphemic transitive stem	✓	✘	✓
2.	*Category restriction*			
	root restricted to verbal category	✘	✓	✓
3.	*Selectional restriction*			
	root restricted to particular valency	✘	✘	✓
	root restricted to particular event type	✘	✘	✓
	root restricted to particular DP features	✘	✘	✓

quadrimorphemic transitive $[\sqrt{\text{ROOT}}+[\sqrt{\text{ROOT}}+v+\text{V}]_{v\text{P}}]_{v\text{P}}$ stems. Finally, X-adjoined roots which are precompiled and precategorized derive bimorphemic intransitive $[\sqrt{\text{ROOT}}+[\sqrt{\text{ROOT}}_{\text{V}}]_{\text{VP}}]_{\text{VP}}$ stems and trimorphemic transitive $[\sqrt{\text{ROOT}}+[\sqrt{\text{ROOT}}_{v}+\text{V}]_{v\text{P}}]_{v\text{P}}$ stems. Diagnostic 2 tracks categorical restrictions: XP-adjoined roots are not categorically restricted, but X-adjoined roots are. Diagnostic 3 tracks the selectional restrictions which are the properties of heads; namely, restrictions on valency event type, and DP features. XP-adjoined roots and X-adjoined roots which are computed are not categorically restricted, but X-adjoined roots which are precompiled are.

The following sections provide evidence for the structures discussed above. I discuss XP-adjoined roots in Section 4.1.2 and X-adjoined roots in Section 4.1.3. Each section has the same structure. First I discuss minimal stems and argue that intransitive stems contain a suffix which instantiates V^0 and transitive stems contain suffixes which instantiate v^0 and V^0. After that, I turn to the diagnostics from Table 4.1 and show how they apply to the roots in minimal stems. It is important to establish the Merge site of roots, because this is directly relevant for the prosodification of roots, which I discuss further in Section 4.2: XP-adjoined roots occur at the left edge of a PWd constituent, while X-adjoined roots do not.

4.1.2 Stems with XP-adjoined roots only

In this section I consider minimal stems which contain XP-adjoined roots only. I discuss paradigmatic intransitive stems in Section 4.1.2.1 and transitive stems in Section 4.1.2.2, and show that they contain suffixes which instantiate V^0 and v^0. This is expected if the stem is an intransitive VP or transitive vP. I spend some time on these sections, because the same arguments hold for verbal heads in stems with an X^0-adjoined root as well, which I turn to in the following section.

4.1.2.1 Intransitive stems contain a V^0

Minimal intransitive verbs are bimorphemic, consisting of a root and a stem-forming suffix. The stem-forming suffixes have the properties of a V^0 head: they are restricted to a particular valency, argument features, and event type, as I discuss below. Some examples are given in Table 4.2. The stem is preceded by the future prefix *aak-* [aːk-] (with allomorph *aaks-* [aːk͡s-] before [i]) and followed by inflectional suffixes.[3]

Table 4.2: Pairs of AI and II stative stems

FUT–[$\sqrt{\text{ROOT}}$–V] –IND–3	Gloss (AI)	FUT–[$\sqrt{\text{ROOT}}$–V]–IND–3	Gloss (II)
áaks–[ikinn –**ssi**]–Ø–wa	's/he will be warm'	áaks–[ikinn –**ii**] –Ø–wa	'it will be warm'
áaks–[iksisto –**'si**]–mm–a	's/he will have a fever'	áaks–[iksísto –**yi**]–Ø–wa	'it will be warm'
áaks–[isam –**ssi**]–Ø–wa	's/he will take a long time'	áaks–[isam –**o**] –Ø–wa	'it will be a long time'
áak– [omahks–**i**] –mm–a	's/he will be large'	áak– [omahk –**o**] –Ø–wa	'it will be large'
áaks–[ikoo –**:si**]–Ø–a	's/he will fall'	áaks–[ikoo –**o**] –Ø–wa	'it will give way, fall'

Regarding valency, the suffixes *-ssi* 'AI' (with allomorph *-'si* after *o*), *-i* 'AI', *-:si* 'AI, *-ii* 'II' (with allomorph *-yi* after *o*), and *-o* 'II' below derive intransitive verbs. Regarding argument features, it is the suffix which determines the animacy of the single argument. To see this, consider the pairs of verbs in (405)–(409), which are glossed examples of the verbs in Table 4.2. The same root can be used to derive an animate intransitive (AI) stem with an animate DP or an inanimate intransitive (II) stem with an inanimate DP, forming derivational paradigms (Bauer 1997). Regarding event type, there is agreement that light *v*P/VP determines event type in Algonquian (Brittain 2003; Hirose 2000; Quinn 2006). Event types in Algonquian are traditionally divided into states, processes, and events (Denny 1978, 1984). The suffixes determine whether an intransitive verb is a state or event. For example, the AI

[3] Some AI verbs are followed by a suffix *-mm* when the argument is an animate third person. Example (1a) shows have *iksisto'si-* 'have a fever', 'be hot' is followed by *-mm* with a third person argument, while (1b) shows that the same stem with a first person argument lacks *-mm*. The AI suffix *-ssi* is realized as *-'si* after [o].) As indicated by my gloss, I have assumed that *-mm* is one instantiation of the indicative clause-typing suffix, which is typically *-hp* for first and second person arguments and *-Ø* for third person arguments (Bliss 2013; Ritter and Wiltschko 2014).

(i) SUFFIX *-mm* CO-OCCURS WITH THIRD PERSON ARGUMENTS

a. *iksísto'simma*
[iksisto–'si]–mm–a
[$\sqrt{\text{HOT}}$–AI]–IND–3
'he had a fever'

b. *nitsíiksisto'si*
nit–[ii\iksisto–'si]–(hp)
1–[IC\$\sqrt{\text{HOT}}$–AI]–(IND)
'I had a fever'

These verbs are designated as '3mm' verbs in Frantz and Russell (2017). All 3mm verbs are AI stative verbs, but not all AI stative verbs are 3mm verbs. The exact distribution must be determined in part by the root, because $\sqrt{\text{IKINN}}$- 'be warm' in (405) and $\sqrt{\text{IKSISTO}}$- 'be hot', 'have a fever' have similar meanings and both combine with *-ssi* $\sim$ *-'si* to derive AI stative verbs. Despite this, the first stem does not occur with *-mm* while the second one does.

suffix *-ssi* and the II suffixes *-ii* and *-o* in (405) and (407) derive states. The AI suffix *-:si* and II suffix *-o* derive events.[4]

(405) a. *áaksikinn**ssi**wa*
aak–[ikinn–**ssi**]–Ø–wa
FUT–[warm–**AI**]–IND–3
's/he will be warm'

b. *áaksikinn**ii**wa*
aak–[ikinn–**ii**]–Ø–wa
FUT–[warm–**II**]–IND–3
'it will be warm'

(406) a. *áaksiksisto**'si**wa*
aak–[iksisto–**'si**]–mm–a
FUT–[emit.heat–**AI**]–IND–3
's/he will be warm, have a fever'

b. *áaksiksisto**yi**wa*
áak–[iksisto–**yi**]–Ø–wa
FUT–[emit.heat–**II**]–IND–3
'it will be warm'

(407) a. *áaksisam**ssi**wa*
áak–[isam–**ssi**]–Ø–wa
FUT–[long.time–**AI**]–IND–3
's/he will be aged, take a long time (in returning)'

b. *áaksisam**o**wa*
áak–[isam–**o**]–Ø–wa
FUT–[long.time–**II**]–IND–3
'it will be a long time'

(408) a. *áakomahks**i**mma*
áak–[omahk–**i**]–mm–a
FUT–[large–**AI**]–IND–3
's/he will be older, large'

b. *áakomahks**i**mma*
áak–[omahk–**o**]–Ø–wa
FUT–[large–**II**]–IND–3
'it will be big' (BB)

(409) a. *áaksikóo**si**wa*
aak–[ikoo–**:si**]–Ø–wa
FUT–[down–**AI**]–IND–3
's/he will fall (due to loss of sustenance or internal support)'

b. *áaksikoo**o**wa*
aak–[ikoo–**o**]–Ø–wa
FUT–[down–**II**]–IND–3
'it will give way, fall'

Note that although the verbs in Table 4.2 form derivational paradigms, there are many other AI stems which do not have an II counterpart, and vice versa, due to semantic or pragmatic factors. For example, the AI event suffix *-:si* 'AI' occurs in (410), which has no II counterpart, and the II event suffix *-o* 'II' occurs in (411), which has no AI counterpart. Nevertheless, these examples confirm that the suffixes place restrictions on their arguments; the stem in (410) cannot combine with an inanimate argument, and the stem in (411) cannot combine with an animate argument.

[4]The traditional division between states, events, and processes is a little vague, and typically based on the English translation, as I have done here. This traditional partition is not detailed enough for Blackfoot, which can be divided into at least four types: (1) stage-level inchoative states, (2) individual-level inchoative states, (3) activities, (4) accomplishments, and (5) achievements. These can be distinguished in Blackfoot via various tests (Chin 2007; Dunham 2007; Reis Silva and Matthewson 2007; Weber 2016c). I predict that each instantiation of V^0 will divide into specific event types, as based on those tests. All stative predicates are compatible with inchoative readings as well (Dunham 2007; Weber 2016c).

(410) *áókaa**si**wa*
[aoo–ka–**:si**]–Ø–wa
[hole–foot–**AI**]–IND–3
'he punctured his foot'

(411) *áaksikokot**o**wa*
aak–[ikokot–**o**]–Ø–wa
FUT–[frozen–**II**]–IND–3
'it will freeze'

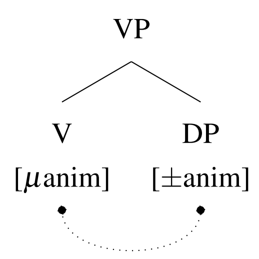
All examples so far are bimorphemic. The question arises whether V^0 is ever null, as is assumed in many frameworks, such as Distributed Morphology. To my knowledge, all intransitive stems in Blackfoot end in a vowel which instantiates V^0. That being said, roots exhibit different amounts of productivity. Some roots combine quite freely with many different verbal heads, while others are restricted to one. A good example is the root √KO'P, which only combines with *-o* 'AI', as in the example below. Roots like this are essentially 'cranberry' morphs, and are the most likely to be reanalyzed as a vowel-final pre-categorized root √KO'PO with a null verbalizing head. In this case, *-o* as an AI verbalizing suffix is the least productive instantiation of V^0 I have come across, but it does still exist in one other verb stem in Frantz and Russell (2017), shown below. This confirms the fact that even very unproductive roots and V^0 suffixes combine in a regular way; no intransitive stem has a null V^0.

(412) *áaksiko'p**o**mma*
aak–[iko'p–**o**]–mm–a
FUT–[afraid–**AI**]–IND–3
'she will be afraid'

(413) *áaksipap**o**mma*
aak–[ipap–**o**]–mm–a
FUT–[emit.burst–**AI**]–IND–3
'there will be lightning'

I treat the verbalizing AI and II suffixes as a light V which determines event type and which probes for DP features (Chomsky 2000, 2001). Specifically, the V^0 enters the derivation with event semantics and an unvalued [μanim] feature and enters a syntactic Agree relation with the local DP, which values the animacy feature as [+anim] or [-anim].

(414) INTRANSITIVE VERB AGREEMENT



The head is then spelled out in different ways depending on the valuation. For example, a state V can spell out as *-ssi* when it is valued as [+anim] and *-ii* when it is valued as [-anim], (415). Likewise, an event V can spell out as *-:si* when it is valued as [+anim] and *-o* when it is valued as [-anim], (415).[5]

[5]Perhaps the inanimate intransitive state *-o* and event *-o* are in reality the same morpheme. If so, the event semantics remain to be worked out.

(415) STATE V^0 SPELL OUT

a. *-ssi* $\leftrightarrow$ $V_{stat}{}^0$ / [+anim]

b. *-ii* $\leftrightarrow$ $V_{stat}{}^0$ / [-anim]

(416) EVENT V^0 SPELL OUT

a. *-:si* $\leftrightarrow$ $V_{evnt}{}^0$ / [+anim]

b. *-o* $\leftrightarrow$ $V_{evnt}{}^0$ / [-anim]

These are not the only choices for spell out: an AI state V^0 can spell out as *-i* and an II state V^0 can spell out as *-ii*. There are two hypotheses for how this spell out is controlled. First, the exponence of V^0 could be root-controlled. In more complicated stems with multiple roots, it is always the adjacent root which determines the exponence of V^0. (See Embick 2010 for one example of how to model root-controlled Vocabulary Insertion.) Second, perhaps each of these exponents carries slightly more grammatical information and is inserted to fulfill the particular event semantics of the root. Denny (1978, 1984) argues that this is true for these types of abstract heads in other Algonquian languages.

In summary, minimal intransitive stems contain a single $\sqrt{\text{ROOT}}$ and a suffix which instantiates V^0. I now turn to a discussion of minimal transitive verbs and argue that they contain a single $\sqrt{\text{ROOT}}$ and two suffixes which instantiate v^0 and V^0, respectively.

4.1.2.2 Transitive stems contain a v^0 and V^0

Minimal transitive verbs are trimorphemic, consisting of a root and two stem-forming suffixes. A non-exhaustive list of schematized transitive stem paradigms is given in Table 4.3, with fully inflected stems given below. As I discussed in Section 3.1.3, semantically bivalent verbs surface with three different stem types: transitive animate (TA), transitive inanimate (TI), and animate intransitive plus object (AI) (Bloomfield 1946; Frantz 2009). Each stem type is associated with a different series of suffixes. The abbreviation THM in the TA column stands for the transitive animate 'theme sign' (Bliss 2005; Bloomfield 1946; Frantz 2009), which I discuss below.

The data in Table 4.3 is organized into three groups by the form of the first suffix, which I argue in Section 4.1.2.2.1 instantiates v^0. There are three patterns, (417). In the majority of cases, the realization of v^0 is invariant across the paradigm; that is, it is a single realization, /X/, in TA, TI, and AI forms. In some cases there are two realizations: the TA form is one realization, /X/, and the TI and AI forms share a second realization, /Y/. Finally, for some cases there are three separate realizations: the TA form contains one realization, /X/, the TI form another, /Y/, and the AI form a third, /Z/.

Table 4.3: Transitive paradigms with XP-adjoined roots only by v^0

TA			TI			AI			Stem gloss
√ROOT	-$\boldsymbol{v}^0$	-V^0	√ROOT	-$\boldsymbol{v}^0$	-V^0	√ROOT	-$\boldsymbol{v}^0$	-V^0	
√ONA	**-t**	-THM	√ONA	**-t**	-oo	√ONA	**-t**	-aa	‘dig’
√ATO	**-t**	-THM	√ATO	**-t**	-oo	√ATO	**-t**	-aa	‘feed to fire’
√INAK	**-at**	-THM	√INAK	**-at**	-oo	√INAK	**-at**	-aki	‘roll’
√SSKSIM	**-at**	-THM	√SSKSIM	**-at**	-oo	√SSKSIM	**-at**	-aki	‘weave, knit’
√ISTTOK	**-i**	-THM	√ISTTOK	**-i**	-Ø	√ISTTOK	**-i**	-aki	‘knock’
√KA’K	**-i**	-THM	√KA’K	**-i**	-Ø	√KA’K	**-i**	-aki	‘chop (wood)’
√KOTT	**-i**	-THM	√KOTT	**-i**	-i	√KOTT	**-i**	-aki	‘stuff’
√SIN	**-a**	-THM	√SIN	**-a**	-i	√SIN	**-a**	-aki	‘draw, write’
√OK	**-i**	-THM	√OK	**-st**	-oo	√OK	**-st**	-aki	‘read, count’
√YIIST	**-am**	-THM	√YIIST	**-aht**	-oo	√YIIST	**-aht**	-aa	‘carry on back’
√YOOHK	**-o**	-THM	√YOOHK	**-Ø**	-i	√YOOHK	**-im**	-aa	‘wait’
√YOOHT	**-o**	-THM	√YOOHT	**-Ø**	-i	√YOOHT	**-im**	-i	‘hear’

(417) PATTERNS OF REALIZATION OF v^0 ACROSS THE PARADIGM

a.

TA = /X/	TI = /X/	AI = /X/
-t	-t	-t
-at	-at	-at
-i	-i	-i
-a	-a	-a

b.

TA = /X/	TI = /Y/	AI = /Y/
-i	-st	-st
-im	-isst	-isst
-am	-aht	-aht

c.

TA = /X/	TI = /Y/	AI = /Z/
-o	-i	-im

There is a fourth logical pattern of realization, where the TI form has one realization, /X/, but the TA and AI forms share a second realization, /Y/. This pattern also occurs in some stems which contain X-adjoined roots. For example, the v^0 after the X-adjoined root *-p* ‘tie’, (418), is *-ist* in TA and AI stems, but *-i* in TI stems.

(418) a. áaksísskoyipistsiiwáyi
aak–[iyissk–**oyi**–p/ist–ii]–Ø–w=ayi
FUT–[tie.down–**mouth**–tie.*v*–3SUB]–IND–3=OBV.SG
'she will tie a cover on his mouth'

b. nitsííyissksipii'pa anní sskinítsimaani
nit–[IC\iyissk–p/i–Ø]–'p–a ann–i sskinitsimaan–i
1–[tie.down–tie/*v*–TI3]–IND–3 DEM–IN.SG bag–IN.SG
'I tied the bag (shut or down)'

c. nitsísskoyipistaa
nit–[IC\iyissk–**oyi**–p/ist–aa]–(hp)
1–[tie.down–**mouth**–tie/*v*–AI]–(IND)
'I bridled'

In what follows, I provide support for the morphemic analysis in Table 4.3 by showing fully inflected examples of each of the stems. Whenever possible, I compare these against an example of the root before a different suffix or stem, so that the root can be clearly delineated from the following suffixes. Many or all of these suffixes also occur in transitive stems which contain head-adjoined roots, which I discuss in the next section, so it is important to establish the patterns in this section. All data is from Frantz and Russell (2017), but the data is sometimes constructed in the following sense. Some of the stems were listed in the dictionary as 'related stems'; related stems are not given their own entry in the dictionary, which means there are no inflected examples to drawn on. Any example which has "(rel. stem *XXX*)" in the free translation line was created by me by adding regular inflectional affixes. Otherwise, the example is taken from within the dictionary entry. After I present the data, I argue that the first suffix instantiates v^0 and the second suffix instantiates V^0 in all three stem types.

In the simplest case, v^0 is instantiated by a single realization for all three bivalent verb stems. This is the case for the root √ONA 'dig', (419), which is followed by v^0 *-t*. This root probably also occurs in the intransitive stem 'to get stuck (in a medium)', where it occurs before the AI suffix *-:si*, (420).

(419) a. *áakonatsiiwa*
aak–[ona–**t**–ii]–Ø–wa
FUT–[dig–***v***–3SUB]–IND–3
's/he will dig him/her' (rel. stem *onat*)

b. *áakonatooma*
aak–[ona–**t**–oo]–m–a
FUT–[dig–***v***–TI2]–IND–3
's/he will dig it' (rel. stem *onatoo*)

c. *áakonataawa*
aak–[ona–**t**–aa]–Ø–wa
FUT–[dig–***v***–AI]–IND–3
's/he will dig'

(420) *áakónaasiwa*
aak–[ona–:si]–Ø–wa
FUT–[dig–AI]–IND–3
'he will get stuck'

The root √ATO 'feed fire', (421), is also followed by v^0 *-t*. This root can be established by paradigmatic contrast with other stems, such as those in (419).

(421) a. *áakatotsiiwa*
aak–[ato–**t**–ii]–Ø–wa
FUT–[feed.fire–***v***–3SUB]–IND–3
's/he will throw him/her in the fire' (rel. stem *ototsi*)[6]

b. *áakatotooma*
aak–[ato–**t**–oo]–m–a
FUT–[feed.fire–***v***–TI2]–IND–3
's/he will throw it in the fire'

c. *áakatotaama*
aak–[ato–**t**–aa]–Ø–wa
FUT–[feed.fire–***v***–AI]–IND–3
's/he will build a fire'

The root √INAK 'roll', (422), is followed by v^0 *-at*. This root can also be followed by the middle reflexive AI suffix *-a'si*, as in (423).

[6]The related TA stem in Frantz and Russell (2017) is listed as *ototsi*. I assume the final *i* is the theme suffix *-ii* '3SUB' which was misanalyzed as part of the stem.

(422) a. *áaksinakatsiiwáyi*
aak–[inak–**at**–ii]–Ø–w=ayi
FUT–[roll–***v***–3SUB]–IND–3=OBV.SG
'she will roll him'

b. *áaksinakatooma*
aak–[inak–**at**–oo]–m–a
FUT–[roll–***v***–TI2]–IND–3
'she will roll it' (rel. stem *inakatoo*)

c. *áaksinakatsiiwáyi*
aak–[inak–**at**–aki]–Ø–w=ayi
FUT–[roll–***v***–AI]–IND–3=OBV.SG
'she will roll s.t.' (rel. stem *inakataki*)

(423) *míístapinaka'sit*
miistap–[inak–a'si]–t–Ø
away–[roll–AI]–2SG.IMP–CMD
'roll away!'

The root $\sqrt{}$SSKSIM 'weave, knit', (424), also is followed by v^0 *-at*. This root can be established by paradigmatic contrast with other stems, such as those in (422).

(424) a. *issksimátsis*
[issksim–**at**–:s]–Ø
FUT–[weave–***v***–2SG:3.IMP]–CMD
'weave it (anim)!' (rel. stem *ssksimat*)

b. *issksimátoot*
[issksim–**at**–oo]–t–Ø
[weave-***v***–TI2]–2SG.IMP–CMD
'weave it!' (rel. stem *issksimatoo*, *ssksimatoo*)

c. *issksimátakit*
[issksim–**at**–aki]–t–Ø
[weave–***v***–AI]–2SG.IMP–CMD
'weave!'

The root $\sqrt{}$ISTTOK 'knock', (425), is followed by v^0 *-i*. This root also occurs before the benefactive suffix *-omo*, (426), and before one version of the 'by heat' precompiled root *-inss*, (427).

(425) a. *isttókiis*
[isttok–**i**–:s]–Ø
[knock–***v***–2SG:3.IMP]–Ø
'knock on him/her!' (id. 'knock on his/her door!')

b. *isttókit*
[isttok–**i**–Ø]–t–Ø
[knock–***v***–TI2]–2SG.IMP–CMD
'knock on it!' (rel. stem *isttoki*)

c. *isttókiaakit*
[isttok–**i**–aki]–t–Ø
[knock–***v***–AI]–2SG.IMP–CMD
'knock!'

(426) *isttókomoos*
[isttok–omo–:s]–Ø
[knock–*v*–2SG:3.IMP]–CMD
'knock on it!' (rel. stem *isttokomo*)

(427) *isttókinssit*
[isttok–inss–i]–t–Ø
[knock–by.heat$_v$–TI1]–2SG.IMP–CMD
'make it (the firewood) blaze!'

The root √KA'K 'fragment', (428), is also followed by v^0 *-i*. This root also occurs before the 'by mouth' precompiled root *-st*, (429).

(428) a. *áaksika'kiyiiwa*
aak–[ika'k–**i**–yii]–Ø–wa
FUT–[fragment–***v***–3SUB]–IND–3
's/he will chop him/her' (rel. stem *ika'ki*)

b. *áaksika'kima*
aak–[ika'k–**i**–Ø]–m–a
FUT–[fragment–***v***–TI2]–IND–3
's/he will chop it' (rel. stem *ika'ki*)

c. *áaksika'kiaakiwa*
aak–[ika'k–**i**–aki]–Ø–wa
FUT–[fragment–***v***–AI]–IND–3
's/he will chop (e.g. wood)'

(429) *áaksika'kstsima*
aak–[ika'k–st–i]–m–a
FUT–[chop–by.mouth$_v$–TI1]–IND–3
'he will bite off of it'

The root √KOTTSI 'stuff', (430), is also followed by v^0 *-i*. This root can be established by paradigmatic contrast with other stems, such as those in (425) and (428).

(430) a. *áaksikóttsiyiiwáyi*
aak–[ikott–**i**–yii]–Ø–w=ayi
FUT–[stuff–***v***–3SUB]–IND–3=OBV.SG
's/he will stuff him/her (e.g. a mattress)'

b. *áaksikóttsiima*
aak–[ikott–**i**–i]–m–a
FUT–[stuff–***v***–TI1]–IND–3
's/he will stuff it' (rel. stem *kottsii*)

c. *áaksikóttsaakiwa*
aak–[ikott–**i**–aki]–Ø–wa
FUT–[stuff–***v***–AI]–IND–3
's/he will stuff (s.t.)' (rel. stem *kottsaaki*)

The root $\sqrt{\text{SIN}}$ 'mark, write, draw', (431), is followed by v^0 *-a*. The root is clearly separable from the suffix *-a*, which can be seen in (432), where it is followed by an incorporated noun *okoop* 'soup', and also in (433), where it occurs before the medial *-sski-* 'face'.[7]

(431) a. *iisínaiiwáyi*
[ii\isin–**a**–ii]–Ø–w=ayi
[IC\mark–***v***–3SUB]–IND–3=OBV.SG
'he drew her'

b. *isínaima*
[isin–**a**–i]–m–a
[mark–***v***–TI1]–IND–3
'he drew it' (rel. stem *sinai*)[8]

c. *isínaakiwa*
[isin–**a**–aki]–Ø–wa
[mark–***v***–AI]–IND–3
'she drew'

(432) a. *iisinokóópatsiiwáyi*
[ii\isin–okoop–at–ii]–Ø–w=ayi
[IC\mark–soup.n^0–v–3SUB]–IND–3=OBV.SG
'he impoverished her'

b. *isinokóópatooma*
[isin–okoop–at–oo]–m–a
[mark–soup.n^0–v–TI2]–IND–3
'he slurped it (e.g. the broth)'

(433) *sinsskipísa*
[sin–sski–p–:s]–Ø
[mark–face–by.mouth$_v$–2SG:3.IMP]–Ø
'lick his face!'

In some cases, v^0 has two different exponents. The first exponent occurs only in TA stems, while the second exponent occurs elsewhere (e.g. in TI and AI stems). This is the case for the root $\sqrt{\text{OK}}$ 'count', (434), which is followed by TA v^0 *-i*, and v^0 *-st* elsewhere.

[7] I have to thank Richard Rhodes for pointing out that $\sqrt{\text{SIN}}$ was the reflex of Proto-Algonquian *mesen- 'mark' (cf. Hewson 1993: 1851–1869).

[8] Although I constructed this example, it matches the stem in related entries in Frantz and Russell (2017), given in (1) and (2).

(434) a. *áóksiyiiwa*
a–[ok–**i**–yii]–Ø–wa
IPFV–[count–***v***–3SUB]–IND–3
'they are counting them' (Frantz 2009: 98)[9]

b. *áakokstooma*
aak–[ok–**st**–oo]–m–a
FUT–[count–***v***–TI2]–IND–3
's/he will count it'

c. *áakokstakiwa*
aak–[ok–**st**–aki]–Ø–wa
FUT–[count–***v***–AI]–IND–3
's/he will count (s.t)'

The root √YIIST 'on back', (435), is followed by TA v^0 *-am*, and v^0 *-aht* elsewhere. The boundary between the root and the suffix can be established by examples like (436), where the root √YIIST 'on back' is followed by an entire stem which begins in [i].

(435) a. *áaksiistamiiwa*
aak–[yiist–**am**–ii]–Ø–wa
FUT–[on.back–***v***–3SUB]–IND–3
's/he will carry him/her on her/his back'

b. *áaksiistahtooma*
aak–[yiist–**aht**–oo]–m–a
FUT–[on.back–***v***–TI2]–IND–3
's/he will carry it on her/his back'

(i) *náátsikapoisínaima*
naatsikapo–[isin–a–i]–m–a
twice–[isin–*v*–TI1]–IND–3
'she marked it with two stripes'

(ii) *áísínai'pi*
a–[isin–a–i]–'p–i
IPFV–[isin–*v*–TI1]–IND–IN.SG
'Writing-On-Stone' (lit. 'it is pictured')

[9]This example is drawn from the grammar, because Frantz and Russell (2017) only lists TA *oksi* as a related stem. There is no entry involving a third person subject on a third person object, but there is this analogous example using an inverse suffix:

(i) *nitáakoksookoo*
nit–aak–[ok–**i**–okoo]–(hp)
1–FUT–[count–***v***–INV]–(IND)
'I will be counted in'

c. *áaksiistahtaawa*
aak–[yiist–**aht**–aa]–Ø–wa
FUT–[on.back–***v***–AI]–IND–3
'*s*/he will carry s.t. on her/his back' (rel. stem *yiistahtaa*)

(436) *iikóki'takiwa* *niitá'payiistsipommatooma*
ii\ik–[ok–i't–aki]–Ø–wa niita'p–a–yiist–[ipomm–at–oo]–m–a
IC\DEG–[bad–by.mind$_v$–AI]–IND–3 really–IPFV–on.back–[transfer–*v*–TI2]–IND–3
otsistotóóhsiistsi
ot–istotoohsin–istsi
3–clothes–IN.PL
'he was so angry that he started to take his clothes off (in order to fight)'

Finally, there are a few cases where v^0 has three different exponents. One exponent occurs only in TA stems, one exponent occurs only in TI stems, and one exponent occurs only in AI stems and is typically *-im*. This is the case for roots like √YOOHK 'wait', (437), and √YOOHT 'hear', (438), where the TA v^0 is *-o*, the TI v^0 is *-Ø*, and the AI v^0 is *-im*.

(437) a. *áakoohkoyiiwa*
aak–[yoohk–**o**–yii]–Ø–wa
FUT–[wait–***v***–3SUB]–IND–3
's/he wait for him/her'

b. *áakoohkima*
aak–[yoohk–**Ø**–i]–m–a
FUT–[wait–***v***–TI1]–IND–3
's/he will wait for it' (rel. stem *yoohki*

c. *áakoohkimaawa*
aak–[yoohk–**im**–aa]–Ø–wa
FUT–[wait–***v***–AI]–IND–3
's/he will wait'

(438) a. *áakoohtoyiiwa*
aak–[yooht–o–yii]–Ø–wa
FUT–[listen–*v*–3SUB]–IND–3
's/he will hear him/her'

b. *áakoohtima*
aak–[yooht–Ø–i]–m–a
FUT–[listen–*v*–TI1]–IND–3
'ŝ/he will hear it' (rel. stem *yoohtsi*

c. *áakoohtsimiwa*
aak–[yooht–im]–i–Ø–wa
FUT–[listen–*v*–AI]–IND–3
'ŝ/he will listen'

To summarize the above patterns, there are several different paradigms of -v^0-V^0 sequences, each of which occurs with multiple different roots. In some cases, the exponence of v^0 is invariant across TA, TI, and AI stems. In other cases, the exponence of v^0 depends on the grammatical features of the internal argument. One or more exponents of v^0 occur with specific features of the argument; some exponents are designated as the 'default' case that obtains whenever those features are absent.

4.1.2.2.1 Transitive stems contain a v^0

I now turn to arguments that the first suffix instantiates v^0. The first suffix has all the properties of a v^0: it is restricted to particular valencies, event types, and argument features. Regarding valency, these suffixes only derive transitive verbs. Regarding event type, v^0 (together with the second suffix, V^0) determines event type. Regarding argument features, v^0 requires the external argument to be sentient.[10] Although all sentient nouns in Blackfoot are grammatically animate, grammatical animacy is not a sufficient property for subjecthood (Frantz 2009). For example, the non-sentient 'knife' in (439a) is grammatically animate and yet cannot appear as the external argument of a TI verb. Instead, instruments like the 'knife' must be introduced obliquely via a relative root *oht*-, which is *iiht*- with initial change in (439b).

(439) a. *	*Oma*	*isttoána*	*ikahksínima*	*annistsi*	*ikkstsíksiistsi.*
	om–a	isttoan–a	[ikahk–n/i–Ø]–m–a	ann–istsi	[ikkst–iksi]–istsi
	DEM–PRX	knife–PRX	[√SEVER–by.blade/*v*–TI3]–IND–3	DEM–IN.PL	[narrow–STICK]–IN.PL

Intended: 'That knife cut off those branches.' (Frantz 1997: 45, (k))

[10]Sentience has been shown to be an important feature for many aspects of Blackfoot grammar (Bliss 2013; Johansson 2009; Kim 2014, 2018; Louie 2008; Meadows 2010; Ritter 2015; Ritter and Rosen 2010; Wiltschko and Ritter 2015).

b.	*Oma*	*isttoána*	***iihts**íkahksinii'pi*	*annistsi*
	om–a	isttoan–a	ii**oht**–[ikahk–ini/Ø]–'p–i	ann–istsi
	DEM–PRX	knife–PRX	IC**MEANS**–[√SEVER–by.blade/*v*–TI3]–IND–3PL	DEM–IN.PL
	ikkstsíksiistsi.			
	[ikkst–iksi]–istsi			
	[narrow–STICK]–IN.PL			

'By means of the knife [somebody] cut off those branches.'
Or 'Someone cut off the branches with the knife.' (Frantz 1997: 45, (l))

The sentience restriction holds for semantically bivalent AI verbs as well. In the examples below, adapted from Kim (2017), the sentient noun 'boy' can serve as the external argument for the AI verb 'to roll' in (440a). (Recall that these verb stems may have an overt or null complement, denoted by the parentheses around *pokon* 'ball'.) However, the non-sentient noun 'wagon' is prohibited from this position, (440b), despite the fact that it is grammatically animate.

(440)	a.	*Anna*	*saahkomaapi*	*inakatakiwa*	*(pokon)*
		ann–a	saahkomaapi	[inak–at–aki]–Ø–wa	(pokon)
		DEM–PRX	boy	[√ROLL–*v*–AI]–IND–3	(ball)

'That boy rolled (a ball).'

b.	**Anna*	*ainaka'si*	*inakatakiwa*	*(pokon)*
	ann–a	a–[inak–a'si]–Ø	[inak–at–aki]–Ø–wa	(pokon)
	DEM–PRX	IPFV–[√ROLL–AI]–IND	[√ROLL–*v*–AI]–IND–3	(ball)

Intended meaning: 'That wagon rolled (a ball) (by hitting or pushing).'
(Adapted from Kim 2017)

Next I argue that the second suffix instantiates V^0 in TA, TI, and AI stems.

4.1.2.2.2 Transitive animate stems contain a V^0

I turn now to the second suffix and show that these have all the properties of a V^0 head: these are restricted to particular valencies, event types, and argument features. Regarding valency, these particular forms of V^0 only occur in transitive verbs; they are distinct from the instantiations of V^0 that I discussed in the previous section which occur in semantically monovalent stems. Regarding event type, V^0 (together with the first suffix, v^0) determines event type. Regarding argument features, V^0 restricts features of the internal argument. I begin by discussing the TA theme sign, which is the most complicated case, and then show that this is also true for the instantiations of V^0 in TI and AI stems.

The form of the TA theme sign depends on the persons of the subject and object of the sentence (Bliss 2005). For example, (441) and (442) both contain a second and third person argument. The only difference is whether the subject is the second person, (441), or third person, (442). Morphologically, the only difference is the theme sign. The theme cannot be reduced to an object markers, since second persons are indexed with the prefix *kit-* regardless of whether the second person is a subject or object. Instead, the theme suffix reflects the alignment of arguments to grammatical relations.

(441) *kitsíínowaa*
kit–[ii\in/o–**aa**]–Ø–wa
2–[IC\see/*v*–**3OBJ**]–IND–3
'You saw him/her.'

(442) *kitsíínooka*
kit–[ii\in/o–**ok**]–Ø–wa
2–[IC\see/*v*–**INV**]–IND–3
'S/he saw you.'

The full paradigm of theme suffixes in TA stems is given in Table 4.4. The person of the subject is shown along the first column, and the person of the object along the top row.[11] (Abbreviations: 1 = first person; 2 = second person; 21 = first person inclusive; 3 = third person); 3′ = third person obviative.)

Table 4.4: Theme suffixes (Frantz 2009)

S\O	1	2	21	3	3′
1	—	-o	—	-aa	-aa
2	-oki	—	—	-aa	-aa
21	—	—	—	-aa	-aa
3	-ok	-ok	-oki	—	-ii
3′	-ok	-ok	-oki	-ok	-ii

The suffixes in Table 4.4 are non-uniform and divide into at least two groups. Descriptively, if persons are arranged in a hierarchy as in (443), then the exponence depends on whether the subject is higher or lower than the object on the person hierarchy, (444).[12] If the subject is higher on the hierarchy, then the theme suffix reflects the person of the object: it is *-o* if the object is second person, and *-aa* or *-ii* if the object is third person, where *-ii* is used if the subject is also third person. If the object is higher on the hierarchy, then the form of the theme suffix is built on the inverse suffix *-ok* 'INV'.

(443) BLACKFOOT PERSON HIERARCHY
$1 > 2 > 21 > 3 > 3'$

(444) a. Subject $\longrightarrow$ Object: THM reflects person of the object
b. Object $\longleftarrow$ Subject: THM is built on the *-ok* 'INV' suffix

[11] If the subject is an unspecified subject, X, the pattern of agreement depends on number as well as person. I leave this part of the paradigm for future research.

[12] To be clear, I use the Blackfoot person hierarchy as a heuristic device, but I do not assume that it is a syntactic primitive.

I posit that V^0 spells out as late and reflects the person of the internal argument. The inverse suffix likely instantiates some higher functional head, with spell out restrictions prohibiting both heads to spell out. Thus, the theme suffix is a composite morpheme, reflecting the spell out of multiple heads. (For other analyses where theme suffixes are analyzed as the spell out of multiple distinct syntactic heads, see Oxford (2014) on Proto-Algonquian and Bliss, Ritter and Wiltschko (2010) on Blackfoot Nishnaabemwin.) The ability to restrict the grammatical features of the internal argument is one of the diagnostics for V^0 which I discussed in Section 4.1.1.

The V^0 head in TI and AI stems also restrict the grammatical features of the internal argument. Table 4.5 and Table 4.6 lay out the same data as before, but organized by the TI and AI V^0, respectively. Table 4.5 shows that there are three instantiations of V^0 in TI stems: TI1 *-i*, TI2 *-oo*, and TI3 *-Ø*.[13] These three suffixes are restricted to clauses with grammatically inanimate internal arguments, which shows that they instantiate V^0. Finally, Table 4.6 shows that there are several instantiations of V^0 in AI stems: *-aa*, *-i*, or *-aki*. These heads only occur in transitive stems when the internal argument is a bare plural or bare nominal (see Section 3.1.3 for the syntax of nominal arguments). This restriction shows that they instantiate V^0.

Table 4.5: Transitive paradigms with XP-adjoined roots only by TI V^0

	TA			TI			AI			Stem gloss
	√ROOT	-v^0	-V^0	√ROOT	-v^0	**-V^0**	√ROOT	-v^0	-V^0	
TI1	√KOTT	-i	-THM	√KOTT	-i	**-i**	√KOTT	-i	-aki	'stuff'
	√SIN	-a	-THM	√SIN	-a	**-i**	√SIN	-a	-aki	'mark, draw, write'
	√YOOHK	-o	-THM	√YOOHK	-Ø	**-i**	√YOOHK	-im	-aa	'wait'
	√YOOHT	-o	-THM	√YOOHT	-Ø	**-i**	√YOOHT	-im	-i	'hear'
TI2	√ONA	-t	-THM	√ONA	-t	**-oo**	√ONA	-t	-aa	'dig'
	√ATO	-t	-THM	√ATO	-t	**-oo**	√ATO	-t	-aa	'feed to fire'
	√INAK	-at	-THM	√INAK	-at	**-oo**	√INAK	-at	-aki	'roll'
	√SSKSIM	-at	-THM	√SSKSIM	-at	**-oo**	√SSKSIM	-at	-aki	'weave, knit'
	√OKS	-i	-THM	√OK	-st	**-oo**	√OK	-st	-aki	'read, count'
	√YIIST	-am	-THM	√YIIST	-aht	**-oo**	√YIIST	-aht	-aa	'carry on back'
TI3	√ISTTOK	-i	-THM	√ISTTOK	-i	**-Ø**	√ISTTOK	-i	-aki	'knock'
	√KA'K	-i	-THM	√KA'K	-i	**-Ø**	√KA'K	-i	-aki	'chop (wood)'

To sum up this description, I argued that transitive stems which contain only an XP-adjoined root are minimally trimorphemic, containing a root followed by two verbalizing suffixes which instantiate v^0 and V^0. This analysis departs from previous research, which treats both verbalizing heads as a single

[13] These are reflexes of the three Proto-Algonquian theme signs (Bloomfield 1962; Goddard 2007: 240).

Table 4.6: Transitive paradigms with XP-adjoined roots only by AI V^0

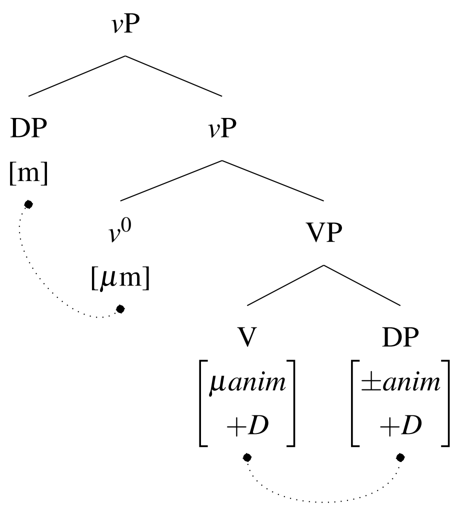
TA	TI	AI	Stem gloss
√ROOT -v^0 -V^0	√ROOT -v^0 -V^0	√ROOT -v^0 -$\mathbf{V^0}$	
√KOTT -i -THM	√KOTT -i -i	√KOTT -i -**aki**	'stuff'
√SIN -a -THM	√SIN -a -i	√SIN -a -**aki**	'mark, draw, write'
√INAK -at -THM	√INAK -at -oo	√INAK -at -**aki**	'roll'
√SSKSIM-at -THM	√SSKSIM-at -oo	√SSKSIM-at -**aki**	'weave, knit'
√OKS -i -THM	√OK -st -oo	√OK -st -**aki**	'read, count'
√ISTTOK-i -THM	√ISTTOK-i -Ø	√ISTTOK-i -**aki**	'knock'
√KA'K -i -THM	√KA'K -i -Ø	√KA'K -i -**aki**	'chop (wood)'
√ONA -t -THM	√ONA -t -oo	√ONA -t -**aa**	'dig'
√ATO -t -THM	√ATO -t -oo	√ATO -t -**aa**	'feed to fire'
√YIIST -am-THM	√YIIST -aht-oo	√YIIST -aht-**aa**	'carry on back'
√YOOHK-o -THM	√YOOHK-Ø -i	√YOOHK-im -**aa**	'wait'
√YOOHT-o -THM	√YOOHT-Ø -i	√YOOHT-im -**i**	'hear'

suffix (Frantz 2009) or argues that the AI stems are morphologically less complex than TA/TI stems (e.g. Déchaine and Weber 2015, 2018; Weber and Matthewson 2014, 2017). The problem is that most previous research focuses on paradigms where the TI V^0 is *-i*; as I showed above, these paradigms are less morphologically complex than those with TI V^0 *-oo*. Stems are more obviously trimorphemic when considering patterns with TI V^0 *-oo*, and when comparing across multiple different patterns, as I do above.

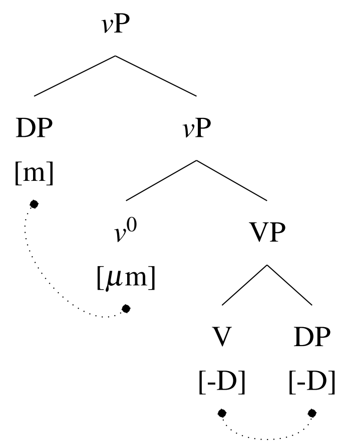
4.1.2.2.3 Analysis of verbal heads

I treat the two suffixes within the transitive stems as light *v* and V which together determine event type and which probe for features of the external and internal arguments, respectively. For concreteness, I model this via an Agree relation (Chomsky 2000, 2001), where a syntactic head with an unvalued feature probes for a nominal expression with interpretable phi-features which can value the feature. Following Kim (2018), Ritter (2015), & Wiltschko and Ritter (2015), the higher v^0 enters the derivation with an unvalued [μm(ental state)] feature. The feature [m] is taken from Reinhart (2002), where it represents a sentient participant whose mental state is relevant to the event, regardless of whether that participant is agentive or not. The head v^0 enters a syntactic relation with the external argument, which values the feature. If the external argument is non-sentient, then the derivation crashes. The lower V^0 head Agrees with features of the internal argument in slightly different ways in TA/TI verb stems versus in AI stems, which I describe in turn. Recall that the complements to TA/TI verbs are full DPs which contain demonstratives. The head V^0 enters the derivation with a [+D] feature and an uninterpretable [μanim] feature. It probes the internal argument to value the [μanim] feature. I assume that the [+D] feature is a property of the D head; if the internal argument is not [+D], then the derivation crashes. The complements to AI verbs are bare plurals and bare nouns, which are smaller than a full DP. I assume that the head V^0 enters the derivation with a [-D] feature, but no [μanim] feature because there are no restrictions on animacy for complements to AI verbs. The V^0 head probes the internal argument; if the internal argument is not [-D], then the derivation crashes.

(445) TA/TI AGREEMENT



(446) AI AGREEMENT



The phonological exponence of the heads is determined relatively "late", after Agreement takes place, as in an interpretive theory of morphology (e.g. Anderson 1992; Halle and Marantz 1993). I model the morphological exponence of V^0 as post-syntactic spell-out rules, similar to post-syntactic Vocabulary Insertion in Distributed Morphology (Halle and Marantz 1993). To take the suffixes that occur with $\sqrt{\text{OK}}$ 'count' as an example, when the lower head V^0 is valued as [+D, +anim], it spells out as *-o* or *-aa* depending on the person of the internal argument. The V^0 spells out as *-oo* when valued as [+D, -anim], and *-aki* when valued as [-D].

(447) TRANSITIVE V^0 SPELL OUT AFTER $\sqrt{\text{OK}}$ 'COUNT'

a. *-o* $\leftrightarrow$ V^0 / [+D, +anim, 2]
   -aa $\leftrightarrow$ V^0 / [+D, +anim, 3]

b. *-oo* $\leftrightarrow$ V^0 / [+D, -anim]

c. *-aki* $\leftrightarrow$ V^0 / [-D]

The higher head v^0 usually has an invariant form (such as *-t* or *-i*) and other times has multiple exponents. I will assume that the head is suppletive based on the value of the animacy feature on the following head. Continuing to use $\sqrt{\text{OK}}$ as an example, this means that v^0 spells out as *-i* when followed by a [+anim] V^0, and *-st* otherwise. Other instantiations of v^0 have a unique exponent before a [-anim] V^0, or two unique exponents before [+anim] V^0 and a [-anim] V^0.

(448) TRANSITIVE v^0 SPELL OUT AFTER $\sqrt{\text{OK}}$ 'COUNT'

a. *-i* $\leftrightarrow$ v^0 / ___-$V^0_{[+\text{anim}]}$

b. *-st* $\leftrightarrow$ v^0

For other Algonquian languages, this suffix is typically glossed as either TA or TI, based on the fact that the TA and TI forms are often different. However, Blackfoot has three semantically bivalent stem types and therefore does not fit into this binary well. Since v^0 spells out with a single realization across the paradigm in most cases, I simply gloss this suffix as *v* and treat the different patterns of realization as different restrictions on Vocabulary Insertion. The stem type can always be recovered by observing the following suffix, which instantiates V^0. can always recover whether it is a TA, TI, or AI stem by looking at the V^0 that follows; this is the only suffix which shows true agreement with the internal argument. Quinn (2006) makes a similar claim for Penobscot.

To recap, transitive verb stems with only an XP-adjoined root are trimorphemic, and I have argued that the second two morphemes instantiate two verbal heads, v^0 and V^0. In other words, transitive verb stems have the syntax of a *v*P. As we saw before, intransitive verb stems have the syntax of a VP. In the next section I discuss the syntax of stems which contain an X^0-adjoined root in addition to an XP-adjoined root.

4.1.3 Stems with X^0-adjoined roots

In this section I consider minimal stems which contain an X-adjoined root. I discuss paradigmatic intransitive stems in Section 4.1.3.1 and transitive stems in Section 4.1.3.2, and show that they contain suffixes which instantiate the same types of V^0 and v^0 heads in stems with XP-adjoined roots only.

4.1.3.1 Intransitive stems contain a V^0

The minimal intransitive stem which contains an X^0-adjoined root is trimorphemic, consisting of two roots and a stem-forming suffix. The suffixes are drawn from the same inventory of suffixes in bimorphemic intransitive verbs. Again, it is the suffixes which have the properties of a V^0 head: they are restricted to a particular valency, argument features, and event type. Regarding valency, the suffixes derive intransitive verbs. Regarding argument features, it is the suffix which determines the animacy of the single argument. To see this, consider the pairs of verbs in (484)–(486). The same roots can be used to derive an animate intransitive (AI) stem with an animate DP or an inanimate intransitive (II) stem with an inanimate DP. Regarding event type, the suffixes determine whether an intransitive verb is a state or process. For example, the AI suffix *-ssi* and the II suffix *-o* in (484) derive states, while the AI suffix *-oyi* and the II suffix *-ii* in (486) derive processes. The X^0-adjoined roots typically have a single exponent, as is the case for *-a'p* 'have quality' and *-ht* 'be positioned'. Other roots like 'by heat' may have different exponents in different stem types.

(449) a. *maká'p**ssi**wa*
[mak–a'p/**ssi**]–Ø–wa
[bad–have.quality/**AI**]–IND–3
'he is bad/mean'

b. *maká'p**ii**wa*
[mak–a'p/**ii**]–Ø–wa
[bad–have.quality/**II**]–IND–3
'it is bad'

(450) a. *iisáókihts**ii**wa*
[ii\isaok–ht/**ii**]–Ø–wa
[IC\flat–be.positioned/**AI**]–IND–3
'he lay down'

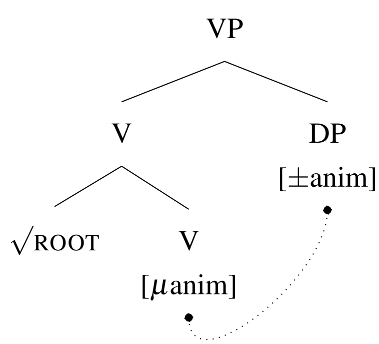
b. *isáókihts**i**wa*
[isaok–ht/**i**]–Ø–wa
[flat–be.positioned/**II**]–IND–3
'it is flat'

(451) a. *áakihkss**oyi**wa*
aak–[ihk–hs/**oyi**]–Ø–wa
FUT–[dry–by.heat/**AI**]–IND–3
'it (anim.) will dry'

b. *áakihkits**i**wa*
aak–[ihk–t/**i**]–Ø–wa
FUT–[dry–by.heat/**II**]–IND–3
'it (inan.) will dry'

Again, I treat the verbalizing AI and II suffixes as a light V which determines event type and which probes for DP features. The syntactic Agree relation is just as in (414), but in addition there is a X^0-adjoined root adjoined to V^0, as in (452).

(452) INTRANSITIVE VERB AGREEMENT



The V^0 head is then spelled out in different ways depending on the valuation. For example, a stative V can spell out as *-ssi* when it is valued as [+anim] and *-ii* when it is valued as [-anim]. A process V can spell out as *-oyi* when it is valued as [+anim] and *-i* when it is valued as [-anim].

(453) STATE V^0 SPELL OUT

a. *-ssi* $\leftrightarrow$ $V_{stat}{}^0$ / {[+anim]}

b. *-ii* $\leftrightarrow$ $V_{stat}{}^0$ / {[-anim]}

(454) PROCESS V^0 SPELL OUT

a. *-oyi* $\leftrightarrow$ $V_{proc}{}^0$ / {[+anim]}

b. *-i* $\leftrightarrow$ $V_{proc}{}^0$ / {[-anim]}

Finally, most low $\sqrt{\text{ROOT}}$s have an invariant form. Others, like the *-hs* $\sim$ *-t* 'by heat' root have two exponents. As I show in the next section, the 'by heat' root also occurs in transitive verbs, where it has the form *-hs*. Therefore, the form *-hs* is the default realization, and the form *-t* only occurs in II verb stems. I model this via spell out rules, where 'by heat' spells out as *-t* before a V^0 which is valued as [-anim], and *-hs* elsewhere.

(455) 'BY HEAT' SPELL OUT

a. *-t* $\leftrightarrow$ $\sqrt{\text{BY.HEAT}}$ / __ $V^0_{[\text{-anim}]}$

b. *-hs* $\leftrightarrow$ $\sqrt{\text{BY.HEAT}}$

In the next section, I turn to a discussion of the morphosyntax of transitive verb stems which contain an X^0-adjoined root.

4.1.3.2 Transitive stems contain a v^0 and V^0

The minimal transitive stem which contains an X^0-adjoined root contains two roots and two stem-forming suffixes.

4.1.3.2.1 Data

To restrict the following discussion, I focus on stems containing a particular set of root-and-stem combinations which are the so-called "instrumental" finals. These are listed in Table 4.7.[14] These are a well-studied class of transitive stem types found across the Algonquian family. As shown in Table 4.7, I have divided the instrumental finals into several classes. The first division is between Class I, which contains roots which are adjoined to X^0 via online computation, and Class II, which contains roots which are adjoined to X via offline precompilation. In Class I the TA stems are formed with v^0 *-o*; this

[14]This table includes phonologically regular allomorphy. Any morpheme which ends in [t] in some environments ends in [$\widehat{\text{ts}}$] (<ts>) before [i]. Additionally, any *hC* suffix has a *ssC* allomorph after certain consonants, with several different patterns of variation (described on Don Frantz's website, now unavailable, but summarized in Peter 2014.) Finally, some of the finals begin with vowels while others begin with consonants; I discuss the diagnostics for determining whether a suffix begins in a vowel or consonant in the next section.

is the only overt realization of v^0 in the Class I paradim. In Class II the v^0 is always null, and so these roots are precompiled offline and have the morphosyntax of precategorized roots. Class II TA stems divide again into two: in Class IIa the low-merged root has a single allomorph in TA, TI, and AI stems, and in Class IIb the low-merged root exhibits suppletive root allomorphy in TA stems. All TI stems in the set of instrumental finals end in *-i*,[15] and all AI stems end in *-aki*.

Table 4.7: Transitive paradigms with "instrumental" X^0-adjoined roots

	TA -√ROOT/-v^0-V^0	TI -√ROOT/-v^0-V^0	AI -√ROOT/-v^0-V^0	Gloss
I	-istot/o-THM	-istots/Ø-i	-istot/Ø-aki	'causative'
	-o't/o-THM	-o'ts/Ø-i	-o't/Ø-aki	'by hand'
	-hk/o-THM ∼ -ssk/o-THM	-hk/Ø-i ∼ -ssk/Ø-i	-hk/Ø-aki ∼ -ssk/Ø-aki	'by foot, body'
	-in/o-THM	-in/Ø-i	—	'by sight'
II.a	-hs/Ø-THM ∼ -ss/Ø-THM	-hs/Ø-i ∼ -ss/Ø-i	-hs/Ø-aki ∼ -ss/Ø-aki	'by heat'
	-itt/Ø-THM	-itts/Ø-i	-itt/Ø-aki	'by blade'
	-inn/Ø -THM	-inn/Ø-i	-inn/Ø-aki	'by hand'
II.b	-imm/Ø-THM	-i'ts/Ø-i	-i't/Ø-aki	'by mind'
	-amm/Ø-THM	-a'ts/Ø-i	-a't/Ø-aki	'watch, look at'
	-p/Ø-THM	-hts/Ø-i ∼ -ssts/Ø-i	-ht/Ø-aki ∼ -sst/Ø-aki	'by mouth, teeth'

Again, it is the suffixes which instantiate v^0 and V^0. I discuss each of these in turn. First, v^0 in this set of finals is instantiated by either *-o* or *Ø*, both of which also occur in transitive verbs with XP-adjoined roots. These suffixes have all the properties of a v^0 head: they are restricted to particular valencies, event types, and argument features. Regarding valency, these suffixes only derive transitive verbs. Regarding event type, v^0 (together with the low-merged root and the second suffix, V^0) determines event type. Regarding argument features, v^0 requires the external argument to be sentient, just as before.

The final suffix instantiates V^0. This suffix takes the form of a theme suffix in TA stems, *-i* in TI stems, and *-aki* in AI stems; all of these are forms of V^0 which also occur in transitive stems which have XP-adjoined roots. These suffixes have all the properties of a V^0 head: they are restricted to particular valencies, event types, and argument features. Regarding valency, these particular forms of V^0 only occur in transitive verbs; they are distinct from the instantiations of V^0 which occur in semantically monovalent stems. Regarding event type, V^0 (together with the first suffix, v^0) determines event type. Regarding argument features, V^0 restricts features of the internal argument. As discussed above, some of the theme suffixes in TA stems agree with the person features of the internal argument. The V^0 *-i* occurs in TI verbs, agreeing with an inanimate DP, and the V^0 occurs in AI forms, agreeing with bare

[15]This vowel continues the TI1 stem class from Proto-Algonquian, which ended in *-am. The morpheme boundary shifted and the *m was reanalyzed as a separate morpheme which now occurs on reflexes of TI2 stems as well (Berman 2006).

plurals and bare nominals. The example below shows how the Class IIa 'by hand' final forms TA, TI, and AI stems, respectively.

(456) a. [ɪspínːi ámo poːkáː]
isspínnii ámo pookáá
[ssp–inn–**ii**]–Ø–wa amo pookaa
[√HIGH–by.hand.*v*–3SUB]–IND–3 DEM child.AN
'he lifted that child' (BB)

b. [ɪspínːimḁ ámo sináːkjaʔt͡sɪs]
isspínnima ámo sináákia'tsis
[ssp–inn–**i**]–m–a amo [[sin–a]–aki]–a'tsis
[√HIGH–by.hand.*v*]–**TI1**–IND–3 DEM [[mark–*v*–AI]]–INS.IN
'he lifted that book' (BB)

c. [ɪspíːnaki (poːkɛ́ːk͡s / sináːkjaʔt͡siːˢt͡s)]
isspínnaki (pookáíks / sináákia'tsiists)
[ssp–inn–**aki**]–Ø–wa pookaa–iksi / [[[sin–a]–aki]–a'tsis]–istsi
[√HIGH–by.hand.*v*–**AI**]–IND–3 child–AN.PL / [[[mark–*v*–AI]]–INS]–IN.PL
'he lifted (children/books)' (BB)

As mentioned above, in Class IIb the low-merged root also has different allomorphs in different stem types. Could this be a type of agreement with the complement? I argue here that it does not, and that this is a case of morphologically-conditioned allomorphy. This means that only the final suffix exhibits properties of a V^0 head. First, X^0-adjoined roots have at most two forms: one is used in the TA stem, while the second is used for the TI and AI stems. This is different than the allomorphy of the final suffix, V^0, which has three separate forms for TA, TI, and AI stems, in agreement with the features of the complements to each of those verb stem types. Second, suppletion is limited to cases where the second TA suffix is -Ø, but not when the second TA suffix is phonologically overt. This is shown clearly in corner cases where the low root of the instrumental suffix can combine with multiple exponents of V^0, but only exhibits suppletion when V^0 is phonologically null. Consider the 'by mind' root, which suppletes to -*imm* before the TA v^0 -Ø, (457a). However, this root can also be followed by the applicative suffix -*omo*, which occurs in the same slot as TA -Ø and creates a TA verb stem. Suppletion is blocked before -*omo*, and 'by mind' is realized as -*i't*, (457b).

(457) a. *áaksiksimatsimmiiwáyi*
aak–[iksimat–**imm**–ii]–Ø–w=ayi
FUT–[√APPRECIATE–**by.mind**.*v*–3SUB]–IND–3=PRX.PL
'she will greet him'

b. *áaksiksimatsí'tomoyiiwáyi*
aak–[iksimat–**i't**/omo–ii]–Ø–w=ayi
FUT–[√APPRECIATE–**by.mind**/APPL.*v*]–3SUB–IND–3=PRX.PL
'she will show him admiration for a new acquisitiion'

Similarly, there are a few stems which include the 'by mind' root followed (unusually) by TA v^0 *-o* instead of *-Ø*. For these verbs, the 'by mind' root is *-i't* instead of **-imm*.[16] As an example, the TA stem for 'believe' does not use the suppleted form *-imm* 'by mind' before TA v^0 *-o*, (458a), but instead uses the regular *-i't*, (458b). This verb otherwise has the expected TI (*i't-i*) and AI (*-i't-aki*) stem types. Again, verbs of this type support the idea that the irregular form of *-imm* 'by mind' is only licensed before a phonologically null v^0.

(458) a. * *áakomaimmoyiiwáyi*
aak–[oma–**imm**/o–yii]–Ø–w=ayi
FUT–[√BELIEVE–**by.mind**/*v*–3SUB]–IND–3=PRX.PL
'he will believe her'

b. *áakomai'toyiiwáyi*
aak–[oma–**i't**/o–yii]–Ø–w=ayi
FUT–[√BELIEVE–**by.mind**/*v*–3SUB]–IND–3=PRX.PL
'he will believe her'

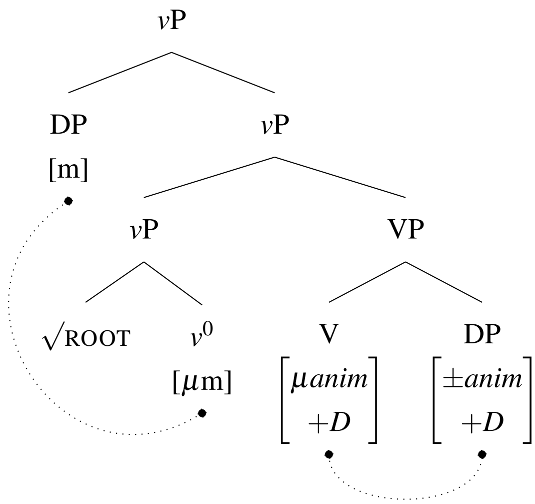
I take these examples as evidence that the X^0-adjoined root does not exhibit agreement with features of the complement. Instead, a small class of roots (Class IIb) exhibits suppletive allomorphy, but only before a phonologically null TA v^0 suffix. In other words, the only suffix which agrees with features of the complement is the V^0 head, instantiated by the second suffix.

4.1.3.2.2 Analysis

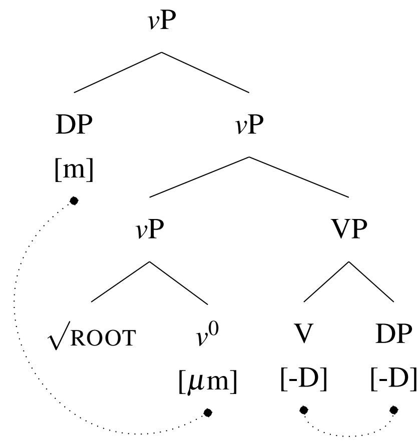
Again, I treat the two suffixes within the transitive stems as light *v* and V which together determine event type and which probe for features of the external and internal arguments, respectively. The syntactic Agree relations are just as in (445) and (446), but there is in addition a low-merged √ROOT which adjoins to the head v^0. The structure for TA/TI stems is given in (459) and the structure for AI stems is given in (460).

[16] TA verb stems of this type listed in Frantz and Russell (2017) include *omai'to-* 'believe', *sapi'to-* 'give assent to', 'show interest by nodding', *sayi'to-* 'doubt the veracity of', and *waanistsi'to-* 'obey'.

(459) TA/TI AGREEMENT



(460) AI AGREEMENT



The phonological exponence of the heads is determined relatively "late", after Agreement takes place, as in an interpretive theory of morphology (e.g. Anderson 1992; Halle and Marantz 1993). I model the phonological exponence of V^0 as post-syntactic spell-out rules, similar to post-syntactic Vocabulary Insertion in Distributed Morphology (Halle and Marantz 1993). When the lower head V^0 is valued as [+D, +anim], it spells out as *-o* or *-aa* depending on the person of the internal argument. The V^0 spells out as *-i* when valued as [+D, -anim], and *-aki* when valued as [-D].

(461) TRANSITIVE V^0 SPELL OUT AFTER √OK 'COUNT'

a. *-o* $\leftrightarrow$ V^0 / [+D, +anim, 2]
   -aa $\leftrightarrow$ V^0 / [+D, +anim, 3]

b. *-i* $\leftrightarrow$ V^0 / [+D, -anim]

c. *-aki* $\leftrightarrow$ V^0 / [-D]

For the Class I roots, the v^0 head spells out as *-o* when followed by a [+anim] V^0, and *-Ø* otherwise, (462). For the Class II roots, the v^0 spells out as *-Ø* in all positions, (462).

(462) TRANSITIVE v^0 SPELL OUT AFTER CLASS I ROOTS

a. *-o* $\leftrightarrow$ v^0 / ___-$V^0_{[+anim]}$

b. *-Ø* $\leftrightarrow$ v^0

(463) TRANSITIVE v^0 SPELL OUT AFTER CLASS II ROOTS

a. *-Ø* $\leftrightarrow$ v^0

Finally, the low √ROOT typically has a single exponent, except for a small class of roots (Class IIb) where the √ROOT has a suppletive form before a phonologically null v^0 in TA stems. For example, √I'T 'by mind' spells out as *-imm* before v^0 -Ø and *-i't* elsewhere.

(464) 'BY MIND' SPELL OUT

a. *-imm* ↔ √BY.MIND / ___ -$Ø_{v^0}$

b. *-i't* ↔ √BY.MIND

To recap, transitive verb stems with instrumental finals are contain two roots and two suffixes, which I have argued instantiate two light verbal heads, v^0 and V^0. What this means is that transitive verbs in Blackfoot contain the internal syntax of a *v*P, while intransitive verbs contain the internal syntax of a VP. In Section 4.1.4 I turn to a discussion of how roots are syntacticized into the *v*P or VP structure.

4.1.4 Roots have non-uniform morphosyntax

In this section I show that roots in Blackfoot exhibit two different sets of morphosyntactic properties, reflecting how the √ROOT associates to the verbal *v*P/VP structure. The diagnostics for determining the Merge site of a √ROOT are repeated in Table 4.8. An XP-adjoined √ROOT is modifier-like: it has none of the category and selectional restrictions of a verbal head, and it derives minimal stems. An X-adjoined head is verb-like: it is restricted to the verbal category and it is bound at the left edge, such that these roots create complex stems. However, the X-adjoined head is not a head itself, because it is followed by one or more suffixes which instantiate v^0 and V^0.

Diagnostic properties for the Merge strategies of roots

Table 4.8: Diagnostic properties for √ROOT vs. head

	DIAGNOSTIC	ROOT XP-ADJOINED	ROOT X-ADJOINED	HEAD
1.	*Morpheme count* (e.g. minimal stem)			
	(a) bi-morphemic intransitive stem	✓	✘	✓
	(b) tri-morphemic transitive stem	✓	✘	✓
2.	*Category restriction*			
	restricted to verbal category	✘	✓	✓
3.	*Selectional restriction*			
	restricted to particular valency	✘	✘	✓
	restricted to particular DP features	✘	✘	✓
	restricted to particular event type	✘	✘	✓

I begin in Section 4.1.4.1 with the stems I discussed in the previous sections and show that the leftmost root in these stems is an XP adjunct. Then in Section 4.1.4.2 I turn to the diagnostics for X-adjoined roots.

4.1.4.1 √ROOT syntacticization: XP-adjoined

I now use the diagnostics in Table 4.8 to show that the √ROOT in minimal verbs has the properties of a phrasal adjunct to an VP or *v*P. Diagnostic 1 counts morphemes: with XP-adjoined roots, intransitive stems are bimorphemic, transitive stems trimorphemic. As I discussed in the previous section, this is true for stems which contain a single XP-adjoined root. Consider the intransitive stems in (465), which are minimally bimorphemic: the Blackfoot root √IKINN 'high' does not directly inflect with agreement; rather, it must combine with a verbalizing suffix which exhibits agreement with the DP argument before being followed by agreement. Transitive stems are trimorphemic, (466), with the root √YIIST 'on back' combining with v^0 (a transitive final) and V^0 (a theme sign). The ill-formed examples show that it is insufficient to add only a V^0 suffix selecting the internal argument.

(465)		FUT–	[√ROOT [–V^0	$]_{VP}]_{VP}$	–IND–PRX		*Gloss*
	a.	*áaks–	[√IKINN[–$\boxed{}$	]]	–Ø–wa	AI	intended: 's/he or it is warm'
	b.	áaks–	[√IKINN[–ssi	]]	–Ø–wa	AI	's/he is warm'
	c.	áaks–	[√IKINN[–ii	]]	–Ø–wa	II	'it is warm'

(466)		FUT–	[√ROOT [–v^0	–V^0	$]_{vP}]_{vP}$	–IND–PRX		*Gloss*
	a.i.	*áak–	[√YIIST [–$\boxed{}$	–ii	]]	–Ø–wa	TA	
	ii.	áak–	[√YIIST [–am	–ii	]]	–Ø–wa	TA	's/he will carry him/her on his/her back'
	b.i.	*áak–	[√YIIST [–$\boxed{}$	–oo	]]	–Ø–wa	TI	
	ii.	áak–	[√YIIST [–aht	–oo	]]	–Ø–wa	TI	's/he will carry it on his/her back'
	c.i.	*áak–	[√YIIST [–$\boxed{}$	–aa	]]	–Ø–wa	AI+O	
	ii.	áak–	[√YIIST [–aht	–aa	]]	–Ø–wa	AI+O	's/he will carry s.t. on his/her back'

Diagnostic 2 tracks whether roots are restricted to categorical contexts. As phrasal adjuncts, XP-adjoined roots can adjoin freely to verb stems and noun stems. For example, a XP-adjoined root like √INIKK 'pout' can combine directly with a V^0 head *-i* to derive a verb stem, (467).

(467) *áaksinikksiwa*
aak–[**inikk**–i]–Ø–wa
FUT–[**pout**–AI]–IND–3
'she will pout'

The same root can also occur as a modifier to a full verb stem, (468), or noun stem, (469).

(468) a. *issapíwa*
[issap–i]–Ø–wa
[watch–AI]–IND–3
'he looked'

b. *ómahksiníkkssapiwa*
[omahk–[**inikk**–[ssap–i]]]–Ø–wa
[big–[**pout**–[watch–AI]]]–IND–3
'she gave a sulking glance'

(469) a. *matapiiwa*
[matapii]–wa
[person]–3
'person, pupil (of eye)'

b. *áaksinikkitapiwa*
aak–[**inikk**–[itapi]]–Ø–wa
FUT–[**pout**–[person]]–IND–3
'he will be an angry type person'

In many other Algonquian languages, XP-adjoined roots are unrestricted in root categorization as well; that is, roots combine freely with either verbalizing or nominalizing suffixes. Taking Plains Cree as an example, √KIMOT 'steal' in (470) can generate root-derived verbs (470a) or nouns, with the latter entity-denoting (470b) or event-denoting (470c). The example in (470c) is not an instance of serial categorization, where the root is first verbalized, and then nominalized. Serial categorization in Plains Cree only arises in the context of stem-derived event-denoting nominals, where both categorizers are phonologically overt; in the Algonquian literature, these are treated as secondary derivation.

(470) PLAINS CREE ROOT CATEGORIZATION

a. *[kimot–i]–w*
√steal–V–3
's/he steals' (AI)

b. *o–[kimot–iw]*
AGT–√steal–NMLZ
'thief' (NA)

c. *[kimot–iwin]*
√steal–NMLZ
'theft' (NI)

(Déchaine and Weber 2018)

However, this strategy is not available for Blackfoot because most nominalizations are stem-derivations (Bliss, Ritter and Wiltschko 2016). For example, the event nominalizing suffix *-n*[17] can occur on the full stem *awahkaa* 'walk, play', (471b) which has already been verbalized with the AI suffix *-aa*. This suffix cannot occur directly on the root, as shown in (471c).

(471) a. [aawahkáát]
[aawahk–aa]–t–Ø
[play–AI]–2SG.IMP–CMD
'walk!', 'play!'

b. [aawahkááni]
[[aawahk–aa]–n]–yi
[[play–AI]–NMLZ]–IN.SG
'playing'

c. *[aawahkíni]
[[aawahk]–n]–yi
[[play–$\boxed{}$]–NMLZ]–IN.SG
'playing'

There are two corner cases where XP-adjoined roots can combine directly with verbalizing and nominalizing heads. First, a small subset of roots can combine directly with verbalizing and nominalizing suffixes. The verbalizing suffix is always *-i* 'AI' and the nominalizing suffix is *-an* or *-aan*.

(472) a. *áaksipisskiwa*
aak–[**ipissk**–i]–Ø–wa
FUT–[**herd.over.cliff**–AI]–IND–3
'she will herd the animals'

b. *pisskáni*[19]
[**pissk**–an]–yi
[**herd.over.cliff**–NMLZ]–IN.SG
'buffalo jump'

(473) a. *nitáaksisttsomo'ki*
nit–aak–[**isttsomo'k**–i]–(hp)
1–FUT–[**hat**–AI]–IND
'I will have a hat'

b. *isttsómo'kaani*
[**isttsomo'k**–aan]–yi
[**hat**–NMLZ]–IN.SG
'hat'

[17]This suffix is *-n* after [a] and *-hsin* after other vowels.
[19]Some speakers pronounce this with a long second vowel: [pɪskáːni] *pisskááni* 'buffalo jump'.

(474) a. *áakokooyiwa*
aak–[**okoo**–yi]–Ø–wa
FUT–[**dwelling**–AI]–IND–3
'she will have a house'

b. *ookóówani*[21]
[**ookoo**–wan]–yi
[3.**dwelling**–NMLZ]–IN.SG
'his/her house'

(475) a. *áakokoyiwa*
aak–[**oko**–yi]–Ø–wa
FUT–[**stomach**–AI]–IND–3
'she will become full'

b. *móókoani*
m–[**ooko**–wan]–yi
BP–[**stomach**–NMLZ]–IN.SG
'stomach'

(476) a. *áaksisstoyiwa*
aak–[**issto**–yi]–Ø–wa
FUT–[**beard**–AI]–IND–3
'he will have whiskers'

b. *mísstoani*
m–[**issto**–wan]–yi
BP–[**beard**–NMLZ]–IN.SG
'beard'

Second, any root referring to a location or position can combine with a nominalizing locative suffix, which I gloss 'WARD'. For example, the XP-adjoined root $\sqrt{\text{SSP}}$ can combine with the V^0 *-ssi* to derive an AI stem, (477a), or *-ii* to derive an II stem, (477b). The same root can also combine with *-ooht* 'WARD', which derives inanimate nominals, (477c).

(477) a. *ííksspssiyi* *omiksi* *áínaka'siksi*
ii\ik–[**ssp**–ssi]–Ø–wa om–iksi a–[inak–a'si]–iksi
IC\DEG–[**high**–AI]–IND–3 DEM–AN.PL IPFV–[roll–AI]–AN.PL
'that car is tall'

b. *ííksspiiwa* *omi* *náápioyisi*
ii\ik–[**ssp**–ii]–Ø–wa om–yi [naapi–oyis]–yi
IC\DEG–[**high**–II]–IND–3 DEM–IN.SG [white–lodge]–IN.SG
'that house is high'

c. *sspóóhtsi*
[**ssp**–ooht]–yi
[**high**–WARD]–IN.SG
'sky, heaven'

The final *i* in (477c) is not part of the morpheme *-ooht* 'WARD'. Instead, it must be an inanimate singular inflectional suffix because it is replaced with *-wa* 'PRX' when the noun refers to a human.

[21] Some people say [oːkóːwaː] *ookóówaa* or [oːkóːwaji] *ookóówayi* 'his/her house'.

(478) a. *saatóóhts**i***
[saat–ooht]–**yi**
[across–WARD]–**IN.SG**
'in the direction of across the mountains'

b. *saatóóht**a***
[saat–ooht]–**wa**
[across–WARD]–**3**
'the one who is across the mountains'

Diagnostic 3 tracks valency, event type, and DP type to detect whether a root shows selectional restrictions. XP-adjoined roots impose no selectional restrictions; as such, they derive intransitive or transitive stems, and are compatible with various event types and DP types. Derivational paradigms (Bauer 1997) of intransitive and transitive stems confirm this. Consider the root √IKOO below. This can occur with verbalizing suffixes which derive intransitive states, (479), as well as transitive processes, (480). The (a) and (b) examples show that the root √IKOO can occur with animate and inanimate DPs, respectively.

(479) a. *áaksikóosiwa*
áak–[**ikoo**–:si]–Ø–wa
FUT–[**down**–AI]–IND–3
's/he will fall (due to loss of sustenance or internal support)'

b. *áaksikooowa*
áak–[**ikoo**–o]–Ø–wa
FUT–[**down**–II]–IND–3
'it will give way, fall'
(=409)

(480) a. *áaksikóoniiwa*
áak–[**ikoo**–n–ii]–Ø–wa
FUT–[**down**–by.hand.*v*–3SUB]–IND–3
's/he will take him/her down'

b. *áaksikoonima*
áak–[**ikoo**–n–i]–m–wa
FUT–[**down**–by.hand.*v*–TI1]–IND–3
'she will take it down'
(=409)

Similarly, the root √IK'AK 'fragile' can occur in inanimate intransitive states, (481a), animate intransitive mental states, (481b), and transitive mental states, (481c). There may be semantic restrictions on the types of verbalizing suffixes that each root occurs with, but crucially, XP-adjoined √ROOTs do not determine category, valency, event type, or DP type.

(481) a. *iká'kiiyi* *annistsi* *kó'sistsi*
[**ika'k**–ii]–Ø–yi ann–istsi ko's–istsi
[**fragile**–II]–IND–3PL DEM–IN.PL dish–IN.PL
'these dishes are delicate'

b. *ikáíka'ki'takiwa*
ik–a–[**ika'k**–i't–aki]–Ø–wa
DEG–IPFV–[**fragile**–by.mind.*v*–AI]–IND–3
'he's very sensitive'

c. *iksíka'kimmiiwa* *ánni* *maaáhsi*
ik–[**ika'k**–imm–ii]–Ø–wa ann–yi m–aahs–yi
DEG–[**fragile**–by.mind.*v*–3SUB]–IND–3 DEM–OBV 3–grandparent–OBV
'she thinks of her grandfather as fragile'

Taken together, the examples above indicate that *v*P/VP-adjoined roots are modifiers unspecified for category, valency, event type, or DP features. Rather, these properties are conditioned by suffixes of the root. Treating the root in minimal stems as a phrasal adjunct captures the fact that it these roots are insensitive to category, valency, event type, and DP features. As modifiers, XP-adjoined roots stack and can modify NPs, as shown in (468)–(469). I turn now to a discussion of X^0-adjoined roots and show that they have different morphosyntactic properties.

4.1.4.2 √ROOT syntacticization: X^0-adjoined

In this section I consider complex stems which have two roots. I use the diagnostics in Table 4.8 to argue that the second √ROOT in all of these constructions has the properties of an adjunct to a V^0 or v^0.

Diagnostic 1 counts morphemes: with X^0-adjoined roots, intransitive stems are trimorphemic, and transitive stems quadrimorphemic. Consider the intransitive stems containing the X^0-adjoined root √A'P 'have quality' in (482), which are minimally trimorphemic. The X^0-adjoined root is followed by a verbalizing suffix which is drawn from the same inventory of suffixes in bimorphemic intransitive verbs. In addition, the X^0-adjoined root must be preceded by a syntactic constituent—most simply by a root, which is what I show here. The ill-formed examples show that this additional root is obligatory before roots like √A'P 'have quality'.

(482)

	[√ROOT	[[√ROOT–V^0]$_{V^0}$	]$_{VP}$]$_{VP}$	–IND	–PRX		*Gloss*
a.i.	*[$\boxed{}$	[[√A'P–ssi]	]]	–Ø	–wa	AI	
ii.	[√MAK	[[√A'P–ssi]	]]	–Ø	–wa	AI	's/he is bad/mean'
b.i.	*[$\boxed{}$	[[√A'P–ii]	]]	–Ø	–wa	II	
ii.	[√MAK	[[√A'P–ii]	]]	–Ø	–wa	II	'it is bad'

Consider now the transitive stems containing the X^0-adjoined root √INN 'by hand' in (483), which are minimally quadrimorphemic. The X^0-adjoined root is followed by two verbalizing suffixes which are drawn from the same inventory of suffixes in trimorphemic intransitive verbs. In addition, the X^0-adjoined root must be preceded by a syntactic constituent—most simply by a root, which is what I show here. The ill-formed examples show that this additional root is obligatory before roots like √INN 'by hand'.

(483)		$[\sqrt{\text{ROOT}}$	$[[\sqrt{\text{ROOT}}–v^0]_{v^0}$	$–\text{V}^0\ ]_{\text{VP}}]_{v\text{P}}$	–IND	–PRX		*Gloss*
	a.i.	*[$\boxed{}$	[[√INN–Ø]	–ii]]	–Ø	–wa	TA	
	ii.	[√ISSP	[[√INN–Ø]	–ii]]	–Ø	–wa	TA	's/he will lift him/her'
	b.i.	*[$\boxed{}$	[[√INN–Ø]	–i]]	–Ø	–wa	TI	
	ii.	[√ISSP	[[√INN–Ø]	–i]]	–Ø	–wa	TI	's/he will lift it'
	c.i	*[$\boxed{}$	[[√INN–Ø]	–aki]]	–Ø	–wa	AI	
	ii.	[√ISSP	[[√INN–Ø]	–aki]]	–Ø	–wa	AI	's/he will lift (s.t.)'

Diagnostic 2 tracks whether roots are restricted to categorical contexts. Unlike high roots, X^0-adjoined roots are restricted to verbal contexts and never occur as adjuncts to nominal stems.

Diagnostic 3 tracks features of the DP arguments, event type, and valency to detect whether a root shows selectional restrictions. X^0-adjoined roots do not encode these properties, but instead reflect the properties of the v^0/V^0 they adjoin to. Relative to features of the DP arguments, the suffixes reflect the animacy of the single argument. To see this, consider the pairs of intransitive verbs in (484)–(486). The same roots can be used to derive an animate intransitive (AI) stem with an animate DP or an inanimate intransitive (II) stem with an inanimate DP.

(484) a. *maká'p**ssi**wa*
[mak–a'p/**ssi**]–Ø–wa
[bad–have.quality/**AI**]–IND–3
'he is bad/mean'

b. *maká'p**ii**wa*
[mak–a'p/**ii**]–Ø–wa
[bad–have.quality/**II**]–IND–3
'it is bad'

(485) a. *iisáókihts**ii**wa*
[ii\isaok–ht/**ii**]–Ø–wa
[IC\flat–be.positioned/**AI**]–IND–3
'he lay down'

b. *isáókihts**i**wa*
[isaok–ht/**i**]–Ø–wa
[flat–be.positioned/**II**]–IND–3
'it is flat'

(486) a. *áakihkss**oyi**wa*
aak–[ihk–hs/**oyi**]–Ø–wa
FUT–[dry–by.heat/**AI**]–IND–3
'it (anim.) will dry'

b. *áakihkits**i**wa*
aak–[ihk–t/**i**]–Ø–wa
FUT–[dry–by.heat/**II**]–IND–3
'it (inan.) will dry'

The same is true of the transitive verbs in (487). The same roots can be used to derive a transitive animate (TA) stem, a transitive inanimate (TI) stem, or an animate intransitive with object (AI+O) stem.

(487) a. [ɪspínːi ámo poːkáː]
isspínnii ámo pookáá
[ssp–inn–**ii**]–Ø–wa amo pookaa
[√HIGH–by.hand.*v*–3SUB]–IND–3 DEM child.AN
'he lifted that child' (BB)

b. [ɪspínːimḁ ámo sináːkjaʔt͡sɪs]
isspínnima ámo sináákia'tsis
[ssp–inn–**i**]–m–wa amo [sinaaki]–a'tsis
[√HIGH–by.hand.*v*–**TI1**]–IND–3 DEM [draw.AI]–INS.IN
'he lifted that book' (BB)

c. [ɪspínːaki (poːkɛ́ːk͡s / sináːkjaʔt͡siːˢt͡s)]
isspínnaki (pookáíks / sináákia'tsiists)
[ssp–inn–**aki**]–Ø–wa pookaa–iksi / [[sinaaki]–a'tsis]–istsi
[√HIGH–by.hand.*v*–**AI**]–IND–3 child–AN.PL / [[draw.AI]–INS]–IN.PL
'he lifted (children/books)' (BB)

Relative to event type, the suffixes determine whether an intransitive verb is a state or process. For example, the AI suffix *-ssi* and the II suffix *-o* in (484) derive states, while the AI suffix *-oyi* and the II suffix *-ii* in (486) derive processes. The X^0-adjoined roots typically have a single exponent, as is the case for *-a'p* 'have quality' and *-ht* 'be positioned'. Other roots like 'by heat' may have different exponents in different stem types. Similarly in transitive verbs, the V^0 (together with the first suffix, v^0) determines event type.

Relative to valency, X^0-adjoined roots can occur in transitive and intransitive stems. For example, the X^0-adjoined root √HS 'by heat' occurs in intransitive stems, (488), and transitive stems, (489). Similarly, the X^0-adjoined root √IN 'by sight' occurs in intransitive stems, (490), and transitive stems, (491).

(488) INTRANSITIVE STEMS

a. *áakihkssoyiwa*
aak–[ihk–**hs**/oyi]–Ø–wa
FUT–[dry–**by.heat**/AI]–IND–3
'it (anim.) will dry'

b. *áakihkitsiwa*
aak–[ihk–**t**/ii]–Ø–wa
FUT–[dry–**by.heat**/II]–IND–3
'it will dry'

(489) TRANSITIVE STEMS

a. *áakihkssiiwa*
aak–[ihk–**hs**–ii]–Ø–wa
FUT–[dry–**by.heat**.*v*–3SUB]–IND–3
's/he will dry him/her' (BB)

b. *áakihkssima*
aak–[ihk–**hs**–i]–m–wa
FUT–[dry–**by.heat**.*v*]–TI1–IND–3
's/he will dry it' (BB)

c. *áakihkssakiwa*
aak–[ihk–**hs**–aki]–Ø–wa
FUT–[dry–**by.heat**.*v*]–AI]–IND–3
'she will dry (s.t.)'

(490) INTRANSITIVE STEMS

a. *maohksinamma*
[maohk–**in**/aa]–mm–wa
[red–**by.sight**/AI]–IND–3
'it (anim.) is red'

b. *maohksinattsiwa*
[maohk–**in**/attsi]–Ø–wa
[red–**by.sight**/II]–IND–3
'it is red'

(491) TRANSITIVE STEMS

a. *áaksipapainoyiiwáyi*
aak–[ipapa–**in**/o–ii]–Ø–w=ayi
FUT–[dream–**by.sight**/*v*–3SUB]–IND–3=OBV.SG
'she will see him in a dream'

b. *áaksipapainima*
aak–[ipapa–**in**/Ø–i]–m–w=ayi
FUT–[dream–**by.sight**/*v*–TI1]–IND–3=OBV.SG
'she will see it in a dream'

The diagnostics show that X^0-adjoined roots have very different properties than XP-adjoined roots. Furthermore, they are followed by suffixes which clearly instantiate v^0 and V^0. In my analysis, X^0-adjoined roots are a-categorical $\sqrt{\text{ROOT}}$s which adjoin to a verbal head v^0 or V^0, creating a complex head.[22] This accounts for why they are restricted to verbal contexts but otherwise have none of the selectional restrictions of heads.

Despite the fact that a complex head contains a $\sqrt{\text{ROOT}}$, the examples above show that a stem cannot contain a X^0-adjoined root alone. Instead, the X^0-adjoined root is bound at the left edge. Consequently, stems which contain low adjuncts are more complex than stems with only high adjuncts. In the simplest case these stems combine with a XP-adjoined root; in more complex cases they may combine with larger adjoined syntactic phrases, including full stems.[23] For example, in (492) the verb stem *pottaa* occurs to the left of the X^0-adjoined root $\sqrt{\text{HK}}$ 'by foot or body'. Example (493) shows that *pottaa* forms a full stem on its own and consists of a root $\sqrt{\text{POTT}}$ 'fly' combines and the common V^0 *-aa* 'AI'.

[22]The complex head corresponds to the Algonquian 'concrete final', to follow the terminology in Denny (1978, 1984). See also Slavin (2012), who has a similar analysis of concrete finals as a $\sqrt{\text{ROOT}}$ plus a verbalizing head.

[23]This is called the 'left edge requirement' in Algonquian verbs (Branigan, Brittain and Dyck 2005; Slavin 2012, among others). Many other researchers have noted that the left edge requirement is neutral with respect to category or type; the initial element of the stem can be a $\sqrt{\text{ROOT}}$, a noun, a particle, a full verb stem, etc.

(492)	*pottááhkomoosa*		(493)	*pottáát*	
	[[pott–aa]–hk/omo–:s]–Ø			[pott–aa]–t–Ø	
	[[fly–AI]–by.body/APPL.v–2SG:3.IMP]–CMD			[fly–AI]–2SG.IMP–CMD	
	'scare the wildfowl into flight for him!'			'fly!'	

Again, given that adjuncts are optional, it seems unusual that a stem would require an adjunct. In the next section I suggest that the verbal heads and X^0-adjoined roots have light verbal semantics and need a concrete lexical item at the left to complete the first phase.

4.1.5 The first phase is a predicate of events

Adjuncts are usually optional, so it is surprising that the roots I analyze as *v*P/VP adjuncts are obligatory. Syntactic analyses of Algonquian verb stems agree that the elements that realize v^0/V^0 are light verbs (Brittain 2003; Hirose 2000; Quinn 2006; Slavin 2012). As I showed above, these light verbs differ based on event type and valency, and they agree with features of the local nominal arguments. Beyond that, they contribute very little, if anything, in terms of meaning. Perhaps adjoined roots are obligatory because the verbal heads are so light that event modifiers are required to restrict their denotation. On this view, some languages restrict light verbs via nominal complements (e.g. English *take a seat*, *do the dishes*), while other languages restrict them via adverbial modifiers (e.g. Blackfoot).

In support of this argument, there are also roots which are too 'light' in terms of event semantics to complete the stem, which are the X^0-adjoined roots. When these roots occur in a stem, they require an XP adjunct root to stack. Again, given that adjuncts are optional, it seems unusual that a stem would require an adjunct. Here too, the reason seems rooted in semantics. Although the X^0-adjoined roots add some sort of concrete meaning, they still have light verbal semantics. For example, a X^0-adjoined root like $\sqrt{\text{INN}}$ 'by hand' denotes that an event occurred by using the hand as an instrument, but says nothing specific about the event itself. Perhaps adjoined roots are obligatory because the complex verbal heads are so light that event modifiers are required to restrict their denotation. The complex heads can combine with a dummy root *anist*- 'thus', (494), which reveals the underlying semantic contribution of the X^0-adjoined root.

(494)		$\sqrt{\text{ROOT}}$	$[[\sqrt{\text{ROOT}}–v^0]_{v^0}$–V	$]_{v\text{P}}$–AGR	Gloss
	a.	anist	$[[$–o't–o$]_{v^0}$–yii	$]_{v\text{P}}$–wa	'*x* take *y* in such a way'
	b.	anist	$[[$–inn–o$]_{v^0}$–yii	$]_{v\text{P}}$–wa	'*x* hold *y* in such a way'
	c.	anist	$[[$–in–o$]_{v^0}$–yii	$]_{v\text{P}}$–wa	'*x* see *y* in such a way'

Since Blackfoot can contain multiple roots, some of which are light verbal elements, at what point does the stem 'close'? I will assume there is a semantic requirement for the stem to include a predicate of events. If there is no element within the stem which can contribute the semantics necessary for that predicate, then an adjunct is required. I hypothesize that this point of completion of the event predicate is the first phase. (See Higginbotham 2000; Pustejovsky 1995; Ramchand 2008 on the internal structure of events.) Thus, the stem has a unified syntactic definition ("the phase", v*P) even though intransitive and transitive verbs have different syntactic phrasal structure.

This is important because the phase corresponds to a particular prosodic constituent (the PWd), with phonological effects. Although high and X^0-adjoined roots are no different in terms of categorization (they are both a-categorical √ROOTS), they do differ in terms of phonological generalizations. Namely, X^0-adjoined roots can begin with either a consonant or a vowel, with consonant clusters broken up by epenthesis. XP-adjoined roots can begin with either a consonant or a vowel at the left edge of the PPh, *but not PPh-medially*, where they all begin with a [+cont] segment. Thus, there is an edge restriction which picks out the left edge of the PWd; XP-adjoined roots are at the left edge of a PWd, but X^0-adjoined roots are not.

Before I move on to discuss the properties of the PWd, I briefly compare my analysis of the Blackfoot verb stem with the traditional analysis of the Algonquian stem. I do this in order to facilitate other researchers who may also be interested in the syntax-prosody mapping in Algonquian languages.

4.1.6 Comparison with Algonquian templatic stem

The Algonquian STEM, (495), in Bloomfieldian tradition is tripartite (Bloomfield 1946; Goddard 1990). The three parts are named according to their templatic position (e.g. initial within the stem, medial within the stem, or final within the stem). In Goddard's 1990 re-interpretation of the Algonquian stem, only the initial is required, while the final determines transitivity and event structure (Denny 1984; Wolfart 1973: 49*ff*). Each component may be simplex or complex, although the discussion here is based around simplex stems.

(495) ALGONQUIAN STEM
[INITIAL–(MEDIAL)–(FINAL)]

The analysis I presented in the previous sections involved a minimally bipartite stem (for intransitive verbs) or tripartite stem (for transitive verbs) (496). For intransitive stems, the initial is a √ROOT, and the final is a V^0. For transitive stems, the initial is a √ROOT, but the final is internally complex in my analysis and corresponds to two heads, v^0 and V^0. Just as in the traditional analysis, the final (either V^0 in intransitive stems, or v^0 and V^0 together in transitive stems) determines event structure.

(496)	a.	Algonquian stem:	[INITIAL	–(MEDIAL)	–(FINAL)]
	b.	Current analysis (intransitive):	[√ROOT		–V^0]
	c.	Current analysis (transitive):	[√ROOT		–v^0–V^0]

Algonquianists have long known that each of the three traditional components of the stem are non-homogenous. For example, Goddard (1990) points out that initials may be either DEPENDENT STEMS, which are stems that are bound at the left edge, or INDEPENDENT STEMS, which do not require anything to the left.[24] Similarly, finals have been divided into abstract finals (which *only* mark transitivity and event structure) versus concrete finals (which connote a more specific meaning in addition to marking transitivity and event structure). My analysis essentially claims that some of this non-uniformity is structural: intransitive finals are monomorphemic, while transitive finals are bimorphemic.

It is worth noting how my analysis differs from many recent formal analyses of Algonquian verbs as well. These analyses treat finals uniformly as a categorizing head v^0, regardless of whether they are abstract or concrete (Brittain 2003; Hirose 2000; Quinn 2006). Although finals are instantiated by 'light' verbal heads in my analysis as well, transitive finals contain two functional heads while intransitive finals contain only one.

4.1.7 Interim summary: *v*P/VP syntax

To re-cap the preceding section, I first showed that the verb stem consists of one or more √ROOT followed by suffixes which instantiate verbal heads within the *v*P/VP shell. I then showed that an a-categorical √ROOT in Blackfoot is syntacticized in two different ways. Some bare roots in Blackfoot merge high as phrasal adjuncts (e.g. XP-adjoined √ROOTs), while other bare roots merge low as adjuncts to a verbal head (e.g. X-adjoined √ROOTs).[25]

Interestingly, high √ROOTs have the properties of syntactic phrasal adjuncts, *except* that they are obligatory whereas adjuncts are typically optional. I suggested that a verb stem with only verbal heads and low √ROOTs is too 'light' to create a predicate of events. Instead, an event modifier of some kind is required to restrict the denotation of the event. In the simplest case, this is a bare √ROOT, but the adjunct may also be a more complex constituent as well, such as a verb or noun stem. Once a high √ROOT or other phrasal adjunct merges, then the stem is 'complete' in the sense that it can combine with inflectional affixes. This suggests there is a unified point of closure in the syntactic derivation once the stem is complete. I have suggested that this point of closure is the first phase (v*P), which predicts that the v*P phase should exhibit unique phonological generalizations.

Having suggested that the verb stem is uniformly a v*P phase, in Section 4.2 I present phonological evidence of a Prosodic Word (PWd) constituent in Blackfoot which corresponds to the v*P phase. After that, in Section 4.3 I discuss how to analyze the correspondence between the v*P and PWd.

[24]For a different view of the non-homogeneity of Algonquian √ROOTs, see Déchaine and Weber (2018).

[25]The distinction between roots as XP-adjuncts and X-adjuncts follows the proposals in Déchaine and Weber (2015, 2018), although I make different assumptions about the correlates for low, X-adjoined roots than those proposals do.

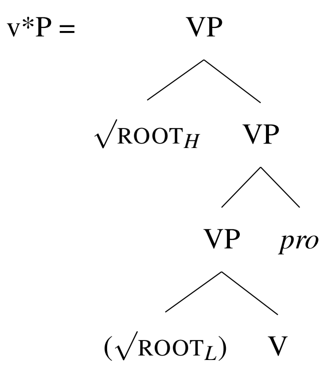
4.2 Phonology of the PWd constituent

In this section I discuss two phonological generalizations that motivate the existence of a Prosodic Word (PWd) constituent which corresponds to the v*P phase. First, an edge restriction prohibits [-cont] at the left edge of the PWd, even though [-cont] segments occur occur at the left edge of PWd-internal morphemes. The left edge of the PPh allows [-cont] segments in order to satisfy syllable onset requirements, so this generalization only holds when the left edge of the PPh and the PWd are distinct. Second, there is a process of epenthesis within the PWd domain, but not outside of it.

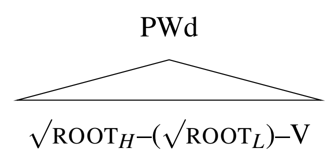
The evidence for both PWd generalizations comes from the different patterns of alternation in different types of roots. "High roots" (XP-adjoined roots which complete a phase of events) exhibit more complicated patterns of alternation than "low roots" (XP-adjoined roots which do not complete the phase and X^0-adjoined roots). I argue that because high and low roots syntacticize in two different manners, they also prosodify into the PWd in two different manners. Consider intransitive stems, (497), which contain a high root ($\sqrt{\text{ROOT}_H}$) and an optional low root ($\sqrt{\text{ROOT}_L}$). The first phase (v*P) is the recursive VP containing the high root, (497a), and this entire constituent is prosodified as a PWd constituent (497b). The high root ($\sqrt{\text{ROOT}_H}$) always occurs at the left edge of a PWd, while the low root ($\sqrt{\text{ROOT}_L}$) never does.

(497) PROSODIFICATION OF $\sqrt{\text{ROOTS}}$ IN INTRANSITIVE VERBS

a. SYNTAX



b. PROSODY

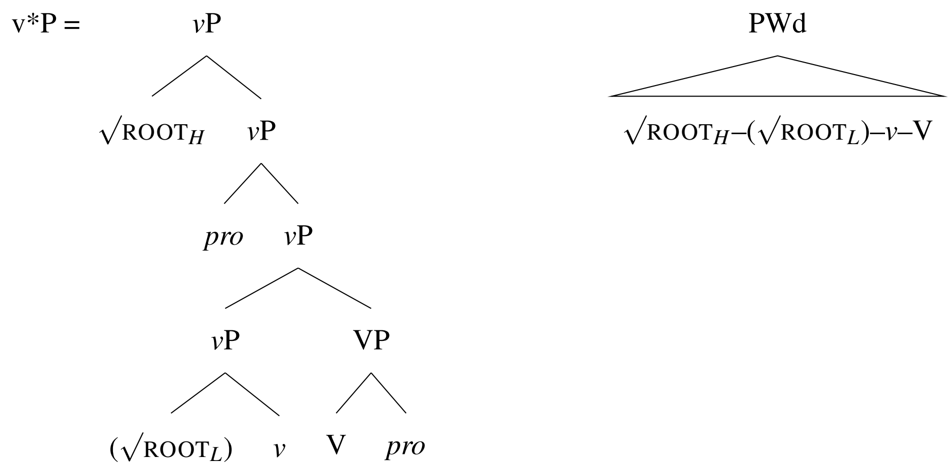


The same argument holds for transitive stems, (498), which also contain a high root ($\sqrt{\text{ROOT}_H}$) and an optional low root ($\sqrt{\text{ROOT}_L}$). The first phase (v*P) is the recursive *v*P containing the high root, (498a), and this entire constituent is prosodified as a PWd constituent (498b). The high root ($\sqrt{\text{ROOT}_H}$) always occurs at the left edge of the PWd, while the low root ($\sqrt{\text{ROOT}_L}$) never does.

(498) PROSODIFICATION OF √ROOTS IN TRANSITIVE VERBS

a. SYNTAX

b. PROSODY



Therefore, the patterns of realization in high roots reflect the phonological generalizations which hold at the left edge of the PWd, while the patterns of realization in low roots reflect the phonological generalizations which hold inside of the PWd and PPh more generally. In Section 4.2.1 I discuss low root alternations and argue that some low roots begin in consonants while others begin in vowels. A process of epenthesis occurs between consonants which is driven by principles of syllabification. In Section 4.2.2 I discuss high root alternations. Based on their realizations in PPh-initial position, I argue that some roots begin in a consonant while others begin in a vowel. However, all high roots which begin in a [-cont] segment in PPh-initial position have a vowel-initial realization in PPh-medial position, regardless of whether they stand after a vowel or a consonant. I argue that some patterns of alternation involve lexically listed allomorphs, while other patterns of alternation result from a process of epenthesis at the left edge of the root. Both types of alternation conspire to satisfy a constraint prohibiting [-cont] segments at the left edge of the PWd. In that sense, both types of alternation (allomorphy and epenthesis) are phonologically optimizing. In Section 4.2.3 I discuss the realizations of inflectional suffixes and show that they, too, do not exhibit the same pattern of epenthesis found within the PWd, indicating that they are outside of the PWd.

4.2.1 Low √ROOT prosodification: PWd-internal epenthesis

In this section I show there is a process of epenthesis between consonants within the PWd which is driven by principles of syllabification (Itô 1986). In this introduction, I describe how the form of the suffixes is indeterminate if we only examine one phonological context or even one pattern of alternation.

I sketch a solution to this problem that relies on comparing two different patterns of suffix alternations against one another. This is the logic that underlies the data in the remainder of this section.

Consider the suffix [-ip] ∼ [-p] ‘tie’ in (499) and (500). This suffix is realized as [-ip] after a consonant, like the root-final [t] in √IPPOT- ‘secure’, (499). It is realized as [-p] after a vowel, like the root-final [o] in √AMO- ‘gather’, (500).

(499) ⟦ɪpːo͡ts**íp**i^{s}taːwḁ⟧
ippots**íp**istaawa
[ippot–**(i?)p**/ist–aa]–Ø–wa
[secure–**tie**/*v*–AI]–IND–3
‘she wore braids’

(500) ⟦amo**p**í^{s}taːni̥⟧
amo**p**ístaani
[[amo–**(i?)p**/ist–aa]–n]–i
[[gather–**tie**/*v*–AI]–NMLZ]–IN.SG
‘ceremonial bundle’

The form of the high roots can be determined by considering derivational paradigms (Bauer 1997). For example, the root √IPPOT- ‘secure’ occurs before an [o]-initial suffix in (501), and the root √AMO- ‘gather’ occurs before a [k]-initial suffix in (502).

(501) ⟦ɪpːotóx^{w}͡tsi̥⟧
ippotóóhtsi
[ippot–ooht]–i
[secure–WARD]–IN.SG
‘in the direction of the door’

(502) ⟦amokíns̩ː͡tsaːkit⟧
amokínsstsaakit
[amo–kinsst–i–aki]–t–Ø
[gather–arm–*v*–AI]–2SG.IMP–CMD
‘close your hand!’

Thus, we clearly establish that the suffix [-ip] ∼ [-p] ‘tie’ exhibits a phonological alternation [i] ∼ Ø. There are two phonological analyses compatible with this data: either the suffix begins with a vowel, /-ip/, and that vowel is deleted after vowels; or the suffix begins with a consonant, /-p/, and the vowel is epenthesized after consonants. This indeterminacy of form is represented by “(i?)” in the morphemic analysis line in (499) and (500).

These two analyses can be distinguished by comparing with another type of alternation. Consider the suffix [-ip] ‘bring’ in (503) and (504). This suffix is realized as [-ip] after a consonant, like the root-final [t] in √OMAT- ‘start’, (503). It is realized as [-oip] after an [o], like the root-final [o] in √AMO- ‘gather’, (504), where [oi] is a diphthong that represents the output of the underlying /o+i/ sequence.

(503) ⟦omat͡s**íp**iːs⟧
omats**íp**iisa
[omat–**ip**/i–:s]–Ø
[start–**bring**/*v*–2SG:3.IMP]–CMD
'transport him!'

(504) ⟦amó**íp**iːsaːwḁ⟧
amó**íp**iisaawa
[amo–**ip**/i–:s]–Ø=aawa
[gather–bring/*v*–2SG:3.IMP]–CMD=PRX.PL
'gather them!'

There are multiple competing vowel hiatus resolution strategies in Blackfoot, which means that the suffix [-ip] 'bring' has other realizations after other underlying vowels. For example, this suffix is realized as [-ɛːp] after an [a], like the root-final [a] in √SA 'out', (505), where [ɛː] is a fusional vowel that reflects an underlying /a+i/sequence.

(505) ⟦s**ɛːp**íːs⟧
sa**ip**íís
[sa–**ip**/i–:s]–Ø
[out–**bring**/*v*–2SG:3.IMP]–CMD
'bring her out!'

Again, the form of the roots in (503)–(505) can be determined by considering derivational paradigms (Bauer 1997). For example, the root √OMAT- 'start' occurs before an [a]-initial suffix in (506), and the root √AMO- 'gather' occurs before a [k]-initial suffix in (507), repeated from above. The root √SA 'out' occurs before a [j]-initial morpheme in (507).

(506) ⟦omataníːt⟧
omataníít
[omat–an/ii]–t–Ø
[start–tell/AI]–2SG.IMP–CMD
'begin the song!'

(507) ⟦amokínṣːt͡saːkit⟧
amokínsstsaakit
[amo–kinsst–i–aki]–t–Ø
[gather–arm–*v*–AI]–2SG.IMP–CMD
'close your hand!' (=502)

(508) ⟦iːsájiːpaʔsiwḁ⟧
iisáyiipa'siwa[27]
ii\isa–[yiip–a'si]–Ø–wa
IC\out–[leaf–AI]–IND–3
'it leafed'

Thus, two patterns of alternation emerge, shown in (509). There are suffixes like 'tie' which exhibit a V ∼ Ø alternation at the left edge. And there are suffixes like 'bring', which have many different realizations that depend on the vowel quality that they follow in the underlying form. (I say "in the underlying form" here because sometimes the two vowels coalesce into a single segment, as for /a+i/ → [ɛː].)

[27] The root {√NIIP-, √YIIP-} 'leaf' occurs in the noun *niip-i* 'leaf' as well as the inanimate intransitive verb 'summer', (1)–(2). Many roots which begin in /n/ in PWd-initial position have a PWd-medial allomorph which begins in /j/; see Section 3.2.1.2.2.

(509)		*Gloss*	*After C*		*After V*			
	a.	‘tie’	⟦-ip⟧	∼	⟦-p⟧			
	b.	‘bring’	⟦-ip⟧	∼	⟦-oip⟧	∼	⟦-ɛːp⟧	∼ …

The key here is to realize that suffixes like ‘bring’ must begin underlyingly in a vowel. This vowel surfaces faithfully after a consonant, and some reflex of this vowel occurs in all of the other realizations as well, depending on the vowel hiatus resolution strategy for any particular combination of vowels. Therefore, a suffix like ‘tie’ cannot also begin in a vowel underlyingly; if it did, then it should exhibit the same pattern of alternation as ‘bring’. The only parsimonious analysis is that suffixes with a simple V ∼ Ø alternation begin in a consonant, and that the vowel is epenthetic between consonants, (510).

(510) a. ‘tie’ /-p/
b. ‘bring’ /-ip/

The remainder of this section discusses the patterns of alternation for PWd-internal suffixes. In Section 4.2.1.1.1 I discuss vowel-initial suffixes, and then in Section 4.2.1.2 I discuss consonant-initial suffixes.[28] After I discuss the phonological properties of this PWd-internal epenthesis, I conclude the section with an analysis. Then in the following two sections I show that this process does not occur outside of the PWd, either in the suffixal or prefixal domain.

4.2.1.1 Vowel-initial suffixes

In this section I confirm that some suffixes begin in short vowels. First, I use evidence from morpheme alternations to show that suffixes can begin in three different vowel qualities ([i], [o], [a]). These vowels surface faithfully after consonants, but coalesce with a preceding vowel with patterns similar to those discussed in Elfner (2006b). Second, I use evidence from velar assibilation to show that there are two types of [i]-initial suffixes, depending on their effect on a preceding [k]. Type 1 causes a preceding [k]

(i) ⟦niːpówḁ⟧
niipówa
[niip–o]–Ø–wa
[leaf–II]–IND–3
‘it was summer’ (e.g. ‘when leaves grow’)

(ii) ⟦ákaːjiːpowḁ⟧
ákaayiipowa
akaa–[yiip–o]–Ø–wa
PRF–[leaf–II]–IND–3
‘it has become summer’

[28]I limit my discussion to suffixes which begin in a short vowel or a single consonant, but I expect that further research will show there are still other patterns of suffixal alternation. For example, it is likely that suffixes may begin with (a) a consonant cluster like /xC/, (b) a glide, (c) a long vowel, or (d) a pre-vocalic or pre-consonantal moraic /s/. I also limit my discussion to cases where each suffix occurs after a short vowel. Long vowels are rare at the right edge of morphemes; it may be that suffixes only occur after a long vowel in so-called “secondary derivation”; that is, when the suffix occurs after a stem.

to assibilate to [$\widehat{ks}$], while Type 2 does not.[29] There are therefore four different short vowels that a suffix may begin in: /i_1/ (Type 1), /i_2/ (Type 2), /a/, or /o/.

4.2.1.1.1 Evidence from allomorphy: vowel coalescence

Elfner (2006b) is the most thorough study of vowel hiatus resolution in Blackfoot. Here, I briefly describe the patterns she found and make one revision. These patterns of vowel hiatus resolution lead to predictions about morphemic alternations involving vowel-initial suffixes. Namely, the underlying vowel quality should surface faithfully after consonants, but should interact with a preceding vowel in exactly the ways described here. I then show that there are indeed suffixes which begin with each of the three short vowels (/i/, /a/, and /o/).

Elfner (2006b) showed that the vowel hiatus resolution strategies employed by Blackfoot speakers can be predicted by taking into account sonority, moraic affiliations, and syllable structure preferences. The hiatus resolution strategies she identifies are summarized in Table 4.9.

Table 4.9: Realization of vowel sequences in Blackfoot (Elfner 2006b: 97)

V1	+ V2		
	a	i	o
a	aː	ɛː	ɔː
i	ja/a	iː	jo/o
o	oa/a	oj	oː

As shown in Table 4.9, Elfner (2006b) claims that /o+a/ sequences are preserved as a tautosyllabic sequence. She bases this on the fact that tautosyllabic [oa] sequences are allowed, as in [imitɛːkoan] 'puppy' and [istːoan] 'knife' (transcriptions from Elfner 2006b: 111).[30] However, the speakers I have worked with pronounce these words with what sounds like a glide [w] between the two vowels, even if the glide is somewhat weak for some speakers. The variable pronunciations are given in (511).

(511) a. [imitɛ́ːkoʌn] ∼ [imitɛ́ːkowʌn] 'puppy'

b. [ɪ^{s}tːoʌ́n] ∼ [ɪ^{s}tːowʌ́n] 'knife'

[29] Frantz (2009) refers to Type 1 as a "breaking i" and writes it as a capital /I/ in morphophonemic representations to distinguish it from Type 2, which is written as a lowercase [i]. In most cases, Type 1 vowels are the regular reflex of Proto-Algonquian * i, while Type 2 vowels are the reflex of PA * e in any position or PA * a word-medially (Berman 2006).

[30] She also includes an example of [o] before a long or superlong [a]. Most research on vowel hiatus resolution in Blackfoot has focused on the resolution of two short vowels in hiatus, and it is not clear whether the same generalizations hold when one or both of the two vowels is long. I leave cases like this for future research.

This suggests that [oa] is not a rising diphthong, as suggested by Elfner (2006b), but two vowels in separate syllables with optional epenthesis of an onset [w]. Additionally, the final <a> in [ɪˢtːoʌ́n] 'knife' carries pitch accent alone. If pitch accent is a system of syllabic prominence, then this also suggests that the two vowels are in separate syllables.

When /o/ and /a/ come into hiatus across a morpheme boundary, they systematically are realized as a long [aː] or a short [a]. This is described in his Rule #5 in the appendix of Frantz (2009):

(512) O-REPLACEMENT

$o \rightarrow a \,/\, \_\_{+}a$,

where + signifies a morpheme break and *a* is not a suffix. (Frantz 2009: 154, Rule #5)

He gives the following example (re-glossed by me).

(513) ⟦âːkot**aː**pɪnːiːwḁ⟧
áakot**aa**pinniiwa
aak–[ot**o**–**a**p–inn–ii]–Ø–wa
FUT–[go.to.do–SHEET–by.hand.*v*–3SUB]–IND–3SG
'he will go adjust it (anim.)' (Frantz 2009: 154)

He also notes that for many speakers, this is simply a deletion rule (e.g. /o+a/ yields a short [a]). Accordingly, I expect that when a suffix which begins in [a] follows a morpheme which ends in [o], the two vowels should coalesce into [aː]/[a]. Table 4.10 reflects this expectation.

(514) ⟦o.ts̩ː.k**a**.pi.nâː.ki⟧
otssk**a**pináakii
[otssk**o**–**a**pin–aakii]–wa
[blue–eye–woman]–PRX
'Blue-Eyed Woman' (a name) (BB)

Table 4.10: Realization of vowel sequences in Blackfoot (revised)

V1	+ V2		
	a	i	o
a	aː	ɛː	ɔː
i	ja/a	iː	jo/o
o	aː/a	oi	oː

Because the data in Elfner (2006b) was based mainly on hiatus resolution strategies between a prefix and a stem, it is worth confirming that these patterns hold within the verb stem. The data from the remainder of this section is taken from Frantz and Russell (2017). Because of this, the data is sometimes incomplete in the sense that the dictionary might not contain examples of each suffix after all three short vowel qualities. Nevertheless, the data follows the patterns in Table 4.10. I take this to mean that vowel hiatus resolution strategies are largely the same inside and outside of the PWd.

The examples below are of PWd-internal roots: either (1) head-adjoined (low) roots, or (2) medials, which are linearized between the lexical $\sqrt{\text{ROOT}}$ and the v^0/V^0 heads. The examples are formatted as follows. Each example on the left shows the suffix in question (in bold) after a particular morpheme (underlined). Each example is paired with another example on the right which contains the same morpheme (underlined) before a different suffix. This is to diagnose morpheme boundaries and to argue that the initial vowel of the suffix is not actually a part of the preceding morpheme.

Suffixes in [i]

Suffixes which begin in underlying /i/ have the following patterns of alternation.

/C+i/	→	Ci
/i+i/	→	iː
/a+i/	→	ɛː
/o+i/	→	oi

Examples of /i/-initial suffixes include: instantiations of v^0-adjoined roots (*-istot* 'CAUS', *-imm* or *-i't* 'by mind'), instantiations of V^0-adjoined roots (*-ipo* 'stand'), and medials (*-in* 'BERRY'). I give evidence for each below.

The v^0-adjoined root *-istot* 'CAUS' surfaces faithfully after a consonant.

(515) ⟦nitóʔtotami^{s}totoːkḁ⟧
nitó'totam**istoto**oka
nit–[o'totam–**istot**/o–ok]–Ø–a
1–[superior–**CAUS**/v–INV]–IND–3
'he bested me'

cf. ⟦nitóʔtotámaʔpsːi⟧
nitó'totáma'pssi
nit–[o'totam–a'p/ssi]–(hp)
1–[superior–be/AI]–(IND)
'I am superior'

(516) ⟦sapíˢtotóːsḁ⟧
sap**ístot**óósa
[sap–**istot**/o–:s]–Ø
[correct–**CAUS**/*v*–2SG:3.IMP]–CMD
‘reach an agreement with him!’

cf. ⟦sápaníːt⟧
sápaníít
nit–[sap–a’p/ssi]–(hp)
1–[correct–be/AI]–(IND)
‘say (it) correctly!’

The initial /i/ in *-istot* ‘CAUS’ coalesces with the final /a/ in *sata* to form [ɛː], (517), with the final /i/ in *ikohki* ‘embarrass’ to form [iː], (518), and with the final /o/ in *isskohto* to form [oi], (519).

(517) ⟦satɛ́ːˢtotoːs⟧
satá**ístot**oosa
[sata–**istot**/o–:s]–Ø
[offended–**CAUS**/*v*–2SG:3.IMP]–CMD
‘purposely make her angry!’

cf. ⟦satɛ́mːis⟧
satá**ímm**is
[sata–**imm**–:s]–Ø
[offended–**by.mind**.*v*–2SG:3.IMP]–CMD
‘wish evil on him!’

(518) ⟦âːk͡sikx̩ʷkíːˢtotojiːwáji̥⟧
áaksikohkí**ístot**oyiiwáyi
aak–[ikohki–**istot**/o–yii]–Ø–w=ayi
FUT–[embarrass–**CAUS**/*v*–3SUB]–IND–3=OBV.SG
‘she will embarrass him’

cf. ⟦âːk͡síkx̩ʷkjaʔpsːiwḁ⟧
áaksíkohkia’pssiwa
aak–[ikohki–a’p/ssi]–Ø–wa
FUT–[embarrass–be/AI]–IND–3
‘she will embarrass him’

(519) ⟦ɪskx̩ʷtoˢtotojiːwáji̥⟧
isskohto**istot**oyiiwáyi
[isskohto–**istot**/o–yii]–Ø–w=ayi
[spite–**CAUS**/*v*–3SUB]–IND–3=OBV.SG
‘he did it to spite her’

cf. ⟦ɪskx̩ʷtoimːx̩ʷsiwḁ⟧
isskohtó**ímm**ohsiwa
[[isskohto–**imm**]–ohs/i]–Ø–wa
[[spite–**by.mind**.*v*]–REFL/AI]–IND–3
‘she did damage to herself despite s.t. (e.g. her good health)’

The v^0-adjoined root *-imm* ∼ *-i’t* ‘by mind’ surfaces faithfully after a consonant.

(520) ⟦âːkx̩ʷpɪmːiːwáji̥⟧
áakohp**imm**iiwáyi
aak–[ohp–**imm**–ii]–Ø–w=ayi
FUT–[ASSOC–**by.mind**.*v*–3SUB]–IND–3=OBV.SG
‘she will associate him with something or someone’

cf. ⟦âːkx̩ʷpópaːt͡siːwáji̥⟧
áakohpópaatsiiwáyi
aak–[[ohp–op/ii]–at–ii]–Ø–w=ayi
FUT–[[ASSOC–sit/AI]–*v*–3SUB]–IND–3=OBV.SG
‘she will hold him on her lap’

(521) ⟦âːkoʔtotamɪmːiːwáji̥⟧
áako’totam**imm**iiwáyi
aak–[o’totam–**imm**–ii]–Ø–w=ayi
FUT–[superior–**by.mind**.*v*–3SUB]–IND–3=OBV.SG
‘she will consider him more important’

cf. ⟦âːkoʔtotamaʔpsːiwḁs⟧
áako’totama’pssiwa
aak–[o’totam–a’p/ssi]–Ø–wa
FUT–[superior–be/AI]–IND–3
‘she will be superior’

(522) ⟦ik͡síst̮oji ʔt͡simḁ⟧
iksísstoy**i’t**sima
[iksisstow–**i’t**–i]–m–a
[waste–**by.mind**.*v*–TI1]–IND–3
‘he wasted it’

cf. ⟦ik͡sistówaʔpsːiwḁ⟧
iksisstówa’pssiwa
[iksisstow–a’p/ssi]–Ø–wa
[waste–be/AI]–IND–3
‘he is wasteful’

The initial /i/ in *-imm* and *-i’t* ‘by mind’ coalesces with the final /a/ in *isska’* ‘shock’ to form [ɛː], (523), with the final /i/ in *ikkihkini* ‘depressed’ to form [iː], (524), and with the final /o/ in *ohko* ‘contrary’ to form [oi], (526). (Again, I have placed alongside each example another example that uses the same prefix in order to show that the vowel is part of the suffix meaning ‘by thought, mind’. Unfortunately, *ohko-* ‘contrary’ only occurs before [i] in the dictionary.)

(523) ⟦ɪskejʔtakit⟧
issk**ai’t**akit
[isska’–**i’t**–aki]–t–Ø
[shock–**by.mind**.*v*–AI]–2SG.IMP–CMD
‘be overwhelmed!’

cf. ⟦nit͡síːksːkɔʔx̩ʷpiʔji̥⟧
nitsííksskao’ohpi’yi
nit–ii\ik–[sska’–ohp/i’yi]–(hp)
1–IC\DEG[shock–fall/AI]–IND)
‘I had a great fall’

(524) ⟦nit͡síkːç̩kíniʔtaki̥⟧
nitsíkkihkíni**i’t**aki
nit–[ikkihkini–**i’t**–aki]–(hp)
1–[depressed.*v*?–**by.mind**.*v*–AI]–(IND)
‘I’m sad’

(525) ⟦âːk͡síkːs̩ːpijiːwáji̥⟧
áaksíkksspiyiiwáyi
aak–[ikk–ssp–i–yii]–Ø–w=ayi
FUT–[hit–head–*v*–3SUB]–IND–3=OBV.SG
‘she will hit him on the head’

cf. ⟦nit͡síkːç̩kínjoxʷsi̥⟧
nitsíkkihkínioohsi
nit–[ikkihkini–ohs/i]–(hp)
1–[depressed.*v*?–REFL/AI]–(IND)
‘I made myself feel depressed (by thinking unpleasant thoughts)’

(526) ⟦oxʷkóímːis⟧
ohkóímmisa
[ohko–imm–:s]–Ø
[contrary–by.mind.v–2SG:3.IMP]–CMD
'find fault with him!'

cf. ⟦âːkx̞ʷkoisk͡sinojiːwáji̥⟧
áakohkoissksinoyiiwáyi
aak–ohko–[issk–in/o–yii]–Ø–w=ayi
FUT–contrary–[memory–by.sight/v–3SUB]–IND–3=OBV.SG
'she will find out the contrary about him, expose his actions'

The V^0-adjoined root *-ipo* 'upright' surfaces faithfully after a consonant-final morpheme like *o't-* 'here, at (a location)' in (527).

(527) ⟦oʔt͡sipójit⟧
o'tsipóyit
[o't–ipo/yi]–t–Ø
[here–stand/AI]–2SG.IMP–CMD
'stand by me!'

cf. ⟦oʔtópiːt⟧
o'tópiit
[o't–op/ii]–t–Ø
[here–sit/AI]–2SG.IMP–CMD
'sit by me!'

The initial /i/ in *-ipo* 'upright' coalesces with the final /a/ in *sa* 'out' to form [ɛː], (528), with the final /i/ in *ihtatsiki* 'middle' to form [iː], (529), and with the final /o/ in *ikssto* 'abreast' to form [oi], (530).

(528) ⟦sɛːpójit⟧
saipóyit
[sa–ipo/yi]–t–Ø
[out–stand.AI]–2SG.IMP–CMD
'stand off! (from the crowd)'

cf. ⟦sɔʔt͡sit⟧
sao'tsit
[sa–o't/Ø–i]–t–Ø
[out–by.hand/v–TI1]–2SG.IMP–CMD
'take it (clothing) off!'

(529) ⟦itɛ́ç̞tat͡sikiːpojiwḁ⟧
itáíhtatsikiipoyiwa
it–a–[ihtatsiki–ipo/yi]–Ø–wa
LOC–IPFV–[middle–stand/AI]–IND–3
'he stands in the middle'

cf. ⟦âːkç̞tát͡sikjôːjiwḁ⟧
áakihtátsikióoyiwa
aak–[ihtatsiki–oo/yi]–Ø–wa
FUT–[middle–eat/AI]–IND–3
'she will eat mid-day meal (lunch)'

(530)	⟦ɔ́ːpak͡síksːtoipojijaːwḁ⟧	cf. ⟦âːkitopak͡siksːtóːpiːjaːwḁ⟧
	áópaksíksstoi**ipo**yiyaawa	áakitopaksiksstóópiiyaawa
	a–opak–[ikssto–**ipo/**yi]–Ø–yi=aawa	aak–it–opak–[ikssto–op/ii]–Ø–yi=aawa
	IPFV–flat–[abreast–**stand/**AI]–IND–3PL=PRX.PL	FUT–LOC–flat–[abreast–sit/II]–IND–3PL=PRX.PL
	‘they stand abreast’	‘they will sit abreast there’

The medial *-in-* ‘BERRY’ surfaces faithfully after consonant-final morphemes, such as *yiistap-* ‘away’, (536), or *o’t-* ‘here’, (537).

(531)	⟦kominokóji̥⟧	cf. ⟦komçkíːtaːni̥⟧
	kom**in**okóyi	komihkíítaani
	[[kom–**in**–k/o]–Ø]–yi	[kom–[ihki–it/aa]–n]–yi
	[[round–**BERRY**–EXT/II]–IND]–IN.SG	[round–[dry–by.heat/AI]–NMLZ]–IN.SG
	‘marble, pill’	‘bun, round loaf of bread’

There are not many examples of this medial after vowels in the dictionary, but the initial *i* of *-in-* ‘BERRY’ coalesces with a preceding /a/ to form [ɛː].[31]

(532)	⟦ɪsksːɪ́ːneːnikɪmːik͡si̥⟧	cf. ⟦ɪsksːɪ́ːnaːwḁ⟧
	issksssíína**iin**ikimmiksi	issksssíínaawa
	[[issksssiinaa–**in**–k/i]–mm]–iksi	[issksssiinaa]–wa
	[[insect–**BERRY**–EXT/AI]–IND]–AN.PL	[insect]–PRX
	‘rice (lit. insect-shaped)’	‘insect’

In sum, there is robust evidence that some low head-adjoined roots and medials begin in a vowel /i/. Later in this section I show that there are two different types of /i/ vowels which have different effects on a preceding [k]. Before I show that, I will show that there are also suffixes which begin in short [a] and short [o].

Suffixes in [a]

Suffixes which begin in underlying /a/ have the following patterns of coalescence.

/C+a/	→	Ca
/i+a/	→	ja/ a
/a+a/	→	aː
/o+a/	→	aː/ a

[31] This is the pronunciation used by the speakers I have worked with. The word for ‘rice’ was listed in the dictionary with two different spellings here: once with <ai> (typically pronounced [ɛː]) and once with <aii> (typically pronounced [eː]). Evidently the speakers I work with have the first pronunciation.

Examples of /a/-initial suffixes include: instantiations of V^0-adjoined roots (*-an* ‘say’), and medials (*-ap* ‘CORD’). (Unfortunately there are no examples of an /a/-initial v^0-adjoined root in the dictionary which occurs after both consonants and vowels.) I give evidence for each below.

The V^0-adjoined root *-an-ii* ‘say’ surfaces faithfully after a consonant-final morpheme like *okam-* ‘straight, honest’ in (535).

(533) ⟦âːkókamaniːwḁ⟧
áakókam**an**iiwa
aak–[okam–**an**/ii]–Ø–wa
FUT–[straight–**say**/AI]–IND–3
‘he will beg’, ‘he will ask permission’

cf. ⟦âːkókamoʔtst͡siːwḁ⟧
áakókamo’tstsiiwa
aak–[okamo’t–st/ii]–Ø–wa
FUT–[straight–be.positioned/II]–IND–3
‘it will be straight’

The initial /a/ in *-anii* ‘say’ coalesces with the final /iː/ in the stem *s’ikopii* ‘sit covered’ to form [jaː], (534), and with the final /o/ in *ohko* ‘contrary’ to form [aː], (535). I found no clear examples of *-anii* ‘say’ after /a/-final morphemes.)

(534) ⟦siʔkopjaːniːt⟧
si’kopi**aan**iit
[[si’k–op/ii]–**an**/ii]–t–Ø
[[cover–sit/AI]–**say**/AI]–2SG.IMP–CMD
‘talk deceptively!’

cf. ⟦oʔtópiːt⟧
o’tópiit
[o’t–op/ii]–t–Ø
[here–sit/AI]–2SG.IMP–CMD
‘sit by me!’

(535) ⟦sawx̩ʷkáːniːt⟧
sawohká**á**niit
saw–[ohko–**an**/ii]–t–Ø
NEG–[contrary–**say**/AI]–2SG.IMP–CMD
‘say something of no importance!’

cf. ⟦sawx̩ʷkóímːis⟧
sawohkóímmisa
saw–[ohko–imm–:s]–Ø
NEG–[contrary–by.mind.*v*–2SG:3.IMP]–CMD
‘be disgusted with him!’ (‘have a negative feeling towards him!’, ‘consider him unimportant!’)

The medial *-ap-* ‘CORD’ surfaces faithfully after consonant-final morphemes, such as *yiistap-* ‘away’, (536), or *o’t-* ‘here’, (537).

(536) ⟦ijíːˢtapapɪnːiːwḁ⟧
iyíístap**ap**inniiwa
[iyiistap–**ap**–inn–ii]–Ø–wa
[away–**CORD**–by.hand.*v*–3SUB]–IND–3
'he adjusted the strand out and away from it'

cf. ⟦míːˢtapoːt⟧
míístapoot
[miistap–oo]–t–Ø
[away–go.AI]–2SG.IMP–CMD
'go away!'

(537) ⟦âːkoʔtapɪnːiːwḁ⟧
áako'**tap**inniiwa
aak–[o't–**ap**–inn–ii]–Ø–wa
FUT–[here–**CORD**–by.hand.*v*–3SUB]–IND–3
'she will adjust it (e.g. the rope) here'

cf. ⟦nikɔ́ʔto⟧
nikáó'too
n–ikaa–[o't–oo]–(hp)
1–PRF–[here–go.AI]–(IND)
'I have arrived'

The initial /a/ in *-ap-* 'CORD' coalesces with the final /a/ in *sa-* 'out' to form [aː], (538), with the final /i/ in the noun *apahkis* 'hide'[32] to form [jaː], (539), and with the final /o/ in *siso* 'cut' to form [aː], (540).

(538) ⟦nítsːaːpɪnːawḁ⟧
nítssa**ap**innawa
nit–[sa–**ap**–inn–a]–Ø–wa
1–[out–**CORD**–by.hand.*v*–3OBJ]–IMP–3
'I adjusted the strand out from the inside of it'

cf. ⟦sɛ́ːpx̩ʷtóːt⟧
saipohtóót
[sa–ip/oht–oo]–t–Ø
[out–bring/*v*–TI2]–2SG.IMP–CMD
'take it out!'

(539) ⟦apx̩kjáːpokoji̥⟧
apahki**áá**pokoyi
[[apahkis–**ap**–k/o]–Ø]–yi
[[hide–**CORD**–EXT/II]–IND]–IN.SG
'hide strip'

cf. ⟦apx̩kísi̥⟧
apahkísi
[apahkis]–yi
[hide]–IN.SG
'hide'

[32] The allomorph for 'hide' in this word is not *apahkis*, but *apahki* without a final *s*. There is a set of nouns which ends in 'non-permanent consonants' (Frantz 2009). These 'non-permanent consonants' occur before singular nominal inflectional suffixes, but delete before plural suffixes. Evidently they also delete before suffixes which are internal to the verbal stem.

(540)	⟦sisáːpɪtːakit⟧	cf. ⟦sisójit⟧
	sisá**áp**ittakit!	sisóyit
	[siso–**ap**–itt–aki]–t–Ø	[siso–yi]–t–Ø
	[cut–**CORD**–by.blade.*v*–AI]–2SG.IMP–CMD	[cut–AI]–2SG.IMP–CMD
	‘shred (the hide) into strips’	‘cut! (s.t. into strips)’

Suffixes in [o]

Suffixes which begin in underlying /o/ have the following patterns of coalescence.

/C+o/	→	Co
/i+o/	→	jo/ o
/a+o/	→	ɔː
/o+o/	→	oː

Examples of /o/-initial suffixes include: instantiations of v^0-adjoined roots (*-o’t* ‘by hand’), and instantiations of V^0-adjoined roots (*-op* ‘sit’). (Unfortunately there are no examples of *o*-initial medials in the dictionary which occur after both consonants and vowels.) I give evidence for each below.

The v^0-adjoined root *-o’t* ‘by hand’ surfaces faithfully after a consonant.

(541)	⟦nitáːpoʔtoːkḁ⟧	cf. ⟦nitápiˢtotoːkḁ⟧
	nitááp**o’t**ooka	nitápistotooka
	nit–[waap–**o’t**/o–ok]–Ø–a	nit–[waap–istot/o–ok]–Ø–a
	1–[release–**by.hand/***v*–INV]–IND–PRX	1–[release–CAUS/*v*–INV]–IND–PRX
	‘she released me from my bonds’	‘she undressed me’
(542)	⟦somóʔtoːs⟧	cf. ⟦somíːkanis⟧
	som**ó’t**oosa	somííkanisa
	[som–**o’t**/o–:s]–Ø	[som–iika–n–:s]–Ø
	[touch.lightly–**by.hand/***v*–2SG:3.IMP]–CMD	[release–back–by.hand.*v*–2SG:3.IMP]–CMD
	‘touch her lightly!’	‘rub her back lightly!’

The initial /o/ in *-o’t* ‘by hand’ coalesces with the final /a/ in *sa* ‘out’ to form [ɔː], (543), and with the final /i/ in the medial *-sski-* ‘face’ to form [jo], (544). (Unfortunately there are no clear examples in the dictionary of *-o’t* after an /o/.)

(543) ⟦sɔʔt͡sit⟧
saoʼtsit → sa**o’t**sit
[sa–**o’t**/Ø–i]–t–Ø
[out–**by.hand**/*v*–TI1]–2SG.IMP–CMD
‘take it off (e.g. a hat)!’

cf. ⟦sɛːpójit⟧
saipóyit
[sa–ipo/yi]–t–Ø
[out–stand/AI]–2SG.IMP–CMD
‘stand off (from the crowd)!’

(544) ⟦sʌ́t͡ːsiksːkjoʔtoːs⟧
sáttsiksski**o’t**oosa
[sattsik–sski–**o’t**/o–:s]–Ø
[scratch–face–**by.hand**/*v*–2SG:3.IMP]–CMD
‘scratch her face!’

cf. ⟦sinsːkipís⟧
sinsskipísa
[sin–sski–p–:s]–Ø
[mark–face–by.mouth.*v*–2SG:3.IMP]–CMD
‘lick his face!’

The head V^0-adjoined root *-op* ‘sit’ surfaces faithfully after a consonant-final morpheme like *sap-* ‘inside’ in (545) and *ikim-* ‘place of honor’ in (546).

(545) ⟦nitâːksːapopi⟧
nitáakssap**op**ii
nit–aak–[sap–**op**/ii]–(hp)
1–FUT–[inside–**sit**/AI]–(IND)
‘I’ll ride in (a vehicle)’

cf. ⟦âːksːapápinoʔtojiːwáji̥⟧
áakssapápino’toyiiwáyi
aak–[sap–apin–o’t/o–yii]–Ø–w=ayi
FUT–[inside–eye–by.hand/*v*–3SUB]–IND–3=OBV.SG
‘she will poke him in the eye’

(546) ⟦âːk͡sikimópiːwḁ⟧
áaksikim**óp**iiwa
aak–[ikim–**op**/ii]–Ø–wa
FUT–[place.of.honor–**sit**/AI]–IND–3
‘she will sit in a place of honor’

cf. ⟦âːk͡sikimç̩kx̩toːmḁ⟧
áaksikimihkahtooma
aak–[ikim–ihk/aht–oo]–m–a
FUT–[place.of.honor–pass.by.hand/*v*–TI2]–IND–3
‘she will pass it to the front’

The initial /o/ in *-op* ‘sit’ coalesces with the final /a/ in *ipakkssa* ‘bare’ to form [ɔː], (547), with the final /i/ in *saoki* ‘prairie’ to form [joː], (548), and with the final /o/ in *oto* ‘go to do’ to form [oː], (549).

(547) ⟦ípʌkːsːɔːpiːwḁ⟧
ípakkssa**op**iiwa
[ipakkssa–**op**/ii]–Ø–wa
[bare–**sit**/AI]–IND–3
‘he’s sitting with nothing on (in the nude)’

cf. ⟦ipʌ́kːsɛːt͡sinsːiwḁ⟧
ipákkssaitsinssiwa
ipakksa–[itsin–ssi]–Ø–wa
bare–[among–AI]–IND–3
‘he entered (e.g. a job or competition) lacking experience’

(548) ⟦itsːɔ́ːkjopiːwḁ⟧
itssáókiopiiwa
it–[saoki–**op**/ii]–Ø–wa
it–[prairie–**sit**/AI]–IND–3
'he is living on the prairie', 'he is living on the flat'

cf. ⟦sɔːkjáwakaːsik͡si̥⟧
saokiáwakaasiiksi
[saoki–[awa–ka–asi]–Ø]–iksi
[prairie–[meander–foot–AI]–IND]–AN.PL
'pronghorns (antelope)'

(549) ⟦âːk͡sɪkːakotoːpiːwḁ⟧
áaksikkakotoopiiwa
aak–ikkak–[oto–**op**/ii]–Ø–wa
FUT–short–[go.to.do–**sit**/AI]–IND–3
'she will go to boarding school at a young age'

cf. ⟦âːkotáːkɪsːiwḁ⟧
áakotáakissiwa
aak–oto–[aakiss–i]–Ø–wa
FUT–go.to.do–[fetch.water–AI]–IND–3
'she will go for water'

In sum, this section showed that when we consider patterns of suffix alternation, and patterns of vowel hiatus resolution in particular, then we find evidence that suffixes may begin with three different underlying short vowel qualities: /i/, /a/, and /o/. In the next section I argue that there are two different kinds of underlying /i/ vowels, which I distinguish via suffixes when needed: /i_1/ and /i_2/. These two vowels have different morphophonological effects on a preceding /k/: /i_1/ always occurs after a [k͡s] assibilant, while /i_2/ always occurs after a [k] plosive. This fact is important to establish, because as I discuss in Section 4.2.1.2, the epenthetic [i] which appears between consonants within the PWd is always /i_1/. I use this as secondary evidence to argue that the vowel is truly epenthetic, because if it had been underlying then we would have expected at least some instances to behave like /i_2/.

4.2.1.1.2 Secondary evidence from [k]-assibilation

Some high front vowels cause assibilation of a preceding /k/ to [k͡s] while others do not. This is a contrastive feature of the initial vowel of the suffix vowel. No suffixes beginning in /a/ or /o/ cause assibilation of a preceding /k/. I review this evidence below, using the same suffixes from the preceding section.

Suffixes in [$\mathbf{i}_1$]

Examples of /i_1/-initial suffixes include: instantiations of v^0-adjoined roots (*-istot* 'CAUS'), instantiations of V^0-adjoined roots (*-ipo* 'upright'), and medials (*-in-* 'BERRY'). Each of these causes a preceding [k] to assibilate to [k͡s]. I give evidence for each below. (A second v^0-adjoined root which begins in /i_1/ is *-in* 'by sight'. I have put that data into the appendix.)

(550) a. *⟦so**k**iˢtot͡sít⟧
so**k**istotsít
[sok–istot/Ø–i]–t–Ø
[good–CAUS/*v*–TI1]–2SG.IMP–CMD
'groom the area!'

b. ⟦so**k͡s**iˢtot͡sít⟧
so**ks**istotsít
[sok–istot/Ø–i]–t–Ø
[good–CAUS/*v*–TI1]–2SG.IMP–CMD
'groom the area!'

(551) a. *⟦itájoxʷ**k**ipojiwḁ⟧
itáyooh**k**ipoyiwa
it–a–[yoohk–ipo/yi]–Ø–wa
LOC–IPFV–stand/AI]–IND–3
intended: 'he stands by the door (entrance)', 'he is goalie'

b. ⟦itájoxʷ**k͡s**ipojiwḁ⟧
itáyooh**ks**ipoyiwa
it–a–[yoohk–ipo/yi]–Ø–wa
LOC–IPFV–stand/AI]–IND–3
'he stands by the door (entrance)', 'he is goalie'

(552) a. *⟦síː**k**inokoji̥⟧
síí**k**inokoyi
[[siik–in–k/o]–Ø]–yi
[[branch?–BERRY–EXT/II]–IND]–IN.SG
intended: 'creeping juniper'

b. ⟦síː**k͡s**inokoji̥⟧
síí**ks**inokoyi
[[siik–in–k/o]–Ø]–yi
[[branch?–BERRY–EXT/II]–IND]–IN.SG
'creeping juniper'

Suffixes in [i$_2$]

An example of an /i$_2$/-initial suffix includes the v^0-adjoined root (*-imm* or *-i't* 'by mind'). As shown in the preceding section, this suffix begins with /i/. Unlike suffixes which begin in /i$_1$/, this suffix never causes a preceding [k] to assibilate. (A second v^0-adjoined root, *-inn* 'by hand', also begins with a /i$_2$/ vowel. I have put that data in the appendix.)

(553) a. ⟦si**k**ímːis⟧
si**k**ímmisa
[sik–imm–:s]–Ø
[black–by.mind.*v*–2SG:3.IMP]
'consider him unclean!'

b. *⟦si**k͡s**ímːis⟧
si**ks**ímmisa
[sik–imm–:s]–Ø
[black–by.mind.*v*–2SG:3.IMP]
'consider him unclean!'

Suffixes in [a]

Examples of /a/-initial suffixes include: instantiations of V^0-adjoined roots (*-an* 'say') and medials (*-ap-* 'SHEET'). No suffixes in /a/ cause a preceding [k] to assibilate to [k͡s]. I give evidence for each below.

(554) a. ⟦itotóískṣ̩**k**aniːt⟧
itotóísskskaniit → itotóíssks**k**aniit
it–oto–[issksk?–an/ii]–t–Ø
LOC–go.to.do–[send?–say/AI]–2SG.IMP–CMD
‘refer back (to it)!’

b. * ⟦itotóísks̩**k͡s**aniːt⟧
itotóíssks**ks**aniit
it–oto–[issksk?–an/ii]–t–Ø
LOC–go.to.do–[send?–say/AI]–2SG.IMP–CMD
intended: ‘refer back (to it)!’

(555) a. ⟦sax**k**apíkɪmːḁ⟧
saah**k**apíkimma
[[saahk–ap–k/i]–mm]–a
[[short–CORD–EXT/AI]–IND]–PRX
‘short length of flexible rope-like material’

b. * ⟦sax**k͡s**apíkɪmːḁ⟧
saah**ks**apí**k**imma
[[saahk–ap–k/i]–mm]–a
[[short–CORD–EXT/AI]–IND]–PRX
intended: ‘short length of flexible rope-like material’

(556) a. ⟦ɪˢt͡ːsi**k**ápokoji̥⟧
isttsi**k**ápokoyi
[[isttsik–ap–k/o]–Ø]–yi
[[smooth–CORD–EXT/AI]–IND]–PRX
‘leather’

b. * ⟦ɪˢt͡ːsi**k͡s**ápokoji̥⟧
isttsi**ks**ápokoyi
[[isttsik–ap–k/o]–Ø]–yi
[[smooth–CORD–EXT/AI]–IND]–PRX
intended: ‘leather’

Suffixes in [o]

Examples of /o/-initial suffixes include: instantiations of v^0-adjoined roots (*-o’t* ‘by hand’) and instantiations of V^0-adjoined roots (*-op* ‘sit’). No suffixes in /o/ cause a preceding [k] to assibilate to [k͡s]. I give evidence for each below.

(557) a. ⟦âːk͡sipx̩ʷ**k**oʔt͡simḁ⟧
áaksipoh**k**o’tsima
aak–[ipohk–o’t/Ø–i]–m–a
FUT–[pluck–by.hand/*v*–TI1]–IND–3
‘she will pluck them (inan)’

b. * ⟦âːk͡sipx̩ʷ**k͡s**oʔt͡simḁ⟧
áaksipoh**ks**o’tsima
aak–[ipohk–o’t/Ø–i]–m–a
FUT–[pluck–by.hand/*v*–TI1]–IND–3
intended: ‘she will pluck them (inan)’

(558) a. ⟦ɪsːi**k**ópiːt⟧
issi**k**ópiit
[issik–op/ii]–t–Ø
[terminate–sit/AI]–2SG.IMP–CMD
‘rest!’

b. * ⟦ɪsːi**k͡s**ópiːt⟧
issi**ks**ópiit
[issik–op/ii]–t–Ø
[terminate–sit/AI]–2SG.IMP–CMD
intended: ‘rest!’

4.2.1.1.3 Summary

There are three vowel qualities, but two different types of [i] based on whether they cause a preceding /k/ to assibilate or not. Thus, suffixes may begin with one of four different morphophonemic vowels (/i_1/, /i_2/, /a/, /o/), as summarized in Table 4.11.

Table 4.11: Underlying short vowels within the PWd

	i_1	i_2	a	o
Vowel quality after C	i	i	a	o
a+V	ɛː	ɛː	aː	ɔː
i+V	iː	iː	ja/a	jo/o
o+V	oi	oi	aː/a	oː
Preceding /k/ assibilates?	✓	✘	✘	✘

It was important to demonstrate in this section that some suffixes truly begin in an underlying vowel and to determine what the properties of those underlying vowels are. The reason is that epenthetic vowels occur between consonants, which is what I discuss next. These epenthetic vowels have previously been analyzed as part of the following suffix; that is, as an underlying vowel. However, as I discuss in Section 4.2.1.2, these vowels do not have the same properties as underlying vowels. It is only once we look at paradigmatic data and compare both patterns of alternation that the difference becomes clear.

4.2.1.2 Consonant-initial suffixes

The purpose of this section is to demonstrate that there are also PWd-internal suffixes which begin in a consonant. These suffixes have two allomorphs: a consonant-initial allomorph [-C…] which occurs directly after a vowel, and a vowel-initial allomorph [-VC…] after a consonant. Crucially, the vowel must be epenthetic. If it were underlying, then we would expect the patterns of alternation to look like other vowel-initial suffixes; that is, the vowel would occur after other vowels and interact in the manners described above.

In the next section, I lay out the distributional evidence that [i] and [o] are epenthetic vowels which break up illicit consonant clusters. In the section after that, I show how epenthetic [i] systematically causes assibilation of a preceding [k], as if it were [i_1].

4.2.1.2.1 Evidence from allomorphy: epenthesis

Consonant-initial suffixes exhibit one of three alternation patterns.

1. Ø ∼ [i]
2. Ø ∼ [o]
3. Ø ∼ [i] ∼ [o]

The Ø alternant occurs after a vowel; he [o] variant occurs after a consonant when the following syllable contains an [o] or [oː]; and the [i] variant occurs after a consonant when the following syllable contains any other vowel. I discuss each of the above three alternation patterns in turn.

Suffixes with Ø ∼ [i] alternations

I discuss two instances of v^0-adjoined roots and one instance of a medial which exhibit an Ø ∼ [i] alternation at the left edge of the suffix. These suffixes are consonant-initial; the suffixes occur unchanged directly after vowel-final suffixes. After a consonant, there is an initial [i] which I interpret as an epenthetic vowel. The reason is because if this [i] were an underlying part of the suffix, then we would expect it to occur after vowels with the same kinds of vowel hiatus resolution strategies discussed above. Later, I also show that this vowel uniformly causes a preceding [k] to assibilate to [k͡s] (unlike underlying /i/ vowels, which may or may not cause a preceding [k] to assibilate).

Turning to the two instantiations of v^0-adjoined roots, one is the instrumental final *-p-Ø* 'by mouth' which forms TA verb stems. (I do not discuss the TI and AI+O finals because those begin with a cluster, *-ht* ∼ *-sst*. Different speakers have different realizations of <hC> clusters, and it isn't always clear which instances of variation in the dictionary are intraspeaker versus interspeaker. I leave this for future research.) To supplement the *-p* TA 'by mouth' final, I also discuss the transitive verb final *-p* 'tie'.

(559)

TA	TI	AI+O	Gloss
v-V	*v*-V	*v*-V	
-p-Ø	(-ht-i)	(-ht-aki)	'by mouth'
-p-ist	-p-i	-p-istaa	'tie'

The v^0-adjoined root for the instrumental 'by mouth' final in TA verb stems is instantiated by *-p* ∼ *-ip* (Table 4.7). The form is *-p* after a vowel-final morpheme like *aato-* 'taste', (560), or *-sski-* 'face', (561). As before, each example on the left shows the suffix in question (in bold) after a particular morpheme (underlined). Each example on the left is paired with another example on the right which contains the same morpheme (underlined) before a different suffix. This is to diagnose morpheme boundaries and to argue that, e.g. the final *i* of *-sski* in (561) is not actually part of the following suffix.

(560) ⟦áːtopiːwaji̥⟧
ááto**p**iiway
[aato–**p**–ii]–Ø–w=ayi
[taste–**by.mouth**.*v*–3SUB]–IND–3=OBV.SG
'he tasted him' (Taylor 1969: 239)

cf. ⟦áːtoxʷt͡s}imḁ⟧
áátohtsima
[aato–ht–i]–m–a
[face–by.mouth.*v*–TI1]–IND–3
'he tasted it'

(561) ⟦sins̩ːki**pí**s⟧
sinsski**p**ísa
[sin–sski–**p**–:s]–Ø
[mark–face–**by.mouth**.*v*–2SG:3.IMP]–CMD
'lick his face!'

cf. ⟦sʌ́t͡ːsiks̩ːkjoʔtoːs⟧
sáttsiksskio'toosa
[sattsik–sski–o't/o–:s]–Ø
[scratch–face–by.hand/*v*–2SG:3.IMP]–CMD
'scratch her face!'

The form is *-ip* after a consonant-final morpheme like *ipon-* 'terminate, cease', (562).

(562) ⟦âːk͡siponipiːwáji̥⟧
áaksipon**ip**iiwáyi
aak–[ipon–**p**–ii]–Ø–w=ayi
FUT–[cease–**by.mouth**.*v*–3SUB]–IND–3=OBV.SG
'she will stop carrying him with her teeth'

cf. ⟦âːk͡siponótaʔsiwḁ⟧
áaksiponóta'siwa
aak–[ipon–ota's–i]–Ø–wa
FUT–[cease–horse–AI]–IND–3
'he will have one of his horses die'

The v^0-adjoined root meaning 'to tie' is instantiated by *-p* ∼ *-ip*. Again, the form is *-p* after a vowel-final morpheme like *aawa-* 'wander', (563), *-sski* 'face', (564), or *amo-* 'gather', (565).

(563) ⟦aːwápiˢtaːt⟧
aawá**p**istaat
[aawa–**p**/ist–aa]–t–Ø
[wander–**tie**/*v*–AI]–2SG.IMP–CMD
'make a cradle swing!'

cf. ⟦áːwatojâːpiks̩sit⟧
ááwatoyáapikssit
[aawa–toyi–apik/ssi]–t–Ø
[wander–tail–throw/AI]–2SG.IMP–CMD
'wag your tail!'

(564) ⟦nit͡sípːots̩ːkipiˢtawḁ⟧
nitsíppotsski**p**istawa
nit–[ippot–sski–**p**/ist–aa]–Ø–wa
1–[secure–face–**tie**/*v*–3OBJ–IND–3
'I put something over his face'

cf. ⟦siˢt͡síks̩ːkjáːkit⟧
sistsíksskiáákit
[sistsik–sski–aki]–t–Ø
[smile–face–AI]–2SG.IMP–CMD
'smile'

(565) ⟦amopíˢtaːni̥⟧
amo**p**ístaani
[[amo–**p**/ist–aa]–n]–i
[[gather–**tie**/*v*–AI]–NMLZ]–IN.SG
‘ceremonial bundle’

cf. ⟦amóípiːsaːwḁ⟧
amóípiisaawa
[amo–ip/i–:s]–Ø=aawa
[gather–bring/*v*–2SG:3.IMP]–IMP=PRX.PL
‘gather them!’

The form is *-ip* after a consonant-final morpheme like *ippot-* ‘secure’, (566).

(566) ⟦ɪpːot͡sípíˢtaːwḁ⟧
ippotsí**p**istaawa
[ippot–**p**/ist–aa]–Ø–wa
[secure–**tie**/*v*–AI]–IND–3
‘she wore braids’

cf. ⟦it͡sípːotɛːpojiwḁ⟧
itsíppotaipoyiwa
it–[ippot–a–ipo/yi]–Ø–wa
LOC–[secure–IPFV–stand/AI]–IND–3
‘he is standing by the door’

I now turn to the medial meaning ‘foot, leg’, which is instantiated by *-ka* ∼ *-ika*. The form is *-ka* after a vowel-final morpheme like *istta-* ‘under’, (567), or *amo-* ‘gather’, (568).

(567) ⟦stámit͡sɪˢtːákaːkit⟧
stámitsisttá**ka**akit
stam–it–[istta–**ka**–aki]–t–Ø
just–LOC–[below–**foot**–AI]–2SG.IMP–CMD
‘put your foot into (s.t.)’

cf. ⟦ɪˢtːajít⟧
isttayít
[istta–yi]–t–Ø
[below–AI]–2SG.IMP–CMD
‘dive!’

(568) ⟦amokápiˢtaːt⟧
amo**ká**pistaat
[amo–**ka**–p/ist–aa]–t–Ø
[gather–**foot**–tie/*v*–AI]–2SG.IMP–CMD
‘hobble!’

cf. ⟦amokíns̩t͡saːkit⟧
amokínsstsaakit
[amo–kinsst–i–aki]–t–Ø
[gather–hand–*v*–AI]–2SG.IMP–CMD
‘close your hand!’

The form is *-ika* after a consonant-final morpheme like *saap-* ‘inside’, (569), or *ki’taw-* ‘across’, (570).

(569) ⟦saːpíkaːkjaʔt͡sisi̥⟧
saap**íka**akia’tsisi
[[saap–**ka**–aki]–a’tsis]–i
[[inside–**foot**–AI]–NMLZ]–IN.SG
‘stirrup (lit: that which is used to place one’s foot into)’

cf. ⟦sapáːkç̩taːt⟧
sapáákihtaat
sap–[aak–ht–aa]–t–Ø
inside–[arrange–*v*–AI]–2SG.IMP–CMD
‘load your things!’

(570) ⟦kiʔtajíka:kato:t⟧
ki'tay**íka**akatoot
[[ki'taw–**ka**–aki]–at–oo]–t–Ø
[[across–**foot**–AI]–*v*–TI2]–2SG.IMP–CMD
'put your foot over it'

cf. ⟦kiʔtawa:t͡sis⟧
ki'tawaatsisa
[[ki'taw–oo]–at–:s]–Ø
[[across–go.AI]–*v*–2SG:3.IMP]–CMD
'cross over him!'

Suffixes with Ø ∼ [o] alternations

There is also a medial meaning 'tail' which is instantiated by *-toyi* ∼ *-otoyi*. The form is *-toyi* after a vowel-final morpheme like *aawa-* 'wander', (571).

(571) ⟦á:watojâ:piks̩:it⟧
ááwa**toy**áapikssit
[aawa–**toyi**–aapik/ssi]–t–Ø
[wander–**tail**–throw/AI]–2SG.IMP–CMD
'wag your tail!'

(572) cf. ⟦áwáka:siwḁ⟧
áwákaasiwa
[[awa–ka–asi]–Ø]–wa
[[wander–foot–AI]–IND]–PRX
'antelope/deer'

The form is *-otoyi* after a consonant-final morpheme like *piin-* 'NEG', (573). This negative prefix is used in negative imperatives. (For some speakers this prefix is *miin-*.)

(573) ⟦pi:notójiwḁ⟧
piin**otóyi**wa
[[piin–**toyi**–Ø]–Ø]–wa
[[NEG–**tail**–AI]–IND]–PRX
'wolverine'

(574) cf. ⟦pi:náʔsojɪn:it⟧
piiná'soyinnit
piin–[a'so–yinn–i]–t–Ø
NEG–[spill–by.hand.*v*–TI1]–2SG.IMP–CMD
'don't spill it!'

This is nearly the same pattern as above in the sense that this suffix begins with a consonant directly after a vowel, but there is an epenthetic vowel inserted when the suffix follows a consonant. In this case, the epenthetic vowel is [o] instead of [i]. This seems to be phonologically predictable: notice that the next vowel following the epenthetic vowel is also an [o]. For this reason, the epenthetic vowel seems to be [o] before an [o] and [i] otherwise. The next example offers supplementary evidence for this claim.

Suffixes with [Ø] ∼ [i] ∼ [o] alternations

There is a suffix which occurs between a classificatory medial and a V^0 that derives a state. The instantiation of V^0 is always either AI *-i* or II *-o*. Examples are given in Table 4.12. This suffix is *-k* if the medial ends in a vowel, such as the medials [a:] ∼ [ɛ:] 'METAL' and [-ikina] 'SUPPORT'. After a consonant, the suffix is *-ik* before AI *-i*, and *-ok* before II *-o*. I have bolded the vowel which alternates in the table.

Table 4.12: States built on classificatory medials (subset)

$\sqrt{}$ROOT–MED–EXT/AI–IND	$\sqrt{}$ROOT–MED–EXT/II–IND	Gloss
$\sqrt{}$ROOT–ai–k/i–mm	$\sqrt{}$ROOT–aa–k/o–Ø	‘be a METAL of type $\sqrt{}$ROOT’
$\sqrt{}$ROOT–ikina–k/i–(mm)	$\sqrt{}$ROOT–ikina–k/o–Ø	‘be a SUPPORT of type $\sqrt{}$ROOT’
$\sqrt{}$ROOT–ap–**i**k/i–mm	$\sqrt{}$ROOT–ap–**o**k/o–Ø	‘be a CORD of type $\sqrt{}$ROOT’
$\sqrt{}$ROOT–an–**i**k/i–mm	$\sqrt{}$ROOT–an–**o**k/o–Ø	‘be a SHEET of type $\sqrt{}$ROOT’
$\sqrt{}$ROOT–in–**i**k/i–mm	$\sqrt{}$ROOT–in–**o**k/o–Ø	‘be a BERRY of type $\sqrt{}$ROOT’

I analyze this suffix as simply /-k/ underlyingly. Since it does not seem to add semantic content I have glossed it rather neutrally as EXT for ‘extension’. This suffix is realized as [-k] after vowels, but a vowel is epenthesized at the left edge of the suffix following a consonant. The epenthetic vowel is [i] before [i] and [o] before [o].

To sum, the evidence from morphemic alternations shows that there is a class of suffixes within the PWd which alternates, [-C…] (after vowels) $\sim$ [-VC…] (after consonants). This class of suffixes differs from the class of suffixes which begin with underlying vowels, for which the vowel is present regardless of whether the suffix follows a consonant or vowel. Therefore, this vowel must be epenthetic, and it is always [o] before [o], and [i] elsewhere.

I now turn to secondary evidence from [k]-assibilation which supports the idea that this [i] is epenthetic. Suffixes which begin with an underlying [i] fall into two types: either the [i] follows a velar assibilant [$\widehat{\text{ks}}$], or it follows a velar plosive [k]. In contrast, this epenthetic [i] uniformly follows an assibilant [$\widehat{\text{ks}}$].

4.2.1.2.2 Secondary evidence from [k]-assibilation

Epenthetic [i] systematically causes a preceding [k] to assibilate to [$\widehat{\text{ks}}$], as if it were [i_1]. Epenthetic [o] does not cause [k] to assibilate, which is expected because underlying [o] also does not cause assibilation.

When the ‘by mouth’ TA final *-p* follows a *k*-final morpheme, the morpheme final *k* assibilates to [$\widehat{\text{ks}}$] before the epenthetic [i]. Example (575) shows that the initial *pikk-* ‘nip’ is realized as *pikks-* before *-p* ‘by mouth’. Similarly, the initial *sik-* ‘bite’ is realized as *siks-* before the epenthetic [i] in (576). In this case, I do not know of any other verbs that contain that initial.

(575) ⟦âːk͡sipík͡ːsipiːwáji̥⟧
áaksipíkks**ip**iiwáyi
aak–[pikk–**p**–ii]–Ø–w=ayi
FUT–[nip–**by.mouth**.*v*–3SUB]–IND–3=OBV.SG
‘he will crack it (anim.) (with his teeth)’

cf. ⟦âːk͡sipíkːsːiwḁ⟧
áaksipíkkssiwa
aak–[píkk–ssi]–Ø–wa
FUT–[nip–AI]–IND–3
‘she will be anxious’

(576) ⟦nitâːksːik͡sipawḁ⟧
nitáakssiks**ip**awa
nit–aak–[sik–**p**–a]–Ø–wa
1–FUT–[bite–**by.mouth**.*v*–3OBJ]–IND–3
‘I will bite him”

In example (577), the v^0-adjoined root *-p* ‘tie’ occurs after the morpheme *yoohk-* ‘lid’. This morpheme is realized with a final assibilant, *yoohks-* ‘lid’, before the epenthetic vowel [i].

(577) ⟦nitâːk͡soxʷk͡sipiˢta⟧
nitáaksoohks**ipistaa**
nit–aak–[yoohk–**p/**ist–aa]–(hp)
1–FUT–[lid–**tie/***v*–AI]–(IND)
‘I will close the tipi flap’

cf. ⟦âːk͡soxʷkójijiːwáji̥⟧
áaksoohkóyiyiiwáyi
aak–[yoohk–oyi–Ø–yii]–Ø–w=ayi
FUT–[lid–mouth–*v*–3SUB]–IND–3=OBV.SG
‘she will cover it with a lid’

In example (578), the medial *-ka* ‘foot, leg’ occurs after the morpheme *omahk-* ‘large’. This morpheme is realized with a final assibilant, *omahks-* ‘large’, before the epenthetic vowel [i].

(578) ⟦iːkómx̩k͡sikawḁ⟧
iikómahks**ika**wa
ii\ik–[omahk–**ka**–Ø]–wa
IC\DEG–[big–**foot**–AI]–IND–3
‘he has big feet’

cf. ⟦ómx̩katajoik͡si̥⟧
ómahkatayoiksi
[omahk–atayo]–iksi
[big–lynx]–AN.PL
‘mountain lions’

In example (579), the medial *-toyi* ‘tail’ occurs after the morpheme *sattsik-* ‘rattle’. The final [k] in this morpheme does not assimilate to [k͡s] before the epenthetic vowel [o], which is as expected.

(579) ⟦sɛ́t͡ːsikotoji̥⟧
<u>sáí’ittsik</u>**otoyi**wa
[[<u>sattsik</u>–**toyi**–Ø]–Ø]–wa
[[<u>rattle</u>–**tail**–AI]–IND]–PRX
‘rattlesnake (lit: rattle tail)’

(580) cf. ⟦ɛ́ːsʌt͡ːsikx̩ʷtamːḁ⟧
á<u>ísattsik</u>ohtaamma
a–[<u>isattsik</u>–oht/aa]–mm–a
IPFV–[<u>rattle</u>–sounds.like/AI]–IND–3
‘it (anim.) is jingling’

4.2.1.2.3 Summary

This section showed that there are suffixes within the PWd which begin with consonants. The evidence comes from morphemic alternations: these suffixes occur directly after vowels but are separated from a preceding consonant by an epenthetic vowel. If the vowel had been part of the underlying form, then we would have expected to see the same vowel hiatus resolution strategies that occur for the suffixes which begin with a true underlying vowel.

These epenthetic vowels are phonologically regular in two ways. The first way is that the epenthetic vowel quality is predictable. It is [o] when the following vowel is [o] or [oː] and [i] otherwise. In this way, the form of the epenthetic vowel is contextually determined. The second way is that epenthetic [i] systematically causes a preceding [k] to assibilate to [k͡s]. In this way, the epenthetic [i] has regular morphophonological effects on the surrounding segments.

4.2.1.3 Summary: PWd-internal epenthesis

In this section I argued that there is a regular process of epenthesis within the PWd. I presented evidence from morphological alternations to argue that some stem-internal suffixes begin with short vowels while others begin with consonants.[33] The initial vowel of vowel-initial suffixes surfaces faithfully after consonants and coalesces with preceding vowels. The initial consonant of consonant-initial suffixes surfaces faithfully after vowels. When a consonant-initial suffix occurs after a consonant, a vowel is epenthesized between the two consonants.[34] This epenthetic vowel is phonologically predictable in two ways. First, the vowel quality is contextually-determined: it is [o] if the following syllable within the stem contains an [o] or [oː], and it is [i] otherwise. Second, the epenthetic [i] systematically causes a preceding [k] to assibilate to [k͡s], whereas underlying [i] vowels come in two types; some cause assibilation while others do not.

In the next section I show that high roots exhibit different patterns of alternation than low roots. Although high roots may begin in a consonant or a vowel at the left edge of the PPh, all roots which

[33]This certainly is not a comprehensive summary of Blackfoot suffixes. It is likely that suffixes also begin with a consonant cluster, a glide, a long vowel, or a moraic [s̩]. I hope that the technique used here of examining a single morpheme after consonants and vowels will be useful in the future for determining more underlying forms.

[34]This kind of epenthesis corresponds to the “connective-*i*” in Proto-Algonquian (Bloomfield 1946) which occurs to break up illicit consonant clusters.

begin with a stop have a second vowel-initial allomorph which occurs in PPh-medial positions. This means that the left edge of the PWd always begins in a continuant as long as it does not coincide with the left edge of the PPh. I argue that there is a positional markedness constraint at the left edge of the PWd that drives two types of root alternations: lexical allomorphy selection and epenthesis. However, the epenthesis that occurs at the left edge of the PWd is distinct from the type of epenthesis that occurs in PWd-medial positions. Thus, the different patterns of alternation in the high roots occur because of phonological restrictions at the left edge of the PWd.

4.2.2 High $\sqrt{\text{ROOT}}$ prosodification: PWd-initial allomorphy and epenthesis

"High roots" (XP-adjoined roots which complete a phase of events) exhibit more complicated patterns of alternation than "low roots" (XP-adjoined roots which do not complete the phase and X^0-adjoined roots). The reason is that high roots are prosodified at the left edge of the PWd, where they are subject to left-edge restrictions that hold of the PWd. There are two relevant phonological environments to consider. First, if there are no prefixes before the high root, (581), then the $\sqrt{\text{ROOT}}$ stands at the left edge of the PPh and is subject to the left edge requirements of the PPh as well as the PWd. Second, if there are prefixes before the high root, (582), the $\sqrt{\text{ROOT}}$ does not stand at the left edge of the PPh and is only subject to the left edge requirements of the PWd. In contrast, low roots are always prosodified into a PWd-medial position, which means they are not affected by any PWd edge restrictions.

(581) HIGH ROOTS: PPH-INITIAL POSITION

a. $[\,[\,\sqrt{\textbf{ROOT}}[\text{–}(v)\text{–V}\,]_{v\text{P}}\,]_{v\text{P}}$ $\quad$ $\text{–I}^0\ \text{–AGR}\ \text{–C}^0\,]_{\text{CP}}$ $\quad$ (syntax)

b. $(\,(\,\sqrt{\textbf{ROOT}}\text{–}(v)\text{–V}\,)_{\text{PWd}}$ $\quad$ $\text{–I}^0\ \text{–AGR}\ \text{–C}^0\,)_{\text{PPh}}$ $\quad$ (prosody)

(582) HIGH ROOTS: PPH-MEDIAL POSITION

a. $[\,[\,\text{prefix–}\ \ [\,\sqrt{\textbf{ROOT}}[\text{–}(v)\text{–V}\,]_{v\text{P}}\,]_{v\text{P}}$ $\quad$ $\text{–I}^0\ \text{–AGR}\ \text{–C}^0\,]_{\text{CP}}$ $\quad$ (syntax)

b. $(\,\text{prefix–}\ \ (\,\sqrt{\textbf{ROOT}}\text{–}(v)\text{–V}\,)_{\text{PWd}}$ $\quad$ $\text{–I}^0\ \text{–AGR}\ \text{–C}^0\,)_{\text{PPh}}$ $\quad$ (prosody)

This section is laid out as follows. In Section 4.2.2.1 I summarize the high root alternations I discussed in Section 3.2 and add a few more patterns of alternation. The realizations of roots at the left edge of the PPh shows that high roots can begin in either a consonant or a vowel. Then in Section 4.2.2.2 I argue that several of these alternations involve lexically-listed allomorph, because neither form can be derived from the other via regular phonology. Nevertheless, there are generalizations we can make about the phonological shape of roots in PPh-initial position and PPh-medial position. In Section 4.2.2.3 I argue that allomorph selection is phonologically optimizing (Mascaró 2007) in the sense that it satisfies positional markedness constraints which hold at the left edge of the PPh and the left edge of the PWd. In doing so, my analysis allows the left edge of the PWd to fall in the middle of a syllable. In fact, I argue that this is necessary in order to explain the distribution of allomorphs, and I return to this point in Section 5.2. Finally, in Section 4.2.2.4 I argue that roots which begin in an underlying stop are subject to a process of epenthesis which holds at the left edge of the PWd when it is disjunct from the left edge of the PPh. This process of epenthesis can be accounted for with the same constraint ranking that accounts for root allomorphy. In Section 4.2.2.5 I conclude.

4.2.2.1 High root alternations

Recall that in Section 3.2 I discussed several different kinds of high root alternations. These included roots which begin in underlying long vowels, (583a), roots which begin in underlying short vowels, (583b), and roots which begin in an underlying /j/, (583c). I also discussed two irregular patterns of alternation, (583c) and (583c), which are phonologically irregular but which functionally avoid glides at the left edge of the PPh. (In the next section I argue that these irregular patterns of alternation involve lexically-listed allomorphs.)

(583)

	PPH-INITIAL		PPH-MEDIAL	GLOSS
a.	⟦iːtsːk⟧	∼	⟦iːtsːk⟧	'scuffle'
	⟦oːk⟧	∼	⟦oːk⟧	'bead'
	⟦aːk⟧	∼	⟦waːk⟧	'argue'
	⟦ɛːˢt⟧	∼	⟦wɛːˢt⟧	'towards'
	⟦ɔːni⟧	∼	⟦wɔːni⟧	'pierce'
b.	⟦itsin⟧	∼	⟦itsin⟧	'among'
	⟦ok⟧	∼	⟦ok⟧	'snare'
	⟦atsinik-⟧	∼	⟦itsinik⟧	'relate a story'
	⟦ak-⟧	∼	⟦ok⟧	'count'
c.	⟦iːp⟧	∼	⟦jiːp⟧	'decrease'
	⟦oːm⟧	∼	⟦joːm⟧	'husband'
	⟦aːm⟧	∼	⟦jaːm⟧	'twisted'
d.	⟦maːk⟧	∼	⟦jaːk⟧	'arrange'
	⟦miːˢtap⟧	∼	⟦jiːˢtap⟧	'away'
	⟦naːm⟧	∼	⟦jaːm⟧	'alone'
	⟦niːp⟧	∼	⟦jiːp⟧	'leaf'

e. ⟦ija:p⟧ ~ ⟦ja:p⟧ 'see'
⟦iji:ˢt⟧ ~ ⟦ji:ˢt⟧ 'cut'
⟦iji:t⟧ ~ ⟦ji:t⟧ 'storage'

Obstruent-initial roots are conspicuously absent from the list in (583). In fact, the dictionary (Frantz and Russell 2017) lists very few verb stems under obstruents, which has led many researchers to conclude that Blackfoot roots only ever begin with a vowel or a glide (e.g. Goddard 2015). In the remainder of this section I show that there are roots with obstruent-initial realizations, but that these realizations only occur in PPh-initial position. As I discussed in Section 3.1.1, only some clause types allow a root to stand at the left edge of the PPh at all. The reason is that several clause types require a person proclitic which agrees with a DP argument of the clause. Those generalizations are repeated in Table 4.13. The independent, unreal, and conjunctive clause types require person proclitics for at least some person types. (The third person proclitic *ot-* is in parentheses in the independent and unreal clause types because it only occurs for particular combinations of persons within transitive clauses; see Bliss 2013; Frantz 2009.) In contrast, the subjunctive and imperative clause types prohibit person proclitics entirely, indicated via ✘.

Table 4.13: Person proclitics in Blackfoot clause types (repeated)

Subject	[+REALIS]			[-REALIS]	
	IND	UNR	CNJ	SBJ	IMP
1s	nit-	nit-	nit-	✘	—
2s	kit-	kit-	kit-	✘	✘
1p	nit-	nit-	nit-	✘	—
2p	kit-	kit-	kit-	✘	✘
21/X	Ø-	Ø-	Ø-	✘	—
3s/3p	(ot-)	(ot-)	ot-	✘	—
4s/4p	(ot-)	(ot-)	ot-	✘	—

The only places where a root or prefix may occur at the left edge of the PPh are (i) in third person indicative or unreal clause types, (ii) the first person plural inclusive across all clause types, and (iii) the subjunctive and imperative clause types. The first person plural inclusive and the unreal and subjunctive clause types are understudied in Blackfoot, so I set those aside. As I discuss in Section 3.2.2 and Appendix C, there is massive neutralization at the left edge of the PPh for third person subjects in the independent clause type, such that all independent clause types begin with [a], [a:], [i], or [i:]. Therefore, I use the imperative to determine the PPh-initial realizations of high roots. If an imperative is unavailable, I sometimes use a noun or a stem nominalization. Imperatives are unavailable for most intransitive verbs. For these, the simple present without initial change also puts the root into a PPh-initial position.

At the left edge of an imperative or nominal, it is clear that some high roots do begin in an obstruent, and that they alternate with PPh-medial realizations which do not begin in an obstruent, (584)–(586). There are two main patterns and one minor subpattern. In the first pattern, a root which begins in an obstruent at the left edge of the PPh surfaces with an [oxʷ] accretion at the left edge in PPh-medial positions, (584).[35] In the second pattern, a root which begins in an obstruent at the left edge of the PPh surfaces with an [i] accretion at the left edge in PPh-medial positions, (585). More precisely, since the [i] does not surface: these roots cause a preceding vowel to lengthen, unless the first consonant of the root is a geminate or part of a cluster, and also to change vowel quality in exactly the same way that an /a+i/ sequence does. Minimally, these roots begin with an additional mora and [+high] feature when they occur in PPh-medial position. A small subset of this second type also involve an irregular pattern of root-internal gemination which arose from a historical process of short vowel deletion with subsequent full assimilation of the resulting consonant cluster (Berman 2006; Elfner 2006b; Thomson 1978). For example, the root *kipita* 'aged' surfaces as [kipita] in PPh-initial position but [ppita] in PPh-medial position with an [i] accretion at the left edge, (586).

(584) a. PPH-INITIAL
⟦pʊmːáːt⟧
pommáát
[pomm–aa]–t–Ø
[√BUY–AI]–2SG.IMP–CMD
'buy!'

b. PPH-MEDIAL (AFTER V)
[ɔ́xʷpʊmːa]
á**óh**pommaawa
a–[**oh**pomm–aa]–Ø–wa
IPFV–[√BUY–AI]–IND–3
's/he is shopping' (BB)

(585) a. ⟦pʊmːóːs⟧
pommóós
[pomm–o–:s]–Ø
[√TRANSFER–*v*–2SG:3.IMP]–CMD
'transfer (e.g. the medicine bundle) to him!'

b. ⟦ɛ́ːpʊmːakiwḁ⟧
á**í**pommakiwa
a–[**i**pomm–Ø–aki]–Ø–wa
IPFV–[√TRANSFER–*v*–AI]–IND–PRX
'the one transferring (previous owner)'

[35] By using the word 'accretion', I intend to remain neutral with respect to whether these alternations involve lexical allomorphy or phonological epenthesis. In the following sections I argue that some of these patterns of alternation must involve lexical allomorphy, while others can be analyzed as phonological epenthesis.

(586) a. [kɪpitáaːki]
kipitáaakii
kipita–[aakii]
√AGED–[woman.*n*]
‘old woman’ (BB)

b. ⟦amɛ́pːitáaːkiːwḁ⟧
amá**íppi**táaakiiwa
ama–**ipp**ita–[aakii]–wa
√PATHETIC–√AGED–[woman.*n*]–PRX
‘pathetic old woman’

The realizations which occur after a vowel also occur after consonants, as shown in (587)–(589). (The PPh-initial form is repeated for convenience in the (a) parts of these examples.) That is, these realizations are the more general ‘elsewhere’ case, whereas the PPh-initial forms only occur at the left edge of the PPh.

(587) a. PPH-INITIAL
⟦pʊmːáːt⟧
pommáát
[pomm–aa]–t–Ø
[√BUY–AI]–2SG.IMP–CMD
‘buy!’

b. PPH-MEDIAL (AFTER C)
⟦âːkχ̩ʷpʊmːaːwḁ⟧
áak**oh**pommaawa
aak–[**oh**pomm–aa]–Ø–wa
FUT–[√BUY–AI]–IND–3
‘she will buy’

(588) a. ⟦pʊmːóːs⟧
pommóós
[pomm–o–ːs]–Ø
[√TRANSFER–*v*–2SG:3.IMP]–CMD
‘transfer (e.g. the medicine bundle) to him!’

b. ⟦âːk͡sipʊ́mːojiːwáji̥⟧
áaks**i**pómmoyiiwáyi
aak–[**i**pomm–o–yii]–Ø–w=ayi
FUT–[√TRANSFER–*v*–3SUB]–IND–3=OBV.SG
‘he will transfer it to her’

(589) a. [kɪ.pi.tá.aːki]
kipitáaakii
kipita–[aakii]
√AGED–[woman.*n*]
‘old woman’ (BB)

b. ⟦âːk͡sɪp.pi.tɛː.ˢta.wa.ta.wḁ⟧
áaks**ipp**itaistawatawa
aak–**ipp**ita–[istaw–at–a]–Ø–wa
FUT–√AGED–[√GROW–*v*–3OBJ]–IND–3
‘she will be raised by the elderly’

To my knowledge, these are the *only* possible patterns of alternation for roots which begin in obstruents in PPh-initial position. There are no roots which surface with an obstruent in both positions without causing the preceding vowel to lengthen and change quality. The patterns of alternation for roots with initial obstruents are summarized below.

(590) Roots with initial obstruents

	PPh-initial		*PPh-medial*	*Gloss*
a.	⟦pʊmː⟧	∼	⟦ox^{w}pʊmː⟧	'buy'
b.	⟦pʊmː⟧	∼	⟦ipomː⟧	'transfer'
c.	⟦kipita⟧	∼	⟦ɪpːita⟧	'aged'

It is worth noting that there is considerable speaker variation with respect to obstruent-initial roots, and that this is reflected in the dictionary. For example, the root *pohk* 'remove' begins with an obstruent in PPh-initial position in some dictionary entries, (591), but not others, (592).[36] In my experience, many speakers neutralize obstruent-initial roots towards the PPh-medial realization. That is, I take the obstruent-initial form in (591) to be the historically more conservative form of the root. I expect that many of the roots listed under <i> and <oh> in the dictionary were historically obstruent-initial, and may yet be for many speakers.

(591) a. ⟦pox^{w}.kɪ́s.to.jiː.s⟧
poohkísstoyiisa
[**pohk**–isstow–i–:s]–Ø
[**remove**–beard–*v*–2SG:3.IMP]–CMD
'shave him!'

b. ⟦âː.k͡si.px̩^{w}.kɪs.to.ji.jiː.wḁ⟧
áaks**ipohk**isstoyiyiiwáyi
aak–[**ipohk**–isstow–i–yii]–Ø–w=ayi
FUT–[**remove**–beard–*v*–3SUB]–IND–3=OBV.SG
'she will shave him'

[36]The [pox^{w}] ∼ [px̩^{w}] alternation in this root is phonologically regular. No PPh has a syllabic dorsal fricative in the first syllable. This drives a neutralization process between roots which begin invariably in [CVx], (1), and roots which alternate between [CVx] in PPh-initial position and [Cx̩] in PPh-medial position, (1).

(i) a. [**ox^{w}**kóːs]
oohkóós
[**yooh**k–o–:s]–Ø
[wait–*v*–2SG:3.IMP]–CMD
'wait for him/her!' (BB;)

b. [iːt**óx^{w}**koji]
iit**óóh**koyiiwa
iit–[**yooh**k–o–yii]–Ø–wa
[wait–*v*–3SUB]–IND–3
'S/he waited for him/her then' (BB;)

(i) a. [**ox^{w}**kóːnɪt]
ohkóónit
[**oh**koo–n–i]–t–Ø
[find–by.sight–TI1]–2SG.IMP–CMD
'find it!' (BB)

b. [iːt**x̩^{w}**kóːnimḁ]
iit**oh**kóónima
iit–[**oh**koo–n–i]–m–a
LOC–[find–by.sight–TI1]–IND–3
'She found it then.' (BB)

(592) a. ⟦i.px̩ʷ.kóʔ.to.moː.s⟧
ipohkó'tomoosa
[**ipohk**–o't/omo–:s]–Ø
[**remove**–by.hand/APPL.v–2SG:3.IMP]–CMD
'pluck it for him!'

b. ⟦âː.k͡si.px̩ʷ.kóʔ.to.mo.ji.jiː.wḁ⟧
áaks**ipohk**ó'tomoyiiwa
aak–[**ipohk**–o't/omo–yii]–Ø–wa
FUT–[**remove**–by.hand/APPL.v–3SUB]–IND–3
'she will pluck it for him'

In the next sections, I first argue that the Ø ∼ [ox] alternations at the left edge of obstruent-initial roots, as well as the irregular {m, n} ∼ [j] alternations, must involve a lexical listing of allomorphs. After that, I show that even though the phonological forms are listed, allomorph selection is phonologically optimizing and provides evidence for a positional markedness constraint against stops at the left edge of the PWd. Finally, I show that the Ø ∼ [i] alternations at the left edge of obstruent-initial stems can be analyzed as a particular kind of epenthesis which is conditioned by the same environments that condition lexical allomorphy selection. In this sense, lexical allomorph selection and epenthesis at the left edge of high roots are both *prosodically-conditioned* processes.

4.2.2.2 Lexical allomorphy

In this section I argue that several subclasses of roots in Blackfoot involve lexical allomorphy. To determine allomorphy, I make the following simplifying assumption: if two realizations of a morpheme cannot be derived from a single underlying representation via regular phonological processes in a single constraint ranking, without resorting to ad hoc stipulations, then both realizations must be listed in the lexical entry for that morpheme. To this end, I do not allow for subclasses of roots to be specially marked in some way, such as via exceptional diacritic marking (Chomsky and Halle 1968), indexed faithfulness constraints (Itô and Mester 1999), indexed markedness constraints (Pater 2000), or co-phonologies (Orgun 1996). (See Inkelas and Zoll 2007 for a comparison of these approaches within Optimality Theory.) Instead, I follow Mascaró (2007) in only listing unpredictable information in the lexicon (i.e. phonological form) and allowing the regular phonological grammar to select the optimal allomorph for each context.

The roots that involve gemination straightforwardly require a lexical listing of both allomorphs, which is not a regular process synchronically in Blackfoot roots.[37] Gemination only occurs for a handful of roots, and must involve two listed allomorphs. In the remainder of the section, I argue that two other patterns of realization involve allomorphy as well: (1) the Ø ∼ [ox] alternation, and (2) the {m, n} ∼ [j] alternation.

[37] There is one area where gemination is still productive, which is when a /t/-final v^0 is followed by a V^0 which is instantiated by the inverse suffix /-ok/. In this context, the /t-ok/ sequence is realized as [kk]; see example (59b) and Frantz (2009) for discussion.

4.2.2.2.1 Root alternation: Ø ∼ [ox]

Recall that the root ‘buy’ is [pʊmː] in PPh-initial position and [ox^{w}pʊmː] ‘buy’ in PPh-medial position. The underlying form cannot be identical to either of the surface realizations. The problem is that this pattern of alternation partially overlaps with other phonologically regular patterns. If the underlying form were /pomː/, the PPh-medial variant cannot be derived via epenthesis at the left edge, because there are also roots which begin in [p] in PPh-initial position but [ip] in PPh-medial position, such as (585). If the underlying form were /ohpomː/, the PPh-initial variant cannot be derived via deletion at the left edge, because there are also roots which begin in invariant [ox^{w}] in both positions, (593).

(593) ROOTS WITH INVARIANT [ox^{w}]

a. PPH-INITIAL

⟦ox^{w}póí́skinis⟧
ohpóísskinisa
[**ohpo**–isski–n–:s]–Ø
[√**GREASE**–face–by.hand.*v*–2SG:3.IMP]–CMD
‘paint his face!’

b. PPH-MEDIAL

⟦íːkɔx^{w}poʔsimḁ⟧
ííka**ohpo**’sima
ii\akaa–[**ohpo**–’si]–m–wa
IC\PRF–[√**GREASE**–AI]–IND–3
‘it (anim.) has been greased’

Therefore, the Ø ∼ [ox] alternation partially overlaps with two other phonologically regular patterns of alternation, as in (594), and there is a many-to-many relationship between morpheme realizations. If a morpheme at the left edge of the PPh begins with [p], then the PPh-medial allomorph may begin with either [ox^{w}p] or [ip]. If a morpheme in PPh-medial position begins with [ox^{w}p], then the PPh-initial allomorph may begin with either [ox^{w}p] or [p]. I conclude that the roots which exhibit a Ø ∼ [ox^{w}] alternation at the left edge must have both allomorphs listed.[38]

(594)

	PPh-initial		PPh-medial	Gloss	
a.	⟦ox^{w}po⟧	∼	⟦ox^{w}po⟧	‘grease’	(vowel-initial)
b.	⟦pomː⟧	∼	⟦o^{w}pomː⟧	‘buy’	(listed allomorphs)
c.	⟦pomː⟧	∼	⟦ipomː⟧	‘transfer’	(obstruent-initial)

[38] An alternative is to posit a very abstract underlyingly representation like /xpomː/ ‘buy’, and to derive the PPh-initial realization via /x/ deletion and the PPh-medial realization via [o] epenthesis. This analysis would also necessitate an irregular phonological analysis, since [o] is not the normal epenthetic vowel before dorsal fricatives. Rather than positing indexed constraints, I use listed allomorphs, which are already required for the roots with irregular gemination.

4.2.2.2.2 Root alternation: {m, n} ∼ [j]

Recall from Section 3.2.1.2.3 that some roots begin in [m] or [n] in PPh-initial position but [j] in PPh-medial position. The underlying form cannot be identical to either of the surface allomorphs. The problem is that this pattern of alternation partially overlaps with other phonologically regular patterns. If the underlying form began with /m, n/, the PPh-medial variant cannot be derived via a regular phonological process, because there are also roots which begin in [m] or [n] in PPh-initial position which have other PPh-medial allomorphs. The examples in (595) and (596) exhibit an accretion at the left edge of the root in PPh-medial position. The accretion is [o] before [m] and [i] before [n], which can be determined by the way that these vowels coalesce with a preceding vowel. (See Section 4.2.1.1.1 for a brief description of coalescence. Elfner (2006b) includes an analysis.)

(595) a. PPH-INITIAL
⟦maːníːwḁ⟧
maaníìwa
[maan–ii]–Ø–wa
[√RECENT–II]–IND–3
'it is new'

b. PPH-MEDIAL
⟦kátɔʔmaːnaʔpiːwaːt͡sik͡si̥⟧
káta**o**'maana'piiwaatsiksi
kata'–[**o**maan–a'p/ii]–Ø–wa=atsiksi
Q–[√RECENT–have.quality/II]–IND–3=NONAFF.3
'was it recent?'

(596) a. ⟦nâːnṣ̩ːkoːs⟧
náansskoosa
[naan–ssk/o–:s]–Ø
[√OWN–get/*v*–2SG:3.IMP]–CMD
'get something for her!'

b. ⟦nitáʔpɛːnaːnṣ̩ːkaː⟧
nita'pa**i**naansskaa
nit–a'p–a–[**i**naan–ssk/aa]–(hp)
1–around–IPFV–[√OWN–get/AI]–IND
'I am going about acquiring gifts'

The examples in (597) and (598) exhibit truncation at the left edge of the root in PPh-medial position, where the nasal does not occur and the vowel is short. (For vowel coalescence where the second vowel is long, see Section 3.2.1.2.1. An underlying /a+iː/ sequence is regularly written <aii> in Frantz and Russell 2017, which is not the case here.)

(597) a. ⟦niːmjáʔpiːˢt͡si̥⟧
niimiá’piistsi
[[**nii**mi–a’p/ii]–Ø]–istsi
[[√MESSY–have.quality/II]–IND]–IN.PL
‘articles which cause a mess’

b. ⟦iːkɛ́ːmiçtakiwḁ⟧
iikáímiihtakiwa
ii\akaa–[**i**mi–iht–aki]–Ø–wa
IC\PRF–[√MESSY–put.*v*–AI]–IND–3
‘he places his articles in a messy way’

(598) a. PPH-INITIAL
⟦niːpóíçt͡síːs⟧
niipóíhtsíísa
[**nii**po–iht/i–:s]–Ø
[√UPRIGHT–put/*v*–2SG:3.IMP]–CMD
‘place it (anim.) upright!’

b. PPH-MEDIAL
⟦iːmatɛ́ːpoipokawḁ⟧
iimatá**í**poipokawa
ii\omat–a–[**i**po–ipok/a]–Ø–wa
IC\start–IPFV–[√UPRIGHT–blow/II]–IND–3
‘it is almost blowing up’

These do not represent an exhaustive catalog of alternations with nasals; for example, I have limited the discussion to roots that begin with nasals before long vowels. Still, it is clear that these patterns overlap with the {m, n} pattern of alternation. Based on the few data points here, it seems that the accretion pattern and the truncation pattern occur in complementary contexts: accretion occurs before long [aː] and truncation occurs before long [iː]. I leave a full analysis of these patterns for future research.

Similarly, if the underlying form began in /j/, the PPh-initial variant cannot be derived via deletion at the left edge, because as I showed in Section 3.2.1.2.2, underlying /j/ deletes in PPh-initial position. Therefore, the {m, n} ∼ [j] alternation partially overlaps with other phonologically regular patterns of alternation, as in (599), and there is a many-to-many relationship between morpheme realizations. If a morpheme at the left edge of the PPh begins with [m] or [n], then the PPh-medial allomorph may begin with a vowel or [j]. If a morpheme in PPh-medial position begins with [j], then the PPh-initial allomorph may begin with either a nasal or a vowel. Furthermore, there is no phonological connection between nasals and glides elsewhere in the grammar; the only place where these sounds exhibit an alternation is at the left edge of high roots. I conclude that this alternation is phonologically irregular, and that the roots which exhibit a {m, n} ∼ [j] alternation at the left edge must have both allomorphs listed.

(599) a. NASAL INITIAL BEFORE LONG [aː] (?)

⟦maːn⟧	∼	⟦omaːn⟧	‘recent’
⟦naːn⟧	∼	⟦inaːn⟧	‘own’

b. NASAL INITIAL BEFORE LONG [iː] (?)

⟦niːmi⟧	∼	⟦imi⟧	‘messy’
⟦niːpo⟧	∼	⟦ipo⟧	‘upright’

c. LISTED ALLOMORPHS

⟦maːk⟧	∼	⟦jaːk⟧	'arrange'
⟦miː^{s}tap⟧	∼	⟦jiː^{s}tap⟧	'away'
⟦naːm⟧	∼	⟦jaːm⟧	'alone'
⟦niːp⟧	∼	⟦jiːp⟧	'leaf'

d. GLIDE-INITIAL

⟦iːp⟧	∼	⟦jiːp⟧	'decrease'
⟦oːm⟧	∼	⟦joːm⟧	'husband'
⟦aːm⟧	∼	⟦jaːm⟧	'twisted'

4.2.2.2.3 Summary of listed allomorphs

To summarize, several patterns of root alternation in Blackfoot cannot be accounted for via the regular phonological grammar. These include irregularly geminated roots, roots which have a Ø ∼ [ox^{w}] alternation, and roots with a {m, n} ∼ [j] alternation.[39] Since lexically listed allomorphs are necessary to account for the irregularly geminated roots, in the following sections I utilize the same architecture to account for the other cases of allomorphy as well. The underlying forms I propose are listed in (600).

(600) ROOTS WITH LISTED ALLOMORPHS

a. /kipita, pːita/ 'aged'

b. /pomː, oxpomː/ 'buy'

c. /maːk, jaːk/ 'arrange'
/miː^{s}tap, jiː^{s}tap/ 'away'
/naːm, jaːm/ 'alone'
/niːp, jiːp/ 'leaf'

In the next section I argue that allomorph selection is phonologically optimizing (Mascaró 2007). After that, I show that the same constraints which condition allomorph selection also trigger a process of epenthesis at the left edge of the PWd. Since the irregularly geminated roots involve both processes, I address those roots in a later section. I focus in the next section on the Ø ∼ [ox^{w}] and {m, n} ∼ [j] alternations.

[39] The [ij] ∼ [j] alternation also overlaps with multiple patterns of alternation with /i/-initial roots and /j/-initial roots. However, there are no roots which begin with [ij] in both positions and exhibit coalescence with a preceding vowel. Therefore it is unclear whether this pattern is phonologically regular or not. I leave this pattern for future research.

4.2.2.3 Phonological optimization

Mascaró (2007) presents several cases where phonologically-conditioned allomorphy is phonologically optimizing. Other research argues that not all allomorphy is optimizing and that some is even 'perverse' with respect to universal markedness (Bye 2007; Paster 2006, 2009). Non-optimizing allomorphy is compatible with a model where affixes contain subcategorization frames in their lexical entries and can be blocked from attaching in particular contexts. There are a couple of reasons why an optimization approach is better suited for the types of allomorphy I discussed above. First, subcategorization frames are typically used for affixes, whereas Blackfoot exhibits root allomorphy. Second, as I show below, allomorph selection in Blackfoot is optimizing in the sense that it is driven by positional markedness constraints at the left edge of the PWd. In a subcategorization approach, one allomorph would select for the left edge of the PPh, while the second allomorph would be the default 'elsewhere' case. In such an analysis, the restrictions at the left edge of the PWd would be accidental and unexplained. For these reasons, I adopt the framework in Mascaró (2007), where allomorphs are lexically organized as a partially ordered set. If no ordering is established, allomorphic choice is determined by the phonology and in particular by The Emergence of The Unmarked (McCarthy and Prince 1994). As I show below, in Blackfoot the listed allomorphs are not ordered, and allomorph selection is driven entirely by phonological markedness constraints.

In the tableaux below, I list both lexically-listed allomorphs in the input line. Each candidate morph in the output corresponds with one of the input allomorphs and the morphological correspondents are indicated by identical subscripts. Faithfulness violations are computed with respect to the candidate's corresponding input allomorph.

One puzzle about Blackfoot allomorphy selection is that it is not driven by syllable structure constraints, even for a root like {pom:, ox^{w}pom:} 'buy', which has one consonant-initial allomorph and one vowel-initial allomorph. In PPh-initial position, (601), the optimal candidate (a) with the obstruent-initial allomorph satisfies ONSET and *CODA to a greater extent than the vowel-initial allomorph. (ONSET ≫ *CODA, from (122); *HIAT ≫ {UNIF, *μ/C, *CODA}, from (297).)

(601)

{pom:$_1$, oxpom:$_2$}-aː-t	ONS	*HIAT	UNIF	*μ/C	*COD
☞ a. (pʊm.m$_1$áː.t)$_{PPh}$				*	*
b. (ox^{w}.pʊ́m.m$_2$aː.t)$_{PPh}$	*!			**	**

But syllable structure constraints cannot account for why the vowel-initial allomorph occurs in PPh-medial position after vowels. In candidate (b) below, the vowel-initial allomorph creates a vowel hiatus context, violating *HIATUS. In Section 3.2.1.3.1 I showed that violations of *HIATUS are avoided by incurring violations of UNIF, as in candidate (c). Candidate (a) with the consonant-initial allomorph is optimal under this constraint ranking because it incurs fewer violations of syllable structure constraints and no violations of faithfulness constraint. However, candidate (c) is the actual output (marked with ☹). This shows that syllable structure is not what drives the choice between an obstruent-initial and a vowel-initial allomorph.

(602)

a-{pom:$_1$, oxpom:$_2$}-aː-wa	ONSET	*HIAT	UNIF	*μ/C	*CODA
☞ a. (á.pʊm.m$_1$áː.wḁ)$_{\text{PPh}}$	*			*	*
b. (á.oxʷ.pʊ́m.m$_2$aː.wḁ)$_{\text{PPh}}$	**!	*!		**	**!
☹ c. (ɔ́xʷ.pʊ́m.m$_2$aː.wḁ)$_{\text{PPh}}$	*		*	**	**!

A clue lies in the types of sounds which can occur at the left edge of the roots when they occur in different positions within the PPh, as shown in Table 4.14. In PPh-initial position, no root begins in a glide, which reflects a positional markedness constraint against glides at the left edge of the PPh (discussed in Section 3.2.1.3.2). In PPh-medial positions, no root begins in a stop. In other words, there is a conspiracy of different patterns of alternation and allomorphy which *avoids* stops at the left edge of a root in PPh-medial positions.

Table 4.14: Segments allowed at the left edge of roots in PPh-initial and PPh-medial positions

	p	m	n	j	w	Vː	V
PPh-initial	✓	✓	✓	✗	✗	✓	✓
PPh-medial	✗	✗	✗	✓	✓	✓	✓

I hypothesize that the alternations satisfy a restriction against [-cont] segments at the left edge of PWds, defined in (603).[40] The effects of this restriction can be seen whenever the left edge of the PPh and the PWd are distinct; that is, when there is a prefix to the left of the root within the PPh. Since high roots are prosodified at the left edge of a PWd, they are affected by this constraint. When the PPh and

[40]The generalizations in Table 4.14 are also compatible with a constraint against all [+cons,-cont] segments. I have formulated this as a constraint against [-cont] instead of [+cons,-cont], because of examples like (587b), shown again below with prosodic boundaries, where a syllabic fricative occurs at the left edge of a PWd. Since fricatives are [+cons,+cont], this shows that the markedness constraint is specifically against stops.

(i) (âː.k(x̩ʷ.pʊm.maː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$

*áak**oh**pommaawa*

aak–[**oh**pomm–aa]–Ø–wa

FUT–[√BUY–AI]–IND–3

'she will buy'

The following example with an [s]-initial root, (1), also shows that the PWd can begin with a [+cons,+cont] segment.

the PWd left edges coincide, as in the imperative, then the left edge of the high root is affected by the left edge restrictions on the PPh and the PWd.

(603) *#[-CONT] (to be revised)

Assign a violation mark for every [-cont] segment occurs leftmost within the PWd.

As I show below, this analysis requires the left edge of the PWd is sometimes misaligned with the left edge of a syllable. Alignment constraints (McCarthy and Prince 1993a) require coincidence between prosodic edges of various types. The alignment constraint in (604) requires the left edge of the PWd to coincide with the left edge of a syllable.

(604) ALIGN(PWd, L σ, L)

Abbreviation: ALIGN-IO(PWd,σ) or AL(PWd,σ) or AL(PWd)

For every PWd in the output, there must exist some syllable (σ) such that the left edge of the PWd coincides with the left edge of the σ.

In an imperative context with no prefixes, the root is at the left edge of the PPh and the PWd. In the tableau below, ONSET ≫ *CODA, from (122). The optimal candidate (a) violates *#[-CONT] but satisfies ONSET, while candidate (b) satisfies ONSET but violates *#[-CONT]. The crucial ranking ONSET ≫ *#[-CONT] in this position ensures that the candidate with a consonant-initial allomorph is optimal. (Note that to save space, I have listed just one MATCH constraint within the tableau, and marked violations as **all* or **only* to indicate which constraint is violated.)

(605) [pʊm.máː.t] *pommáát* 'buy!'

{pomː$_1$, oxpomː$_2$}-aː-t	ONS	MATCH	*#[-CONT]	AL(PWd)	*μ/C	*COD
☞ a. ((pʊm.m$_1$áː)$_{PWd}$.t)$_{PPh}$			*			*
b. ((ox^w.pʊ́m.m$_2$aː)$_{PWd}$.t)$_{PPh}$	*!				*	**

Crucial rankings: ONSET ≫ *#[-CONT]

When the left edge of the PPh and the PWd do not coincide, the positional markedness constraint *#[-CONT] at the left edge of the PWd plays a crucial role. The root follows a vowel in the tableau

---

(i) ROOTS WITH INITIAL [s]

a. ((so.k͡si.^{s}to.t͡sí)$_{PWd}$.t)$_{PPh}$

soksistotsít

[sok–istot/Ø–i]–t–Ø

[good–CAUS/*v*–TI1]–2SG.IMP–CMD

'groom the area!'

b. (âː.kṣ.(so.kç̩.kaʔ.si)$_{PWd}$.wḁ)$_{PPh}$

áakssokihka'siwa

aak—[sok–ihk/a'si]–Ø–wa

FUT–[good–behave/AI]–IND–3

'she will act good'

below. Candidate (a) violates *#[-CONT] and is suboptimal. Candidate (b) uses the vowel-initial allomorph but leaves the two vowels in hiatus which satisfies ALIGN-IO(PWd,σ) but violates ONSET (and *HIAT). The optimal candidate (c) satisfies *#[-CONT]. Crucially, I argue that the prosodic boundary falls in the middle of a syllable, incurring a violation of ALIGN-IO(PWd,σ). Candidates (d) and (e) satisfy the syllable alignment constraint but violate MATCH(PWd), either by including more segmental material which lies outside of the v*P phase, in (d), or by not including all of the segmental material which lies inside the v*P, in (e).[41]

(606) [ɔ́xʷ.pʊm.maː.wḁt] *áóhpommaawa* ‘she is shopping’

a-{pom:, oxpom:}-a:-wa	ONS	MATCH	*#[-CONT]	AL(PWd)	*μ/C	*COD
a. (á.(pʊm.m$_1$aː)$_{PWd}$.wḁ)$_{PPh}$	*		*!			*
b. (á.(oxʷ.pʊm.m$_1$aː)$_{PWd}$.wḁ)$_{PPh}$	**!				*	**
☞ c. (ɔ́(xʷ.pʊm.m$_2$aː)$_{PWd}$.wḁ)$_{PPh}$	*			*	*	**
d. ((ɔ́xʷ.pʊm.m$_2$aː)$_{PWd}$.wḁ)$_{PPh}$	*	*only!			*	**
e. (ɔ́xʷ.(pʊm.m$_2$aː)$_{PWd}$.wḁ)$_{PPh}$	*	*all!	*		*	**

Crucial rankings: {MATCH, *#[-CONT]} ≫ ALIGN-IO(PWd,σ)

The root follows a candidate in the tableau below. Since all candidates in the tableau violate ONSET equally, I leave this constraint out. Candidate (a) includes the consonant-initial allomorph, which violates the *[-cont][+cons] sequencing constraint (abbreviated as SEQ to save space in the tableau), and also incurs violations of *#[-CONT] and *CODA. Since we know that *#[-CONT] ≫ ALIGN-IO(PWd,σ), this candidate is suboptimal no matter where *[-cont][+cons] ranks. The optimal candidate (b) satisfies *#[-CONT], but violates the alignment constraint. Candidates (c) and (d) satisfy the alignment constraint but violate MATCH and *#[-CONT]. (Another candidate to consider includes the consonant-initial allomorph but avoids violations of *[-cont][+cons] by epenthesizing a vowel between the two consonants. I consider candidates like these in the next section.)

[41] Because the vowel [ɔ] results from fusion of a v*P-internal vowel and and v*P-external vowel, it is a little hard to tell when MATCH is violated or not. I will assume that features may be linked across a boundary without MATCH violations. (Linking of features across boundaries instead violates a CRISPEDGE constraint; Itô and Mester 1994; Selkirk 2011.) However, candidate (d) involves a violation of MATCH because the PWd includes a mora that was linked to the underlying /a/ outside of the v*P.

(607) [âː.kx̩ʷ.pʊm.maː.wḁ] *áakohpommaawa* ‘she will buy’

aːk-{pomː$_1$, oxpomː$_2$}-aː-wa	SEQ	MATCH	*#[-CONT]	AL(PWd)	*μ/C	*COD
a. (âːk.(pʊm.m$_1$aː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$	∗!		∗!			∗∗
☞ b. (âː.k(x̩ʷ.pʊm.m$_2$aː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$				∗	∗	∗
c. (âː.(kx̩ʷ.pʊm.m$_2$aː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$		∗only!	∗		∗	∗
d. (âː.kx̩ʷ.(pʊm.m$_2$aː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$		∗all!	∗		∗	∗

When there is only one listed allomorph, such as for vowel-initial roots, then that allomorph occurs in all candidates. In the two tableaux below, all candidates incur the same number of violations of *μ/C and *CODA, so I leave those constraints out. Vowel-initial roots do not incur violations of *#[-CONT] in either position. In PPh-medial position, the constraint ranking from above predicts that the PWd boundary should be misaligned from a syllable onset.

(608) [oxʷ.póí̵s.ki.ni.s] *ohpóísskinis* ‘paint his face!’

ohpo-isski-n-:s	ONS	MATCH	*#[-CONT]	AL(PWd)
☞ a. ((oxʷ.póí̵s.ki.ni)$_{\text{PWd}}$.s)$_{\text{PPh}}$	∗			

(609) [í̵ːkɔxʷpoʔsimḁ] *íí̵kaohpo’sima* ‘it (anim.) has been greased’

iikaa-ohpo-’si-m-a	ONS	MATCH	*#[-CONT]	AL(PWd)
a. (í̵ː.kɔxʷ.(poʔ.si)$_{\text{PWd}}$.mḁ)$_{\text{PPh}}$	∗!	∗all!	∗	
☞ b. (í̵ː.kɔ(xʷ.poʔ.si)$_{\text{PWd}}$.mḁ)$_{\text{PPh}}$	∗!			∗
c. (í̵ː.k(ɔxʷ.poʔ.si)$_{\text{PWd}}$.mḁ)$_{\text{PPh}}$	∗!	∗only!		∗
d. (í̵ː.(kɔxʷ.poʔ.si)$_{\text{PWd}}$.mḁ)$_{\text{PPh}}$	∗!	∗only!	∗	

Crucial rankings: {MATCH, *#[-CONT]} ≫ ALIGN-IO(PWd)

The {m, n} ∼ [j] alternation is also phonologically optimizing, but does not rely on MATCH and ALIGN-IO(PWd,σ), so I leave those constraints out of the following tableau. At the left edge of the PPh, the optimal candidate (a) begins with an [m]. Since this nasal is also at the left edge of a PWd, this candidate violates *#[-CONT]. Candidates (b) with the glide-initial allomorph violates *#G, and candidate (c) with the glide-initial allomorph violates MAX-IO(Seg) and ONSET. Recall that *#G ≫ MAX-IO(Seg) ≫ ONSET from (313), so candidate (c) is suboptimal no matter where ONSET ranks with respect to *#[-CONT].

(610) [mâː.kx̩ʷ.toː.t] *máakohtoot* ‘arrange it’ (=279)

{maːk$_1$, jaːk$_2$}-oht-oo-t	*#G	MAX	ONS	*#[-CONT]	*G
a. ((mâː.k$_1$x̩ʷ.toː)$_{PWd}$.t)$_{PPh}$				*	
☞ b. ((jâː.k$_2$x̩ʷ.toː)$_{PWd}$.t)$_{PPh}$	*!				*
c. ((âː.k$_2$x̩ʷ.toː)$_{PWd}$.t)$_{PPh}$		*!	*		

Crucial rankings: {*#G, MAX-IO(Seg)} ≫ *#[-CONT]

In PPh-medial position, the positional markedness constraint against glides has no affect. Instead what matters is the ranking between the positional markedness constraint at the left edge of the PWd and the general markedness constraint against glides. Since candidate (b) is optimal, the general markedness constraint must rank lower.

(611) [á.jâː.kx̩ʷ.toː.mḁ] *áyáakohtooma* ‘she is arranging it’ (=279)

a-{maːk$_1$, jaːk$_2$}-oht-oo-m-wa	*#G	MAX	ONS	*#[-CONT]	*G
a. (á.(mâː.k$_1$x̩ʷ.toː)$_{PWd}$.mḁ)$_{PPh}$				*!	
☞ b. (á.(jâː.k$_2$x̩ʷ.toː)$_{PWd}$.mḁ)$_{PPh}$					*

Crucial rankings: *#[-CONT] ≫ *G

In sum, the patterns of alternation show that stops are avoided at the left edge of the PWd, encoded by *#[-CONT], although the requirement for a PPh to begin with an onset can override the effects of *#[-CONT]. Listed allomorphs are selected in different contexts in order to optimally satisfy these constraints, but in order to maintain this analysis, syllables sometimes span the left edge of the PWd. In my analysis, this is because the syllable alignment constraint is ranked below the constraint that requires prosody-syntax correspondence (MATCH), the left edge of the PWd falls in the middle of a syllable. Interactions between the constraints that regulate the syntax-prosody correspondence and the prosody-metrical correspondence are predicted by my model, which separates the prosodic and metrical hierarchies. I return to this point in Chapter 5. In the next section I show that epenthesis at the left edge of the PWd is driven by the same constraint ranking needed for lexical allomorphy.

4.2.2.4 Epenthesis at the left edge of the PWd

Recall that the root ‘transfer’ is [pʊmː] in PPh-initial position and [ipʊmː] ‘transfer’ in PPh-medial position. The underlying form cannot be identical to the PPh-medial surface realization because there are also roots which begin in invariant [i] in both positions, (612).

(612) ROOTS WITH INVARIANT [i]

a. ⟦ipót͡simat͡sís⟧
ipótsimatsísa
[ipotsim–at–:s]–Ø
[√POISON–v–2SG:3.IMP]–CMD
'poison him!'

b. ⟦âːk͡sipót͡simat͡siːwḁ⟧
áaksipótsimatsiiwa
aak–[ipotsim–at–ii]–Ø–wa
FUT–[√POISON–v–3SUB]–IND–3
'she will poison him'

The Ø ∼ [i] alternations are compatible with an analysis that involves listed allomorphs. However, that would mean that there are no roots with a single, obstruent-initial underlying representation—*all* of the obstruent-initial roots would have at least two listed allomorphs. Instead, I pursue an analysis where roots with a Ø ∼ [i] alternation begin in an underlying consonant, with epenthesis at the left edge of the root in PPh-medial positions.

An obstruent-initial root does not violate the *#G constraint that holds at the left edge of the PPh. The optimal candidate in this position is the faithful candidate (a), even though it violates *#[-CONT]. The candidates which violate DEP-IO(μ) in PPh-initial position also violate ONSET, which is ranked about *#[-CONT].

(613) [pʊmːóːs] *pommóós* 'transfer to him'

pom:-o-:s	ONS	MATCH	*#[-CONT]	DEP(μ)	AL(PWd)	*Vː
☞ a. ((pʊm.móː)$_{PWd}$.s)$_{PPh}$			*			*
b. ((i.pʊ́m.moː)$_{PWd}$.s)$_{PPh}$	*!			*		*
c. (i.(pʊ́m.moː)$_{PWd}$.s)$_{PPh}$	*!	*!	*	*	*	*

Crucial rankings: ONSET ≫ *#[-CONT]

After a vowel, the optimal candidate (b) epenthesizes a vowel,[42] despite the fact that simply concatenating the morphemes, as in (a), would satisfy syllable structure constraints. In the tableau below, all candidates violate ONSET, *μ/C and *CODA the same number of times, so I have left those constraints out. Epenthesis occurs in order to satisfy the same constraint that drives allomorph selection, *#[-CONT].

[42] Or at least a mora and a [+high] feature. In this section I consider the violations of DEP-IO(μ) but do not have an explanation for why the roots must begin with [+high].

(614) [ɛ́ːpʊmːakiwḁ] *áípommakiwa* ‘the one transferring’

a-pom:-aki-wa	MATCH	*#[-CONT]	DEP(μ)	AL(PWd)	*Vː
a. (á.(pʊm.ma.ki)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$		∗!			
b. ((á.pʊm.ma.ki)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$	∗!				
☞ c. (ɛ́(ɛ́.pʊ́m.ma.ki)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$			∗	∗	∗
d. ((ɛ́ː.pʊ́m.ma.ki)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$	∗only!		∗		∗
e. (ɛ́ː.(pʊ́m.ma.ki)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$	∗all!	∗	∗		∗

Crucial rankings: {MATCH, *#[-CONT]} ≫ {DEP-IO(μ), ALIGN-IO(PWd,σ), *Vː}

If epenthesis is available to avoid violations of *#[-CONT] at the left edge of the PWd, then it potentially blocks allomorph selection. Consider again a root like /pomː, oxpomː/ ‘buy’. In order for candidate (b) with the [oxʷ]-initial allomorph to be chosen in a PPh-medial position, DEP-IO(μ) must dominate ALIGN-IO(PWd). (All candidates below violate ONSET and MATCH to an equal extent, so I leave them out. *Vː ≫ *CODA, from (123).)

(615) [ɔ́xʷ.pʊm.maː.wḁt] *áóhpommaawa* ‘she is shopping’

a-{pomː$_1$, oxpomː$_2$}-aː-wa	*#[-CONT]	DEP(μ)	AL(PWd)	*Vː	*μ/C	*CODA
a. (á.(pʊm.m$_1$áː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$	∗!			∗	∗	∗
☞ b. (ɔ́(xʷ.pʊ́m.m$_2$aː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$			∗	∗	∗∗	∗∗!
c. (ɛ́(ɛ́.pʊm.m$_1$áː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$		∗!	∗	∗∗	∗	∗

Constraint rankings: {*#[-CONT], DEP-IO(μ)} ≫ ALIGN-IO(PWd)

(616) [âː.kx̩ʷ.pʊm.maː.wḁ] *áakohpommaawa* ‘she will shop’

aːk-{pomː$_1$, oxpomː$_2$}-aː-wa	*#[-CONT]	DEP(μ)	AL(PWd)	*Vː	*μ/C	*COD
a. (âːk.(pʊm.m$_1$aː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$	∗!			∗∗	∗	∗∗
☞ b. (âː.k(x̩ʷ.pʊm.m$_2$aː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$			∗	∗∗	∗∗	∗
c. (âː.k͡s(i.pʊm.m$_1$aː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$		∗!	∗	∗∗	∗	∗
d. (âː.k͡si.(pʊm.m$_1$aː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$	∗!	∗		∗∗	∗	∗
e. (âː.(k͡si.pʊm.m$_1$aː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$		∗!		∗∗	∗	∗

Constraint rankings: {*#[-CONT], DEP-IO(μ)} ≫ ALIGN-IO(PWd)

Finally, the constraint ranking developed above also accounts for irregular geminating roots like [kipita] ∼ [ipːita] ‘aged’, which involve both processes: allomorph selection and epenthesis at the left edge of the PWd. In PPh-medial position, the actual output contains the allomorph with the geminate, but this candidate (marked by ☹) is not optimal under this ranking. A candidate with a vowel at the left edge of the PWd is more harmonic than any candidate with a [-cont] segment at the left edge. (I have left out *μ/C and *Coda in the tableaux below. These are both dominated by *Vː, from (123), and are ranked too low to affect the most harmonic output.)

(617) [a.mɛ́p.pi.tá.aː.kiːwḁ] *amáíppitáaakiiwa* 'pathetic old woman'

ama-{kipita$_1$, pːita$_2$}-aːkiː-wa	Ons	Match	*#[-cont]	Dep(μ)	Al(PWd)	*Vː
a. (a.má.(kɪ.pi.tá$_1$.aː.kiː)$_{PWd}$)$_{PPh}$	**		*!			**
b. (a.máp.(pɪ.tá$_2$.aː.kiː)$_{PWd}$)$_{PPh}$	**	*all!	*			**
☞ c. (a.mɛ́(ɛ́.kɪ.pi.tá$_1$.aː.kiː)$_{PWd}$)$_{PPh}$	**			*	*	***
d. (a.mɛ́p.(pɪ.tá$_2$.aː.kiː)$_{PWd}$)$_{PPh}$	**	*all!	*	*		**
☹ e. (a.mɛ́(p.pɪ.tá$_2$.aː.kiː)$_{PWd}$)$_{PPh}$	**		*!	*	*	**

The effects of *#[-cont] are flouted in exactly the handful of cases where the root allomorph begins in a geminate consonant. I propose that *#[-cont] needs to be more specifically defined, as in (618). A [-cont] geminate is doubly linked to the preceding coda, and so it "escapes" this constraint.

(618) *#[-cont] (revised)

Assign a violation mark for every [-cont] segment which is exhaustively dominated by a syllable and occurs leftmost within the PWd. ("Assign a violation mark for every stop which occurs leftmost within the PWd and is not linked to any other element.")

e.g. * $_{PWd}[$ σ | [-cont]

With this new definition, the correct output candidate (e) is optimal in PPh-medial position because it incurs one fewer violations of *Vː than candidate (c). (The same ranking of *Vː ≫ {*μ/C, *Coda} is responsible for vowel length neutralization in closed syllables, (123).)

(619) [a.mɛ́p.pi.tá.aː.kiːwḁ] *amáíppitáaakiiwa* 'pathetic old woman'

ama-{kipita$_1$, pːita$_2$}-aːkiː-wa	Ons	Match	*#[-cont]	Dep(μ)	Al(PWd)	*Vː
a. (a.má.(kɪ.pi.tá$_1$.aː.kiː)$_{PWd}$)$_{PPh}$	**		*!			**
b. (a.máp.(pɪ.tá$_2$.aː.kiː)$_{PWd}$)$_{PPh}$	**	*all!				**
c. (a.mɛ́(ɛ́.kɪ.pi.tá$_1$.aː.kiː)$_{PWd}$)$_{PPh}$	**			*	*	***!
d. (a.mɛ́p.(pɪ.tá$_2$.aː.kiː)$_{PWd}$)$_{PPh}$	**	*all!		*		**
☞ e. (a.mɛ́(p.pɪ.tá$_2$.aː.kiː)$_{PWd}$)$_{PPh}$	**			*	*	**

In PPh-initial position, the candidate which includes the /kipita$_1$/ allomorph does much better than the alternative candidates, all of which violate ONSET one additional time.

(620) [ki.pi.tá.aː.kiː.wḁ] *kipitáaakiiwa* 'old woman'

{kipita$_1$, pːita$_2$}-aːkiː-wa	ONS	MATCH	*#[-CONT]	DEP(μ)	AL(PWd)	*Vː
☞ a. ((kɪ.pi.tá$_1$.aː.kiː)$_{PWd}$)$_{PPh}$	*		*			**
b. ((p^{μ}ɪ.tá$_2$.aː.kiː)$_{PWd}$)$_{PPh}$	**!		*			**
c. (i.(kɪ.pi.tá$_1$.aː.kiː)$_{PWd}$)$_{PPh}$	**!		*	*		**
d. (ip.(pɪ.tá$_2$.aː.kiː)$_{PWd}$)$_{PPh}$	**!			*		**
e. ((i.kɪ.pi.tá$_1$.aː.kiː)$_{PWd}$)$_{PPh}$	**!			*		**
f. ((ip.pɪ.tá$_2$.aː.kiː)$_{PWd}$)$_{PPh}$	**!			*		**

To sum up, I showed that many roots in Blackfoot begin with obstruents in PPh-initial position. I argued that the roots which exhibit a Ø ∼ [i] alternation at the left edge begin with an obstruent in their underlying form. The same constraint ranking which determined lexical allomorph selection in the preceding section also accounts for why roots exhibit epenthesis at the left edge in PPh-medial position, even when they occur after vowels. Most importantly, the geminating root allomorphs have lexically-listed allomorphs and also exhibit epenthesis, and the constraint ranking above correctly chooses the optimal output for these cases.

4.2.2.5 Summary: PWd-initial allomorphy and epenthesis

In this section I showed that no high roots begin in a stop in PPh-medial positions. I argued that this restriction results from a positional markedness constraint that holds at the left edge of the PWd. This constraint is the driving force behind high root alternations, including phonologically optimizing allomorph selection and a process of epenthesis at the left edge. One consequence of this proposal is that the left edge of the PWd sometimes falls in the middle of a syllable. This is predicted by my proposal of the separation of prosodic and metrical structure outlined in Section 1.2.3.2. I return to this point in Chapter 5.

The two processes of epenthesis have different correlates. The low roots are the simpler case, because they always occur in a PWd-medial (and PPh-medial) position. Schematically, low roots fall into several classes based on their realizations after consonants vs. vowels, (621). One group of low roots in (a) begins with a vowel (V) after both vowels and consonants. (Vowel sequences coalesce across morpheme boundaries, so the schematizations here are broad morphophonemic transcriptions representing the shape of morphemes before internal sandhi applies.) A second group in (b) begins with a [+cons] segment (C) after vowels and a VC sequence after a consonant, but no low roots begin in C after both vowels and consonants. I take this to mean that the first group of roots begin in an underlying vowel while the second group of roots begins with an underlying C, with an epenthetic vowel which breaks up illicit consonant clusters, as discussed in Section 2.4.2.2.3.

(621) LOW $\sqrt{}$ROOT REALIZATIONS

	After V		*After C*	*UR*
a.	[-V...]	∼	[-V...]	/-V.../
b.	[-C...]	∼	[-VC...]	/-C.../
c. *	[-C...]	∼	[-C...]	

High roots exhibit a different pattern of epenthesis, as shown in (622). There are high roots which begin in a vowel in all three environments, (a). The high roots which begin in a consonant in PPh-initial position either begin in PPh-medial position with [i], (b), with *ox^w*, (c), or with an [i] plus root-internal gemination. Unlike low roots, high roots have a single realization after consonants and vowels, and exhibit many more, partially overlapping, patterns of alternation. Crucially, there are no high roots which begin in an obstruent in all positions, which I take to mean that one or more of the other patterns begins with an underlying C. I argued above that the Ø ∼ [i] cases involve epenthesis.

(622) HIGH $\sqrt{}$ROOT REALIZATIONS

	PPh-initial		*After V*		*After C*	*UR*
a.	[V...]	∼	[V...]	∼	[V...]	/V.../
b.	[C...]	∼	[iC...]	∼	[iC...]	/C.../
c.	[C...]	∼	[ox^{w}C...]	∼	[ox^{w}C...]	{C..., ox^{w}C}
d.	[C_1VC_2...]	∼	[iC_2ː...]	∼	[iC_2ː...]	{C_1VC_2..., C_2ː...}
e. *	[C...]	∼	[C...]	∼	[iC...]	

In the next section I argue that the suffixes to the *v*P/VP are outside of the PWd. The suffixal domain has different phonological properties than the PWd. In particular, the process of epenthesis which occurs inside the PWd does not occur in the suffixal domain.

4.2.3 Suffixal domain: outside the PWd

The inflectional suffixes in the suffixal domain are not included in the PWd. The evidence is that if the suffixal domain has a process of epenthesis, then it has different properties than the epenthesis which occurs within the PWd. If the suffixal domain exhibits the same process of epenthesis that occurs within the PWd, then there should be some suffixes which begin with a consonant after a vowel, but begin with [i] ∼ [o] after another consonant. The inflectional suffixes include I^0 (instantiated by clause-typing suffixes), plural person agreement suffixes, and C^0.

Of these three suffixes, only the plural agreement suffixes provide any strong evidence for or against epenthesis. As shown in Section 3.1.1, all overt instantiations of C^0 begin with a vowel after a consonant, and a glide after vowels. The clause-typing suffixes in I^0 are summarized in (623). The allomorphs in parentheses are only used for 21 or indefinite subjects in intransitive verbs. The instantiations of I^0 which begin in a consonant actually begin in an *hC* cluster. These clusters are subject to speaker variation, but usually alternate with a moraic [s̩] after consonants (Peter 2014).

(623) INSTANTIATIONS OF I^0 BY CLAUSE TYPE

IND	*-hp* ∼ *-mm* ∼ *-m* ∼ *-Ø* (∼ *-o'p* '21')
UNR	*-ht* ∼ *-hp* ∼ *-waht* (∼ *-o't* '21')
CNJ	*-hs* (∼ *-o's* '21')
SBJ	*-in* ∼ *-s* (∼ *-o'k* '21')
IMP	*-t* ∼ *-k* ∼ *-ːs* ∼ *-ok*

However, the plural agreement suffixes can occur after over instantiations of I^0 as well as the phonologically null *-Ø* allomorph of the independent clause-typing suffix. This means they can occur after vowels (e.g. when I^0 is null and the theme suffix ends in a vowel) and also after consonants (e.g. the final consonant of I^0, or after a null I^0 when the theme suffix ends in a consonant). The first person plural agreement suffix is [-nːaːn] after a vowel, (624a), and [-ɪnːaːn] after a consonant, (624b).

(624) a. ⟦nit͡sikákomɪmːʌ**nːaːn**i̥⟧ kitánik͡si̥⟧
Nitsikákomimma**nnaan**i kitániksi.
nit–ik–[akom–imm–aa]–Ø–**nnaan**–i k–itan–iksi
1–DEG–[favor–by.mind.*v*–3OBJ]–IND–**1PL**–3PL 2–daughter–AN.PL
'We (excl.) love your daughters.' (Frantz 2009: 53, (g))

b. ⟦nit͡sikákomɪmːok**ɪnːaːn**i̥⟧ kitánik͡si̥⟧
Nitsikákomimmok**innaan**i kitániksi.
nit–ik–[akom–imm–ok]–Ø–**innaan**–i k–itan–iksi
1–DEG–[favor–by.mind.*v*–INV]–IND–**1PL**–3PL 2–daughter–AN.PL
'Your daughters love us.' (Frantz 2009: 56, (i))

Similarly, the plural agreement suffix is [-waː] after a vowel, (625a), and [-oaː] after a consonant, (625b).

(625) a. ⟦kit͡sikákomɪmːa**waː**ji̥⟧ nitánik͡si̥⟧
Kitsikákomimma**waa**yi nitániksi.
kit–ik–[akom–imm–aa]–Ø–**waa**–yi k–itan–iksi
2–DEG–[favor–by.mind.*v*–3OBJ]–IND–**PL**–3PL 2–daughter–AN.PL
'You (pl.) love my daughters.' (Frantz 2009: 53, (h))

b. ⟦kit͡sikákomɪmːok**oaː**ji̥⟧ kitánik͡si̥⟧
Kitsikákomimmok**oaa**yi kitániksi.
kit–ik–[akom–imm–ok]–Ø–**oaa**–yi k–itan–iksi
2–DEG–[favor–by.mind.*v*–INV]–IND–**PL**–3PL 2–daughter–AN.PL
'Your daughters love you (pl.).' (Frantz 2009: 56, (j))

In other words, both suffixes begin with a consonant after a vowel, and a vowel after a consonant. However, only the '1PL' suffix exhibits alternations compatible with epenthesis, because the vowel-initial realization is formed by adding an extra vowel [ɪ] to the left edge of the morpheme. In contrast, the 'PL' suffix shows a pattern of [w]-vocalization after consonants.[43] Even if the [ɪ] at the left edge of the '1PL' suffix is epenthesized, these alternations have different morphophonological correlates than PWd-internal epenthesis. Specifically, the [k] before [-ɪnːaːn] '1PL' does not assibilate.

(626)

	After V		*After C*	*Gloss*
a.	[-nːaːn]	∼	[-ɪnːaːn]	'1PL'
b.	[-waː]	∼	[-oaː]	'PL'

I conclude that there is no process of epenthesis within the suffixal domain, or that epenthesis occurs but regular assibilation is blocked before epenthetic vowels. (A similar idea occurs in Armoskaite 2006, who argues that the domain of /k/-assibilation in Blackfoot does not extend into the suffixes, although she did not consider interactions between epenthesis and assibilation.) Because a process of deletion is not regular within the PWd, I conclude that the inflectional suffixes are outside the domain of the PWd but inside the PPh.

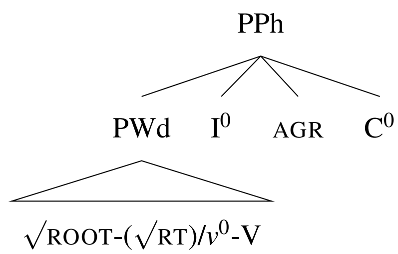
4.2.4 Interim summary: PWd phonology

The prosodic structure within the Blackfoot structure can be established on grounds which are independent from syntactic arguments. First, the stem prosodifies as a PWd, such that the left edge of an XP-adjoined root coincides with the left edge of the PWd, but the left edge of an X-adjoined root does not. Second, the inflectional suffixes are outside the PWd but within the PPh. Either of the following two

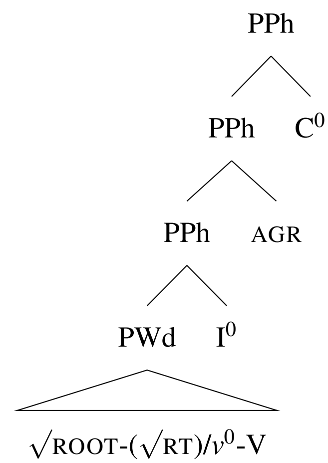
[43] Or possibly truncation at the left edge. In my own fieldwork, I always transcribe this suffix as [-waː] after vowels and [-owaː] after consonants, suggesting that the glide-initial variant is formed by deleting the vowel at the left edge. More research is needed to see whether deletion of vowels occurs at the left edge of other suffixes as well.

structures is logically compatible with these claims. However, the structure in (627b) makes the incorrect prediction that there should be multiple PPh right edges (e.g. multiple degenerate syllables, multiple devoiced syllables, etc.) Since this is not the case, I assume that the suffixes are able to prosodify as free clitics (Peperkamp 1996; Selkirk 1996), e.g. as sisters to a PWd and daughters to a PPh, (627a).

(627) a.



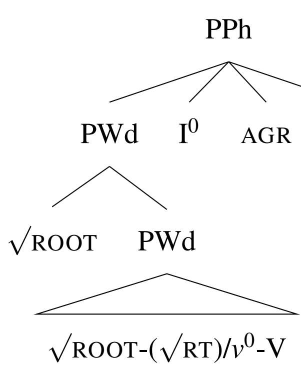
b.



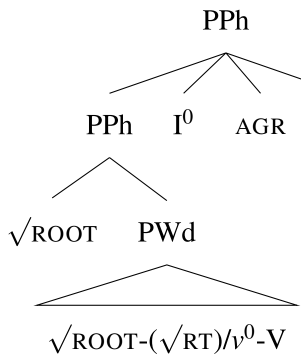
Next, consider an embedded case, where a root adjoins to a v*P phase. A few relevant prosodifications are shown in (628), and again, not all of these are compatible with the data. An adjoined and an embedded root exhibit the same patterns of allomorphy and edge effects, which means they must both prosodify at the left edge of a PWd. Thus, (b) is incorrect. There are no CP internal domains of final devoicing or degenerate syllables, etc., so the stem itself does not fall at the right edge of a PPh. Thus, (c) is incorrect. The tree in (a) must be correct.

(628) PROSODY

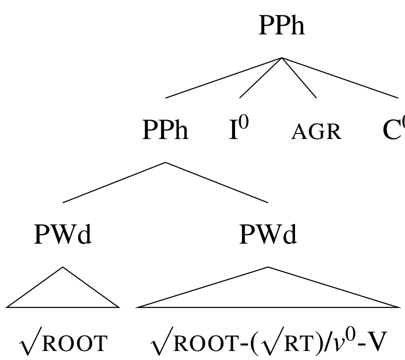
a.



b.



c.

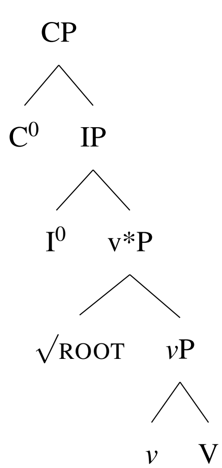


In the next section I show how the MATCH constraints defined in Section 1.2.4.1 can account for this prosody.

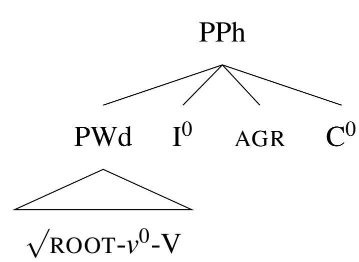
4.3 Mapping the *v*P/VP to prosodic structure

First, consider a stem which has one and only one XP-adjoined root. The syntactic structure below on the left corresponds to the prosodic structure on the right.

(629) SYNTAX

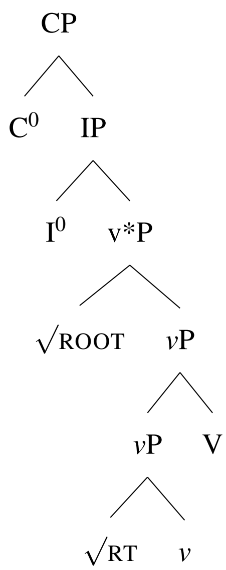


(630) PROSODY

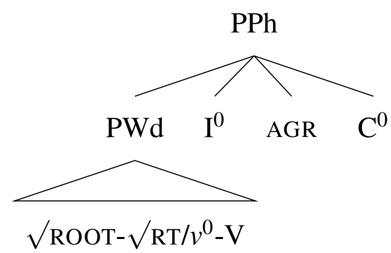


Next, consider a stem which has one and only one XP-adjoined root, but also an X^0-adjoined root. The syntactic structure below on the left corresponds to the prosodic structure on the right.

(631) SYNTAX



(632) PROSODY



There are a few things to mark. First, each *v*P phrase which is either a phase or a projection of a phase is prosodified as a PWd. Prosodic recursion mirrors syntactic recursion—exactly what Match Theory predicts (Selkirk 2011). I take this as evidence that Match Theory basically correctly predicts this prosodic structure. Second, not every *v*P in the syntax has a corresponding PWd in the prosodic structure. I assume that the stem is a predicate of events and is the first syntactic phase; this is the smallest *v*P which has a corresponding PWd in the prosodic structure. If a √ROOT merges but does not complete the phase, it will be prosodified inside the PWd. Third, not every XP between the PWd and the PPh is prosodified as a PWd or PPh. Instead, several inflectional suffixes are prosodified inside the PPh but outside the PWd. For these two reasons, a theory that maps every XP indiscriminately to a prosodic constituent will not be able to account for Blackfoot. I take this to mean that Match Theory must be modified, which I did by redefining the MATCH constraints in Section 1.2.4.1.

Recall from Section 3.3 that the optimal ranking of constraints for PPhs is:

(633) MATCH(CP) (All), EQSIS, M-∃(CP) $\gg$ BINMIN, M-∃(PPh)

This has the effect of prosodifying the entire verbal complex into a PPh. This constraint ranking also works for the v*P level, as shown in the tableau below. (MATCH-∃(PPh) is ranked below EQUAL-SISTERS but is not shown in this tableau.) The relevant v*P boundary is marked by [ ]; { } marks the CP in the input and the PPh in the output; *x* represents the stem within the v*P; *z* represents any inflectional suffixes which are outside the v*P but inside the CP. Note that BINMIN is still evaluated with respect to the number of PWds inside a PPh. Candidate (a) is the prosodification which matches the empirical facts in Blackfoot. In order for this candidate to win, MATCH(v*P) (Only) and MATCH-∃ (PWd) must dominate EQUALSISTERS.

(634)

{ [x $]_1$ z }	M_A(V*P)	M_O(V*P)	M-∃ (V*P)	M-∃ (PWD)	EQSIS	BIN
☞ a. {(x $)_1$ z }					*	*
HB b. {(x (z $)_1$ $)_2$}	*x!	*x!		*!	*	*
HB c. {((x $)_1$ (z $)_3$ $)_2$}				*!*		
d. {(x $)_1$ (z $)_2$}				*!		
HB e. {((x $)_1$ z $)_2$}				*!	*	*
f. {(x z $)_1$}		*y!				*

Crucial rankings: {MATCH(v*P) (Only), MATCH-∃ (PWd)} ≫ EQUALSISTERS

Finally, in the next chapter I revisit some of the implications of this research.

Chapter 5

Discussion

Some recent proposals assume that each syntactic phase corresponds to the same type of prosodic constituent, whether that is the PWd, the PPh, or something else (Adger 2007; Arad 2003; Bobaljik and Wurmbrand 2013; Dobashi 2003; Elfner 2011; Ishihara 2007; Kratzer and Selkirk 2007; Marvin 2002; Newell 2008; Newell and Piggott 2014; Svenonius 2004). In Section 5.1 I confirm that the PPh and the PWd constituents are distinct in Blackfoot. I conclude that the CP and v*P phases correspond to distinct prosodic categories. This type of correspondence relation is easily accounted for in my model, which uses a modified version of Match Theory (Selkirk 2011) to regulate the syntax-prosody correspondence. It cannot be accounted for in a theory that uniformly maps phases to a single prosodic constituent.

In Section 5.2 I discuss how to account for the misalignment of PWd boundaries and syllable boundaries in Blackfoot. I use Alignment constraints (McCarthy and Prince 1993a) to align prosodic and metrical constituent edges. This predicts a wide typology of language types, some of which prefer to align syllables to PWd edges by violating syllable structure constraints or the syntax-prosody (MATCH) constraints. Others, like Blackfoot, tolerate misalignments.

5.1 PWd $\neq$ PPh

In this section I compare the PWd and PPh in Blackfoot and argue that they are distinct prosodic constituents. Suppose that the first phase (v*P) and the second phase (CP/DP) corresponded to the same prosodic constituent, α, as in (635). Under the Prosodic Hierarchy Theory (Nespor and Vogel 2007; Selkirk 1986), phonological generalizations take constituents of a particular prosodic category as their domain. Therefore a recursive category, α, should have the same generalizations at both levels of recursion (Itô and Mester 2012).

(635) HYPOTHETICAL CORRESPONDENCE

However, the PPh and the PWd have different phonological generalizations, which means they must be distinct. These generalizations are summarized in Table 5.1. There are left edge restrictions which hold of the PPh but not the PWd, and vice versa, and there are also domain-restricted generalizations which hold of the PPh but not the PWd, and vice versa.

Table 5.1: Phonological generalizations of the PPh and PWd constituents

	PHONOLOGICAL GENERALIZATION	PPh	PWd
1.	*Left edge restrictions*		
	(a) *{w, j}	✓	✘
	(b) *[-cont]	✘	✓
2.	*Domain-restricted generalizations*		
	(a) Stress assignment	✓	✘
	(b) Phonotactically-driven epenthesis	✘	✓

In the next sections I summarize each of the phonological generalizations in Table 5.1 in turn.

5.1.1 Left edge restrictions

Regarding the left edge restrictions in Table 5.1, I showed in Section 3.2.1 that no PPh begins in a glide, even though smaller constituents like the PWd can begin in a glide. I repeat two examples from that section in (636) and (637), and indicate the prosodic structure. The (a) examples show that the PWd may begin in a glide, and the (b) examples show that the PPh may *not* begin in a glide. No PWd begins in a glide in both positions.

(636) a. (á.(**j**aː.mo.jíʔ.po.ji)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$
*á**y**aamoyí'poyiwa*
a–[**y**aam–oyi–i'po/yi]–Ø–wa
IPFV–[twisted–mouth–speak/AI]–IND–3
'S/he is joking/jesting.'

b. ((aː.mo.jíʔ.po.ji)$_{\text{PWd}}$.t)$_{\text{PPh}}$
aamoyí'poyit
[**y**aam–oyi–i'po/yi]–t–Ø
[twisted–mouth–speak/AI]–2SG.IMP–CMD
'Jest!' (=211)

(637) a. (á.kaː.(**w**aː.poʔ.kjoʔ.t͡si)$_{\text{PWd}}$.mḁ)$_{\text{PPh}}$
*ákaa**w**aapo'kio'tsima*
akaa–[aapo'ki–o't/Ø–i]–m–wa
PRF–[inside.out–by.hand/*v*–TI1]–IND–3
'S/he has turned it inside out.'

b. ((aː.póʔ.kjoʔ.t͡si.)$_{\text{PWd}}$t)$_{\text{PPh}}$
aapó'kio'tsit
[aapo'ki–o't/Ø–i]–t–Ø
[inside.out–by.hand/*v*–TI1]–2SG.IMP–CMD
'Turn it inside out!' (=210)

I argued that there is a phonotactic constraint against glides at the left edge of the PPh, but not at the left edge of the PWd, which drives the morphemic alternation seen in (636). Here, the high root √YAAM begins in an underlying glide, which surfaces in a PPh-medial position. The glide is deleted at the left edge of the PPh. In (637) the high √AAPO'KI 'inside out' begins in an underlying long vowel, which surfaces faithfully in PPh-initial position. A glide is inserted at the left edge of the root after a vowel in order to avoid vowel hiatus; this glide is tolerated in PPh-medial position because there is no restriction against glides at the left edge of the PWd.

As I discussed in Section 4.2.2, no PWd begins in a [-cont] segment when it is not initial within the PPh. I repeat some examples from that section which begin in plosives in (638) and (639), and indicate the prosodic structure. In (638) the high root √POMM 'buy' begins in a consonant at the left edge of the PPh, but an /ox/ in PPh-medial positions.

(638) a. ((pʊm.maː)$_{\text{PWd}}$.t)$_{\text{PPh}}$
pommáát
[pomm–aa]–t–Ø
[√BUY–AI]–2SG.IMP–CMD
'buy!'

b. (âː.k(x̩ʷ.pʊm.maː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$
*áak**oh**pommaawa*
aak–[**oh**pomm–aa]–Ø–wa
FUT–[√BUY–AI]–IND–3
'she will buy'

c. (ɔ́(**ɔ́x^{w}**.pʊm.ma)$_{PWd}$)$_{PPh}$

***áóh**pommaawa*

a–[**oh**pomm–aa]–Ø–wa

IPFV–[√BUY–AI]–IND–3

's/he is shopping' (BB)

In (639) the high root √POMM 'transfer' begins in a consonant at the left edge of the PPh, but an [i] in PPh-medial positions.

(639) a. ((pʊm.mó:)$_{PWd}$.s)$_{PPh}$

pommóós

[pomm–o–:s]–Ø

[√TRANSFER–*v*–2SG:3.IMP]–CMD

'transfer (e.g. the bundle) to him!'

b. (âː.k͡s(**i**.pʊ́m.mo.jiː)$_{PWd}$.wáji̥)$_{PPh}$

*áaks**i**pómmoyiiwáyi*

aak–[**i**pomm–o–yii]–Ø–w=ayi

FUT–[√TRANSFER–*v*–3SUB]–IND–3=OBV.SG

'he will transfer it to her'

c. (ɛ́(**ɛ́**.pʊm.ma.ki)$_{PWd}$.wḁ)$_{PPh}$

*á**í**pommakiwa*

a–[**i**pomm–Ø–aki]–Ø–wa

IPFV–[√TRANSFER–*v*–AI]–IND–PRX

'the one transferring (previous owner)'

A handful of forms involve root-internal gemination. In (640) the high root √KIPITA 'aged' begins in a consonant at the left edge of the PPh, but an [i] in PPh-medial positions with root-internal irregular gemination. This type of gemination only occurs for a handful of forms in the lexicon.

(640) a. ((kɪ.pi.tá.aː.ki)$_{PWd}$)$_{PPh}$

***kip**itáaakii*

kipita–[aakii]

√AGED–[woman.*n*]

'old woman' (BB)

b. (âː.k͡s(ɪp.pi.tɛː.ˢta.wa.ta)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$
   *áaks**ipp**itaistawatawa*
   aak–**ipp**ita–[istaw–at–a]–Ø–wa
   FUT–√AGED–[√GROW–*v*–3OBJ]–IND–3
   'she will be raised by the elderly'

c. (a.mɛ́(p.pi.tá.aː.kiː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$
   *amá**ípp**itáaakiiwa*
   ama–**ipp**ita–[aakii]–wa
   √PATHETIC–√AGED–[woman.*n*]–PRX
   'pathetic old woman'

I argued in Section 4.2.2 that some alternations, like the one in (638), involve lexically listed allomorphs. Other alternations, like the one in (639), involve epenthesis at the left edge of a root. Still others, like the one in (640), involve allomorphy and epenthesis. Both types of alternation are phonologically optimizing. There is a positional markedness constraint against [-cont] segments at the left edge of a PWd, but not at the left edge of a PPh. This accounts for why a PWd in PPh-medial positions never begins with a [-cont] segment, even though roots which are internal to the PWd can.

5.1.2 Domain-restricted generalizations

Regarding the domain-restricted generalizations in Table 5.1, I argued in Section 3.2.2 that the PPh is the domain of obligatory and culminative stress. In contrast, primary stress does not necessarily fall within the PWd. For example, in (642) and (644), stress falls on a prefix but there is no stress on the inner PWd. This shows that the PPh and PWd are distinct; if stress were obligatory within the PWd, then we would expect stress to fall within the inner PWd.

(641) STRESS ON PWD
   ((**a**.t͡si.ní.ki)$_{\text{PWd}}$.t)$_{\text{PPh}}$
   [**a**tsinik–i]–t–Ø
   [relate.story–AI]–2SG.IMP–CMD
   'relate a story!' (BB)

(642) STRESS OUTSIDE PWD
   a. (á.kɛ(ɛ.t͡si.ni.ki)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$
      akaa–[itsinik–i]–Ø–wa
      PRF–[tell.story–AI]–IND–3
      's/he has told a story'
   b. * (a.kɛ(ɛ.t͡si.ní.ki)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$

(643) ((i.$\underline{\widehat{\text{ks}}\text{ím}}$.ʔs̩ː.ta)$_{\text{PWd}}$.ja)$_{\text{PPh}}$
[iksim–sst/aa]–Ø–yi=aawa
[wish/AI]–IND–C^{0}=PRX.PL
'they thought'

(644) a. (i.ta.$\underline{\text{ní}}$.$^{\text{s}}\widehat{\text{ts}}$(ɪ.$\widehat{\text{ks}}$ɪm.ʔs̩ː.ta)$_{\text{PWd}}$.ja)$_{\text{PPh}}$
it–anist–[iksim–sst/aa]–Ø–yi=aawa
LOC–MANNER–secret–[wish/AI]–IND–3PL=PRX.PL
'they decided thus'

b. * (i.ta.nɪ.$^{\text{s}}\widehat{\text{ts}}$(ɪ.$\underline{\widehat{\text{ks}}\text{ím}}$.ʔs̩ː.ta.)$_{\text{PPh}}$ja)$_{\text{PPh}}$

As I discussed in Section 4.2, the (recursive) PWd is the domain of epenthesis which is driven by principles of syllabification. Within the PWd itself, not all morpheme boundaries are alike. Epenthesis at morpheme boundaries that are not at a PWd edge has three core properties:

1. Occurs to avoid illicit consonant clusters.
2. The epenthetic vowel is predictably [o] when the following vowel is [o], and otherwise it is [i].
3. A preceding /k/ always assibilates to [$\widehat{\text{ks}}$] before an epenthetic [i].

For example, head-adjoined roots are prosodified inside the PWd and can begin with either a consonant or a vowel. An epenthetic vowel is inserted between a consonant-initial head-adjoined root like √-P 'tie' and a preceding consonant, (645). No epenthesis is needed after vowels like the root-final [o] in √AMO- 'gather', (646).

(645) ((ɪp.po.$\widehat{\text{ts}}$**í**.pi.$^{\text{s}}$taː)$_{\text{PWd}}$.wḁ)$_{\text{PPh}}$
*<u>ippots</u>**íp**istaawa*
[<u>ippot</u>–**p**/ist–aa]–Ø–wa
[<u>secure</u>–**tie**/*v*–AI]–IND–3
'she wore braids' (=499)

(646) ((a.mo.**pí**.$^{\text{s}}$taː)$_{\text{PWd}}$.n)$_{\text{PPh}}$
*<u>amo</u>**p**ístaan*
[[<u>amo</u>–**p**/ist–aa]–n]
[[<u>gather</u>–**tie**/*v*–AI]–NMLZ
'ceremonial bundle' (=500)

Epenthesis of this sort does not occur at the left edge of the PWd, nor at the left edge of each prefix to the PWd. I argued above that epenthesis at the left edge of high roots is one of several types of morphophonological alternations which conspire to avoid [-cont] segments at the left edge of the PWd. This type of epenthesis bleeds the phonological environments where the PWd-internal epenthesis would have occurred. Epenthesis at the left edge of a PWd differs from PWd-internal epenthesis in two ways. First, the accretive element occurs after vowels as well as consonants, so it is not driven by principles of syllabification. And second, the accretive element is invariably [i], even when the following vowel is [o], so it does not exhibit the same type of "coloring" as the PWd-internal epenthetic vowel. These differences are summarized in (647). Again, these differences show that phonotactically-driven epenthesis is a property of the PWd, but not of the PPh as a whole.

(647) TWO DIFFERENT TYPES OF EPENTHESIS

	PWd left edge	PWd-internal
Epenthesis occurs V__C	✓	✘
Epenthetic vowel is [o] before [o]	✘	✓

Although the wellformedness conditions on syllable structure hold outside the PWd in the suffixal domain as well, the process of epenthesis does not. The only V $\sim$ Ø alternation in the suffixal domain could equally well be analyzed as deletion rather than epenthesis, (648). If the alternation is due to epenthesis, then it has different correlates than PWd-internal epenthesis, because it does not cause a preceding [k] to assibilate, (648b). This shows that phonotactically-driven epenthesis is a property of the PWd, but not of the PPh. I take this to mean that the inflectional suffixes are prosodified outside of the PWd but inside of the PPh, and that some other type of alternation occurs at morpheme boundaries in order to create wellformed syllables.

(648) a. (ni.t͡si.k (á.ko.mɪm.mʌ**n**)$_{\text{PWd}}$**.naː.ni̥**)$_{\text{PPh}}$ (ki.tá.ni.k͡si̥)$_{\text{PPh}}$

*Nitsikákomimma**nnaan**i* *kitániksi.*

nit–ik–[akom–imm–aa]–Ø–**nnaan**–i k–itan–iksi

1–DEG–[favor–by.mind.*v*–3OBJ]–IND–**1PL**–3PL 2–daughter–AN.PL

'We (excl.) love your daughters.' (Frantz 2009: 53, (g))

b. (ni.t͡si.k (á.ko.mɪm.mo)$_{\text{PWd}}$.k**ɪn.naː.ni̥**)$_{\text{PPh}}$ (ki.tá.ni.k͡si̥)$_{\text{PPh}}$

*Nitsikákomimmok**innaan**i* *kitániksi.*

nit–ik–[akom–imm–ok]–Ø–**innaan**–i k–itan–iksi

1–DEG–[favor–by.mind.*v*–INV]–IND–**1PL**–3PL 2–daughter–AN.PL

'Your daughters love us.' (Frantz 2009: 56, (i))

5.1.3 Summary and future research

In conclusion, the PPh and the PWd are distinct prosodic constituents in Blackfoot. This means that the two different types of phases must correspond to unique prosodic categories. In my proposal, this is accomplished by using modified MATCH constraints (Selkirk 2011).

The generalizations listed in Table 5.1 are not exhaustive by any means, and I predict that future research will reveal still others. For example, other Blackfoot research discusses a general phenomenon of final devoicing which holds of the PPh but not of the PWd (Bliss 2013; Bliss and Gick 2009; Bliss and Glougie 2010; Gick et al. 2012; Windsor 2017a,b). The degenerate syllables I discuss in Section 2.4.4 align to the right edge of a PPh, but not to the right edge of a PWd. Furthermore, there are properties of the PPh which occur across PWd boundaries, suggesting that the PWd is contained within a PPh (cf. Downing 1999). Because the PWd is contained within the PPh, we expect any generalizations which hold of the PPh to also hold within the PWd, ignoring any PWd boundaries. This is true: the sequence *[ti] is prohibited within the PPh and is repaired via a process of /t/ → [t͡s] assibilation (cf. Bliss 2013), even when the /t-i/ sequence occurs across the left edge of a PWd. Another unknown in Blackfoot is whether or not there are prosodic clitics at the PWd and PPh level, and what their phonological correlates are.

In the next section, I return to my proposal that prosodic and metrical hierarchies are separate and can correspond in one of two ways. I argue that this proposal predicts that PWd boundaries can span metrical boundaries.

5.2 Prosodic and metrical misalignment

In Section 4.2.2 I argued that the different patterns of alternation in XP-adjoined roots arise in order to satisfy a positional markedness constraint that holds of the left edge of the PWd. As a consequence, root alternations are often ‘perverse’ with respect to syllable structure (i.e. vowel-initial forms follow vowels) but optimizing with respect to prosodic edges (i.e. morphological forms avoid [-cont] segments at the left edge of the PWd). Because of this, I argued that the left edge of the PWd often falls in the middle of a syllable. In this section, I show that misalignment between prosodic edges and metrical constituents is predicted in a model with separate prosodic and metrical hierarchies and two different sets of correspondence relations (the syntax-prosody correspondence, and the prosody-metrical correspondence). I conclude this section by briefly considering the typological predictions of this result.

Recall from Section 1.2.4.2 that the prosodic, (649), and metrical, (650), hierarchies are separate in my proposal (following Inkelas 1990, 1993 and subsequent research).

(649) PROSODIC CATEGORIES

IPh	intonational phrase
PPh	phonological phrase
PWd	prosodic word

(650) METRICAL CATEGORIES

Ft	foot
σ	syllable
μ	mora

I assume that distinctive units (e.g. segments or features) are parsed into a metrical structure consisting of the categories shown in (650). Constituents within either hierarchy obey Proper Bracketing, (651), such that each category type is fully contained in a constituent of the next-higher level.

(651) PROPER BRACKETING

Every C_j ($\neq C^{\text{MAX}}$) has one and only one mother node (i.e., a given constituent cannot simultaneously be part of two or more higher prosodic [or metrical—NW] constituents).

(Itô and Mester 2003: 33, (10))

However, since the prosodic and metrical structures are separate, no such containment relation exists between prosodic constituents, such as the PWd, and metrical constituents. This leaves open the possibility for misalignment between prosodic and metrical constituents. Now I show how such misalignments are predicted in a model where MATCH constraints (regulating the syntax-prosody correspondence) and ALIGN constraints (regulating the prosody-metrical edge alignments) can be freely ranked against one another.

In my proposal, prosodic representation is independent from but closely related to syntactic structure. Correspondence (MATCH) constraints require an exact match between prosodic and syntactic structure. In addition, Alignment (ALIGN) constraints control the relation between prosodic structure and metrical structure (McCarthy and Prince 1993a; Selkirk 1986). In a parallel model of phonology (Optimality Theory; McCarthy and Prince 1993a,b; Prince and Smolensky 1993) the MATCH and ALIGN constraints are ranked against one another as part of each language's phonological grammar. Generally speaking, languages might favor prosody-syntax correspondence over prosody-metrical arrangements, or vice versa, with the predictions in (652).

(652) a. ALIGN $\gg$ MATCH

Syntax-prosody correspondence is violated in order to align prosodic and metrical edges.

b. MATCH $\gg$ ALIGN

Prosodic-metrical alignment is violated in order to maintain syntax-prosody correspondence.

The first type of language is fairly common in the prosodic phonology literature. This is any language which allows minor metrical reconfigurations at prosodic edges. For example, a consonant at the right edge of a prefix might syllabify as the onset of the first syllable in a PWd, so that (see Guekguezian 2017 for recent arguments that Creek is this type of language). Or a language that prefers bimoraic feet might allow a degenerate foot at the right edge of a PWd so that the right edge of the foot aligns with the right edge of the PWd rather than spanning the edge of the PWd and parsing more material.

Blackfoot, on the other hand, instantiates the second kind of language. In Blackfoot, the alignment of metrical constituents with PWd boundaries is foregone in order to maintain a strong syntax-prosody correspondence. However, the alignment of metrical constituents with PPh boundaries is robust:

- Regarding feet and stress:
  - Stress is obligatory within the PPh, but not the PWd.

- Stress obeys NONINITIALITY within the PPh, not not within the PWd.
- Primary stress falls towards the left edge of the PPh, but not the PWd.
- The location of primary stress is affected by PPh-internal affixes and clitics, but not by a neighboring PPh.
- The head foot is leftmost within the PPh, but not within the PWd.

• Regarding syllables:

- Onsetless syllables are freely allowed at the left edge of the PPh, but not the PWd.
- Degenerate feet are allowed at the right edge of the PPh, but not the PWd.
- There are robust generalizations on wellformed syllables which hold across the entire PPh (as well as the PWd, which is contained in the PPh).
- Syllables can span PWd edges (Section 4.2.2), but not PPh edges. (Phonological segments do not resyllabify across a PPh boundary.)

To account for this, I propose that metrical constituents like feet and syllables in Blackfoot align to PPh edges but not necessarily to PWd edges. This section illustrates how this can be achieved using Alignment constraints (McCarthy and Prince 1993a). In Blackfoot, the constraint which aligns syllables to PPh edges crucially dominates the constraint which aligns syllables to PWd edges. The MATCH constraints at the v*P level also dominate the PWd alignment constraint, or else the PWd alignment constraint could be satisfied by shifting the PWd boundaries.

(653) BLACKFOOT

ALIGN (PPh, L, σ, L), MATCH(v*P) ≫ALIGN (PWd, L, σ, L)

This ranking means that it is more important to MATCH the v*P and PWd exactly than it is to align the left edge of the PWd with a syllable boundary. This predicts that a PWd boundary can fall inside of a syllable or a foot. In other words, syllables and feet are not contained by the PWd, which must be true in Blackfoot in order to account for patterns of $\sqrt{}$ROOT allomorphy at the left edge of the PWd. The evidence comes from vowel-initial PWds in PPh-medial positions. The vowel at the left edge of the PWd may be underlying or derived in order to satisfy positional markedness constraints at the left edge of the PWd. For this reason, the example in (654) contains a stem that begins with an underlying vowel, and the example in 655 contains a stem that begins in an underlying consonant. This distinction can be seen when the left edge of the stem coincides with the left edge of the verbal complex, as in (654a) and (655a). After a vowel, (654b) and (655b), both stems begin in a vowel [i] which coalesces with the preceding [a] of a prefix to create a long [ɛː]. After a consonant, (654c) and (655c), both stems begin in a vowel [i].

(654) VOWEL-INITIAL PWD

a. PPH-INITIAL

[**a**.t͡si.ní.ki.t]
atsinikit
[**a**tsinik–i]–t–Ø
[relate.story–AI]–2SG.IMP–CMD
'relate a story!' (BB)

b. AFTER VOWEL

⟦**ɛ́ː**.t͡si.ni.ki.wḁ⟧
áítsinikiwa
a–[**i**tsinik–i]–Ø–wa
IPFV–[tell.story–AI]–IND–3
's/he is relating a story'

c. AFTER CONSONANT

⟦nox^w^kit͡sínikit⟧
noohk**i**tsínikit
noohk–[**i**tsinik–i]–t–Ø
counter.expectations–[relate.story–AI]–2SG.IMP–CMD
'please tell a story!'

(655) CONSONANT-INITIAL PWD

a. PPH-INITIAL

⟦pʊmːóːs⟧
pommóós
[pomm–o–ːs]–Ø
[√TRANSFER–*v*–2SG:3.IMP]–CMD
'transfer (e.g. the medicine bundle) to him!'

b. AFTER VOWEL

⟦ɛ́ːpʊmːakiwḁ⟧
á**í**pommakiwa
a–[**i**pomm–Ø–aki]–Ø–wa
IPFV–[√TRANSFER–*v*–AI]–IND–PRX
'the one transferring (previous owner)'

c. AFTER CONSONANT

⟦âːk͡sipʊ́mːojiːwáji̥⟧
áaks**i**pómmoyiiwáyi
aak–[**i**pomm–o–yii]–Ø–w=ayi
FUT–[√TRANSFER–*v*–3SUB]–IND–3=OBV.SG
'he will transfer it to her'

In the tableau below, I use square brackets [ ] to mark the left and right edge of the first syllable. Candidates (a) and (b) satisfy the syllable alignment constraint but violate MATCH(PWd). However, these parses must be incorrect. The reason is that we posited the left edge of the PWd to account for why all XP-adjoined roots begin with a [-cont] segment in PPh-medial positions. If we shift the boundary, then we lose the ability to account for that restriction. The candidates, (c) and (d) satisfy the syllable alignment constraints by syllabifying each vowel on either side of the PWd boundary, thereby incurring violations of *HIATUS. These parses must also be incorrect. There is no evidence that there are two syllables in hiatus here. First, if this were possible, we would also expect V.VV or VV.V or VV.VV sequences across this boundary, but the same phonotactics hold here as elsewhere. Second, pitch accent is a syllable-based phenomenon, and when pitch accent falls on the syllable which spans the PWd boundary, it falls on both moras of the syllable. The optimal candidate (e) instead allows the syllable containing a long [ɛː] to span the left edge of the PWd.

(656)

[a–[itsinik–i]$_{v*P}$–Ø–wa]$_{CP}$	MATCH(PWD)	*HIATUS	AL(PWd,σ)
a. ([ɛ́ː].(t͡si.ni.ki)$_{PWd}$.wḁ)$_{PPh}$	*!		
b. (([ɛ́ː].t͡si.ni.ki)$_{PWd}$.wḁ)$_{PPh}$	*!		
c. ([ɛ́].(ɛ.t͡si.ni.ki)$_{PWd}$.wḁ)$_{PPh}$		*!	
d. ([á].(i.t͡si.ni.ki)$_{PWd}$.wḁ)$_{PPh}$		*!	
☞ e. ([ɛ́(ɛ́].t͡si.ni.ki)$_{PWd}$.wḁ)$_{PPh}$			*

There are several consequences of this proposal for prosodic typology. In addition to language-specific rankings of prosodic wellformedness constraints, languages can also vary in terms of whether metrical constituents align to the L/R edges of the PPh/PWd. Many studies have argued that some languages have "clausal words", such as Nuu-chah-nulth (Wojdak 2008), Inuit (Compton and Pittman 2010), Plains Cree, Ojibwe, Potawatomi (Déchaine 1999), Onondaga and Ojibwe (Barrie and Mathieu 2016), Swampy Cree (Russell and Reinholtz 1995), and Cayuga (Dyck 2009). However, those studies often rely on criteria other than syllabification, e.g. pauses, boundary tones, or grammatical boundedness, which makes it difficult to compare to languages which have "stem-sized" words. I hypothesize that "clausal words" arise by ranking MATCH(PWd) above metrical alignment constraints, just like Blackfoot. In other words, the proposal above provides a theory-internal definition of "clausal words" as a PPh domain which aligns with metrical constituents.

Chapter 6

Conclusion

To conclude, this dissertation accomplishes two goals. First, it describes the syntactic, prosodic, and metrical generalizations within Blackfoot, an Algonquian language spoken in northern Montana, USA and southern Alberta, Canada. Second, I discuss how to modify current proposals of the syntax-prosody correspondence and the alignment of prosodic and metrical constituents to account for languages like Blackfoot.

I argue that there are two main prosodic constituents in Blackfoot, the Phonological Phrase (PPh) and the Prosodic Word (PWd), which correspond roughly to a CP/DP and to a *v*P, respectively. I argue that the syntactic unit in both cases is a phase. In particular, the "first" phase is a predicate of events (v*P) and closes when that predicate is complete. The second phase is the CP or DP, roughly equivalent to a semantic proposition and an individual, respectively. Despite the close relation between syntax and prosody, the prosodic structure is in some ways non-isomorphic to syntax. For example, while a syntactic CP contains DPs, there is no evidence that this results in a recursive prosodic structure. Instead, prosodic structure is "flatter", with each of the DPs and the remainder of the CP mapping to the same type of phonological domain.

The two prosodic constituents have different phonological generalizations, showing that they are distinct. The PPh prohibits glides at the left edge, and is the domain of obligatory and culminative stress, where the location of primary stress is calculated from the left edge of the PPh. The PPh is also the domain where generalizations about syllable wellformedness hold; it is a single domain of syllabification. The PWd prohibits [-cont] segments at the left edge, which is only apparent when the left edge of the PPh and the PWd are distinct. This means that the PWd in Blackfoot is roughly the same syntactic size as PWds in other languages (e.g. a v*P phase of events) but does not have some of the phonological correlates of PWds in other languages. Specifically, metrical constituents like syllables can span PWd edges and the domain of stress assignment is the PPh rather than the PWd.

Given the data in Blackfoot, a model of the correspondence relations between syntax, prosody, and metrical constituents must account for two facts:

1. There is a close relationship between syntactic phases and prosodic constituents, and yet syntactic and prosodic structures sometimes mismatch.

2. Metrical constituents align to PPh edges but are misaligned from PWd boundaries.

Regarding the first fact, I argue that the syntax-prosody correspondence in Blackfoot can be accounted for with a modified version of Match Theory (Selkirk 2011). Each syntactic phase and every branching XP above matches to a particular prosodic category, encoded via universal, violable MATCH constraints. Specifically, the first syntactic phase (the predicate of events, roughly the *v*P), matches to a Prosodic Word (PWd) constituent, and the DP and CP phases match to Phonological Phrase (PPh) constituents. Mismatches between syntactic phases and prosodic structure occur when prosodic well-formedness constraints outrank the MATCH constraints. In Blackfoot, I argue that a constraint which requires sister nodes within the prosodic structure to be of the same type outranks the syntax-prosody correspondence constraints at the PPh level. This forces each DP argument and also the remainder of the CP (e.g. the verbal complex) to each be matched to a PPh constituent.

Regarding the relation between prosody and metrical structure, I hypothesize that Alignment constraints (McCarthy and Prince 1993a) regulate alignment between prosodic and metrical constituent edges. I argue that in Blackfoot, alignment between PWd and syllable edges is less harmonic than satisfying (a) the MATCH constraints between the PWd and the v*P phase, or (b) higher-ranked foot and syllable wellformedness constraints. Instead, metrical constituents in Blackfoot align to PPh edges but span PWd boundaries. It is the combination of these two factors that gives the verbal complex in Blackfoot its dual nature as a syntactic phrase and phonological word: the verbal complex is a prosodic PPh, which happens to correspond roughly to a syntactic CP phase but which also is parsed into metrical constituents. In this way, syntactic and metrical constituents correspond only indirectly and are mediated by the prosodic structure. The model I propose accounts for the correspondence relations in Blackfoot, and leads to a typology of predicted language types.

The data in Blackfoot supports the central idea in Match Theory which is that prosodic recursion arises from syntactic recursion. A recursive *v*P/VP in the syntax is MATCH-ed to a recursive PWd in the prosody, as long as the recursive verbal phrases include or dominate the first phase of events. However, the data in Blackfoot *refute* the implementation of Match Theory in Selkirk (2011), where every syntactic XP MATCH-es to a PPh. This is not true; *v*P/VP phrases below the first phase are not mapped to a PWd or a PPh, and XPs outside of the maximal *v*P/VP projection are not required to MATCH to either a PWd or a PPh. I propose modified definitions of the MATCH constraints in order to account for this.

A secondary outcome of this dissertation is to contribute a morphological and phonological analysis of verbal stems in Blackfoot. The dictionary (Frantz and Russell 2017) is largely stem-based, and the morphemic composition of many stems has been obscured by diachronic changes as well as the unique prosodic-metrical correspondence in Blackfoot as compared to related languages. I present diagnostics for determining where morpheme boundaries fall and for determining whether a morpheme begins with a consonant or a vowel. With the aim to make the internal composition of stems more transparent, I often give example using four- or five-line glosses. I also document the Káínai dialect, especially as spoken by Beatrice Bullshields. The current dictionary was created with input from many speakers from each of the four reserves and reservations. Despite this, it is well-known that there are multiple differences between and even within the dialects associated with each reserve. This dissertation contributes to the documentation of variation by taking these dialectal differences seriously and providing an in-depth description of a single person's speech characteristics.

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Appendix A

Minimal pairs

This appendix includes additional support for the phonemic inventory discussed in Chapter 2. There are relatively few minimal pairs in Blackfoot, as noted in previous research (e.g. Denzer-King 2009: 16; Taylor 1969: 25; Elfner 2006b: 30). This is perhaps because the polysynthetic nature of Blackfoot leads to long words,[1] which have a smaller chance of differing by only a single sound. Even when minimal pairs at the word level do exist, further morphological analysis sometimes reveals that one or both of the sounds in question are predictable at a more abstract level of representation. In order to be transparent about the internal morphology of each word in a minimal pair, the following examples are given in a five-line interlinear gloss.

A.1 Consonants

A.1.1 Contrast based on place and manner

The minimal and near-minimal pairs in (1)–(11) establish that the obstruents /p t k s t͡s k͡s/ can distinguish lexical items. As I discuss in Section 2.1.2, [t] and [t͡s] never contrast because [t͡s] is a positional variant of /t/ before [i], [iː], and [j].

(1) CONTRAST BETWEEN /p/ AND /k/

a. ⟦**p**ot͡sís⟧
pot͡sís
[**p**ot–:s]–Ø
[beat.*v*–2SG:3.IMP]–CMD
'beat/batter him/her!'

b. ⟦**k**ot͡sís⟧
kot͡sís
[**k**ot–:s]–Ø
[give.*v*–2SG:3.IMP]–CMD
'give (it) to him/her!'

[1] The "word" throughout this appendix is the phonological PPh.

(2) a. ⟦âːkx̩ʷ**p**oːnimḁ⟧
áakoh**p**oonimwa
aak–[oh**p**o–ːn–i]–m–a
FUT–[grease–by.hand.*v*–TI1]–IND–IND–3
'''s/he will oil it'''

b. ⟦âːkx̩ʷ**k**oːnimḁ⟧
áakoh**k**oonimwa
aak–[oh**k**oon–i]–m–a
FUT–[find.*v*–TI1]–IND–IND–3
's/he will find it'

(3) CONTRAST BETWEEN /p/ AND /t͡s/

a. ⟦oʔ**p**ísi̥⟧
o'**p**ísi
w–[o'**p**is]–i
3–[rope]–OBV
'his/her rope'

b. ⟦oʔ**t͡s**ísi̥⟧
o'**ts**ísi
w–[o'**ts**is]–i
3–[hand]–IN.SG
'his/her hand/arm'

(4) CONTRAST BETWEEN /p/ AND /k͡s/

a. ⟦oʔ**p**ísi̥⟧
o'**p**ísi
w–[o'**p**is]–i
3–[rope]–OBV
'his/her rope'

b. ⟦oʔ**k͡s**ísi̥⟧
o'**ks**ísi
w–[o'**ks**is]–i
3–[armpit]–IN.SG
'his/her armpit'

(5) CONTRAST BETWEEN /t/ AND /k/

a. ⟦simí**t**⟧
simi**t**
[sim–i]–**t**–Ø
[drink–AI]–2SG.IMP–CMD
'(you sg.) drink!'

b. ⟦simí**k**⟧
simi**k**
[sim–i]–**k**–Ø
[drink–AI]–2PL.IMP–CMD
'(you pl.) drink!'

(6) a. ⟦oː**t**áːni̥⟧
oo**t**ááni
[[oo**t**–aa]–n]–i
[[leggings–AI]–NMLZ]–IN.SG
'leggings'

b. ⟦oː**k**áːni̥⟧
oo**k**ááni
[[oo**k**–aa]–n]–i
[[Sundance–AI]–NMLZ]–IN.SG
'Sundance lodge'

(7) a. ⟦pʌs**tá**ːni̥⟧
passt**á**áni
[[pass**t**–aa]–n]–i
[[bridge–AI]–NMLZ]–IN.SG
'bridge'

b. ⟦pʌs**ká**ːni̥⟧
pass**k**áání
[[pass**k**–aa]–n]–i
[[dance–AI]–NMLZ]–IN.SG
'dance'

(8) CONTRAST BETWEEN /t/ AND /s/

a. ⟦simí**t**⟧
simi**t**
[sim–i]–**t**–Ø
[drink–AI]–2SG.IMP–CMD
'(you sg.) drink!'

b. ⟦simí**s**⟧
simi**s**
[sim]–**:s**–Ø
[stab.TA2SG:3.IMP]–CMD
'stab him/her!'

(9) CONTRAST BETWEEN [k] AND [k͡s]

a. ⟦ɪs**k**í̵t⟧
iss**k**ít
[iss**k**–Ø–i]–t–Ø
[by.body–*v*–TI1]–2SG.IMP–CMD
'break it!'

b. ⟦ɪs**k͡s**ít⟧
iss**k͡s**ít
[iss**k**–i]–t–Ø
[urinate–AI]–2SG.IMP–CMD
'urinate!'

=(9)

(10) CONTRAST BETWEEN /k/ AND /s/

a. ⟦simí**k**⟧
simí**k**
[sim–i]–**k**–Ø
[drink–AI]–2PL.IMP–CMD
'(you pl.) drink!'

b. ⟦simí**s**⟧
simi**s**
[sim]–**:s**–Ø
[stab.*v*–2SG:3.IMP]–CMD
'stab him/her!'

(11) CONTRAST BETWEEN /t͡s/ AND /k͡s/

a. ⟦moʔ**t͡s**ísi̥⟧
mo'**t͡s**isi
m–[o'**t͡s**is]–i
BP–[arm]–IN.SG
'hand/arm'

b. ⟦moʔ**k͡s**ísi̥⟧
mo'**k͡s**isi
m–[o'**k͡s**is]–i
BP–[armpit]–IN.SG
'armpit'

The near-minimal pair in (12) establishes that /m/ and /n/ distinguish lexical items, while the minimal and near-minimal pairs in (13)–(21) establish that the difference between the two nasals and the obstruents also can distinguish lexical items.

(12) CONTRAST BETWEEN /m/ AND /n/

a. ⟦âːka**m**iwḁ⟧
aaka**m**iwa
aak–[a**m**–i]–Ø–wa
FUT–[be–AI]–IND–3
'it will be the thing identified'

b. ⟦âːka**n**iːwḁ⟧
aaka**n**iiwa
aak–[a**n**–ii]–Ø–wa
FUT–[say–AI]–IND–3
s/he will say (s.t.)'

(13) CONTRAST BETWEEN /m/ AND /p/

a. ⟦**m**óːsḁ⟧
moosa
m–[oos]–a
BP–[anus]–PRX
'anus'

b. ⟦**p**óːsḁ⟧
poosa
[**p**oos]–a
[cat]–PRX
'cat'

(14) CONTRAST BETWEEN /m/ AND /k/

a. ⟦âːk͡sɪkːa**m**sːiwḁ⟧
aaksikka**m**ssiwa
aak–[ikka**m**–ssi]–Ø–wa
FUT–[fast–AI]–IND–3
's/he will be quick'

b. ⟦âːk͡sɪkːa**k**sːiwḁ⟧
aaksikka**k**ssiwa
aak–[ikka**k**–ssi]–Ø–wa
FUT–[short–AI]–IND–3
's/he will be short'

(15) CONTRAST BETWEEN /m/ AND /k͡s/

a. ⟦**m**íːni⟧
mííni
[**m**iin]–i
[berry]–IN.SG
'berry'

b. ⟦**k͡s**íːniwḁ⟧
k͡siiniwa
[**k͡s**iini]–wa
[cowbird]–PRX
'cowbird'

(16) CONTRAST BETWEEN /n/ AND /p/

a. ⟦ájáḱ͡sinit⟧
áják͡sinit
[ayak–i**n**/i–Ø]–t–Ø
[both–by.blade/*v*–TI3]–2SG.IMP–CMD
'cut both of them!'

b. ⟦ajak͡sipít⟧
ayaksi**p**it
[ayak–**p**/i–Ø]–t–Ø
[both–tie.*v*–TI3]–2SG.IMP–CMD
'wrap it!', 'tie (the tipi poles) together!'

(17) CONTRAST BETWEEN /n/ AND /t/

a. ⟦ato**n**áːt⟧
ato**n**aat
[ato**n**–aa]–t–Ø
[quill–AI]–2SG.IMP–CMD
'do quillwork!'

b. ⟦ato**t**áːt⟧
ato**t**aat
[ato–**t**–aa]–t–Ø
[make.fire–*v*–AI]–2SG.IMP–CMD
'make fire!'

(18) a. ⟦ɪst͡ːsi**n**áːwḁ⟧
isttsi**n**aawa
[isttsi**n**–aa]–Ø–wa
[rations–AI]–IND–3
's/he drew rations'

b. ⟦ɪst͡ːsi**t**áːwḁ⟧
isttsi**t**aawa
[istt–i**t**/aa]–Ø–wa
[embers–by.heat/AI]–IND–3
's/he roasted (in coals)'

(19) CONTRAST BETWEEN /n/ AND /k/

a. [âːko**n**ataːwḁ]
aako**n**ataawa
aak–[o**n**a–t–aa]–t–Ø
FUT–[dig–*v*–AI]–IND–3
'she will dig'

b. [âːko**k**ataːwḁ]
aako**k**ataawa
aak–[o**k**–at–aa]–Ø–wa
FUT–[rope–*v*–3OBJ]–IND–3
's/he will be snared' (BB)

(20) a. ⟦âːko**n**aʔpsːiwḁ⟧
áako**n**a'pssiwa
aak–[o**n**–a'p/ssi]–Ø–wa
FUT–[hurry–be/AI]–IND–3
's/he will prepare herself to leave'

b. ⟦âːko**k**aʔpsːiwḁ⟧
áako**k**a'pssiwa
aak–[o**k**–a'p/ssi]–Ø–wa
FUT–[bad–be/AI]–IND–3
's/he will be mean'

(21) CONTRAST BETWEEN /n/ AND /s/

a. ⟦nit͡síːnaː**n**i̥⟧
nitsiinaa**n**i
nit–[ii\inaa**n**–i]–(hp)
1–[IC\own–AI]–(IND)
'I have money'

b. ⟦nit͡síːnaː**s**i̥⟧
nitsiinaa**s**i
nit–[ii\ona–a**s**i]–(hp)
1–[IC\dig–AI]–(IND)
'I got stuck'

The examples in (22) and (23) establish that the difference between the glides and other phonemes can also distinguish lexical items.

(22) CONTRAST BETWEEN /w/ AND /m/

a. ⟦ɪsta**w**at͡siːwáji̥⟧
issta**w**atsiiwáyi
[issta–**w**at–ii]–Ø–w=ayi
[prepare.hide–*v*–3SUB]–IND–3=OBV.SG
's/he scraped it (the hide)'

b. ⟦ɪsta**m**at͡siːwáji̥⟧
issta**m**atsiiwáyi
[issta**m**–at–ii]–Ø–w=ayi
[pole–*v*–3SUB]–IND–3=OBV.SG
's/he tethered him/her to a stake'

(23) CONTRAST BETWEEN /j/ AND /k/

a. ⟦iː**j**óʔsiwḁ⟧
ii**y**o'siwa
[[ii\o–yi]–o'si]–Ø–wa
[IC\eat–AI]–AI]–IND–3
's/he prepared a meal' (JIPA)

b. ⟦iː**k**óʔsiwḁ⟧
ii**k**o'siwa
[ii\oko's–i]–Ø–wa
[IC\child–AI]–IND–3
'she had a child' (JIPA)

(24) a. ⟦**ij**ím:it⟧
ijímmit!
[yimm–i]–t–Ø
[laugh–AI]–2SG.IMP–CMD
'laugh!'

b. ⟦i**k**ím:it⟧
i**k**ímmit!
[ikimm–:s]–Ø
[care.*v*–2SG:3.IMP]–CMD
'bestow power on him/her!'

Finally, the velar fricative /x/ has an extremely limited distribution and only occurs before obstruents, where it contrasts with /ʔ/ and /s/. (No other consonants occur pre-consonantally.) The examples below are all body parts. Example (25) shows that /ʔ/, /x/, and /s/ can occur in similar phonological contexts; all three examples occur after a back rounded vowel and are followed by [t] and another back rounded vowel.

(25) INTERVOCALIC [Ct] CLUSTERS

	Transcription	Orthography	Gloss
a.	⟦mo**x**ʷtó:kisi̥⟧	*mo**h**tóókisi*	'ear'
b.	⟦mo**ʔ**toká:ni̥⟧	*mo'tokááni*	'head/hair'
c.	⟦mʊ**s**tok͡sísi̥⟧	*mo**ss**toksísi*	'face'

A similar case is shown in (26). Here, /ʔ/, /x/, and /s/ all occur after a back rounded vowel and before a [k] followed by a high front vowel.

(26) INTERVOCALIC [Ck] CLUSTERS

	Transcription	Orthography	Gloss
a.	⟦mo**x**ʷkinánḁ⟧	*mo**h**kinána*	'calf (of the leg)'
b.	⟦mo**ʔ**kíni̥⟧	*mo'kíni*	'trunk of body/torso'
c.	⟦mʊ́**s**kit͡sipx̥pi̥⟧	*mó**ss**kitsipahpi*	'heart'

A.1.2 Contrast based on length

Length is distinctive for the plosives [p t k], the sibilants [s t͡s k͡s], and the nasals [m n]. The examples in (27)–(33) below collectively show that the short and long plosives occur in overlapping phonological environments. Some are true minimal or near minimal pairs. For instance, the words [ɛ́:pota:wḁ] 'he is getting a beating' and [ɛ́:pʊt:a:wḁ] 'he is flying' in (30) only differ in the length of the medial consonant [t] or [t:] and the quality of the preceding vowel. Lax vowels occur predictably before geminate consonants, so the only contrastive difference here is the length of of the consonant. However, minimal pairs of long and short consonants are rare in Blackfoot, and Derrick (2007) estimates that there are fewer than 300 in Frantz's entire dictionary. Therefore, other examples are not minimal or near pairs, but do establish that short and long consonants can appear in similar local contexts. For instance, the examples in (27) show that [p] and [pː] can both occur between high front vowels.

(27) CONTRAST BETWEEN SHORT /p/ AND LONG /pː/

a. ⟦ki**p**itáaːkiːwḁ⟧
kі**p**itaaakiiwa
kipita–[aakii]–wa
aged–[woman]–PRX
'old woman'

b. ⟦kɪ**pː**itáːmḁ⟧
ki**pp**itaama
k–[ippitaa]–m–wa
2–[wife]–POSS–PRX
'your wife'

(Denzer-King 2009: 7g,h)

(28) a. ⟦si**p**át͡simoji̥⟧
si**p**atsimoyi
[sipat–im/o]–yi
[sweetgrass–smells.like/II]–IN.SG
'sweetgrass'

b. ⟦iːk͡sí**pː**at͡sinimḁ⟧
iiksi**pp**atsinima
ii\ik–[ippat–in–i]–m–a
IC\DEG–[curious–by.sight.*v*–TI1]–IND–3
's/he is curious about seeing it'

(29) CONTRAST BETWEEN SHORT /t/ AND LONG /tː/

a. ⟦mo**t**okísḁ⟧
mo**t**okisa
m–[otokis]–a
BP–[hide]–PRX
'skin, hide'

b. ⟦mʊ**tː**ok͡sísḁ⟧
mo**tt**oksisa
m–[ottoksis]–wa
BP–[knee]–PRX
'knee'

(30) a. ⟦ɛ́ːpo**t**aːwḁ⟧
aipo**t**aawa
a–[ipo–t–aa]–Ø–wa
IPFV–[beat–*v*–3OBJ]–IND–3
'he is getting a beating'

b. ⟦ɛ́ːpʊ**tː**aːwḁ⟧
aipo**tt**aawa
a–[ipott–aa]–Ø–wa
IPFV–[fly–AI]–IND–3
'he is flying'

(Denzer-King 2009: 7k,l)

(31) a. ⟦otáni̥⟧
otani
w–[itan]–i
3–[daughter]–3OBV
'his/her daughter'

b. ⟦ot:oáni̥⟧
ottoani
w–[isttoan]–i
3–[knife]–3OBV
'his/her knife'

(32) CONTRAST BETWEEN SHORT /k/ AND LONG /kː/

a. ⟦máːtomɛː**k**amotaːwḁ⟧
maatomai**k**amotaawa
maat–omaa–[ikamot–aa]–Ø–wa
NEG–yet–[escape–AI]–IND–3
'she has not yet given birth'

b. ⟦ɛ́**kː**amókskaʔsiwḁ⟧
áí**kk**amokska'siwa
a–ikkam–[oksk–a'si]–Ø–wa
IPFV–fast–[number–AI]–IND–3
's/he runs fast'[2]

(33) a. ⟦kí͡tsːiʔka**k**i̥⟧
kitssi'ka**k**i
kit–[ssi'k–aki]–(hp)
2–[kick–AI]–(IND)
'you kicked'

b. ⟦kí͡tsːiʔkʌ**kː**i̥⟧
kitssi'ka**kk**i
kit–[ssi'k–at–oki]–(hp)
2–[kick–*v*–INV.21]–(IND)
'you kicked me'

(Denzer-King 2009: 7a,b)

The short and long sibilants [s], [t͡s], and [k͡s] can also occur in similar environments, as shown in (37) and (39). Note that [t͡s] and [t͡ːs] are predictable variants of /t/ and /tː/, respectively, and long [k͡ːs] always alternates with long /kː/; they are not contrastive.

(34) CONTRAST BETWEEN SHORT /s/ AND LONG /sː/

a. ⟦i**s**apiːki͡tsoxʷsaʔ͡tsisḁ⟧
i**s**apiikitsoohsa'tsisa
[isap–iikit–i–ohs/i]–a'tsis–a
[inside–finger–*v*–REFL/AI]–NMLZ–PRX
'ring'

b. ⟦ɪ**sː**apjáʔ͡tsisi̥⟧
i**ss**apia'tsisi
[issap–i]–a'tsis–i
[watch–AI]–NMLZ–IN.SG
'telescope/binoculars'

[2]Beatrice Bullshields often translates this as 's/he's a miler' or 's/he counts miles'. The root *oksk* 'number' is probably the same root in the numerals 'one' and 'three':

(i) ⟦niʔtókskaːwḁ⟧
ni'tokskaawa
ni't–[oksk–aa]–Ø–wa
one–[number–AI]–IND–3
'one (IN)'

(ii) ⟦njóːkskaːwḁ⟧
nióókskaawa
ni–[oksk–aa]–Ø–wa
three–[number–AI]–IND–3
'three (IN)'

(35) a. ⟦ákɛːsːi**s**ḁ⟧
ákaissi**s**a
akaa–[issis]–Ø–a
PRF–[fat]–IND–3
‘it is old fat’

b. ⟦nisːí**sː**ḁ⟧
nissi**ss**a
n–[ississ]–a
1–[younger.sibling]–PRX
‘my younger sibling (female spkr)’

(36) a. ⟦i**s**x̩ʷkóːs⟧
i**s**ohkóósa
[isohk–o–:s]–Ø
[test–*v*–2SG:3.IMP]–CMD
‘test him out!’

b. ⟦ní**sː**x̩ʷkowḁ⟧
ní**ss**ohkowa
n–iss–[ohko]–wa
1–in.front–[son]–PRX
‘my grandson’

(37) CONTRAST BETWEEN SHORT /t͡s/ AND LONG /t͡ːs/

a. ⟦âːkoji**t͡s**iʔtakiwḁ⟧
aakoji**t**si’takiwa
aak–[oyit–i’t–aki]–Ø–wa
FUT–[sad–by.mind.*v*–AI]–IND–3
‘she will feel sad’

b. ⟦pakójɪ**t͡ːs**iji̥⟧
pakoji**tts**iyi
[pakoyittsi]–yi
[fire]–IN.SG
‘fire’

(38) a. ⟦iˢ**t͡s**óːjit⟧
istsóóyit
ist–[ioo–yi]–t–Ø
LOC–[eat–AI]–2SG.IMP–CMD
‘eat then (at that time)!’

b. ⟦ɪˢ**t͡ːs**ôːjit⟧
isttsóoyit
[istt–oyi–Ø]–t–Ø
[sting–mouth–AI]–2SG.IMP–CMD
‘be foul mouthed!’

(39) CONTRAST BETWEEN SHORT /k͡s/ AND LONG /k͡ːs/

a. ⟦si**k͡s**ináːt͡ːsiwḁ⟧
si**k**sináttsiwa
[sik–in/attsi]–Ø–wa
[black–looks.like/II]–IND–3
‘it’s black’

b. ⟦ksɪ**k͡ːs**inát͡ːsiwḁ⟧
ksi**kks**ináttsiwa
[ksikk–in/attsi]–Ø–wa
[which–looks.like/II]–IND–3
‘it is white’

(Denzer-King 2009: 7o,p)

(40) a. ⟦miːstá**k͡s**oːmḁxki̥çkinaːwḁ⟧
miistá**ks**oomahkihkinaawa
[miistak]–i–[omahk–ihkin–aa]–wa
[mountain]–??–[big–head–AI]–PRX
'bighorn sheep'

b. ⟦awʌ́**k͡ːs**oːpanḁ⟧
awá**kks**oopana
[awakk–i]–opan–a
[chew–AI]–bullet–PRX
'bullet'

Finally, the nasal stops [m] and [n] also have short and long counterparts. Example (41) showing that short and long /m/ can occur in overlapping environments, while example (44) establishes the same for /n/.

(41) CONTRAST BETWEEN SHORT /m/ AND LONG /mː/

a. ⟦âːk͡si**m**inçkat͡siːwaji̥⟧
aaksiksi**m**inihkatsiiwayi
aak–iksim–[inihk–at–ii]–Ø–w=ayi
FUT–secret–[call–*v*–3SUB]–IND–3=OBV.SG
'she will call him by a pet name'

b. ⟦âːk͡sɪ**mː**inçkat͡siːwaji̥⟧
aaksiksi**mm**inihkatsiiwayi
aak–iksimm–[inihk–at–ii]–Ø–w=ayi
FUT–joke–[call–*v*–3SUB]–IND–3=OBV.SG
'she will refer to him jokingly'

(Denzer-King 2009: 7c,d)

(42) a. ⟦nit͡siːki**m**ópi⟧
nitsiiki**m**opii
nit–ii\ikim–[op–ii]–(hp)
1–IC\honor–[sit–AI]–(IND)
'I sat in a place of honor'

b. ⟦nit͡síkɪ**mː**okʰḁ⟧
nitsiki**mm**oka
nit–[ikimm–ok]–Ø–a
1–[power.*v*–INV]–IND–PRX
'he bestowed power on me'

(43) a. ⟦i**m**itáːwḁ⟧
i**m**itaawa
[imitaa]–wa
[dog]–PRX
'dog'

b. ⟦ɪ**mː**iwḁ⟧
i**mm**iwa
[imm–i]–Ø–a
[deep–II]–IND–PRX
'it is deep'

(44) CONTRAST BETWEEN SHORT /n/ AND LONG /nː/

a. ⟦âːk͡si**n**imḁ⟧
aaksi**n**ima
aak–[in–i]–m–wa
FUT–[by.sight.*v*–TI1]–IND–3
'he will see it'

b. ⟦âːk͡sɪ**nː**imḁ⟧
aaksi**nn**ima
aak–[inn–i]–m–wa
FUT–[by.sight.*v*–TI1]–IND–3
'he will hold it'

(Denzer-King 2009: 7e,f)

A.1.3 Assibilants and contrast

In Section 2.1.1 I argued that [k] and [k͡s] contrast before [i]. Here I consider the distribution of [k] and [k͡s] more broadly before different vowel qualities. Both can occur before all of the contrastive vowel qualities, as summarized below. (Length is unspecified in the table.)

Context:	__ [i]	__ [ɛ]	__ [a]	__ [ɔ]	__ [o]
[k]	✓	✓	✓	✓	✓
[k͡s]	✓	✓	✓	✓	✓

The assibilant [k͡s] can occur before the three phonemic short vowels *i o a* in initial, (45), and medial, (46), positions.

(45) Initial [k͡s] occurs before short vowels

a. ⟦**k͡si**kíːnis⟧ ***ksi**kí:nis* 'wake him!'

b. ⟦**k͡so**wóːt⟧ ***kso**wóót* 'quit!'

c. ⟦**k͡sa**mɔ́ːkoʔsit⟧ ***ksa**máóko'sit* 'have an illegitimate child!'

(46) Medial [k͡s] occurs before short vowels

a. ⟦i**k͡sí**pɪnːit⟧ *i**ksí**pinnit* 'lift it!'

b. ⟦miʔkapí**k͡so**jiːk͡si̥⟧ *mi'kapí**kso**yiiksi* 'red osiers, dogwoods'

c. ⟦âː**k͡sa**máxkjaːkiwḁ⟧ *áaksamááhkiaakiwa* 'he will sweep'

The assibilant [k͡s] can occur before the five phonemic long vowels *i: o: E: O: a:* in initial, (47), and medial, (48), positions. No words in Frantz and Russell (2017) begin in [k͡s] before long [ɛː], [ɔː], or [oː]. I take these to be accidental gaps, since [k͡s] can occur before these vowels in word-medial position. The only example of [k͡s] before [ɔ] occurs before a short vowel; as I discuss in Section 2.4.2, vowels are predictably short in closed syllables, so this short [ɔ] is a predictable allophone of long /ɔː/ in closed syllables.

(47) [k͡s] occurs before long vowels

a. ⟦**k͡síː**niwḁ⟧ ***ksíí**niwa* 'cowbird'

b. *[ksoː] —

c. *[ksɛː] —

d. *[ksɔː] —

e. ⟦**k͡saː**máʔps̩ːinḁ⟧ ***ksaa**má'pssina* 'cancerous tumor'

(48) [k͡s] OCCURS BEFORE LONG VOWELS

a.	⟦âːk͡si**k͡siː**nimḁ⟧	*áaksi**ksii**nima*	‘she will touch it’
b.	⟦âː**k͡soː**ks̩kɛːk͡siˢt͡sikowḁ⟧	*áa**ksoo**kskaiksistsikowa*	‘it will be three days’
c.	⟦óxʷkoto**k͡sɛː**sik͡sikimiji̥⟧	*óóhkoto**ksai**siksikimiyi*	‘coffee (lit. stone tea)’
d.	⟦içtɛ́ːpi**k͡sɔ**ʔpik͡si̥⟧	*iihtáípi**ksao**s’piksi*	‘hammers’
e.	⟦âːk͡si**k͡saː**mɛ́skiniːwḁ⟧	*áaksi**ksaa**máísskiniiwa*	‘she will be hunchbacked (id. mischievous)’

In the next section I turn to a discussion of the vowel inventory.

A.2 Vowels

A.2.1 Vowel quality

For short vowels, there is a small number of minimal pairs of lexical items that show that /i/, /a/, and /o/ contrast. The minimal pair in (49) exhibits a contrast between /i/ and /o/. The pair in (50) show that [ɪ] and [ʌ] occur in the same phonological environment. Lax [ɪ] represents the neutralization of contrast between /i/ and /iː/ in this position, while lax [ʌ] represents the neutralization of contrast between /a/ and /aː/ in this position (see Section 2.2.2).

(49) a. ⟦koʔk**í**wḁ⟧
kòo ʔk**í**wa
[ko’k**i**]–Ø–wa
[corner]–IND–3
‘it is a corner’ (Taylor 1969: 32)

b. ⟦koʔk**ó**wḁ⟧
kòo ʔk**ó**wa
[ko’k–**o**]–Ø–wa
[night–II]–IND–3
‘it is night’ (Taylor 1969: 32)

(50) a. ⟦p**ʌ**skáːni̥⟧
p**a**sskááni
[[p**a**ssk–aa]–n]–i
[[dance–AI]–NMLZ]–IN.SG
‘(festival) dance’

b. ⟦p**ɪ**skáːni̥⟧
p**i**sskááni[4]
[[p**i**ssk–aa]–n]–i
[[fence–AI]–NMLZ]–IN.SG
‘buffalo jump’

Outside the domain of lexical items, contrasts can be easily found in the demonstrative system. The examples below demonstrate a contrast between /a/ and /i/ (51a), between /a/ and /o/ (51b), and

[4]For some speakers the final vowel of this word is short, ⟦pɪskʌ́n⟧ ‘buffalo jump’. Both words can be said with stress on the first syllable, e.g. ⟦pʌ́skaːn⟧ ‘dance’ and ⟦pískaːn⟧ ‘buffalo jump’.

between /a/, /i/, and /o/ (51c). The fricatives which follow the vowels in (51c) are predictable variants of /x/ after each of those respective vowels, which I discuss in Section 2.4.2.1.1.

(51)	a.	⟦am**á**⟧	*am-**á***	'this/that (AN)'
		⟦am**í**⟧	*am-**í***	'this/that (IN)'
	b.	⟦ʌn**:á**m⟧	*ann-**á**-ma*	'that (PRX), deceased'
		⟦ʌn**:ó**m⟧	*ann-**ó**-ma*	'here'
	c.	⟦ʌn**:á**xk⟧	*ann-**á**-hka*	'him/her (INVS)'
		⟦ʌn**:í**çk⟧	*ann-**í**-hka*	'it (INVS)'
		⟦ʌn**:ó**xʷk⟧	*ann-**ó**-hka*	'today'

A.2.2 Vowel quantity

Vowel length is also distinctive in open syllables. In Section 2.4.1 I give some minimal pairs for vowel length. Here I show that vowel length is distinctive before all possible onsets. These examples are arranged in pairs based on consonant place and manner. For each pair, the example on the left shows that a short vowel can occur before that particular onset consonant, and the example on the right shows that a long vowel can occur in the same environment. I have chosen examples where the short and long vowels have the same vowel quality. Some of the examples are minimal pairs, which shows that vowel length is contrastive before simple onsets; if no minimal pair could be found, then I show pairs with similar local phonological contexts on either side of the vowels in order to show that vowel length is not conditioned by neighboring segments.

An onset [p] can be preceded by a short or long vowel.

(52) a. ⟦sin**a**pí:ˢt͡sinit⟧
sin**a**píístsinit
sin**a**p–[yiist–in/i–Ø]–t–Ø
aslant–[cut–by.blade/*v*–TI3]–2SG.IMP–CMD
'cut it on a slant!'

b. ⟦pin**á:**poxʷt͡si̥⟧
pin**áá**poohtsi
[pin**aa**p–ooht]–i
[east–WARD]–IN.SG
'east'

An onset [t] can be preceded by a short or long vowel. The prefixes in these two examples are distinguished solely by the length of the vowel [o] before [t]: [sotam-] 'really' and [so:tam-] 'despite'.

(53) a. ⟦s**o**támáwaːsejʔniwḁ⟧
sotámáwaasai'niwa
s**o**tam–a–[aasai'n–i]–Ø–wa
really–IPFV–[cry–AI]–IND–3
'she's really crying'

b. ⟦s**óː**tamanɪˢtaːwḁ⟧
s**óó**tamanistaawa
s**oo**tam–[an–ist–aa]–Ø–wa
despite–[tell–*v*–3OBJ]–IND–3
'I told her in spite of all else'

An onset [k] can be preceded by a short or long vowel. In this case, the two words form a minimal pair, distinguished only by the length of the vowel [o] before [k].

(54) a. ⟦âːk**o**kaːwḁ
aak**o**kaawa
aak–[**o**k–aa]–Ø–wa
FUT–[rope–AI]–IND–3
'he will rope'

b. ⟦âːk**oː**kaːwḁ⟧
aak**oo**kaawa
aak–[**oo**k–aa]–Ø–wa
FUT–[Sundance–AI]–IND–3
'she'll sponsor a Sundance'
(=83)

An onset [s] can be preceded by a short or long vowel.

(55) a. ⟦s**i**sáːpɪtːakit⟧
s**i**sáápittakit
[s**i**so–ap–itt–aki]–t–Ø
[cut–SHEET–by.blade.*v*–AI]–2SG.IMP–CMD
'shred (the hide) into strips!'

b. ⟦ɪskit͡s**íː**saːkit⟧
isskits**íí**saakit
[isskits**ii**si–aki]–t–Ø
[bend.over.*v*–AI]–2SG.IMP–CMD
'bend over!'

An onset [t͡s] can be preceded by a short or long vowel. As I show later, the vowel length distinction is neutralized to short before coda consonants, so this is evidence that the assibilant [t͡s] is an onset and not a coda-onset cluster.

(56) a. ⟦oxʷtɛ́skap**a**t͡sɪs⟧
ohtáísskap**a**tsisa
[[oht–a–isskap/i]–**a**t–:s]–Ø
[[MEANS–IPFV–drag/AI]–*v*–2SG:3.IMP]–CMD
'drag her along!'

b. ⟦póp**aː**t͡sɪs⟧
póp**aa**tsisa
[[ohp–op–**ii**]–**a**t–:s]–Ø
[[COM–sit–AI]–*v*–2SG:3.IMP]–CMD
'hold him on your lap!'

An onset [k͡s] can be preceded by a short or long vowel. Note that this is evidence that the assibilant [k͡s] is an onset and not a coda-onset cluster.

(57) a. ⟦kitâːka$\widehat{\text{ks}}$ina$\widehat{\text{w}}$ʔpɪnːaːn⟧
kitáak**a**ksinao'pinnaan
kit–aak–[**a**ksina']–o'p–innaan
2–FUT–[surround.AI]–21.IND–1PL
'we will surround you'

b. ⟦âːk**âː**$\widehat{\text{ks}}$ina$\widehat{\text{w}}$ʔsiwḁ⟧
áak**áa**ksinao'siwa
aak–[**aa**k–ina/o'si]–Ø–wa
FUT–[arrange–dress/AI]–IND–3
'she will wear regalia'

An onset [m] can be preceded by a short or long vowel. These two words form a minimal pair, distinguished only by the length of the vowel [a] before [m] in the two morphemes [ajam-] 'aggrieved' and [ajaːm-] 'misdirected'.

(58) a. ⟦áj**a**moːwḁ⟧
áy**a**moowa
[ayam–oo]–Ø–wa
[aggrieved–go.AI]–IND–3
'he left with hurt feelings'

b. ⟦áj**aː**moːwḁ⟧
áy**aa**moowa
[ayaam–oo]–Ø–wa
[misdirected–go.AI]–IND–3
'he went in a different direction'
(=81)

An onset [n] can be preceded by a short or long vowel. The two words form a minimal pair distinguished only by the length of the vowel [i] before [m].

(59) a. ⟦ôː$\widehat{\text{ts}}$iˢ$\widehat{\text{ts}}$**í**ni̥⟧
ootsists**í**ni
w–[ootsists**i**n]–i
3–[palate]–OBV
'palate, his/her palate'

b. ⟦ôː$\widehat{\text{ts}}$iˢ$\widehat{\text{ts}}$**íː**ni̥⟧
ootsists**íí**ni
[ootsist–**ii**n]–i
[strawberry–berry]–IN.SG
'strawberry'
(=80)

An onset [w] can be preceded by a short or long vowel.

(60) a. ⟦nítsːp**i**wôː⟧
níssp**i**wóo
nit–[ssp**i**–woo]–(hp)
1–[water–go.AI]–(IND)
'I went into the river'

b. ⟦iː$\widehat{\text{ks}}$íp**iː**woːwḁ⟧
iiksíp**ii**woowa
iik–[ip**ii**–woo]–Ø–wa
DEG–[far–go.AI]–IND–3
'she travelled far'

An onset [j] can be preceded by a short or long vowel.

(61) a. ⟦aːt**o**jínːajit⟧
aat**o**yínnayit
[aat**o**w–inna/yi]–t–Ø
[holy–praise/AI]–2SG.IMP–CMD
'sing and pray for good fortune (e.g. food)!'

b. ⟦aːt͡si^{s}t**óː**jɪnːit⟧
aatsi^{s}t**óó**yinnit
[aatsist**oo**–yinn–i]–t–Ø
[diagonal–by.hand.*v*–TI1]–2SG.IMP–CMD
'hold it diagonally across your body'

A.2.3 Non-derived lax mid vowels

In Section 2.2.1 I showed that lax mid vowels contrast with other long vowels in Blackfoot. Here I provide further examples of non-derived lax mid vowels; that is, vowels which do not arise due to internal sandhi. Examples (62)–(66) show that non-derived /ɛː/ can occur in open syllables. Some of the pronunciations below are one of several dialectal variants, which I have marked with the % judgement mark.

(62) % ⟦s**ɛː**tamit⟧
s**ai**tamit
[s**ai**t–am/i]–t–Ø
[breathe–be/AI]–2SG.IMP–CMD
'breathe!' (Piikáni dialect)

(63) % [sɛʔ**ɛ́ː**]
sai'**áí**[6]
[sai'**ai**]–(wa)
[duck]–(PRX)
'duck' (BB)

(64) % [m**ɛː****ɛ́ː**]
mai**áí**[7]
[m–ai**ai**]–(wa)
[BP–robe]–(PRX)
'robe' (BB)

[6] Frantz and Russell (2017) gives only *sa'áí*. BB, a Káínai speaker, always used [sɛʔɛ́ː].

[7] Frantz and Russell (2017) lists *maiáí* as a dialectal variant of *maaáí* but does not specify the dialect. The Káínai speakers I have worked with, including BB, always used [mɛːɛ́ː]. The dependent noun in 'robe' might also be the noun final in 'brown weasel' and 'white weasel', which are sometimes translated as 'weasel in his summer/winter coat'.

(65) % [otɛ́ː]
otáíáí[8]
[ot–**aiai**]–(wa)
[brown–weasel]–(PRX)
'brown weasel (in summer)' (BB)

(66) % [áːpɛː]
áápaiai[9]
[aap–**aiai**]–(wa)
[white–weasel]–(PRX)
'white weasel (in winter)' (BB)

Similarly, examples (67)–(72) show that non-derived /ɔː/ can occur in open syllables.

(67) ⟦sɔːkç͡tsíːt⟧
s**ao**kihtsíít
[s**ao**k–iht/ii]–t–Ø
[flat–place/AI]–2SG.IMP–CMD
'lie down!'

(68) ⟦sɔːks̩ːpḁ⟧
s**ao**ksspa[10]
[s**ao**kssp]–a
[spine]–PRX
'spine'

(69) ⟦mɔ́ːtoʔkiːk͡si̥⟧
m**áó**to'kiiksi
[m**ao**to'ki]–iksi
[Buffalo.Women]–AN.PL
'members of the Buffalo Women's Society'

(70) ⟦mɔ́ːkajisi̥⟧
m**áó**kayisi
m–[**ao**kayis]–i
BP–[chest]–IN.SG
'chest, breast'

[8]Frantz and Russell (2017) lists *otáíáí* (given in (65)) as a dialectal variant of *otáá*, but does not specify the dialect. The Káínai speakers I have worked with use [otáː].
[9]Frantz and Russell (2017) lists *áápaa* as a dialectal variant of *áápaiai* (given in (66)), but does not specify the dialect. The Káínai speakers I have worked with use [áːpaː].
[10]This noun might contain *saok*- 'flat, stretched out'.

(71) ⟦ɔːníːt⟧
aoníí-t
[**ao**–n/i–i]–t–Ø
[hole–by.needle/*v*–TI1]–2SG.IMP–CMD
'pierce it!'

(72) [stáʔɔː]
stá'**ao**
[sta'**ao**]–(wa)
[ghost]–(PRX)
'ghost/spirit' (BB)

There are also non-derived instances of short [ɛ] and [ɔ] in closed syllables. As I discuss in Section 2.4.2, vowels are predictably short before coda consonants, so the short [ɛ] and [ɔ] in these cases can be taken as predictable variants of long [ɛː] and [ɔː] and are therefore not distinctive. Examples (73) and (74) contain non-derived [ɛ] before a /xC/ and /ʔC/ cluster, respectively.

(73) ⟦óːp**ɛ**çpi̥⟧
óóp**ai**hpi
[oop**ai**hp]–i
[waist]–IN.SG
'waist'

(74) ⟦m**ɛ**ʔstóːwḁ⟧
m**ai**'stóówa
[m**ai**'stoo]–wa
[crow]–PRX
'crow'

The following examples contain non-derived [ɔ] before a /xC/ cluster, (75)–(76), a /ʔC/ cluster, (77), and before a geminate, (78)–(79).

(75) ⟦m**ɔ́**xʷk͡sinʌt͡ːsiwḁ⟧
m**áó**hksinattsiwa
[m**ao**hk–in/attsi]–Ø–wa
[red–by.sight/II]–IND–3
'it is red'

(76) ⟦ɔxʷkíːji̥⟧
aohkííyi
[**ao**hkii]–yi
[water]–IN.SG
‘water’

(77) ⟦anɔ́ʔkoxʷt͡si̥⟧
an**áó**’koohtsi
[an**ao**’k–ooht]–i
[half–WARD]–IN.SG
‘half of s.t.’

(78) ⟦sɔpːisoʔtoːs⟧
s**ao**ppiso’toos
[s**ao**ppis–o’t/o–:s]–Ø
[squash–by.hand/*v*–2SG:3.IMP]–CMD
‘squash him!’

(79) ⟦sɔ́pːɪskit⟧
s**ao**ppisskit
[s**ao**ppis–hk/Ø–i]–t–Ø
[squash–by.body/*v*–TI1]–2SG.IMP–CMD
‘crush it!’

Appendix B

X-adjoined root alternations: supplemental evidence

B.1 Roots beginning with [i_1]

One further example of a head-adjoined root which begins with [i_1] is *-in* ‘by sight’, which does cause assibilation of a preceding [k]. When this root appears directly after consonants, the underlying vowel surfaces faithfully.

(80) ⟦âːk͡sipouninʌmːḁ⟧
áaksipon**in**amma
aak–[ipon–**in/**a]–mm–a
FUT–[terminate–**by.sight/**AI]–IND–3
‘she will quickly drop from sight’

cf. ⟦âːk͡siponótaʔsiwḁ⟧
áaksiponóta’siwa
aak–[ipon–ota’s–i]–Ø–wa
FUT–[terminate–horse–AI]–IND–3
‘he will have one of his horses die’

(81) ⟦iːkí͡tsijinʌmːḁ⟧
iikítsiy**in**amma
ii\ik–[itsiw–**in/**a]–mm–a
IC\DEG–[fine–**by.sight/**AI]–IND–3
‘it looks of high quality’

cf. ⟦iːkí͡tsowaʔpṣ̩ːiwḁ⟧
iikítsowa’pssiwa
ii\ik–[itsiw–a’p/ssi]–Ø–wa
IC\DEG–[fine–be/AI]–IND–3
‘he is handsome’

After vowels, there is coalescence.

(82) ⟦âːk͡sipapɛːnojiːwáji̥⟧
áaksipapa**in**oyiiwáyi
aak–[ipapa–**in**/o–yii]–Ø–w=ayi
FUT–[dream–**by.sight**/*v*–3SUB]–IND–3=OBV.SG
'she will see him in a dream'

cf. ⟦âːk͡sipɔʔkaːwḁ⟧
áaksipapao'kaawa
aak–[ipapa–o'k/aa]–Ø–wa
FUT–[dream–sleep/AI]–IND–3
'she will see him in a dream'

(83) ⟦âːk͡siˢt͡ːsikx̩ʷpoinʌ́t͡ːsiwḁ⟧
áaksisttsikohpo**in**áttsiwa
aak–isttsik–[ohpo–**in**/attsi]–Ø–wa
FUT–smooth–[grease–**look.like**/II]–IND–3
'it will have a grimy appearance'

cf. ⟦síkx̩ʷpojíːji̥⟧
síkohpoyííyi
[sik–[ohpo–yii]–Ø]–yi
[black–[grease–II]–IND]–IN.SG
'motor oil'

A preceding [k] always assibilates before *-in* 'by sight'.[1]

(84) a. * ⟦ɪs**k**inójiːwḁ⟧
iss**k**inóyiiwa
[issk–in/o–yii]–Ø–wa
[return–by.sight/*v*–3SUB]–IND–3
'she knows him'

b. ⟦ɪs**k͡s**inójiːwḁ⟧
iss**ks**inóyiiwa
[issk–in/o–yii]–Ø–wa
[return–by.sight/*v*–3SUB]–IND–3
'she knows him'

B.2 Roots beginning with [i_2]

One further example of a head-adjoined root which begins with [i_2] is *-inn* 'by hand' , which does not cause assibilation of a preceding [k]. When this root appears directly after consonants, the underlying vowel surfaces faithfully. (Note that there is no contrast between [w] and [j] at the right edge of roots. In (86), the root-final /w/ in /kaaw-/ surfaces as [j] before a high front vowel.)

[1] The root in (84) is probably *ssk-* 'return, back'. It has the more concrete meaning 'return' when used as a prefix to a full verb stem. It can also be used in other memory-related activities, (1), as well as to refer to the past in (2).

(i) ⟦ɪsk͡sikajaːwḁ⟧
issksikayaawa
[issk–ikay/aa]–Ø–wa
[return–??/AI]–IND–3
'he recited (s.t.) from memory'

(ii) ⟦ɪskóxʷt͡si̥⟧
isskóóhtsi
[issk–ooht]–i
[return–WARD]–IN.SG
'past time, before, long ago'

(85) ⟦ɪspínːit⟧
issp**inn**it
[issp–**inn**–i]–t–Ø
[high–**by.hand**.*v*–TI1]–2SG.IMP–CMD
‘lift it!’

cf. ⟦ɪspáxkit⟧
isspááhkit
[issp–aahk/i–Ø]–t–Ø
[high–by.tool/*v*–TI3]–2SG.IMP–CMD
‘pry it up!’

(86) ⟦kaːjínːit⟧
kaay**ínn**it
[kaaw–**inn**–i]–t–Ø
[open–**by.hand**.*v*–TI1]–2SG.IMP–CMD
‘hold it open (e.g. a door)!’

cf. ⟦kaːwéjʔpik͡sit⟧
kaawáí’piksit
[kaaw–ai’pik/i–Ø]–t–Ø
[open–haul/*v*–TI3]–2SG.IMP–CMD
‘open it!’

And after a vowel there is coalescence.

(87) ⟦ɪˢtːɛ́nːis⟧
isttá**ínn**is
[istta–**inn**]–ːs–Ø
[under–**by.hand**.*v*]–2SG:3.IMP–Ø
‘stab it!’

cf. ⟦ɪˢtːx̩kápit⟧
isttahkápit
[istta–hkap/i]–t–Ø
[under–crawl/AI]–2SG.IMP–CMD
‘crawl under (s.t.)!’

A preceding [k] never assibilates before *-inn* ‘by hand’.

(88) a. ⟦siʔ**k**ínːit⟧
si’**k**ínnit
[si’k–inn–i]–t–Ø
[cover–by.hand.*v*–TI1]–2SG.IMP–CMD
‘cover it!’

b. * ⟦siʔ**k͡s**ínːit⟧
si’**ks**ínnit
[si’k–inn–i]–t–Ø
[cover–by.hand.*v*–TI1]–2SG.IMP–CMD
‘cover it!’

Appendix C

Neutralization in the independent clause type

As I explained in Section 3.2.1 and Section 4.2.2, XP-adjoined roots can have two different realizations, conditioned by whether they stand at the left edge of a PPh or not. In this appendix I describe an orthogonal type of alternation, which is syntactically conditioned by clause type and aspect. Roots which stand at the left edge of a perfective indicative clause exhibit massive neutralization compared to their realizations at the left edge of an imperative clause.

In this appendix I describe some of the patterns of neutralization. This type of neutralization is not conditioned by prosody, since both realizations occur at the left edge of a PPh. In this thesis I focus on prosodically-conditioned root alternations, and a full analysis of the neutralization at the left edge of the PPh is beyond the scope of this thesis. However, note that there is a lot of speaker variation and more documentation work is needed. Also, I based this off of forms in Frantz and Russell (2017), but different patterns can be seen in earlier descriptions of the Montana Blackfeet dialect (Taylor 1967, 1969; Uhlenbeck 1938).

C.1 Roots beginning with long vowels

The imperative form for roots which begin with a long vowel is given on the left; the comparable indicative form is given on the right. (H = 'high pitch', e.g. stress.)

(89) a. IMPERATIVE

⟦**iː**.ts̩ː.káː.t⟧
iitsskáát
[iitssk–aa]–t–Ø
[scuffle–AI]–2SG.IMP–CMD

‘fight!’

b. INDICATIVE

⟦**íː**.ts̩ː.káː.wḁ⟧
íítsskááwa
[ii\iitssk–aa]–Ø–wa
[IC\scuffle–AI]–IND–3

‘he fought’

(90) a. ⟦**ôː**.ká.ta.ki.t⟧
óokátakit
[ook–at–aki]–t–Ø
[bead–*v*–AI]–2SG.IMP–CMD

‘bead!’

b. ⟦**iː**.ká.ta.ki.wḁ⟧
iikátakiwa
[ii\ook–at–aki]–Ø–wa
[IC\bead–*v*–AI]–IND–3

‘she beaded’

(91) a. ⟦**aː**.kx̩ʷ.kí.maː.t⟧
aakohkímaat
[[aak–ohk/i]–m–aa]–t–Ø
[[argue–vocalize/AI]–*v*–AI]–2SG.IMP–CMD

‘argue!’

b. ⟦**áː**.kx̩ʷ.kí.maː.wḁ⟧
áákohkímaawa
[[H\aak–ohk/i]–m–aa]–Ø–wa
[[IC\argue–vocalize/AI]–*v*–AI]–IND–3

‘he argued’

(92) a. ⟦**ɛː**.ˢtá.aː.t⟧
aistáaatsisa
[[aist–oo]–at–:s]–Ø
[[towards–go.AI]–*v*–2SG:3.IMP]–CMD

‘come and visit her!’

b. ⟦**ɛ́ː**.ˢtá.aː.t͡siː.wá.ji̥⟧
áístáaatsiiwáyi
[[H\aist–oo]–at–ii]–Ø–w=ayi
[[towards–go.AI]–*v*–3SUB]–IND–3=OBV.SG

‘he came to see her’

(93) a. ⟦**ɔː**.níː.t⟧
aoníít
[ao–n/i–i]–t–Ø
[hold–by.needle/*v*–TI1]–2SG.IMP–CMD

‘pierce it!’

b. ⟦**ɔ́ː**.ni.mḁ⟧
áónima
[H\ao–n/i–i]–t–Ø
[IC\hold–by.needle/*v*–TI1]–2SG.IMP–CMD

‘he pierced it’

These patterns are summarized in Table C.1, where I have listed the initial vowel at the left edge edge of the PPh in the imperative and the indicative, as well as the PPh-medial form. If the vowel is [+high] in the imperative, then the initial vowels neutralize to a long [iː] at the left edge of the indicative. If the vowel is [-high], then there is a stem-internal change, which is that stress (expressed via high pitch) falls on that initial vowel in the indicative forms.

C.2 Roots beginning with short vowels

The imperative form for roots which begin with a short vowel is given on the left; the comparable indicative form is given on the right.

Table C.1: Initial vowel mutation for stems with initial long vowels

PPh-initial		PPh-medial
IMP	IND	
iː	iː	iː
oː	iː	oː
aː	áː	waː
ɛː	ɛ́ː	wɛː
ɔː	ɔ́ː	wɔː

(94) a. IMPERATIVE
⟦**i**.t͡sí.nx̩ʷ.toː.t⟧
itsínohtoot
[itsin–oht–oo]–t–Ø
[among–put.*v*–TI2]–2SG.IMP–CMD
'place it among the rest!'

b. INDICATIVE
⟦**iː**.t͡sí.nx̩ʷ.toː.mḁ⟧
iitsínohtooma
[ii\itsin–oht–oo]–m–Ø–w=ayi
[IC\among–put.*v*–TI2]–3→0–3=OBV.SG
'he placed it among the rest'

(95) a. ⟦**o**káːt⟧
okáát
[ok–aa]–t–Ø
[snare–AI]–2SG.IMP–CMD
'rope!'

b. ⟦**iː**káː.wḁ⟧
iikááwa
[ii\ok–aa]–Ø–wa
[IC\snare–AI]–IND–3
'she roped/snared'

(96) a. ⟦**a**t͡siníkit⟧
atsinikit
[atsinik–i]–t–Ø
[relate.story–AI]–2SG.IMP–CMD
'relate a story'

b. ⟦**iː**t͡siníki⟧
iitsiníki
[ii\itsinik–i]–Ø–wa
[IC\relate.story–AI]–2SG.IMP–CMD
's/he is relating a story'

(97) a. ⟦**a**ks̩tákit⟧
akstákit
[ak–st–aki]–t–Ø
[count–*v*–AI]–2SG.IMP–CMD
'read!'

b. ⟦**iː**ks̩táki⟧
iikstáki
[ii\ok–st–aki]–Ø–wa
[IC\count–*v*–AI]–IND–3
's/he is reading/counting'

These patterns are summarized in Table C.2, where I have listed the initial vowel at the left edge edge of the PPh in the imperative and the indicative, as well as the PPh-medial form. Although roots begin in the imperative with [i], [o], or [a], there is a neutralization of contrast at the left edge of the indicative, where all roots begin with a long [iː].

Table C.2: Initial vowel mutation for stems with initial short vowels

PPh-initial		PPh-medial
IMP	IND	
i	iː	i
o	iː	o
a	iː	i
a	iː	o

C.3 Roots beginning with /j/

The imperative form for roots which begin with a glide is given on the left; the comparable indicative form is given on the right.

(98) a. IMPERATIVE

⟦iː.pí.ˢto.t͡si.t⟧
iipístotsit
[**y**iip–istot/Ø–i]–t–Ø
[decrease–CAUS/*v*–TI1]–2SG.IMP–CMD
'decrease the volume of it (e.g. of your load of ironing)!'

b. INDICATIVE

⟦iː.pí.ˢto.t͡si.mḁ⟧
iipístotsima
[Ø**y**iip–istot/Ø–i]–m–a
[IC\\decrease–CAUS/*v*–TI1]–IND–3
'he decreased it'

(99) a. ⟦iː.ˢt͡si.pʊ́m.ma.toː.t⟧
iistsipómmatoot
yiist–[ipomm–at–oo]–t–Ø
on.back–[transfer–*v*–TI2]–2SG.IMP–CMD
'unload it from your back!'

b. ⟦iː.ˢt͡si.pʊ́m.ma.toː.mḁ⟧
iistsipómmatooma
Ø**y**iist–[ipomm–at–oo]–m–a
IC\\on.back–[transfer–*v*–TI2]–IND–3
'he unloaded it'

(100) a. ⟦iː.ˢtó.ms̩ː.koxʷ.si.t⟧
iistómsskoohsit
[**y**iistom–ssk/o–ohs/i]–t–Ø
[body–by.body/*v*–REFL/AI]–2SG.IMP–CMD
'exercise!'

b. ⟦iː.ˢtó.ms̩ː.koxʷ.si.wḁ⟧
iistómsskoohsiwa
[Ø**y**iistom–ssk/o–ohs/i]–Ø–wa
[IC\\body–by.body/*v*–REFL/AI]–IND–3
'he exercised'

(101) a. ⟦iː.t͡si.max.kaː.t⟧
iitsimaahkaat
[[**y**iit–im–aa]–hk/aa]–t–Ø
[[storage–*v*–AI]]–GET/AI]–2SG.IMP–CMD
'store food for the winter!'

b. ⟦iː.**j**iː.t͡si.max.kaː.wḁ⟧
iiyíítsimaahkaawa
[[ii**y**iit–im–aa]–hk/aa]–Ø–wa
[[IC\storage–*v*–AI]–GET/AI]–IND–3
'he stored food for the winter'

(102) a. ⟦ôː.mi.t⟧
óomit
[**y**oom–i]–t–Ø
[husband–AI]–2SG.IMP–CMD
'marry!'

b. ⟦á.kaː.**j**ôː.mi.wḁ⟧
iyóomiwa
[i**y**oom–i]–Ø–wa
[IC\husband–AI]–IND–3
'she married'

(103) a. ⟦aː.mo.jîːʔ.po.ji.t⟧
aamoyíi'poyit
[**y**aam–oyi–i'po/yi]–t–Ø
[twisted–mouth–speak/AI]–2SG.IMP–CMD
'joke/jest from a twisted mouth!'

b. ⟦i.**j**áː.mo.jîːʔ.po.ji.wḁ⟧
iyáámoyíi'poyiwa
[i**y**aam–oyi–i'po/yi]–Ø–wa
[IC\twisted–mouth–speak/AI]–IND–3
'he joked'

(104) a. ⟦aː.tóː.t⟧
aatóót
[**y**aat–oo]–t–Ø
[growl–AI]–2SG.IMP–CMD
'howl (as a dog)!'

b. ⟦i.**j**áː.toː.wḁ⟧
iyáátoowa
[i**y**aat–oo]–Ø–wa
[IC\growl–AI]–IND–3
'he howled'

These patterns are summarized in Table C.3, where I have listed the initial vowel at the left edge edge of the PPh in the imperative and the indicative, as well as the PPh-medial form. If a root begins with underlying /jiː/, then it either is identical in the indicative and the imperative (beginning in [iː]) or there is an [iː] accretion in the indicative. If a root begins with underlying /joː/ or /jaː/ then there is an [i] accretion in the indicative.

Table C.3: Initial vowel mutation for stems with initial /j/

PPh-initial		PPh-medial
IMP	IND	
iː	iː	jiː
iː	iːjiː	jiː
oː	ijoː	joː
aː	ijaː	jaː

C.4 Roots beginning with {m, n} ∼ [j] alternations

The imperative form for roots which begin with a nasal in PPh-initial position and a glide in PPh-medial position is given on the left; the comparable indicative form is given on the right.

(105) a. IMPERATIVE

⟦**m**âː.kx̩^{w}.toː.t⟧
máakohtoot
[**m**aak–oht–oo]–t–Ø
[arrange–put.*v*–TI2]–2SG.IMP–CMD

'arrange it (e.g. the contents of a letter)!'

b. INDICATIVE

⟦i.**j**âː.kx̩^{w}.toː.mḁ⟧
iyáakohtooma
[i**y**aak–oht–oo]–m–a
[IC\arrange–put.*v*–TI2]–IND–3

'he arranged it'

(106) a. ⟦**m**íː.^{s}ta.poː.t⟧
míístapoot
[**m**iistap–oo]–t–Ø
[away–go.AI]–2SG.IMP–CMD

'go away!'

b. ⟦iː.**j**íː.^{s}ta.poː.wḁ⟧
iiyíístapoowa
[ii**j**iistap–oo]–t–Ø
[IC\away–go.AI]–2SG.IMP–CMD

'he went away'

(107) ⟦**n**aː.mi.tá.piː.wḁ⟧
náámitapiiwa
[**n**aam–itap/ii]–Ø–wa
[alone–person/AI]–IND–3

'he is on his own'

(108) ⟦**n**iː.pó.wḁ⟧
niipówa
[**n**iip–o]–Ø–wa
[leaf–II]–IND–3

'it was summer'

These patterns are summarized in Table C.4, where I have listed the initial vowel at the left edge edge of the PPh in the imperative and the indicative, as well as the PPh-medial form. For roots that begin with [m] in the imperative, the indicative is formed via an accretion [i] or [iː] at the left edge of the PPh-medial allomorph, which begins in a glide. For roots that begin with [n] in the imperative, Frantz and Russell (2017) did not include clear entries of stems with examples of the root in all three contexts.

Table C.4: Initial vowel mutation for stems with initial {m, n} ∼ /j/

PPh-initial		PPh-medial
IMP	IND	
maː	ijaː	jaː
miː	iːjiː	jiː
??	naː	jaː
??	niː	jiː

C.5 Roots beginning with [ij] ∼ [j] alternations

The imperative form for roots which begin with [ij] in PPh-initial position and a glide in PPh-medial position is given on the left; the comparable indicative form is given on the right.

(109) a. IMPERATIVE

⟦i**j**âːpit⟧
i**y**áapit
[i**y**aap–i]–t–Ø
[see–AI]–2SG.IMP–CMD

'see!'

b. INDICATIVE

⟦i**j**âːpiwḁ⟧
i**y**áapiwa
[i**y**aap–i]–Ø–wa
[IC\\see–AI]–IND–3

'she visualized (s.t.)'

(110) a. ⟦i**j**íːˢt͡sinit⟧
i**y**íístsinit
[i**y**iist–in/i–Ø]–t–Ø
[cut–by.blade/*v*–TI3]–2SG.IMP–CMD

'cut it!'

b. ⟦iː**j**íːˢt͡sinimḁ⟧
iiyíístsinima[2]
[ii**y**iist–in/i–Ø]–m–a
[IC\\cut–by.blade/*v*–TI3]–IND–3

'he cut them

[2] Frantz and Russell (2017) lists an alternate form of this verb as well:

(i) ⟦a**j**íːˢt͡sinimḁ⟧
ayíístsinima[4]
[a**y**iist–in/i–Ø]–m–a
[IC\\cut–by.blade/*v*–TI3]–IND–3

'he cut them

(111) a. ⟦**ij**í͡tsɪ͡tːsimaːt⟧
iyítsittsimaat
[[**y**iit–itt–i]–m–aa]–t–Ø
[[storage–by.blade.*v*–TI1]–*v*–AI]–2SG.IMP–CMD
'cut meat!' (to dry for storage)

b. ⟦**ij**íː͡tsɪ͡tːsimaːwḁ⟧
iyíítsittsimaawa
[[i**y**iit–itt–i]–m–aa]–Ø–wa
[IC\\storage–by.blade.*v*–TI1]–*v*–AI]–IND–3
'he sliced meat'

These patterns are summarized in Table C.5, where I have listed the initial vowel at the left edge edge of the PPh in the imperative and the indicative, as well as the PPh-medial form.

Table C.5: Initial vowel mutation for stems with initial [ij] ∼ /j/

PPh-initial		PPh-medial
IMP	IND	
ijaː	ijaː	jaː
ijiː	iːjiː	jiː
iji	ijiː	jiː

C.6 Roots beginning with obstruents

The imperative form for the roots which begin with [p] in PPh-initial position is given on the left; the comparable indicative form is given on the right.

(112) a. IMPERATIVE
⟦pʊmːáːt⟧
pommáát
[pomm–aa]–t–Ø
[√BUY–AI]–2SG.IMP–CMD
'buy!'

b. INDICATIVE
⟦içpʊ́mːaːwḁ⟧
iihpómmaawa
[**ii\\oh**pomm–aa]–Ø–wa
[**IC**\\√BUY–AI]–IND–3
'she bought'

(113) a. ⟦pʊmːóːs⟧
pommóós
[pomm–o–:s]–Ø
[√TRANSFER–*v*–2SG:3.IMP]–CMD
'transfer (e.g. the medicine bundle) to him!'

b. ⟦iːpʊ́mːojiːwájḭ⟧
iipómmoyiiwáyi
[**ii\\i**pomm–o–yii]–Ø–w=ayi
[**IC**\\√TRANSFER–*v*–3SUB]–IND–3=OBV.SG
'she transferred it to him!'

These patterns are summarized in Table C.6, where I have listed the initial vowel at the left edge edge of the PPh in the imperative and the indicative, as well as the PPh-medial form. The indicative is formed via ablaut of the initial vowel of the PPh-medial allomorph to [ii].

Table C.6: Initial vowel mutation for stems with initial obstruents

PPh-initial		PPh-medial
IMP	IND	
p	içp	$ox^{w}p$
p	iːp	ip

C.7 Summary

There are multiple different types mutation near the left edge of the PPh in the indicative clause type, including stress shifts to the initial syllable, vowel ablaut, and prothesis of [i] or [iː] or [ox]. These mutations are not prosodically conditioned, but are conditioned by clause type. They are likely a reflex of Algonquian "initial change" (Brittain and Dyck 2006; Costa 1996; Déchaine and Wiltschko 2010). Finally, in many cases the mutations are ambiguous as to whether they occur on the PPh-initial form of the root or the PPh-medial form. There are a few examples which clearly show that mutations occur on the PPh-medial form, such as (105b), (106b), and (112b). Perhaps initial change in Blackfoot can be analyzed as an abstract prefix, as in Brittain and Dyck (2006). If so, this would explain why it only occurs on PPh-medial forms of the root—the root technically follows the abstract prefix.