Proto-Algonquian phonotactics*

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Manuscript, 2016

Abstract

This paper sketches the synchronic phonotactics of Proto-Algonquian (PA). Although the PA phonotactic system is more intricate than that of most modern Algonquian languages, I show that it is typologically natural and can be described in terms of well-established phonological categories and constraints. The PA syllable template is (C)(G)V(·)(C). The content of onsets is mostly unrestricted, but the content and distribution of codas is tightly constrained, with only a limited number of coda-onset sequences (i.e. consonant clusters) permitted. The restrictions on clusters are shown to follow from general principles of coda licensing, coda neutralization, and syllable contact. The phonotactic analysis of PA provides a set of constraints that can serve as a starting point for a comparative phonotactic analysis of the daughter languages.

1 Introduction

The sound system of Proto-Algonquian (PA) has been reconstructed in great detail (Michelson 1920, 1935; Bloomfield 1925, 1946; Siebert 1941; Goddard 1974b, 1979, 1994; Pentland 1979). The reconstructed phonemic inventory of PA is simple and natural, with each proto-phoneme reflected unchanged in at least one daughter language. The reconstructed syllable template, (C)(G)V(·)(C), is also simple. The reconstructed phonotactics, however, are more complex. For example, the set of possible consonant clusters is restricted in intricate ways and has undergone simplification in all of the daughter languages. This paper examines the phonotactics of PA from the perspective of synchronic phonology rather than historical linguistics. I show that despite the complexity and abstractness of the reconstructions, the PA phonotactic system is typologically natural, with all restrictions following from established constraints such as coda neutralization, coda licensing, and syllable

*I am grateful to Elan Dresher, Peter Jurgec, David Pentland, Graham Still, and the audience at the University of Toronto Phonetics-Phonology Group for helpful comments.

contact. This conclusion is of interest for two reasons: (1) it helps to establish that the reconstructed sound system of PA stands on firm ground not only from the perspective of historical linguistics, but typologically as well; and (2) it provides a foundation for a comparative analysis of the phonotactics of the daughter languages, whose phonological systems are understudied (Quinn 2011).

The most extensive existing work on Algonquian phonotactics has been conducted on Blackfoot (Elfner 2005, 2006; Denzer-King 2009, 2012; Goad & Shimada 2014).[1] Blackfoot is the most divergent Algonquian language (Goddard 1994) and its phonotactic system is considerably different from that of PA and other more conservative Algonquian languages. Nevertheless, the effects of sonority, licensing, and syllable contact that I will demonstrate for PA in this paper are quite similar to those which have been shown to be active in Blackfoot. These parallels will be highlighted as the paper proceeds.

The paper begins with a description of the phonemic inventory of PA based on existing sources (§2). The PA syllable template and principles of syllabification are then presented (§3). The remaining sections examine the phonotactic restrictions on the three constituents of the syllable: nucleus (§4), onset (§5), and coda (§6). The phonotactic generalizations are based upon what I will call the "Hewson corpus," a set of 11,467 reconstructed PA words from Hewson's (1993) *Computer-Generated Dictionary of Proto-Algonquian* (4067 words) and Hewson's (2010) *Proto-Algonkian Roots* (7400 additional words).[2] Hewson 1993 is the source of all PA forms in this paper for which a citation is not provided. Citations are given for forms from Hewson 2010 or other sources.[3]

2 Inventory

This section describes the phonemic inventory of PA (§2.1) and discusses some minor controversies in the reconstruction of particular segments (§2.2).

2.1 The PA phonemic inventory

The PA inventory of vowels, glides, and non-glide consonants is shown in (1) (Bloomfield 1946; Goddard 1979; Pentland 1979; Thomason 2006; §2.2 below). Following Algonquianist conventions, all reconstructions are marked with an asterisk and set in italics;

[1] See also LeSourd 1993 on Passamaquoddy and Bowers 2012 on Odawa.

[2] The numbering in Hewson 1993 goes only to 4066 but there is an additional entry following #3090.

[3] I rewrite Hewson's **l* as **r* (see §2.2.1), his **x* as **ʔ* (see §2.2.6), and his **çk* as **rk* (see §6.1).

vowel length is indicated by a middle dot (e.g. short **i* vs. long **i·*). The Americanist notation can be converted to broad IPA by changing *š č y* to [ʃ tʃ j]. Some older works (notably Bloomfield 1946) write **q* instead of **ʔ*.

(1) a. PA vowels and glides

	FRONT		BACK	
GLIDE	**y*		**w*	
HIGH V	**i·*	**i*	**o·*	**o*
LOW V	**e·*	**e*	**a·*	**a*

b. PA consonants

STOP	**p*		**t*	(**č*)	**k*	**ʔ*
FRICATIVE		**θ*	**s*	**š*		**h*
NASAL	**m*		**n*			
LIQUID			**r*			

Table 1 gives the frequency of each segment in the forms in the Hewson corpus, not counting inflectional affixes. The inclusion of inflectional affixes would bias the counts in favor of segments that occur in the inflection of citation forms, such as the third-person *-*w* that occurs on all verbs in the Hewson corpus.

Vowels (total 45,491)			**Consonants** (total 52,568)			
**a*	10490	23.1%	**k*	10922	20.8%	
**e*	10136	22.3%	**t*	7386	14.1%	(**t* 5766 + **č* 1620; §2.2.5)
**i*	8613	18.9%	**n*	6593	12.5%	
**a·*	6361	14.0%	**p*	5263	10.0%	
**e·*	5232	11.5%	**h*	4870	9.3%	
**i·*	2308	5.1%	**m*	4549	8.7%	
**o*	1446	3.2%	**š*	3084	5.9%	
**o·*	905	2.0%	**θ*	2785	5.3%	
Glides (total 14,221)			**ʔ*	2754	5.2%	(**x* 1266 + **ʔ* 1488; §2.2.6)
**w*	11827	83.2%	**s*	2635	5.0%	
**y*	2394	16.8%	**r*	1727	3.3%	(**l* 1600 + **ç* 127; §2.2.1, §6.1)

Table 1: Segment frequencies in Hewson, minus inflection (total segments 112,280)

2.2 Points of controversy

Although the PA inventory is solidly reconstructed, there are minor controversies in the reconstruction of the following segments: **r*, *θ, **o*, the glides, **č*, and **x*.

2.2.1 The phonetic value of **r*

The PA liquid was symbolized as **l* by Bloomfield (1946), but Pentland (1979:350) and Goddard (1994:204–5) have argued that its phonetic value was more likely rhotic than lateral. I follow Goddard (1994) in writing **r* for Bloomfield's (and Hewson's) **l*.

2.2.2 The phonetic value of *θ

Bloomfield described *θ with some ambiguity: "unvoiced interdental or lateral ?" (1946:87). Several subsequent authors have taken *θ to be the lateral fricative [ɬ] (Siebert 1975:300; Picard 1981, 1984, 1994; Proulx 1984b:423; Blevins 2004:296), but Goddard (1994:204) argues for interdental [θ]. The phonological consequences of the choice between [θ] and [ɬ] are minor, as *θ remains a non-strident coronal fricative under either analysis.

2.2.3 The phonemic status of short **o*

Although **o* is typically included in the PA vowel inventory, it is sparsely attested and often derivable from either **we* or long **o·* (Goddard 1979:75; Berman 1982:414). Goddard (1979:75) concludes that "an independent phoneme **o* is of no great antiquity in [PA]."

2.2.4 The phonemic status of the glides

Bloomfield (1946:86) described the glides **y* and **w* as positional variants of the short vowel phonemes **i* and **o*, but Hockett (1948:130) considered this conclusion hasty. In any case, Bloomfield represented the glides using the distinct symbols **y* and **w*, a practice that the field has continued. In this paper I treat the glides as distinct phonemes because this allows the phonotactic constraints to be stated as simply as possible.

2.2.5 The phonemic status of **č*

Bloomfield (1946:87) lists **t* and **č* as separate phonemes, but the two segments are mostly in complementary distribution: **č* occurs before **i·*, *i*, *y* and **t* occurs elsewhere. This distribution led Kaye (1978:144) and Pentland (1979:340–41; 1983; 1999:226) to conclude that **č* is simply a palatalized allophone of **t*. However, Hockett (1956:207) notes certain limited circumstances under which **t* and **č* may have contrasted in PA and suggests that PA **t* and **č* were in the incipient stage of a phonemic split. For the purposes of the analysis in this paper, I will treat **t* and **č* as allophones of the same phoneme (*/t∼č/), but in the presentation of data I will maintain the standard Algonquianist practice of distinguishing between **t* and **č* (to be understood here as a sub-phonemic distinction).

2.2.6 The phonemic status of **x*

Bloomfield (1946:88) reconstructed the "obscure element" **x*, which occurs only as the first consonant in the clusters **xp* and **xk* and does not necessarily have the phonetic value of IPA [x]. Neither Pentland nor Goddard regards Bloomfield's **x* as a distinct proto-phoneme. Pentland (1979:382) proposes that **x* belongs to the same phoneme as **ʔ*, for two reasons. First, **x* and **ʔ* are in complementary distribution: **x* occurs before **p* and **k* while **ʔ* occurs before other consonants. Second, **x* and **ʔ* both arise synchronically from the same process: the neutralization of preconsonantal stops (e.g. $*p + *k \rightarrow *xk$; $*p + *t \rightarrow *ʔt$). Goddard (1994:205), on the other hand, proposes that **x* belongs to the same phoneme as **s*, primarily because **s*C clusters are not otherwise attested in PA. However, in Section 6 I will propose that the absence of **s*C clusters is in fact a principled consequence of a more general neutralization of place contrasts in PA codas. I thus follow Pentland in analyzing Bloomfield's (and Hewson's) **x* as **ʔ*.

2.3 Summary: Inventory

The PA phonemic inventory is relatively small and typologically unmarked; the only remotely complex property is the existence of three coronal fricatives (**θ s š*). Although there are certain points of minor controversy in the reconstruction of the PA inventory, the only point that bears crucially on the phonotactic analysis in this paper is the identity of Bloomfield's **x*, which I follow Pentland in assigning to the phoneme **ʔ*.

3 Syllabification

The PA syllable template is (C)(G)V(·)(C), in which G is a glide and C is a non-glide consonant. Examples illustrating each of the 16 possible PA syllable types are given in (2). In these and all subsequent examples, syllable boundaries are indicated by a vertical bar.[4]

(2) PA syllable types

V   *___e___|_re|nyi|wa_   ‘man’   CV   *___ma___|_či_   ‘bad’
V·   *___e·___|_ri|kwa_   ‘ant’   CV·   *___ma·___|_ma|wi_   ‘together’
VC   *___eh___|_kwa_   ‘louse’   CVC   *___maθ___|_kwa_   ‘bear’
V·C   *___e·h___|_sa_   ‘clam’   CV·C   *___ma·n___|_θeh|si_   ‘flint’

GV   *___wa___|_to·|wa_   ‘clot’   CGV   *___kwe___|_či_   ‘try to’
GV·   *___wa·___|_ši_   ‘den’   CGV·   *___kwi·___|_θa|wi_   ‘impatiently’
GVC   *___waʔ___|_šaš|kwa_   ‘muskrat’   CGVC   *___kweʔ___|_ta|mwa_   ‘s/he fears it’
GV·C   *___wa·ʔ___|_se·h|či|ka|ni_   ‘window’   CGV·C   *___kwe·θ___|_ki_   ‘other side’

Syllabification in PA is straightforward. Every vowel is syllabified as the nucleus of a syllable. Word-initial consonants and glides are syllabified as an onset of the form C, G, or CG; no other initial sequences are attested. Word-final consonants and glides do not exist, as every freestanding PA word ends with a vowel (see §6 below). Word-medial consonants and glides require more attention. The following medial sequences occur: VCV, VGV, VCGV, VCCV, and VCCGV. I show that intervocalic C or G is syllabified as a simple onset (§3.1), intervocalic CG is syllabified as a complex onset (§3.2), intervocalic CC is syllabified as a coda followed by a simple onset (§3.3), and intervocalic CCG is syllabified as a coda followed by a complex onset (§3.4).

3.1 Intervocalic C or G is a simple onset

A single intervocalic consonant or glide is syllabified as the onset of the following vowel, as in *_e_|___wa___|___ki___ ‘they say so’. Beyond the crosslinguistic preference for onset maximization (e.g. Clements & Keyser 1983; Itô 1986; Blevins 1995), there is also PA-internal evidence that these segments are syllabified as onsets rather than codas. It will be shown in Section 6 below that the content of PA codas is heavily restricted: glides are banned and all plosives (*_p t k_) are neutralized to *_ʔ_. Intervocalic consonants and glides, on the other hand, are subject to no such restrictions, as shown by the intervocalic occurrence of the glide *_w_ and the plosive *_k_ in *_ewa_***ki*** ‘they say so’. Since *_w_ and *_k_ are both banned in PA codas, their occurrences in this form can only be syllabified as onsets.

[4]Although it is more conventional to use a dot to indicate syllable boundaries, this would conflict with the Algonquianist convention of using a dot to mark vowel length.

3.2 Intervocalic CG is a complex onset

The possibility for CG sequences to be syllabified as complex onsets is established by the occurrence of such sequences word-initially (****pye***·|*wa* 's/he comes') and postconsonantally (**eš*|***pya***·|*wi* 'it is high'). Since CG is a valid onset, the principle of onset maximization favors the syllabification of the C in an intervocalic CG sequence as part of the onset (**ne*|***pyi*** 'water') rather than as a coda (**ne****p***|***yi***). PA-internal evidence for the onset analysis comes from the restrictions on codas mentioned in §3.1 above (see §6 for more details). In particular, the plosives **p t k* do not occur in codas; only neutralized **ʔ* is possible. The plosive **p* in **ne****pyi*** 'water' thus cannot possibly be a coda and must instead be syllabified with **y* as an onset (**ne*|***pyi***).

3.3 Intervocalic CC is coda + simple onset

CC sequences are attested in PA, such as the **šk* in **we****ški*** 'new'. In a brief sketch of PA phonotactics, Thomason (2006:191) analyzes such sequences as onsets. However, this analysis fails to capture the fact that the distribution of CC sequences is more restricted than that of CG sequences. CG sequences can occur word-initially (****čya***·|*ki* 'completely') and postconsonantally (**ka*·|*win*|***šyi*** 'bramble'), but CC sequences cannot: ****ška***·|*ki* and **ka*·|*win*|***ški*** are not possible PA words. CC sequences occur only intervocalically in PA, as in **we****š***|***ki*** 'new', **a*·|*θe****n***|***ta*** 'some', and **a****ʔ***|***se***|*nya* 'stone'. Since these CC sequences cannot occur word-initially or postconsonantally, onset maximization provides no grounds for syllabifying them as complex onsets. The PA-internal evidence instead indicates that the first C is a coda, as it is restricted in ways that PA onset consonants never are. For example, the first C cannot be a plosive: there are CC sequences with an initial **ʔ*, as in **a****ʔ***|***se***|*nya* 'stone', but none with an initial plosive such as **k*, as in unattested **a****k***|***se***|*nya*. I conclude that CC sequences in PA are always heterosyllabic: C_1 is a coda and C_2 is an onset. The constraints on PA codas are examined further in Section 6.

3.4 Intervocalic CCG is coda + complex onset

In an intervocalic CCG sequence, the first C (C_1) is a coda and the following CG sequence (C_2G) is a complex onset, as in **e****š***|***pya***·|*wi* 'it is high' and **ne****ʔ***|***θwi*** 'three'. C_1 obeys the same restrictions as other codas, such as the ban on plosives: there are CCG sequences with an initial **ʔ*, as in **ne****ʔ***|***θwi*** 'three', but none with an initial plosive such as **k*, as in unattested *ne**k**|**θwi**. This restriction does not apply, however, to the adjacent C_2G sequence, which patterns like a typical CG onset. For example, it is possible for C_2 to be a plosive, as in *e**š**|**py**a·|wi 'it is high'. These facts are consistent with the analysis of C_1 as a coda and C_2G as a complex onset.

3.5 Summary: Syllabification

This section has shown that the set of possible syllables in PA is restricted to those of the shape (C)(G)V(·)(C). The syllabification of medial consonants and glides is consistent with onset maximization: a medial CG sequence is syllabified as a complex onset while a medial CC sequence is syllabified as a coda followed by an onset.

The (C)(G)V(·)(C) template alone, however, is not sufficient to characterize the set of possible PA syllables, as the realization of the template by particular consonants, glides, and vowels is further restricted by a variety of constraints on the position and co-occurrence of particular classes of segments. The following sections examine the constraints on the realization of each syllable component: nucleus (§4), onset (§5), and coda (§6).

4 Nucleus

The nucleus consists of a short or long vowel; there are no diphthongs (Bloomfield 1946:93). The choice of vowel quality is mostly unrestricted, but short *i and *o did not occur in word-initial syllables (Bloomfield 1946:93; Goddard 1979:72) and *o, o· did not occur after a CG sequence (Goddard 1974a:104). Vowel length is contrastive in all positions, as illustrated by the (near-)minimal pairs for short *a versus long *a· in (3).

(3) Contrast between short *a and long *a· in all positions

a.	Open initial syllable	***a**|wa|nwi*	'it is foggy'
		***a·**|wa|nwi*	'it is the same'
b.	Closed initial syllable	***aʔ**|te·|wi*	'it is there'
		***a·ʔ**|te·|wi*	'it stops burning'
c.	Open medial syllable	**na|**ha**|pi|wa*	's/he sits down'
		na|ha·**|pi|wa*	's/he sees well'
d.	Closed medial syllable	**eš|**kwan**|ta|mwa*	's/he leaves it from eating'
		eš|kwa·n**|te·|mi*	'door'

e.	Open final syllable[5]	**e*|***na***	'that' (Goddard 2003:56)
		e*|*na·***	'that (remote/absent)' (ibid.)

Word-final vowels in PA are usually short. It was once thought that they were *always* short (Bloomfield 1946:93; Goddard 1979:72), but evidence of a length contrast in final position was later found (Proulx 1980:12, 1990; Goddard 1980:150–1; 2003:56, 2007:213; Pentland 2000; Thomason 2006), as in the minimal pair in (3e) above.

5 Onset

The template (C)(G)V(·)(C) reflects the occurrence of three types of onsets: (1) NULL ONSETS, i.e. onsetless syllables; (2) SIMPLE ONSETS consisting of a consonant or glide; and (3) COMPLEX ONSETS consisting of a consonant plus a glide. Each type is exemplified in (4).

(4) PA onset types

a. Null onset (_V) ****_e***\|*ta*\|*mwa* 's/he says it so'
b. Simple onset (**C**V, **G**V) ****ke***\|*to*\|*wa* 's/he calls', ****we***\|*to·*\|*ni* 'his/her mouth'
c. Complex onset (**CG**V) ****kw*e**\|*ta*\|*ka* 'other'

It is useful to distinguish three environments in which onsets occur: (1) WORD-INITIAL, i.e. an onset that follows a word boundary; (2) INTERVOCALIC, i.e. an onset that follows an open syllable; and (3) POSTCONSONANTAL, i.e. an onset that follows a closed syllable. Examples showing the complex onset **kw* in each environment are given in (5).

(5) PA onset environments

a. Word-initial onset (#**CG**V) ****kw***e\|*ta*\|*ka* 'other'
b. Intervocalic onset (V\|**CG**V) **a*\|***kw***e\|*na*\|*mwa* 's/he puts it on'
c. Postconsonantal onset (C\|**CG**V) **pe·n*\|***kw***e\|*si*\|*wa* 's/he is clean/dry'

The parameters of onset type and onset environment are needed in order to describe the restrictions on the content of PA onsets. This section examines the restrictions on each type of onset in turn: null onsets (§5.1), simple onsets (§5.2), and complex onsets (§5.3).

5.1 Restrictions on null onsets

Onsetless syllables occur only in the word-initial environment, as in ****a***\|*ni·*\|*pyi* 'leaf', ****o·***\|*ši* 'canoe', and ****eh***\|*kwa* 'louse'. Medial syllables must have an onset: PA does not permit

[5] No examples from closed final syllables can be given because PA final syllables are always open (§6.2.1).

hiatus. When hiatus arises from the concatenation of morphemes, it is repaired either by the insertion of **y* or the deletion of a short vowel (Bloomfield 1946:93), as in (6).

(6) Hiatus repair (Bloomfield 1946:93; Proulx 2005:197)
  a. **y*-insertion: **ašy**e·**-* 'back' + *-***a·****ʔšiwa* 's/he is blown' → **a*|*šy**e·**|**ya·**ʔ|šiwa*
  b. Short V deletion: ****ne****-* 'my' + ****o·****hkomehsa* 'grandmother' → ****no·****h*|*ko*|*meh*|*sa*

On the surface phonetic level, the requirement for an onset may even have applied to initial syllables. Although onsetless initial syllables are widely attested in PA, Proulx (2005:197) suggests that the initial vowel in such syllables may in fact have been preceded by a non-contrastive [h], as is the case, according to Proulx, in Shawnee, Menominee, Potawatomi, Cheyenne, Arapaho, and Mi'gmaq.

5.2 Restrictions on simple onsets

The content of simple onsets is mostly unrestricted. As illustrated in Table 2, most PA consonants and glides can occur as a simple onset in all three environments (word-initial, intervocalic, and postconsonantal). There are, however, some gaps, the most obvious of which is the exclusion of **ʔ* from all onsets. Diachronically, **ʔ* arose from the debuccalization of the plosives **p t k* in codas (Meeussen 1959; see §6.2.2 and §6.2.4 below), which

C/G	WORD-INITIAL		INTERVOCALIC		POSTCONSONANTAL	
**p*	****pe***|*myi*	'oil'	**a*|***pi***|*wa*	's/he sits'	**eš*|***pe***|*si*|*wa*	's/he is tall'
**t*	****te·***|*pi*	'enough'	**a*|***teh***|*kwa*	'caribou'	**te·n*|***te·***|*wa*	'frog, toad'
**č*	****či·***|*ki*	'close to'	**ki·*|*mo·*|***či***	'secretly'	**wen*|***či***	'whence'
**k*	****kaθ***|*ki*|*wa*	'heron'	**kwe*|*ta*|***ki***	'other'	**e·š*|***ka***|*na*	'horn'
**θ*	****θeh***|*ki*	'long time'	**a*|***θa·n***|*kwa*	'star'	**a·ʔ*|***θa***|*mi*	'upstream'
**s*	****si·***|*pi·*|*wi*	'river'	**me*|***sa***|*ya*	'fish'	**aʔ*|***sen***|*ya*	'stone'
**š*	****ši·***|*pi·*|*wa*	's/he stretches'	**a·*|***ša***|*wi*	'beyond'	**waʔ*|***šaš***|*kwa*	'muskrat'
**r*	****re·***|*ka*|*wi*	'sand'	**e·*|***ri***|*kwa*	'ant'	**aʔ*|***ra***|*pya*	'net'
**m*	****maθ***|*kwa*	'bear'	**a*|***meθ***|*kwa*	'beaver'	**wi·*|*ki*|*wa·h*|***mi***	'house'
**n*	****na***|*me·*|*wa*	'fish'	**a*|*ši*|*ka*|***na***	'stocking'	—	
**w*	****wa·***|*ši*	'den'	**a*|***wa***|*ni*	'fog'	(C*w* = complex onset: §4.2)	
**y*	—		**či·*|*pa*|***ya***	'corpse'	(C*y* = complex onset: §4.2)	
**h*	—		**pye·*|***ho***|*wa*	's/he waits'	—	
**ʔ*	—		—		—	

Table 2: Examples of simple onsets (C or G) across environments

is why we find *ʔ only in codas.[6] Synchronically, the ban on *ʔ in onsets is consistent with an established sonority effect: laryngeals are often considered the most sonorous consonants (e.g. de Lacy 2006:94–6) and there is a crosslinguistic tendency for high-sonority consonants to be disfavored in onsets (e.g. Clements 1990; Smith 2008; de Lacy 2006:94).

The other laryngeal consonant, **h*, is slightly less restricted than *ʔ in that it can occur in intervocalic onsets, but it is banned from word-initial and postconsonantal onsets. Also unattested in the Hewson corpus are word-initial **y* and postconsonantal **n*. The absence of initial **h* and **y* may reflect domain-initial strengthening of the constraint against high-sonority consonants in onsets mentioned above (e.g. Smith 2002; Barnes 2006:§4.3). The restriction on postconsonantal **n* will be attributed to syllable contact below (§6.2.5).

5.3 Restrictions on complex onsets

This section describes the restrictions on complex (CG) onsets in each possible environment: intervocalic (§5.3.1), postconsonantal (§5.3.2), and word-initial (§5.3.3). Since *ʔ never occurs in onsets (§5.2 above), it is omitted from all tables in this section.

5.3.1 Intervocalic complex onsets

In intervocalic position, all logically possible C*y*/C*w* onsets are attested, as illustrated in Table 3. The only gap, the absence of **θy*, is due to a regular phonological process that palatalizes **θ* to **š* before **y* (Bloomfield 1946:92). There are also no onsets of the form **ty* or **čw* due to the complementary distribution of **t*∼*č* in PA (discussed in §2.2.5 above): **č* occurs before **i·, i, y* (as in **čy*) and **t* occurs elsewhere (as in **tw*).[7]

5.3.2 Postconsonantal complex onsets

Postconsonantal CG onsets are illustrated in Table 4. Since **h* and **n* do not occur postconsonantally (§5.2 above), they are omitted from consideration in the table. The only other

[6] Given that *ʔ originated from the debuccalization of **p t k*, one might wonder whether it is necessary to recognize PA *ʔ as a distinct phoneme in the first place. Could we instead analyze *[ʔ] as a debuccalized allophone of **p*, **t*, or **k*? Such an analysis would be highly abstract, because the diachronic debuccalization of coda plosives applied not only across morpheme boundaries but also within roots, creating non-alternating instances of *ʔ (e.g. **peʔt-* 'accident', **seʔsw-* 'scatter', **mi·ʔl-* 'fur'). Since the *ʔ in these roots never alternates with a plosive, there is no reason for a learner to posit an underlying plosive.

[7] An additional gap, the absence of **hy*, has also been reported (Goddard 1979:72), but David Pentland (p.c.) provides **ne|te·|**hyi*** 'my hand' and Hewson (2010) lists **na|**hye·**|ke|na|mwa* 's/he folds it up properly'.

<table>
<tr><th>C</th><th>Cy</th><th></th><th>Cw</th><th></th></tr>
<tr><td>*p</td><td>*ah|ta·|pya</td><td>‘bow’</td><td>*a|pwi|ya</td><td>‘paddle’</td></tr>
<tr><td>*t∼č</td><td>*ni·|čya·|na</td><td>‘child’</td><td>*a|θe|twi</td><td>‘it stinks’</td></tr>
<tr><td>*k</td><td>*me|kyi</td><td>‘scab’</td><td>*pe|pi|kwa</td><td>‘flea’</td></tr>
<tr><td>*θ</td><td>— (*θy → *šy)</td><td></td><td>*a|θwa</td><td>‘pine snake’</td></tr>
<tr><td>*s</td><td>*wa|syeʔ|θa|nwi</td><td>‘nest’</td><td>*mo·|swa</td><td>‘moose’</td></tr>
<tr><td>*š</td><td>*ke|šye|te·|wi</td><td>‘it is hot’</td><td>*a·|šwi|ka|ni</td><td>‘bridge’</td></tr>
<tr><td>*r</td><td>*me|ryi</td><td>‘pus’</td><td>*me|rwi</td><td>‘well’</td></tr>
<tr><td>*m</td><td>*pe|myi</td><td>‘oil’</td><td>*ma|mwa</td><td>‘s/he takes it’</td></tr>
<tr><td>*n</td><td>*e|re|nyi|wa</td><td>‘man’</td><td>*a|wa|nwi</td><td>‘fog’</td></tr>
<tr><td>*h</td><td>*ne|te·|hyi</td><td>‘my hand’†</td><td>*ma|hwe·|wa</td><td>‘wolf’</td></tr>
</table>

†The form *nete·hyi* is from David Pentland (p.c.).

Table 3: Intervocalic complex onsets

<table>
<tr><th>C</th><th>Cy</th><th></th><th>Cw</th><th></th></tr>
<tr><td>*p</td><td>*wa|to·ʔ|pyi</td><td>‘alder’</td><td>*weʔ|pwa·|ka|na</td><td>‘pipe’</td></tr>
<tr><td>*t∼č</td><td>*ne|θen|čyi</td><td>‘my hand’</td><td>*pi·n|twi|ke·|wa</td><td>‘s/he enters’</td></tr>
<tr><td>*k</td><td>*maš|kih|kyi|wi</td><td>‘herb’</td><td>*pen|kwi</td><td>‘ashes’</td></tr>
<tr><td>*θ</td><td>— (*θy → *šy)</td><td></td><td>*neʔ|θwi</td><td>‘three’</td></tr>
<tr><td>*s</td><td>*pi·ʔ|sya·|wi</td><td>‘it is fine’</td><td>*wen|swe·|wa</td><td>‘s/he boils him/her’</td></tr>
<tr><td>*š</td><td>*meʔ|šya·|wi</td><td>‘it is big’</td><td>*mo·n|šwe·|wa</td><td>‘s/he cuts his/her hair’</td></tr>
<tr><td>*r</td><td>*ki·n|ryi·|wi</td><td>‘it is sharp’</td><td>—</td><td></td></tr>
<tr><td>*m</td><td>—</td><td></td><td>*ke|ne|pa·h|mwa·</td><td>‘you (pl.) sleep’†</td></tr>
</table>

†The example *kenepa·hmwa·* is formed according to the verb paradigms in Goddard 2007:265: verb stem *nepa·*- ‘sleep’ + 2pl inflection *ke*- -*hmwa*.

Table 4: Postconsonantal complex onsets

gap is the absence of *my* and *rw*. It is not clear whether this gap is systematic or accidental. It is possible to characterize *my* and *rw* as a phonological natural class: they are the only CG onsets in (6) that consist of two sonorants that disagree in place. Their absence could reflect a constraint against such onsets in postconsonantal position. However, it is also the case that postconsonantal examples of *m* and *r* are rare in general, as shown in (7): of all the consonants that can occur in postconsonantal position, *m* and *r* are by far the scarcest. The absence of postconsonantal *my* and *rw* in the Hewson corpus could be an accidental consequence of this scarcity.

(7) Number of postconsonantal instances in the Hewson corpus

*k	*t∼č	*θ	*š	*p	*s	*r	*m
4369	2371	802	678	661	640	153	6

5.3.3 Word-initial complex onsets

The word-initial CG onsets attested in the Hewson corpus are illustrated in Table 5. The table reveals a significant gap: in word-initial position, no CG onsets are attested with **θ*, **s*, **š*, or **r*. (Word-initial **nw* onsets are also unattested; I set this smaller gap aside, as it is not clear whether it is systematic or accidental.) The pattern in Table 5 has a simple phonological characterization: in a word-initial CG onset, C can be a plosive (**p t k*) or a nasal (**m n*) but not a continuant (**θ s š r*). This restriction does not follow from sonority, as the banned continuants are intermediate in sonority between the attested plosives and nasals. Since both the consonant and the glide in the banned CG onsets are continuants, the pattern may instead be an effect of the Obligatory Contour Principle: a word-initial complex onset cannot consist of a sequence of two continuants.

C	C*y*		C*w*	
**p*	***_pye·_**|*wa*	's/he comes'	***_pwa·_**|*wa*|*θe·*|*wa*	's/he is overloaded'
**t∼č*	***_čya·_**|*ke*|*so*|*wa*	's/he burns'	***_twa·h_**|*ši*|*nwa*	's/he falls through ice'
**k*	***_kyi·š_**|*pe*|*ne*	'if'	***_kwa_**|*ya·*|*ši*	'long ago / for good'
**θ*	—		—	
**s*	—		—	
**š*	—		—	
**r*	—		—	
**m*	***_mye·_**|*wi*	'path'	***_mwa·_**|*kwa*	'loon'
**n*	***_nye·_**|*wi*	'four'	—	

Table 5: Word-initial complex onsets

5.4 Summary: Onsets

PA onsets can be null (_V), simple (**C**V, **G**V), or complex (**CG**V). Null onsets occur only in word-initial position. Simple and complex onsets are least restricted in intervocalic position: setting aside **ʔ*, which never occurs in onsets in PA, all logically possible C, G, and CG onsets are attested intervocalically. Postconsonantal onsets add one further restriction:

**n* and **h* are excluded, an effect that will be attributed to syllable contact in Section 6 below. Word-initial onsets are more restricted still: the Hewson corpus contains no instances of initial **h* or **y*, nor any initial CG onsets beginning with a continuant.

6 Coda

The treatment of codas is the most complex aspect of PA phonotactics. The importance of the coda may not be obvious at first glance, however, as the historical Algonquianist literature makes no use of the notion of codas. Instead, effects that I will attribute to constraints on codas are expressed as properties of clusters. This section begins by showing how PA clusters can be understood as coda-onset sequences (§6.1). I then argue that the intricate restrictions on the content and distribution of PA codas follow from three constraints: coda licensing, coda neutralization, and syllable contact (§6.2).

6.1 Clusters and codas

A CLUSTER, in Algonquianist parlance, is a sequence of two non-glide consonants: the C_1C_2 sequence **mp* is a cluster while the CG sequence **mw* is not. In most historical work on Algonquian, the internal structure of clusters is ignored and each cluster is effectively treated like a phoneme: just as there is an inventory of simple consonants (e.g. **p t k*), so too is there an inventory of clusters (e.g. **mp nt nk*), each with its own reflex in the daughter languages.

This "atomic" approach to clusters is appropriate for historical reconstruction, but from a phonological perspective, it misses a significant asymmetry between the two consonants: C_2 patterns the same as a simple consonant while C_1 is subject to severe restrictions and receives special treatment in sound changes (Pentland 1979:30). As Bloomfield (1946:88) puts it, clusters "consist of ordinary consonants preceded by obscure elements". Recognizing the syllable structure of clusters gives us a way to explain this asymmetry: a sequence such as VC_1C_2V is syllabified as $VC_1|C_2V$. Since C_2 is an onset, it patterns no differently from any other PA onset. C_1, on the other hand, is a coda, and can thus be subject to special coda constraints that give rise to its "obscure" and idiosyncratic patterning. Such constraints apply to codas in many languages; Japanese is a well-known example (e.g. Itô 1986).

The constraints on PA codas affect both their distribution and their content. In terms of distribution, codas are restricted to word-medial position. There are no word-final codas in PA; all words end with a vowel (Bloomfield 1946:93).[8] For example, *waʔ|šaš|kwa 'muskrat', with medial coda *š, is a well-formed PA word, but *waʔ|šaš, with final coda *š, is impossible. In terms of content, codas host a reduced set of consonant contrasts. Some consonants are banned outright from codas while others can occur as a coda only if followed by a particular onset consonant. As a result, the set of possible consonant clusters in PA is fairly small. Of the 121 logically possible clusters that would result from combining the 11 non-glide consonants *p t k s š θ r m n h ʔ, only the 28 clusters shown in (8) are possible. (For simplicity, I omit *č from the list of onsets, treating it as an allophone of *t; see §2.2.5.) Within PA morphemes, no clusters other than these are found. Illicit clusters created by the concatenation of morphemes are repaired either by epenthesis of a vowel or adjustment of C_1 to create a licit cluster (Bloomfield 1946:90–91).

(8) PA clusters (Bloomfield 1946; Goddard 1979; Pentland 1979)

<table>
<tr><th rowspan="3">C₁ (CODA)</th><th colspan="11">C₂ (ONSET)</th></tr>
<tr><th colspan="3">PLOSIVE</th><th colspan="4">CONTINUANT</th><th colspan="2">NASAL</th><th colspan="2">LAR</th></tr>
<tr><th>*k</th><th>*p</th><th>*t</th><th>*s</th><th>*š</th><th>*θ</th><th>*r</th><th>*m</th><th>*n</th><th>*h</th><th>*ʔ</th></tr>
<tr><td>*h</td><td>*hk</td><td>*hp</td><td>*ht</td><td>*hs</td><td>*hš</td><td>*hθ</td><td>(*hr)</td><td rowspan="2">*Hm</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>*ʔ</td><td>*ʔk</td><td>*ʔp</td><td>*ʔt</td><td>*ʔs</td><td>*ʔš</td><td>*ʔθ</td><td>*ʔr</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>*m∼n</td><td>*nk</td><td>*mp</td><td>*nt</td><td>*ns</td><td>*nš</td><td>*nθ</td><td>*nr</td><td>—</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>*š</td><td>*šk</td><td>*šp</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>*θ</td><td>*θk</td><td>*θp</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>*r</td><td>*rk</td><td>(*rp)</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td></tr>
</table>

Before we consider the constraints that give rise to this restricted set of clusters, some clarifying remarks on the presentation of clusters in (8) are necessary:

- ***hr.** The cluster *hr occurs in only one PA morpheme (Goddard 1979:72).
- ***Hm.** The notation *Hm (Goddard 1974b) indicates the lack of a contrast between *h and *ʔ before *m. Goddard (e.g. 2007) now writes *hm while Pentland (1979, 1999) prefers *ʔm.
- ***ʔk/ʔp.** As discussed above (§2.2.6), I follow Pentland (1979) in analyzing Bloomfield's *xk/xp as *ʔk/ʔp, contra Goddard's (1994) *sk/sp.

[8] There is one exception to this statement: the bound auxiliary-like elements known as PREVERBS, which always precede the verb stem, can end with a consonant in PA (Pentland 2005). This is not the only respect in which preverbs differ phonologically from freestanding words: a PA preverb can consist of just a single syllable (e.g. *ki· 'around, about', *pwa· 'fail to'; Pentland 2005:326) whereas a freestanding word must consist of at least two syllables due to a word minimality constraint that blocks final vowel deletion in two-syllable words (Bloomfield 1946:93). I do not consider the exceptional phonotactics of preverbs in this paper.

- ***št.*** I omit Bloomfield's **št*, which is reconstructed in only one PA morpheme. Pentland (1977) argues that the apparent evidence for **št* is in fact the result of borrowing.
- ***rk/rp.*** Bloomfield (1946) reconstructed **çk* but not **çp*. Tentative examples of **çp* were identified by Pentland (1979:65) and have been endorsed by Proulx (1984a:191) and Thomason (2006:191). I follow Goddard (1994) in analyzing Bloomfield's **ç* as **r*, giving the clusters **rk* and **rp*. Pentland and Proulx instead write **sk/sp*.
- ***čp/čk.*** I omit Bloomfield's **čp/čk*, which are based on limited evidence from Menominee and "probably do not represent a genuine set of correspondences" (Pentland 1979:384).

6.2 Constraints on codas

The restrictions on PA codas raise the following three questions. I will propose that the answer to each question lies in a crosslinguistically familiar constraint on codas.

1. Why can PA codas occur word-medially but not word-finally?
   Answer: this is an effect of CODA LICENSING (§6.2.1).

2. Why can't all consonants be PA codas? As shown in (8) above, the only possible codas are **h*, **ʔ*, **m∼n*, **š*, **θ*, and **r*.
   Answer: this is an effect of CODA NEUTRALIZATION (§6.2.2).

3. Why are PA codas constrained by the following onset? For example, we see in (8) that coda **h* can precede nearly any onset while coda **š* can precede only **p* and **k*.
   Answer: this is an effect of SYLLABLE CONTACT (§6.2.3).

Under the analysis that I will propose, there is nothing unusual about the restrictions on PA codas. Although the reconstructed set of PA clusters goes beyond the data in the sense that it is more complex than that found in any of the daughter languages, it is nevertheless fully phonologically natural: the set of possible clusters in (8) is exactly what we expect to find under a particular combination of well-attested coda constraints.

6.2.1 Coda licensing: Why can codas be medial but not final?

Codas in PA occur word-medially, as in **waʔ|ša**š**|kwa* 'muskrat', but not word-finally, as in unattested **waʔ|ša**š***. All PA words end with a vowel. This restriction can be attributed to the CODA LICENSING constraint in (9) (Kaye 1990; Polgárdi 1996; Scheer 2004).

(9) Coda licensing: A coda consonant must be followed by an onset consonant.

Coda licensing prohibits word-final codas, as there is no following onset to license them. Many languages nevertheless allow word-final consonants; Kaye (1990) argues that such consonants are better analyzed as the onset of a following empty nucleus. If a language does not allow the nucleus to be empty, the result will be a complete ban on word-final consonants, as in PA.

6.2.2 Coda neutralization: Why can't all consonants be codas?

The set of possible clusters in (8) above shows that not all PA consonants can occur as codas. PA codas can consist of the laryngeals **ʔ h*, the nasals **m n*, and the continuants **θ š r*. PA codas cannot consist of the plosives **p t k* or the continuant **s*. These possibilities are illustrated in (10).

(10) a. Consonants that occur as codas

Laryngeals **h ʔ*	(**e·**h**|sa* 'clam', **a**ʔ**|kyi* 'land')
Nasals **m n*	(**we|**tem**|pi* 'his/her brain', ****ken**|ri|wa* 'eagle')
Continuants **θ š r*	(**ma**θ**|kwa* 'bear', **we**š**|ki* 'young', **me**r**|kwi* 'blood')

b. Consonants that do not occur as codas

Plosives **p t k*	(unattested **e·**t**|sa*)
Continuant **s*	(unattested **we**s**|ki*)

Neutralization provides a partial explanation for the absence of **p t k s* in codas. The operation of neutralization in codas is most obvious with respect to the nasals **m n*. Although both nasals occur in codas, they do not contrast. Instead, the nasal is conditioned by the following consonant: ****m*** occurs before ****p*** (e.g. **we\|**tem\|pi*** 'his/her brain') and ****n*** occurs elsewhere (e.g. **še**n\|ta*** 'conifer', **pe**n\|kwi*** 'ashes', **ma·**n\|θ**eh\|si* 'flint', **we**n\|so**\|wa* 's/he boils', ****ken\|ri**\|wa* 'eagle'). The assimilation of nasal codas can be observed in morphological alternations such as (11), where **m* + **t* becomes **nt*.

(11) **wa·pa**m**-* 'see' + **-**t**amwa* 's/he acts on it' → **wa·\|pa**n\|t**a\|mwa* 's/he sees it'

Since the nasals **m* and **n* differ only in place, their neutralization indicates that PA codas are subject to the CODA NEUTRALIZATION constraint in (12).

(12) Coda neutralization: Place contrasts are not licensed in PA codas.

I suggest that this neutralization constraint applies not just to coda nasals, but to all coda consonants, as proposed for Blackfoot by Goad & Shimada (2014). The complete absence of place contrasts in PA codas is supported by the fact that the entire set of PA coda consonants can be characterized "placelessly" while the consonants banned from codas cannot, as shown in (13).

(13) a. Consonants permitted in codas can be characterized placelessly

**h*	spread glottis
ʔ	constricted glottis
**m∼n*	nasal
**š*	strident
**θ*	non-strident
**r*	approximant

b. Consonants banned from codas cannot be characterized placelessly

**p*	labial plosive
**t*	coronal plosive
**k*	dorsal plosive
**s*	anterior strident (contrasts for place with **š*)

Adopting place neutralization as a general constraint on PA codas allows us to explain the absence of **s* in codas: since the stridents **s* and **š* contrast only in place, the constraint in (12) forces their contrast to be neutralized in codas. It remains to be explained why the outcome of this neutralization is **š* rather than **s*. Phonetic dispersion may play a role here, as the choice of **š* maximizes the distance from the other coronal fricative **θ*.

Place neutralization is also consistent with the absence of a contrast between the plosives **p t k* in codas. However, neutralization alone is not sufficient to explain the patterning of plosives. Unlike coda nasals, coda plosives do not simply assimilate to the place of the following consonant—they instead debuccalize to **ʔ* (Meeussen 1959), as illustrated in (14) (Pentland 1979:374).

(14) **a**p**-* 'seated' + *-*te·wi* 'it is' → **a**ʔ**|te·|wi* 'it is in place' (not **a**t**|te·|wi*)

It is shown below (§6.2.4) that debuccalization of coda plosives is a side-effect of the syllable contact law that will be established on independent grounds in the following section (§6.2.3).

6.2.3 Syllable contact: Why are codas constrained by the following onset?

In addition to neutralization, coda consonants are subject to a further restriction: each coda consonant can occur only before particular onset consonants. As a result, many of the logically possible coda-onset combinations cannot occur, as shown by the blank areas in (15).

(15) Possible PA coda-onset combinations (repeated from (8))

	C$_1$ (CODA)	**C$_2$ (ONSET)**										
		PLOSIVE			CONTINUANT				NASAL		LAR	
		*k	*p	*t	*s	*š	*θ	*r	*m	*n	*h	*ʔ
LAR	*h	*hk	*hp	*ht	*hs	*hš	*hθ	(*hr)	*Hm	—	—	—
	*ʔ	*ʔk	*ʔp	*ʔt	*ʔs	*ʔš	*ʔθ	*ʔr		—	—	—
NAS	*m∼n	*nk	*mp	*nt	*ns	*nš	*nθ	*nr	—	—	—	—
CONT	*š	*šk	*šp	—	—	—	—	—	—	—	—	—
	*θ	*θk	*θp	—	—	—	—	—	—	—	—	—
	*r	*rk	(*rp)	—	—	—	—	—	—	—	—	—

When the manner of articulation of the attested coda-onset combinations is compared, a clear pattern emerges, as summarized in (16).

(16) Attested PA coda-onset combinations

a. No codas occur before laryngeal onsets (*h ʔ).

b. Laryngeal codas (*h ʔ) occur before nasal onsets (*m),[9] continuant onsets (*s š θ r), and plosive onsets (*p t k).

c. Nasal codas (*m∼n) occur before continuant onsets (*s š θ r) and plosive onsets (*p t k).

d. Continuant codas (*š θ r) occur before plosive onsets (*p k).[10]

e. Plosive codas (*p t k) do not occur.

The pattern in (16) can be described in terms of the hierarchy in (17). In PA, a coda is always followed by an onset that ranks lower on the hierarchy.

(17) Coda-onset hierarchy (coda must outrank onset)

Laryngeal	>	Nasal	>	Continuant	>	Plosive
*h ʔ		*m n		*š s θ r		*p t k

From a crosslinguistic perspective, the order of categories in (17) is familiar: this is a version of the SONORITY HIERARCHY, which is known to play a pervasive role in syllabification (e.g. Clements 1990; de Lacy 2006). The hierarchy in (17) is similar to that proposed by Elfner (2005) for Blackfoot, including the high ranking of /ʔ/.[11] The only unusual aspect of the

[9] The nasal onset following a laryngeal can be *m but not *n. This is addressed in §6.2.5 below.

[10] The plosive onset following a continuant can be *p k but not *t. This is addressed in §6.2.5 below.

[11] Those who are uncomfortable with regarding [ʔ] as highly sonorous may prefer to conceive of the sonority hierarchy as scale of consonantal *weakness* rather than sonority. The two conceptions are essentially equivalent in practice, as Elfner (2005) discusses.

PA hierarchy in (17) is the inclusion of *r with the fricatives, but such patterning is attested in other languages as well: van Oostendorp (2001) discusses the "chameleonic behaviour" of /r/ and notes that /r/ patterns like a fricative in some languages. From an Algonquian perspective it is particularly unsurprising to see *r and *θ patterning together, as *r and *θ merge in most of the daughter languages (Bloomfield 1946:87).

Interpreting (17) as a sonority hierarchy gives us a simple way to describe the coda-onset patterns in (16): in PA, a coda is always followed by a less sonorous onset. This generalization, too, is crosslinguistically familiar: it is a form of the SYLLABLE CONTACT LAW (Hooper 1976; Murray & Vennemann 1983; Vennemann 1988; Gouskova 2004), which reflects a crosslinguistic preference for falling sonority across a syllable boundary. In PA, the only attested clusters are those that obey the syllable contact constraint in (18).

(18) Syllable contact: A heterosyllabic consonant cluster must have falling sonority.

Syllable contact has been shown to play a role in the phonotactics of Blackfoot as well (Elfner 2005), although the constraint in Blackfoot is more relaxed than in PA, permitting either level or falling sonority (Goad & Shimada 2014).

Two further applications of syllable contact are demonstrated in the remaining two sections, which will complete the analysis of PA codas. Section 6.2.4 addresses the debuccalization of coda plosives and Section 6.2.5 considers the role of place in syllable contact.

6.2.4 Syllable contact and debuccalization

In the discussion of coda neutralization above (§6.2.2), we saw that PA coda plosives (*$p\ t\ k$) are not simply neutralized, but debuccalized as well, becoming *$ʔ$. This debuccalization can be understood as a response to the syllable contact constraint in (18). Consider any CC sequence in which the coda is a plosive, such as *ks. Syllable contact requires a sonority drop, but since plosives are already at the bottom of the sonority hierarchy, a sonority drop is impossible: the coda plosive *k cannot be followed by a less sonorous onset because there are no consonants less sonorous than *k. The complete absence of coda plosives in PA is thus a consequence of syllable contact. When coda plosives arise at morpheme boundaries, as in the example in (14) above (*p +*t → *$ʔt$), the illicit cluster can be repaired by debuccalization of the coda plosive to *$ʔ$. Since the laryngeal stop *$ʔ$ has much higher sonority than the oral stops *$p\ t\ k$, the resulting cluster now involves a sonority drop, satisfying the syllable contact constraint.

6.2.5 Syllable contact and place

The requirement for falling sonority accounts for most of the gaps in the set of PA clusters. Each gap marked by a checkmark in (19) involves either flat or rising sonority and is thus correctly predicted to be illicit. However, there are two additional gaps, marked by "**?**", that do not follow from the sonority hierarchy in (17).

(19) PA clusters (✓ = gap explained by hierarchy; **?** = gap not explained by hierarchy)

C₁ (CODA)		**C₂** (ONSET)										
		PLOSIVE			CONTINUANT				NASAL		LAR	
		**k*	**p*	**t*	**s*	**š*	**θ*	**r*	**m*	**n*	**h*	**ʔ*
LAR	**h*	**hk*	**hp*	**ht*	**hs*	**hš*	**hθ*	(**hr*)	**Hm*	**?**	✓(flat)	
	**ʔ*	**ʔk*	**ʔp*	**ʔt*	**ʔs*	**ʔš*	**ʔθ*	**ʔr*				
NAS	**m∼n*	**nk*	**mp*	**nt*	**ns*	**nš*	**nθ*	**nr*	✓(flat)		✓(rising)	
CONT	**š*	**šk*	**šp*	**?**	✓(flat sonority)				✓(rising)		✓(rising)	
	**θ*	**θk*	**θp*									
	**r*	**rk*	(**rp*)									

The two additional gaps are the absence of **Hn* and the absence of **št θt rt*. Neither gap follows from the sonority hierarchy in (17) above. The hierarchy predicts that the laryngeal coda **H* can be followed by the nasal onsets **m* and **n*, since **Hm* and **Hn* both have falling sonority. However, this prediction is only half correct: **Hm* occurs as predicted but **Hn* does not. Similarly, the hierarchy predicts that the continuant codas **š θ r* can be followed by the plosive onsets **p t k*, since the resulting clusters all have falling sonority. Again, this prediction is only partially correct: the clusters ending with **p* (**šp θp rp*) and **k* (**šk θk rk*) occur as predicted but the clusters ending with **t* (**št θt rt*) do not.

A generalization about these gaps can be made. In both cases, the sonority hierarchy correctly identifies the *manner* of the following onset, but the set of possible onsets is further restricted by *place*: the coronal consonants **t* and **n* are excluded. The laryngeal coda **H* can be followed by a nasal onset as long as it is not the coronal nasal **n*. The continuant codas **š θ r* can be followed by a plosive onset as long as it is not the coronal plosive **t*.

The simplest explanation for this pattern would be to say that codas can never be followed by coronal onsets, but this cannot be correct, as some coda + coronal clusters are attested:

(20) a. Attested coda + coronal clusters: **ʔt, ht, nt*
b. Unattested coda + coronal clusters: **θt, Hn*
c. Attested coda + non-coronal clusters: **θp, θk, Hm*

Why, then, is **θt* banned while **θp/θk* are permitted? I propose that the answer lies in a revision to the PA sonority hierarchy. If we maintain that PA clusters are regulated by a syllable contact constraint that requires falling sonority, it must be the case that unattested **θt* does not have an adequate sonority drop while attested **θp/θk* do. In other words, coronal **t* must have higher sonority than non-coronal **p/k*. This conclusion leads us to revise the sonority hierarchy by ranking coronals as more sonorous than non-coronals, as in (21).[12] This ranking has been proposed for other languages as well; see e.g. Ladefoged 1982 for English, Steriade 1982 for Latin, and Murray & Vennemann 1983 for Spanish.

(21) PA sonority hierarchy (revised from (17))

laryngeal	>	coronal nasal	>	non-coronal nasal	>	continuant	>	coronal plosive	>	non-coronal plosive
**h ʔ*		**n*		**m*		**š s θ r*		**t*		**p k*

Under the revised sonority hierarchy, the attested clusters **θp θk* have a sonority drop of magnitude 2 while the unattested cluster **θt* has a sonority drop of magnitude 1. The same is true for attested **Hm* versus unattested **Hn*. In fact, all of the attested clusters in (19) now have a sonority drop of at least 2 while all of the unattested clusters have either a sonority drop of 1, level sonority, or rising sonority. The syllable contact constraint in (18) can thus be revised to require a minimum SONORITY DISTANCE of 2 (see e.g. Gouskova 2004):

(22) Syllable contact (revised from (18)):
The sonority of a heterosyllabic consonant cluster must fall by at least two degrees.

With these revisions, we now have a unified account of the constitution of the set of clusters in (19): these are exactly the clusters that are well-formed under the proposed coda neutralization and syllable contact constraints.

6.3 Summary: Coda

PA coda consonants, which occur in word-medial position only, are subject to strict restrictions that limit the set of possible consonant clusters. The patterning of PA codas can be accounted for by the three coda constraints in (23), all of which are well-established in the

[12] I thank Emily Clare (p.c.) for suggesting this analysis.

phonological literature, together with the sonority hierarchy in (24).

(23) PA coda constraints

a. Coda licensing: A coda consonant must be followed by an onset consonant.
b. Coda neutralization: Place contrasts are not licensed in codas.
c. Syllable contact: The sonority of a cluster must fall by at least two degrees.

(24) PA sonority hierarchy

$$\text{laryngeal} > \begin{array}{c}\text{coronal}\\\text{nasal}\end{array} > \begin{array}{c}\text{non-coronal}\\\text{nasal}\end{array} > \text{continuant} > \begin{array}{c}\text{coronal}\\\text{plosive}\end{array} > \begin{array}{c}\text{non-coronal}\\\text{plosive}\end{array}$$

Coda licensing accounts for the absence of word-final codas. Coda neutralization accounts for the complementary distribution of **m* and **n* in codas and the absence of a contrast between **s* and **š*. Syllable contact explains why many logically possible clusters are banned: their sonority does not fall at least two steps on the hierarchy in (24). Syllable contact also accounts for the ban on coda plosives: since plosives are the least sonorous consonants, a cluster beginning with a plosive cannot possibly have falling sonority. Debuccalization of coda plosives to **ʔ* satisfies syllable contact by increasing the sonority of the coda.

7 Conclusion

This paper has sketched the phonotactics of Proto-Algonquian. The PA syllable template is (C)(G)V(·)(C). The content of the onset is mostly unrestricted. The restrictions on codas are much more extensive but can be understood as following directly from three simple constraints: coda licensing, coda neutralization, and syllable contact.

Although PA is a "virtual" language created by linguists through the application of the comparative method, the phonotactic patterns displayed by its reconstructed sound system are fully natural and can be straightforwardly described using categories and constraints that are widely attested across languages and are central to various theoretical approaches to phonology. This outcome is particularly striking in the case of coda consonants, which are the most difficult component of the PA sound system to reconstruct; they have undergone many changes in the daughter languages and their identities are often "obscure" (Bloomfield 1946:88). Nevertheless, as this paper has shown, the set of PA coda-onset clusters that has emerged from painstaking historical reconstruction is perfectly compatible with a phonological analysis. This finding provides an additional layer of confirmation of the typological validity of the reconstructed PA sound system.

The phonotactic system of PA has changed to at least some degree in all of the daughter languages. Coda consonants are particularly volatile, with the set of consonant clusters undergoing considerable simplification in many languages; for example, coda nasals have debuccalized to *h* in Cree and Menominee (Bloomfield 1946:88–90). Other sound changes have created new phonotactic possibilities, such as the word-final consonants that are found in many languages due to the loss of final vowels (Bloomfield 1946:93). The analysis of PA phonotactics in this paper provides a set of structures and constraints that can shed light on the nature and trajectory of these changes, thus laying the groundwork for a comparative analysis of phonotactics across the Algonquian languages.

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