The Status of Blackfoot /s/ Analyzed in Optimality Theory

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INTRODUCTION

In this paper I seek to explain the peculiar distribution of /s/ in Blackfoot, viz., /s/ is the only phoneme that can occur in complex onsets, and geminate /ss/ is the only geminate that can occur between consonants.1 The data presented herein comes from Frantz and Russell (1995), which is currently the most widely used dictionary of Blackfoot and the only one still in print. Forms are followed by the page number on which they occur in the dictionary. IPA transcriptions given throughout are based on general rules of Blackfoot pronunciation as outlined in Frantz (1991).

1. I am indebted to the comments and suggestions of many people on various stages of this research. This paper grew first into and later out of my MA thesis, so first and foremost I have to thank my MA thesis committee: Mizuki Miyashita, who commented on many, many drafts of this research, from ideological conception to conference paper to thesis, Leora Bar-el, Naomi Shin, and Don Frantz, to whom I am indebted for his keen insight into the language and his close attention to forms I was curious about. Any inaccuracies or inconsistencies, in English or Blackfoot, are of course my own. I would also like to thank Annabelle Chatsis, whose teachings have certainly contributed to my knowledge of the Blackfoot language. I would like to thank Miranda McCarvel, Gustavo Guajardo, Scott Sterling, Donald Derrick, Amanda Denzer-King, and fellow students in a 2009 Field Methods seminar at the University of Montana, all of whom lent me assistance at various points. I must also thank audiences at CELCNA 2008, the 8th Annual University of Montana Graduate Student and Faculty Research Conference, and of course the 40th Algonquian Conference, especially Ives Goddard and David Pentland, who asked important questions and provided critical feedback at several stages of research. Last but not least I am indebted to an anonymous reviewer, whose knowledge of Blackfoot and understanding of the theoretical issues at stake provided many insightful comments and questions that led to a significant sharpening and focusing of this paper.
I here propose that the distribution of /s/ in Blackfoot can be explained by positing that /s/ is inherently moraic in Blackfoot. I focus specifically on two aspects of moraic /s/. The first is that /s/ in complex onsets, e.g., stsiki, ‘another,’ is extrasyllabic, and that a moraic /s/ reduces the markedness of these extrasyllabic segments. The second is that because /s/ is moraic, it can act as a syllable nucleus, which explains why the distribution of geminate /ss/ is more similar to long vowels than to geminate consonants. In Blackfoot, clusters of more than two consonants occur only with /s/, and clusters of more than three consonants occur only with geminate /ss/. The Blackfoot syllable seems to be overwhelmingly simple, with /ss/ clusters being the only outliers. While all other geminates occur between vowels, geminate /ss/ often occurs before, after, or between other consonants. Proposing an inherently moraic /s/ in Blackfoot explains this distribution. I also propose an explanation for geminates that does not rest on moraicity, and thus allows us to distinguish between short moraic /s/ and long moraic /s/ in Blackfoot.

I will first discuss background information, including an overview of the Blackfoot language as well as an explanation of Optimality Theory (OT), the theoretical framework used here. I will then delve into syllable analysis, starting with a general discussion of syllable structure under Optimality Theory and moving on to an OT analysis of Blackfoot syllable structure. I then deal with the analysis of specific traits in Blackfoot phonology, namely syllabic /ss/ and extrasyllabic /s/. The paper ends with summary conclusions and directions for further work.

BACKGROUND

This section outlines the main phonological traits of the Blackfoot language that are relevant to my claims, as well as discussing the theoretical background of Optimality Theory and how it relates to the phonology of Blackfoot.

Overview of Blackfoot

Blackfoot is an Algonquian language with around 100 speakers in Montana and 5,000 in Alberta (Gordon 2005). It is the western-most Algonquian language, and was the first to diverge from Proto-Algonquian, lacking several of the linguistic innovations shared by the other Algonquian languages (Proulx 1989:44). There are four dialects of Blackfoot, three of which are spoken in Canada and one which is spoken in the United States:
The Status of Blackfoot

Siksiká (Blackfoot), to the southeast of Calgary, AB, Kainai (Blood), spoken in Alberta between Cardston and Lethbridge, Aapátohsipikani (Northern Piegan), to the west of Fort MacLeod, and Aamsskáápipikani (Southern Piegan), in northwestern Montana (Frantz 2007, Frantz and Russell 1995).

Blackfoot has a relatively small consonant inventory compared to many neighboring indigenous languages, e.g., Kutenai or Kalispel, primarily in that it does not employ glottalization or voicing for phonemic contrasts. (1) shows the orthographic representation of consonants in Blackfoot, as well as the corresponding IPA symbols where they differ from the orthography.

(1) Consonants in Blackfoot

<table>
<thead>
<tr>
<th></th>
<th>Labial</th>
<th>Alveolar</th>
<th>Palatal</th>
<th>Velar</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop</td>
<td>p</td>
<td>t</td>
<td>k</td>
<td></td>
<td>’ [ʔ]</td>
</tr>
<tr>
<td>Fricative</td>
<td>s</td>
<td></td>
<td>h [x~χ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasal</td>
<td>m</td>
<td></td>
<td>n</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affricate</td>
<td>ts</td>
<td></td>
<td>ks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glide</td>
<td>w</td>
<td></td>
<td>y [j]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All symbols are the orthography developed by Don Frantz in conjunction with Blackfoot community members (Frantz 1978). Most symbols retain standard IPA values, except for the use of /h/ for the velar fricative [x], /y/ for the palatal glide [j], and ’/ for the glottal stop [ʔ]. The stops, /p/, /t/, /k/, and ’/, are all voiceless and unaspirated (Frantz 1991). All stops occur syllable-initially and syllable-finally except ’/, which only occurs syllable-finally with a few exceptions. The nasal stops /m/ and /n/ can appear syllable-initially, though never after /s/, and syllable-finally as the first member of a geminate or before geminate /ss/. /m/ only occurs as a coda word-medially. Blackfoot has two affricates: /ts/ and /ks/. These two affricates can occur syllable-initially or syllable-finally, and have the same distribution in phonology and morphology as other stops. For these and other reasons these affricates are treated as single phonemes (Elfner 2005), not as a stop + fricative series.

/h/ [x] is always preceded by a vowel and followed by a stop, i.e., it only occurs as a coda. One reason for this is that in most cases any consonant occurring before a stop, i.e., in coda position, was leveled to /h/ historically (Proulx 1989). Frantz and Russell (1995) lists only seven /h/-initial stems, four of which are bound. The three free morphemes are
all expressions that are not strictly lexical: hánnia, ‘expression used in response to a topic of interest,’ ha’, ‘expression used to show scorn for someone’s showy behavior,’ and há’ayaa, ‘expression used mainly by males in anticipation of a reprimand.’ In these cases the orthographic /h/ represents a “smooth onset” rather than a fricative (Don Frantz, p.c.). In Blackfoot, /w/ only occurs phonemically in syllable-initial position, though phonetically it often occurs at the end of a word due to reduction of the third person suffix -(a)wa. Underlying /y/ always occurs syllable-initially, though underlying /i/ sometimes surfaces as [j] after a consonants and before a vowel, e.g., kiááyo, ‘bear’ [ki.áː.jo] or [k̞iáː.jo].

/s/ has a distribution that differs significantly from every other phoneme, and for this reason is the subject of investigation in this paper. /s/ can occur syllable-initially or -finally. In addition, /s/ is the only phoneme that can occur in complex onsets and one of three (with /h/ and ’/’) that can occur in complex codas. Geminate /ss/ occurs word-initially, but I have found no instances of word-final geminate /ss/. Geminate /ss/ can also occur before, after, and between other stops, whereas all other geminates occur only between vowels. It may be relevant for the claims put forth in this paper regarding the peculiar distribution of /s/ that /s/ is the only fricative that can occur in multiple positions within the syllable, since /h/ can only occur syllable-finally. However, since /s/ has peculiar characteristics in many other languages, including English, Cherokee, and Haida, I take the position that it is /s/, and not fricatives in general, which behaves differently in Blackfoot.

The vowel system of Blackfoot remains understudied, and is phonetically quite complex. However, Frantz (1991) posits only three phonemic vowels in Blackfoot: /a/, /i/, /o/. (2) shows underlying vowels and diphthongs in Blackfoot as well as their common phonetic realizations, which are not entirely predictable (Elfner 2005, Van der Mark 2003, Frantz and Russell 1995, Frantz 1991), as discussed below.

(2) Vowels in Blackfoot

| /a/ | a, ʌ |
| /i/ | i, ɪ, e, j |
| /o/ | o, ə, u |
| /ai/ | e, ɛ, aj, ej, æ |
| /ao/ | ɔ, ao, aw |
| /oi/ | ɔ ] |
While other vowels have been treated as phonemic by some authors, for example, Taylor (1969) treats [u] as a phoneme and Van der Mark (2003) treats [e] and [ɔ] as phonemes, there are no minimal pairs contrasting [u] and [o], [e] and [i], etc. [u] and [o] seem to be in free variation (Elfner 2006), while [e], [ɛ], and [ɔ] occur as merged forms of the diphthongs /ai/ and /ao/. [ʌ] is a variant of short /a/, especially before geminates. [i] and [e] seem to be unpredictable variants of /i/, especially [ei] for /iː/, while [ɪ] occurs as the lax version of short /i/ before geminates and in a few common affixes. /i/ becomes the glide [j] when it occurs after a consonant and before a vowel. The difference between [o], [ʊ], and [u] is not entirely predictable and often varies from speaker to speaker and token to token, but there are no minimal pairs or near minimal pairs contrasting these vowels. /ai/ is most often realized as [e], or [ɛ] before geminates, but is pronounced as [ei] when long. The [aj] variant is fairly uncommon. [æ] is a dialectal variant used on the Blood Reserve (Frantz 1991). /ao/ is usually realized as [ɔː], but occasionally as [ao] or [aw]. All Blackfoot monophthongs, as well as the diphthongs /ai/ and /ao/, can be either long or short. /oi/ is always short. In addition to length, pitch is also phonemic for Blackfoot vowels. High pitch is marked with an acute accent (´), while low pitch is unmarked. Blackfoot is generally considered to be a pitch accent language (Frantz 1991, Van der Mark 2003), though Stacy (2004) argues convincingly that in fact Blackfoot has a tonal system.2

Theoretical Background

The primary theoretical framework used in this paper is that of Optimality Theory (OT), first put forward by Prince and Smolensky (1993) and McCarthy and Prince (1993). The basic premise of this theory is that rather than phonological rules, languages have correspondence and markedness constraints that prefer or disprefer certain surface pronunciations, termed outputs in OT, of underlying forms, which are termed inputs. Faithfulness constraints govern the correspondence between the input and output of a given item, mostly in the context of ensuring as much as possible that the surface pronunciation matches the underlying representation. Markedness or well-formedness constraints keep phonetic realizations in line with cross-linguistic trends, e.g., voiced codas are dispreferred, syllable onsets are preferred, syllable nuclei should consist of one vowel (Kager 2001).

2. I am indebted to an anonymous reviewer for bringing this to my attention.
At the heart of OT is the conflict between faithfulness constraints, which keep surface representations in line with the abstract phonological forms, and well-formedness constraints, which seek to keep surface realizations in line with cross-linguistic generalizations based on markedness. This exemplifies the basic concept behind OT: all languages have the same constraints, all of which are violable. The output forms of the corresponding input depends on which constraints are the most important in a given language. Violations, as well as the optimal output, are represented visually through the use of a tableau. A general example is given in (3).

(3) a. Language A

<table>
<thead>
<tr>
<th>/ /</th>
<th>Y</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>(b)</td>
<td>!</td>
<td></td>
</tr>
</tbody>
</table>

b. Language B

<table>
<thead>
<tr>
<th>/ /</th>
<th>Y</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>!</td>
<td></td>
</tr>
<tr>
<td>(b)</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

In the tableaux above, a ‘*’ indicates a violation of a given constraint, and a ‘!’ indicates a fatal violation (one that disqualifies the candidate). Shading after the fatal violations indicates that satisfying or violating the lower-ranked constraints is irrelevant after a fatal violation. In (3a), the second candidate is disqualified because it violates constraint X, which is more highly ranked in language A. In (3b), the first candidate is disqualified for violating constraint Y, which is more highly ranked in language B.

**Syllable Analysis**

The following sections propose two primary ways in which moraic /s/ reduces the markedness of the seemingly complex syllables involving /s/: (i) an extrasyllabic moraic consonant is less marked than a non-moraic one, and (ii) moraic /s/ can act as a syllable nucleus. I first give some background about the analysis of syllable structure and the emergence of the unmarked
CV syllable in Optimality Theory. I then discuss how the claim that /s/ in inherently moraic predicts that having a complex onset with /s/ as the first member is less marked than having a complex onset with some other phoneme as the first member. Since a claim of inherent moraicity (usually reserved for vowels) predicts that /s/ should be able to act as a syllable nucleus, I then look at evidence that this is the case in Blackfoot.

_Syllable Structure in Optimality Theory_

The most basic constraints on syllable structure come from simple cross-linguistic generalizations. For instance, cross-linguistically the most common syllable type is CV. All languages have CV syllables, and some languages have only CV syllables. V and VC syllables are less common, and more marked, which leads to the formation of the Onset constraint.

(4) **Onset**: Syllables must have onsets.
This captures the generalization that syllables with onsets are more common and less typologically marked than syllables without onsets. The unmarkedness of the CV syllables leads to another generalization: open syllables are less marked than closed ones, e.g., CVC syllables are more marked than CV syllables. This leads to the formulation of the NoCoda constraint.

(5) **NoCoda**: Syllables must be open.
These two constraints account for the markedness differences between CV, CVC, V, and VC syllables, which is all many languages allow. This is because syllables with complex margins are even more typologically marked. These include types such as CCV, CCVC, VCC, etc. The markedness of complex syllable margins is indicated by the *Complex constraint.

(6) ***Complex**: Syllable margins must be simple.
These three constraints are the primary markedness constraints on basic syllable types.

Without faithfulness constraints all output forms would be the same: whatever form is judged to be the least marked cross-linguistically. One of the primary faithfulness constraints is the Max constraint.
(7) MAX: Input elements are present in the output.  
More accurately, MAX is a family of constraints that can be applied to  
any level or phonological, prosodic, or morphological structure. The typical  
constraint used for mapping input segments to output segments is phrased  
as MAX-IO.

(8) MAX-IO: Input segments are present in the output.  
Another constraint that will be useful is the MAX-µ constraint, which  
militates against input moras not present in the output.

(9) MAX-µ: Input moras are present in the output.  
MAX-µ has been used to explain length contrasts by many different sources,  
including Rosenthall (1994), Sherer (1994), and, regarding Blackfoot, Elfner  
(2007, 2006). In Blackfoot this constraint is most relevant for long vowels.  
Short vowels are associated with one mora, while long vowels are associated  
with two. A vowel with two moras should surface as a long vowel if it is not  
to violate the MAX-µ constraint (Elfner 2007). This faithfulness constraint  
conflicts with *LONGV, a markedness constraint supported by the universal  
tendency for long vowels to be more marked than short vowels cross-  
linguistically, e.g., there are languages which have only short vowels, but  
no languages which have only long vowels.

(10) *LONGV: Output vowels should be linked to a single mora.  
(11) shows one instance of MAX-µ at work.

(11) Tableau for nínna, ‘man.’

<table>
<thead>
<tr>
<th>/ni₃นำ₃µ/</th>
<th>MAX-µ</th>
<th>*LONGV</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) nina</td>
<td>*!</td>
<td></td>
</tr>
<tr>
<td>☒ b) nínna</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

As shown in (11), MAX-µ must be ranked above *LONGV for any long  
vowels to surface, e.g., in languages with long vowels. Since candidate (11a)  
does not preserve both input moras associated with the final /a/, candidate  
(11b) is the optimal output.
Previous sections have introduced the research questions of this paper and the theoretical frameworks in use here. The purpose of this section is to take an in-depth look at the distribution of /s/ and how it differs from other phonemes in Blackfoot. /s/ is the only phoneme that makes syllabification difficult in Blackfoot. In words without /s/, syllabification is straightforward, since except for syllables involving /s/, the maximal Blackfoot syllable is CVVCC, and all geminates are intervocalic and thus can be explained as ambisyllabic within moraic phonology as detailed in Hayes (1989). The phoneme /s/ is unique in Blackfoot in three ways: (i) all geminates are intervocalic except some instances of /ss/, (ii) all complex onsets involve /s/, and (iii) all heterorganic consonant clusters involve /s/. This section offers a unified explanation for these three facts by proposing that /s/ is inherently moraic, and because of this can act as a syllable nucleus. However, because proposing an underlyingly moraic /s/ in Blackfoot begs the question of deriving a distinction between, e.g., /isa/ and /issa/, I propose in the next section a theory of geminates that does not rest on a moraic/nonmoraic distinction.

This section focuses on how the proposal of moraic /s/ reduces syllable margin markedness by parsing the first member of a complex onset to a prosodic category higher than the syllable. To my knowledge there is no complex onset in Blackfoot that does not involve /s/. To explain the fact that /s/ readily participates in complex onsets, I propose that in these cases /s/ is extrasyllabic, i.e., parsed to some prosodic category higher than the syllable, so that at the syllabic level, an onset involving /s/ is not actually complex. This parallels Kiparsky’s (2003) analysis of certain initial consonant clusters in Arabic, as shown in (12).³

(12) Extrasyllabic consonants in Arabic (from Kiparsky 2003). See Figure 1.

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³ Kiparsky (2003) lists three main dialect groups of Arabic: VC-dialects, C-dialects, and CV-dialects, which differ from each other based on syllable structure. The syllabification shown in (12) is what Kiparsky proposes for VC- and C-dialects of Arabic, which include Iraqi, Syrian, and Tunisian varieties, as well as several others.
The extrasyllabic /s/ in (12a) retains its mora to satisfy mora preservation. If the /s/ is parsed to a syllable node, we would expect to find it in a weight-bearing position, i.e., not in onset position. In some dialects, an i- is inserted before the /s/: is.laah, shown in (12b) (Kiparsky 2003). In this way the /s/ can be parsed to a syllable without a complex margin, since the consonant cluster is being split between two syllables. Crucially, the /s/ can still retain its mora, since it occurs in the coda, which is a weight-bearing position associated with a mora. This parallels exactly the pattern of word-initial moraic /s/ in Blackfoot discussed below. Just as in Arabic, the insertion of the vowel is in free variation with its complex onset counterpart. This type of insertion occurs only in VC- and C-dialects of Arabic; in CV-dialects the /s/ loses its mora: si.laah. Thus in cases like these is for the mora attached to the /s/ is deleted, violating mora preservation.

According to Selkirk (1995), the reason extrasyllabic segments are marked is that prosodic elements should be parsed to the category directly above them, i.e., segments should be parsed to moras, moras should be parsed to syllables, etc. Because of this, extrasyllabic segments are progressively more marked the higher the prosodic category to which they are parsed. When dealing with extrasyllabic segments parsed to a foot or prosodic word, this means that a segment attached to a mora would be less marked, because the mora is higher up the prosodic structure than the

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4. This i-insertion is also evident in English-language learners whose native language is Arabic (see Alezetes 2007). The various dialects of Arabic have different insertion points for breaking up CC clusters, yielding CVC or VC.C sequences depending on the dialect. Interestingly, Alezetes (2007) provides data which suggests that in both types of dialects, sC clusters are resyllabified as is.C sequences, rather than an sVC sequence.
segment itself. Thus while a segment attached directly to the prosodic word is skipping three prosodic categories (mora, syllable, foot), a moraic segment attached to the prosodic word only skips two (syllable, foot). I take this to parallel Borowsky’s (1989) analysis of coronals in English, which also appear in complex syllable margins, as shown in (13).

(13) Coronal appendices in English (from Borowsky 1989). See Figure 2.

\[ \begin{array}{c}
\sigma \\
\text{App} \quad \text{Onset} \quad \text{Rime} \quad \text{App} \\
x \quad x \quad x \quad x \quad x \\
s \quad t \quad j \quad e \quad j \quad n \quad d \zeta
\end{array} \]

Figure 2.

Borowsky (1989) uses the notion of appendices that attach to the syllable node separately from the onset or coda in X theory. Since current theory does not recognize separate nodes for onset, rime, etc., I will be using the notion at a higher level of prosodic structure, proposing that these appendices, which only occur at word edges, attach directly to the prosodic word, which parallels Roca and Johnson’s (1999) analysis of appendices in English. (14) shows a revision of (13).

(14) Extrasyllabic coronals.

\[ \begin{array}{c}
\text{PrWd} \\
\text{Ft} \\
\sigma \\
\mu \quad \mu \\
s \quad t \quad j \quad e^3 \quad n \quad d \zeta
\end{array} \]

5. While the literature on English does not comment on the moraic representation of diphthongs, here I have chosen to represent the diphthong in “strange” as a long /e/, since this diphthongization of tense vowels in English is predictable, and in this case does not arise from the treatment of two phonologically separate segments as a single vowel (Roca and Johnson 1999).
This same type of extrasyllabicity would explain the ability of /s/ to participate in complex onsets in Blackfoot. (15) shows the proposed prosodic organization for *stsiki*, ‘another.’

(15) Prosodic structure for *stsiki*.

In (15), the /s/ is parsed directly to the prosodic word, avoiding what would otherwise be a complex onset parsed to the syllable node. This also in some ways parallels Bagemihl’s (1991) analysis for Bella Coola, whereby segments are licensed (i.e., in a pre-OT framework protected from Stray Erasure) by attachment to a mora, which means that moraic segments outside the core syllable are still pronounced.

Some Blackfoot speakers seem not to allow complex onsets, and instead insert an epenthetic vowel (somewhere between ə and ɪ) before the initial /s/. I believe that this type of variance can and should be accounted for within the theory of moraic /s/ in Blackfoot. If /s/ is indeed always moraic in Blackfoot, then it needs to be in a weight-bearing position if it is not extrasyllabic. This means that the /s/ must be in a coda or nucleus when it is not extrasyllabic, i.e., speakers for whom the type of extrasyllabicity proposed above is unacceptable may seek to reduce the complexity of the cluster by putting the initial /s/ after the epenthetic vowel, e.g., *astsiki*. This type of vowel insertion crucially never takes place between the two consonants: *sitsiki* is an unattested form. When epenthesis is involved, it always occurs before the cluster, creating a coda-position /s/, as in *astsiki*. The proposal that /s/ is moraic explains the distribution of /s/ in weight-bearing positions, but may seem problematic for instances of /s/ in onset position. I turn to this problem at the end of the next section.
The proposal of moraic /s/ in Blackfoot explains why it can be extrasyllabic while other consonants cannot: the parsing of a moraic segment to the prosodic word is less marked than the parsing of a nonmoraic segment. Claiming that /s/ is moraic in Blackfoot makes a further prediction. Since the usual proposal is that moraic segments are limited to nucleus position, it would be odd to propose a moraic segment that only occurred in onset and coda position, but never in nucleus position. If Blackfoot /s/ is moraic, as are vowels, it should be able to act as a syllable nucleus. Evidence that this is in fact the case is considered in the next section.

Syllabic /s/

The previous section considered evidence that /s/ in Blackfoot complex onsets is extrasyllabic, and that the proposal of moraic /s/ would reduce the structural markedness of this extrasyllabicity. This section details several reasons for positing syllabic /s/ in Blackfoot, looking first at ambisyllabicity and the distribution of geminate /ss/. Derrick (2007) suggests that /s/ is syllabic in Blackfoot, and supports this claim with typological and phonetic evidence, including the general simplicity of the Blackfoot syllable, with /s/ clusters being the only outliers, and the difference in duration between different types of /s/. While the proposal of syllabic /s/ does explain some of these phenomena, syllabic /s/ still requires some underlying motivation. My proposal that /s/ is inherently moraic in Blackfoot, as discussed in the previous section, supports the notion of syllabic /s/: the inherent moraicity of /s/ licenses it to act as a syllable nucleus. It is important to note that it is the inherent moraicity of /s/ which predicts that it can act as a syllable nucleus. Coda consonants are moraic in languages with heavy CVC syllables, but we do not expect them to be syllabic. If /s/ in Blackfoot is inherently moraic, as are vowels, it should be able to act as a syllable nucleus. However, just as vowels can also be nonmoraic, e.g., /u/ becomes /w/ and /i/ becomes /j/, we should not expect /s/ to be syllabic in every instance. This section will first discuss ambisyllabicity in Blackfoot, and why geminate /ss/ cannot always be ambisyllabic. Then I turn to the distribution of geminate /ss/ and how it parallels the distribution of long vowels rather than other geminate consonants. I next look at root-initial geminate /ss/ and how the proposal of syllabic /s/ explains the presence of geminates in this unexpected position. Finally I turn to the thornier issue of how to derive the contrast between
/isa/ and /issa/, and propose a new representation of geminates that does not hinge on moraicity.

**Ambisyllabicity in Blackfoot**

Because /ss/ in Blackfoot occurs between consonants, not all instances of geminate /ss/ can be ambisyllabic. In a sequence such as -CssC-, it is impossible for both instances of geminate /ss/ to be split between two syllables without creating a consonantal nucleus. Positing syllabic /s/ in Blackfoot eliminates the need to try to parse these geminates as ambisyllabic, since syllable nuclei can be long without being ambisyllabic. The following section considers in detail the question of how to analyze seeming instances of tautosyllabic /ss/.

**Distribution of Geminate /ss/**

This section shows how positing syllabic /s/ in Blackfoot explains the unexpected presence of tautosyllabic geminate /ss/ in Blackfoot. Just as short /s/ has a different distribution from other phonemes, appearing in complex onsets and codas, geminate /ss/ has a very different distribution from other geminates. As will be shown in this section, the distribution of geminate /ss/ more closely matches long vowels than geminate consonants. Most geminate consonants can only occur intervocally, and thus can be attributed to ambisyllabicity, as shown in (16).

(16) Geminate stops and affricates in Blackfoot.

<table>
<thead>
<tr>
<th>Example</th>
<th>Pronunciation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. iiksipatsinima</td>
<td>[iikspat'înîm̩a]</td>
<td>she is curious about (s.t.) (79)</td>
</tr>
<tr>
<td>b. nottoksiksi</td>
<td>[notot'îkê]</td>
<td>my knees (130)</td>
</tr>
<tr>
<td>c. sooyikinssimojiksi</td>
<td>[soojik'mesimojikê]</td>
<td>poisonous plants (218)</td>
</tr>
<tr>
<td>d. ikkia'yoohkottsi'poyiwa</td>
<td>[ik'já:joxko'tîpôjiw̩]</td>
<td>she had trouble speaking (43)</td>
</tr>
<tr>
<td>e. ikkipööhko'siksi</td>
<td>[îkk'pôxko'sîk̩]</td>
<td>tin cans (44)</td>
</tr>
<tr>
<td>f. áaksinnaapowa</td>
<td>[âa:k'mápowâ]</td>
<td>he will go east (190)</td>
</tr>
<tr>
<td>g. itsikinaamna</td>
<td>[î'tîkînâm̩â]</td>
<td>he appears weak (101)</td>
</tr>
</tbody>
</table>


---

6. I mean by this structural ambisyllabicity, i.e., the simultaneous attachment of one segment to two syllables, as coda to one and onset to the next.
affricates in (16d) and (16e) rather than stop + homorganic affricate sequences. The geminates shown above never occur before, after, or between other consonants. Geminate /ss/, on the other hand, does occur before, after, and between other consonants. Any consonant can occur before geminate /ss/ except for /w/, and any consonant can occur after geminate /ss/ except for /w/, /y/, and /’/.

(17) Long /s/ in Blackfoot.

Intervocalic
a. kiááhkao’tsisissi [kˈːɑχkːoʔt’isisisi] for you to smoke (108)
b. iimatsiiyisiwa [iimat’iː̃jgiwi] he crouched in ambush (162)

Preconsonantal
c. isspihkima [iː̃spı̃xki̱ma] he slacked off toward it (227)
d. áisinapisstama [ési̱napi̱sstamə] he is nailing it together badly (83)
e. nitohtoisskima [nitoχtɔjškimə] I herded (151)

Postconsonantal
f. sooyikkinissimoiyiksi [sojikːimɔsi̱jik’] poisonous plants (218)
g. kipahtani’ssini [kipaχtani̱sini] your cut (253)

Interconsonantal
h. ikksspisa [iːkːspi̱sa] hit him on the head! (45)
i. iikómsspika’pssiwa [iikomspikaʔpsiw] he is hard to take care of (165)

(17) shows that /ss/ has a very different distribution from all other geminates. All other geminates can only occur intervocically,7 but /ss/ can appear not only between vowels (17a-b), but before (17c-e), after (17f-g), or between other consonants (17h-i). Thus /ss/ is the only geminate which can occur in any environment. This is schematically represented in (18).

7. An anonymous reviewer notes that Frantz and Russell (1995) has /mms/ and /nns/ in a few forms. I was unable to locate any forms like these, but obviously forms such as these would be relevant for this argument. However, I believe this additional data would not refute the arguments presented herein, since they are by far the exception, whereas /ss/ quite commonly occurs before, after, or between consonants.
(18) Possible environments for geminates in Blackfoot.

<table>
<thead>
<tr>
<th></th>
<th>V_V</th>
<th>V_C</th>
<th>C_V</th>
<th>C_C</th>
</tr>
</thead>
<tbody>
<tr>
<td>pp</td>
<td>✓</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>tt</td>
<td>✓</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>kk</td>
<td>✓</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>tts</td>
<td>✓</td>
<td>✗</td>
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</tr>
<tr>
<td>kks</td>
<td>✓</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>nn</td>
<td>✓</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>mm</td>
<td>✓</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>ss</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

The fact that geminate /ss/ occurs before and after stops does not mean that Blackfoot certainly has syllabic /s/. However, whatever the explanation is, it involves structural markedness: the only possibilities are extremely complex syllable margins, tautosyllabic geminates, or syllabic /s/. The discussion below shows that in many ways it is most useful to analyze these sequences as having a syllabic /ss/, because positing syllabic /ss/ solves the problems of pre- and post-consonantal geminates and extreme syllable complexity that only occurs with /ss/.

**Root-Initial Syllabic /ss/**

Besides occurring before, after, and between consonants, geminate /ss/ also occurs word-initially. Since in moraic phonology onsets should not be associated with a mora, this creates a problem for how to represent these word-initial geminates. However, if we assume that these geminates are syllabic, this solves the problem of how to represent them. In this case the moraic /s/ appears in a position where it can be associated with a mora: the nucleus. While it may not directly support syllabic /s/, I believe the existence of initial [iss] ~ [ss] in many of these roots does directly support the hypothesis of moraic /s/ in Blackfoot. (19) surveys a range of [ss]-initial roots, showing the variation between [iss] and [ss].
(19) [ss] ~ [iss] alternations.

a. sskaˈmitaopikˈkini crazy, daft (223)
b. sskaˈmitaopikˈkinit be daft! (223)
c. (i)sskáˈmitáóopikˈkinniwa she was daft (223)
d. ssim pay (a curer) for treatment (222)
e. ssimisa pay him! (222)
f. issimiiwa he brought her payment (222)

These examples are difficult to explain and to syllabify without syllabic /s/, but with syllabic /s/ they can be syllabified the same as words beginning with a long vowel. It may be that for speakers who seek to avoid initial consonant clusters or syllabic /s/, an epenthetic [i] is inserted before the /s/, which avoids an initial geminate or syllabic /s/, but remains faithful to the mora attached to the /s/, since the /s/ still appears in a weight-bearing position: the coda.

The reader may wonder if in fact it is justified to list these roots as beginning with a long /ss/ rather than /iss/, given that if epenthesis occurs in Blackfoot, this root-initial “connective- /i/” (Frantz 1991, Elfner 2005) seems to be the only case. Frantz and Russell (1995) gives the root for ‘measure’ as sskskaaki, even though in many words the root has an initial [i]. This is because not all forms have this output [i]. The first person form for ‘I measure(d)’ is nítsskskaaki. It would be difficult to explain the loss of a vowel between two consonants if the root really did begin with i-. It is unexpected that nítsskskaaki does not feature any kind of morphophonemic deletion or epenthesis, especially since the first person prefix nít- has an allomorph ni- before most consonants, as in nikihtsipimiotaˈsiksi, ‘my pinto horses,’ from kííhtsipimiotaˈsí, ‘pinto horse.’ If, on the other hand, the /ss/ is syllabic, e.g., niˈtssks.kaa.ki, there would be no need for an /i/ to break up the consonant cluster. In addition, we may wonder, as did an anonymous reviewer, if the /i/-less forms are imperatives. However, not only does this variation only occur with /s/-initial roots, but also there are /i/-initial /ss/ roots that are not imperatives, e.g., issimáˈtoot, ‘smell it!’ (222), isskatáˈpiksistsiˈsa, ‘yank her backwards!’ (223).

8. Blackfoot has no formal way of marking past, so many verb forms can be interpreted as past or present depending on context. In general, zero marking receives a past interpretation, while the “durative” receives a present interpretation. See Dunham (2007).
The fact that the presence of initial *i-* in these roots is only occasional, combined with the fact that first and second person forms never contain an *-i-* between the person prefix and the root, suggests that the /ss/ in these roots is at least sometimes, if not always, syllabic. If [ss] can act as a syllable nucleus, there would be no reason for deletion or epenthesis, since the *-t-* of *nit-* would form the onset of a syllable with *-ss-* as the nucleus. The optional, or in some cases obligatorily absent, *i-* means that either these words contain a syllable-initial geminate, something that is at the very least highly marked since they occur in few if any languages (Davis 1999, Hume et al. 1997), or a syllabic /s/.

Nonmoraic /s/

A remaining question is whether the claim of inherently moraic /s/ can account for intervocalic length distinctions, e.g., /isa/ vs. /issa/. In a Hayes-ian moraic geminate framework, /issa/ should have the underlying structure /\textit{i} s a /, which is the same structure I have proposed exists for /isa/ within the moraic /s/ framework. In does not seem fruitful to attempt to derive these conflicting output forms from a single input, so we need to posit some difference in underlying forms for these two sequences. One solution would be to posit that short intervocalic /s/ is tied to a single mora, while long intervocalic /s/ is associated with two moras; this extends the analysis of /s/ as a vowel-like segment, since vowels are held to inherently have one mora, with a second mora added for long vowels. Thus a VssV sequence would be treated the same as a CVVC sequence, rather than as a VCCV sequence.

This issue is one which needs significant further study, because it rests firmly on the question of the structural representation of geminates. While Hayes proposes that geminates arise from association with an underlying mora, there are many problematic issues that arise from this assumption (many of them discussed in Hayes 1989). Swadesh (1937) is one of the first of many attempts to determine whether it is more theoretically desirable to represent geminates as single doubly linked phonemes or a sequence of two identical phonemes, e.g., /p/ vs. /p:/ or /p/ vs. /pp/. The former approach has been by far the favored one of late, but I will propose here that if we adopt the latter approach we can derive length differences in Blackfoot /s/ without reference to moraicity. More precisely, I will briefly sketch an idea for what we can call the Copy Theory of Geminates, which posits an
underlying phonemic difference between short and long phonemes, realized at the surface level as a sequence of two identical phonemes.

The basic idea behind the Copy Theory of Geminates is that long consonants (and probably vowels) are specified underlyingly as long, e.g., in Blackfoot there is an underlying phoneme /s/ and there is an underlying phoneme /s\text{L}/.\textsuperscript{9} The latter long phoneme is then realized at the surface level as a sequence of two identical phonemes, i.e., the phoneme is marked with some underlying feature that triggers copying, so that at the surface level, the phoneme appears twice in succession. This theory has a major theoretical and empirical advantage, in that we can now divorce gemination from moraicity, so that we can posit a short moraic consonant, as instantiated by moraic coda consonants, as well as long nonmoraic consonants, as are found in Leti (Hume et al. 1997). This view of geminates also divorces gemination from ambisyllabicity, which seems to be perhaps the most serious issue with the moraic theory of geminates. In moraic phonology, there should a priori be no difference between long and short ambisyllabic moraic consonants. If, on the other hand, we assume the Copy Theory of Geminates, we can derive the difference between a short moraic ambisyllabic consonant, such as the /l/ in English bowling (see Cutler et al. 1986), and a long moraic ambisyllabic consonant, such as the /t/ in Blackfoot nottoki Isi.

There is also at first glance a major theoretical and empirical cost to this theory, in that if geminates truly are sequences rather than being single doubly linked consonants, we lose an explanation for geminate integrity and inalterability. Doubtless there is a way in this Copy Theory to account for geminate integrity, but I will argue that in fact we should relinquish at least the current description of geminate integrity. The beauty of the doubly linked theory of geminates is that it accounts for why nothing can be inserted in the middle of a geminate, and why geminates rarely display edge effects. However, less studied is that fact that other clusters also display these properties. In the so-called VC-dialects of Arabic, disallowed

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\textsuperscript{9} In many ways this echoes earlier attempts to represent long segments as [+long]. Whether or not this new Copy Theory can account for every instance of geminates and their interaction with morphophonology remains to be seen. The most serious foreseeable problem is that a feature such as [+long] does not spread. Quite the opposite, sequences of geminates seem to be vanishingly rare cross-linguistically. However, a thorough typological investigation is beyond the scope of this paper.
CC clusters are broken up by prothesis: $CC \rightarrow VC.C$, e.g., /st/ $\rightarrow$ [ist]. In the CV-dialects, on the other hand, CC clusters are dealt with by epenthesis, where CC becomes CVC, e.g., /kt/ $\rightarrow$ [kit]. Unexpectedly, /st/ clusters are not syllabified in the normal way, but undergo prothesis, as in VC-dialects, instead of the usual epenthesis, e.g., /st/ $\rightarrow$ [ist] (Alezetes 2007). This seems to be a peculiarity of the phoneme /s/, and carries over to Arabic speakers leaning English as a second language (Alezetes 2007, Broselow 1993). Thus unless we are to treat these two phenomena separately, we need a different theory of integrity, a full investigation of which is outside the scope of this paper.

If we accept the Copy Theory of Geminates, it is no longer difficult to derive the difference between sequences such as /isa/ vs. /issa/ or /ist/ vs. /isst/ in Blackfoot. In all cases the /s/ is attached to a mora, but in the case of long /s/ the phoneme is underlyingly specified as long. The rough sketch of the theory given above is certainly not an adequate analysis of geminates cross-linguistically, but even at this initial stage accounts for the Blackfoot data. One remaining question is how geminate affricates are to be analyzed, since the copying of a long affricate would result in *[tsts]*, rather than the correct [tts]. This is one of many questions I must leave to future research. In cases where a long /ss/ forms a nucleus or coda and the onset of the following syllable, we can assume that only the first /s/ is attached to a mora, but in the case of consonant-bounded long /ss/ forming a syllable nucleus, we should probably assume that, like long vowel nuclei, this /ss/ is attached to two moras. However, this assumption requires further research to be proven or disproven.

**Conclusion**

This section has considered evidence for the proposal of an inherently moraic /s/ in Blackfoot. This assumption has several advantages. The first is that positing moraic /s/ in all situations removes the burden of explanation from syllabic /s/ and geminate /s/. If /s/ is inherently associated with a mora, it should be able to occupy nucleus position, just as vowels do. This predicts that it should be possible to have a syllable with /s/ as an onset and as a syllable nucleus. Don Frantz (p.c.) reports that this does seem to be the case in áyaahssskópiwa, ‘he likes to rest,’ which “really sounds like [á.yah.sss.si.kó.pi:w].” The theory of moraic /s/ can also be used to explain how /s/ can participate in complex syllable margins. If /s/ is moraic, it can be parsed to a higher prosodic node without necessarily being more marked.
However, as I showed above, we can still account for non-moraic onset /s/, and we can also derive the distinction between intervocalic short versus long /s/ if we accept the Copy Theory of Geminates proposed above.

The proposal of moraic /s/ would be strengthened by examining other languages to see if such a proposal would be valuable in any other language, either for /s/, which often acts differently from other phonemes, or for any other segment. I have shown that this type of moraic segment can more readily be extrasyllabic, and that the distribution of word-initial complex clusters in Blackfoot is in some ways similar to some dialects of Arabic, as outlined in Kiparsky (2003). (20) summarizes the surface realizations of moraic /s/.

(20) Underlying and surface realizations of moraic /s/.

a. /sᵢ/
   i. Extrasyllabic: /štsi.ki/ another (232)
   ii. Ambisyllabic: /ii.ma.tsii.yig ři.wa/ he crouched in ambush (162)
   iii. Syllabic: /ki.pah.ta.ni’i ři.ni/ your cut (253)
   iv. Non-moraic: /ša.’áí/ duck (206)

b. /sᵢᵢ/
   i. Syllabic: /ii.kóm ss.pi.ka’.ps.si.wa/ he’s a burden (165)

(20a) shows monomoraic /s/ with four surface realizations. In (i) the initial moraic /s/ in /stsiki/ is parsed as extrasyllabic, in order to avoid a complex onset. In (ii) the /s/ in ambisyllabic, just as are other geminates, forming the moraic coda to the first syllable and the non-moraic onset to the next. In (iii) the /s/ is syllabic, forming the nucleus of the fifth syllable, as well as being the non-moraic onset of the sixth syllable.10 In (iv) /s/ is the non-moraic onset to the first syllable. (20b) shows bimoraic /s/ surfacing as

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10. It may seem odd to propose an ambisyllabic segment that forms both nucleus and onset, but I see no reason not to do so, since this seems to be the case not only for Blackfoot /s/, but for [+ATR] vowels in many languages, e.g., the brand name Vaio in English: /vaj.jo/, where the doubling of the /j/ indicates not gemination, but ambisyllabicity. This is also true of Blackfoot, which lacks the [+ATR] vowel off-gliding of English: /no.wa.pss.pi/, ‘my eye,’ where the /w/ is not part of the underlying form, but is nonetheless acknowledged by some speakers. (NB: There is evidence to suggest that the glide /w/ in Blackfoot is a non-syllabic /o/, not least of all the tendency before standardized orthography to write this glide as the vowel /o/ rather than the consonant /w/.)
a long syllable nucleus between two consonants. In (i) /s/ is attached to
two moras, just as long vowels are, where long /ss/ is acting as a syllable
nucleus.

Because an inherently moraic segment should be able to act as a
syllable nucleus, this section discussed evidence for syllabic /s/ in Blackfoot.
Proposing a moraic /s/ predicts that /s/ should be syllabic in Blackfoot, and I
have presented evidence above that this is the case. Mizuki Miyashita (p.c.)
reports that her Blackfoot speaking consultant writes consonant-bounded
geminate /ss/ separately when breaking down words to teach pronunciation
to children at the Blackfoot immersion school in Browning, MT. While this
does not mean that Blackfoot has a syllabic /s/, it does show that /s/ is in
some way a separate prosodic unit.

In some way, /ss/ is very different from other phonemes at the prosodic
level, as shown by the various methods native speakers use to syllabify such
clusters, which seem to defy all normal attempts at syllabification. While
more research needs to be done, there seems to be no data from native
speakers that directly contradicts the notion of syllabic /s/ in Blackfoot.
Positing a moraic /s/ in Blackfoot explains several of the peculiarities of the
phoneme, and seems to be a useful analysis for the purposes of Blackfoot
syllabification. The problems such an assumption creates can be eliminated
by accepting the Copy Theory of Geminates, which is independently
motivated and can derive the contract between intervocalic short and long
/s/. While intervocalic geminate /ss/ can be explained by the moraic theory
of geminates, interconsonantal geminate /ss/ cannot be, especially when it
comes before or after other geminates. The next section offers an analysis
of moraic /s/ in Optimality Theory, including an analysis of extrasyllabic
/s/ and an analysis of syllabic /s/.

ANALYSIS

This section offers an OT analysis of the generalizations set forth in the
previous sections. I first look at extrasyllabic /s/ in OT, then examine syllabic
/s/, and end with a summary and conclusions.

Extrasyllabic /s/ in OT

I proposed above that positing moraic /s/ reduces the markedness of complex
onsets involving /s/ because a moraic /s/ can more easily be extrasyllabic. I
stress again that some explanation for complex syllable margins in Blackfoot is necessary because complex clusters in Blackfoot only exist if they involve /s/ or /ss/. By positing extrasyllabicity for word initial /s/ in complex onsets, the “complex” onsets do not actually violate *COMPLEX, since at the syllabic level they are simple.

**Exhaustivity**

To show that extrasyllabicity is relevant to the theory of moraic /s/ in Blackfoot, I appeal to Selkirk’s (1995) EXHAUSTIVITY, rephrased slightly from the original version.

(21) EXH(AUSTIVITY): No prosodic category immediately dominates a constituent more than one level below it.\(^{11}\)

Because this constraint does not reference a specific level of structure, a form may violate or satisfy different levels of exhaustivity, e.g., EXH(σ), in which the syllable would be dominating a constituent more than one level below it, or EXH(PrWd), where the prosodic word would be dominating a constituent more than one level below it (Selkirk 1995). (22) illustrates the satisfaction and violation of EXH, specifically EXH(PrWd), at the level of the prosodic word.

(22) Satisfaction and violation of EXHAUSTIVITY.

\[
\begin{array}{ll}
\text{a. Satisfaction} & \text{b. Violation} \\
\begin{array}{c}
\text{PrWd} \\
F \\
σ \\
μ \\
a
\end{array} & \\
\begin{array}{c}
\text{PrWd} \\
F \\
σ \\
μ \\
\text{ta ta}
\end{array}
\end{array}
\]

---

\(^{11}\) When constraints are introduced, the full forms are given with parenthesis around material that is omitted in tableaux for spatial economy, e.g., PR(OSODIC)SEQ(UENCING) will in general be written as PRSEQ.
In (22a), there are no **exhaustivity** violations because each prosodic category dominates a constituent that is directly beneath it: the prosodic word dominates a foot, the foot dominates a syllable, the syllable dominates a mora, and the mora dominates a segment. (22b) contains one violation of **exh(PrWd)**, because the prosodic word dominates an unfooted syllable, and two violations of **exh(σ)**, because the onsets of both syllables are parsed directly to the syllable node without an intervening mora, which means that the syllable nodes dominate constituents that are two levels below them.

While the concept of exhaustivity entered into linguistics with relevance to stress assignment (Kager 2001), it is also relevant to the issue of extrasyllabic moraic segments. The **exhaustivity** constraint indicates that an extrasyllabic moraic segment will be less marked than an extrasyllabic nonmoraic segment, which supports the analysis of extrasyllabic moraic /s/ in Blackfoot. Because of this constraint, an extrasyllabic consonant will incur a violation, because it will be parsed to a prosodic category multiple levels above it. However, violations of **exh** do occur: an onset segment parsed directly to the syllable rather than to a mora will violate **exh(σ)**, because the syllable will be dominating a constituent that is more than one level below it, the mora level being the level directly below the level of the syllable. In the case of an extrasyllabic segment parsed to the prosodic word, the prosodic word is four levels above the segment level, with mora, syllable, and foot intervening between. However, if the segment is moraic, this means that it is parsed to a mora, and the mora is parsed to the prosodic word in the case of an extrasyllabic moraic segment. The addition of the mora level makes the extrasyllabicity less marked, since the moraic segment only has the syllable and foot between it and the prosodic word. This means that an extrasyllabic moraic segment should *ceteris paribus* be less marked than a non-moraic extrasyllabic segment. (23) illustrates this graphically.

(23) Prosodic structure for (a) non-moraic and (b) moraic extrasyllabic /s/.
In (23) the dominating category is the prosodic word. In (a) the dominated category is the segment, while in (b) it is the mora. (a) shows a segment parsed to a prosodic word, which is four levels above it. In (b), on the other hand, where the moraic segment’s mora is parsed to the prosodic word, the dominating category is only three levels higher. The parsing of a nonmoraic segment in (a) is the type of extrasyllabicity found in English, while the parsing of a moraic segment in (b) is the type found in Blackfoot. In this way the parsing of a moraic segment to the prosodic word is less marked than parsing a nonmoraic segment to a prosodic word. As mentioned above, this parallels Kiparsky’s (2003) analysis of initial complex clusters in some dialects of Arabic. This type of extrasyllabicity prevents complex margins at the syllabic level. (24) shows the ranking of *COMPLEX and EXH(PrWd) in Blackfoot.

(24) Ranking of *COMPLEX and EXH(PrWd).

*COMPLEX >> EXH(PrWd)

This ranking predicts that extrasyllablic segments attached directly to the prosodic word will always be preferred to complex syllable margins. Since extrasyllabicity is more common at word edges (Green 2003), this ranking may need to be revised for word-medial complex syllable margins, but explains word-initial complex onsets in Blackfoot. (25) gives a tableau for the EXH(PrWd) violation represented in (23b), which represents the optimal type of extrasyllabicity, both because the /s/ retains its mora, and because this mora reduces the markedness of the extrasyllabic segment. This type of gradient markedness, with an extrasyllabic moraic segment representing a less severe violation of EXH(PrWd) than an extrasyllabic non-moraic segment, is an area which requires future research.

(25) Tableau for stsiki, ‘another.’

<table>
<thead>
<tr>
<th>/s_tsi_ki/</th>
<th>*COMPLEX</th>
<th>EXH(PrWd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) s_tsi_ki</td>
<td>*!</td>
<td></td>
</tr>
<tr>
<td>b) &lt;s&gt;_tsi_ki</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

Candidate (a) contains a complex onset, and so is disqualified by *COMPLEX. Candidate (b) emerges as the optimal candidate, even though it incurs a violation of EXH because of its extrasyllabic segment. As in all situations
of markedness, however, elements or features are not simply marked or unmarked; there are varying degrees of markedness. A syllable node directly dominating a segment is marked, while a foot directly dominating a segment is more marked, and a prosodic word directly dominating a segment is even more marked. Since a syllable is two levels above the segment level, a syllable directly dominating a segment violates Exhaustivity. Since onsets are not moraic, there must be some other markedness constraint more highly ranked than Exh which prefers nonmoraic onsets even though they violate exhaustivity. It should be noted that in some sense the assumption of an underlying mora goes against the “Richness of the Base” hypothesis underlying OT. However, to a large extent the language and notation I use throughout this paper to describe /s/ as “inherently moraic” need not mean literally that /s/ is attached to a mora at the input level. As can be seen above, I also indicate that vowels are underlyingly attached to a mora, whereas in OT vowels are parsed to moras as syllable nuclei. The entire argument structure of this paper could just as easily be phrased in these terms, whereby whatever inherent property of vowels makes them parsed to syllable nuclei in the output (traditionally their high sonority) is shared by /s/ in Blackfoot, and possible other languages. Thus for example we could speak of not Max-µ, but rather some constraint that requires a syllable nucleus to be parsed to a mora, focusing on the output rather than the input, which would be more in line with the theoretical assumptions of OT.

**Prosodic Sequencing**

As mentioned above, Exh violations seem to be tolerated more at category edges, e.g., extrasyllabic consonants are more marked word-internally than at word edges (Green 2003). To take into account this generalization I propose the PROSODICSEQUENCING constraint, which militates against having lower-level prosodic categories parsed between higher-level prosodic categories.

\[(26)\ \text{PR(O)SODICSEQ(UENCING)}: \text{The level of a dominated prosodic category must increase toward the perceptual center of a dominating category.}\]12

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12. De Jong (1994:447) defines a perceptual center as “the point in time that subjects use to align syllables in a regular rhythm.” This is a necessary distinction from the actual “center” of the syllable, since in a syllable such as stsi the center is /ts/, but the perceptual center is /i/, and it is this perceptual center which is relevant for processes such as prosodic sequencing.
While for the purposes of this paper this constraint is most relevant for prohibiting moraic onsets, it also predicts that codas will be nonmoraic, and thus that moraic codas are more marked than nonmoraic codas. This would be supported if it turns out that more languages count CVC syllables as light than heavy. Most likely some future revision will be necessary, because even if it is true that codas are more commonly nonmoraic, the fact remains that moraic codas are less marked than moraic onsets, and as currently stated the **PROSODICSEQUENCING** constraint does not account for this difference. The **PROSODICSEQUENCING** constraint also predicts that complex syllable margins will be marked, since when two non-moraic or two moraic segments are attached to the same node, the level of the dominated category, in this case the segment, stays the same rather than rising. However, it is assumed in this paper that a candidate with the dominated category decreasing when it should be increasing will be more marked than a candidate with the dominated category remaining at the same level when it should be increasing, and thus I will only mark a violation for onsets with the dominated category decreasing. This again illustrates the need to account for markedness gradience within OT: *sts* and *s tsi* both violate **PROSODICSEQUENCING**, but *s ts* does so more severely. (27) shows the prosodic structure for *sts*ki, ‘another,’’ showing the difference between a moraic and non-moraic onset /s/. The dotted lines track the level of the dominated category for each syllable. The relevant contrast occurs in the first syllable.

(27) Violation and satisfaction of prosodic sequencing.

<table>
<thead>
<tr>
<th>Violation</th>
<th>Satisfaction</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>b.</td>
<td>c.</td>
</tr>
<tr>
<td><img src="#" alt="Diagram" /></td>
<td><img src="#" alt="Diagram" /></td>
<td><img src="#" alt="Diagram" /></td>
</tr>
</tbody>
</table>

In (27a) the segment /s/ is moraic, but the segment /ts/ is nonmoraic, which means that the level of the dominated category goes down before rising back to the mora level at the syllable nucleus. In (27b) the level of the dominated category increases towards the nucleus, satisfying prosodic sequencing, but violates mora preservation because the /s/ is no longer associated with a mora. (27c) satisfies both prosodic sequencing and mora preservation by
having an extrasyllabic /s/ which retains its mora but does not participate in prosodic sequencing at the syllabic level. The PROSODICSEQUENCING constraint would explain the tendency for onsets to be nonmoraic: by parsing onsets directly to the syllable, the level of the dominated category increases towards the center of the syllable because the left edge is a segment (two levels below the syllable), while the nucleus is attached to a mora (one level below the syllable).

Here I have attempted to provide a reason for the extant *ONS-µ constraint (see Kager 2001), which is certainly relevant, but lacks an explanation of why moraic onsets are marked. If PROSODICSEQUENCING proves to be a motivated cross-linguistic constraint, it may also explain the existence of languages that count CVC syllables as light for purposes of stress assignment: the syllable nucleus is a higher prosodic category while both edges are lower. This type of sequencing parallels sonority sequencing, in which the sonority of segments should increase towards the center of a syllable; indeed, the PRSEQ constraint is essentially this idea applied to prosodic categorization. The constraint also makes a prediction: that moraic codas are more marked than non-moraic codas, because only in the case of a nonmoraic coda does the dominated category decrease from the syllable nucleus, from moraic to nonmoraic. Since moraic onsets are more marked than moraic codas, it may be relevant that the existence of onsets is unmarked while their attachment to a mora is marked, and on the other hand that the existence of codas is marked while their attachment to a mora may be unmarked, or at the very least less marked than the attachment of an onset to a mora.

The PRSEQ constraint must be ranked above EXH(PrWd), because otherwise moraic onsets would be preferred to extrasyllabic moraic segments. The other possibility for an input with a moraic onset, which violates PRSEQ, is the loss of the associated mora, which would result in a candidate that satisfies PRSEQ but violates MAX-µ. Since this is not the case, MAX-µ must also be ranked above EXH(PrWd). This ranking is given in (28).

(28) Ranking of MAX-µ, PRSEQ, and EXH(PrWd).

MAX-µ, PRSEQ >> EXH(PrWd)

An example of underlying moraic /s/ is given in (29) for the word _stsiki_, ‘another’; a tableau is given in (30). Syllable boundaries are marked with a period, while an extrasyllabic segment is enclosed in angled brackets (<>).
(29) Prosodic structures for candidates in (30).

\[
\begin{array}{ccc}
\text{a. PrWd} & \text{b. PrWd} & \text{c. PrWd} \\
\begin{array}{c}
F \\
\sigma \\
\mu \\
ts i k i
\end{array} & \\
\begin{array}{c}
F \\
\sigma \\
\mu \\
ts i k i
\end{array} & \\
\begin{array}{c}
F \\
\sigma \\
\mu \\
ts i k i
\end{array}
\end{array}
\]

(30) Tableau for \textit{stsiki}, ‘another.’

<table>
<thead>
<tr>
<th>/s\textsubscript{\textmu}tsi\textsubscript{\textmu}ki\textsubscript{\textmu} /</th>
<th>MAX-\textmu</th>
<th>PRSEQ</th>
<th>EXH(PrWd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) (sts\textsubscript{\textmu},ki\textsubscript{\textmu})</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) (s\textsubscript{\textmu}tsi,ki\textsubscript{\textmu})</td>
<td></td>
<td>*!</td>
<td></td>
</tr>
<tr>
<td>\textbf{c) &lt;s\textsubscript{\textmu}&gt;(tsi,ki\textsubscript{\textmu})}</td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

Candidate (a) is eliminated because of a MAX-\textmu violation, since the mora attached to the initial /s/ is not preserved. Candidate (b) violates PRSEQ because the prosodic level dominated by the syllable goes down and then up: from the mora, down to the segment level, then back up to the mora level. Winning candidate (c) suffers an EXH(PrWd) violation because of its extrasyllabic /s/, which bypasses the syllable and foot nodes and is parsed directly to the prosodic word, but this is not enough to disqualify it. Perhaps crucially, even though the /s/ is violating exhaustivity, it satisfies prosodic sequencing, as opposed to, e.g., a foot-medial extrasyllabic consonant. A foot-medial extrasyllabic consonant would violate prosodic sequencing because at either edge of the foot the dominated category would be the syllable, while medially the dominated category would be the segment. This decrease in the level of the dominated category is exactly what is prohibited by prosodic sequencing.

The PRSEQ constraint attempts to account for the fact that onsets should not be moraic, while nuclei should be moraic. It also provides a reason for the extrasyllabicity of /s/, but not other consonants. This constraint predicts that nonmoraic codas will be less marked than moraic ones, i.e., more languages should count CVC syllables as light than heavy.
Syllabic /ss/ in OT

I proposed above that /s/ is inherently moraic in Blackfoot, which predicts that /s/ should be able to act as a syllable nucleus. I then surveyed evidence that Blackfoot does have a syllabic /s/, including the difficulty in syllabifying Blackfoot words without this assumption. Another difficulty without assuming syllabic /s/ is that there would exist nasal-fricative clusters that violate cross-linguistic well-formedness constraints. As Elfner (2005) mentions, Blackfoot has highly restrictive phonotactics, and because of this it would be unusual for Blackfoot, which does not even allow the cross-linguistically well-formed onset *sn-, to allow the extremely marked coda -ns. Goldsmith (1990) makes the universal claim that in any given language, codas will be a subset of onsets. In the case of complex syllable margins we must take into account sonority sequencing, so that if a language has a coda -ns we would not expect that the language will also have the onset ns-, but rather that the language will have the onset sn-, e.g., English has the coda -ns in “trance,” and also the onset sn- in “snack.” In Blackfoot this is not the case, so it is worthwhile to look for some other explanation for these -nss- clusters in Blackfoot. (31) shows a selection of [Ns:] sequences in Blackfoot, where /N/ represents any nasal, i.e., /m/ or /n/.

(31) -Nss- clusters in Blackfoot.

a.  otáí’nssi [otɛ́jʔnːsi] when he died (229)
b.  iikómsspika’pssiwa [iːkómʔspikaʔpsːiw] he’s a burden (165)
c.  sooyikkimsimoyiiksi [sojɪkːɪmsimoiːkɛ] poisonous plants (218)

Without syllabic /s/, all of these words would have syllables ending with -Ns, a coda that does not have a corresponding onset, violating Goldsmith’s (1990) universal claim. Furthermore, Goldsmith notes that even in languages like English that allow onsets and codas of three to four segments, this type of syllable markedness usually occurs only across morphological boundaries. Thus in a language such as Blackfoot, which allows much less syllable complexity, it would be unexpected to find a -ms coda within a root, where

13. It is the inherent moraicity of /s/ in Blackfoot which predicts its ability to act as a syllable nucleus. Coda consonants, though often moraic because of Weight-by-Position, are not expected to act as nuclei.
it cannot be separated by any kind of prosodic or morphological boundary. The proposal of syllabic /s/ reanalyzes these clusters so that the geminate /ss/ in (31) forms a syllable nucleus, rather than being an ambisyllabic geminate, which explains this apparent exception to Goldsmith’s universal.

The existence of nasal + voiceless obstruent clusters is marked (Kager 2001, Hayes and Stivers 2000, Pater 1999, McCarthy and Prince 1995, Itô and Mester 1986, Justeson and Stephens 1981, Drachman and Malikouti-Drachman 1973), but it is inaccurate to think of clusters as simply “marked” or “unmarked”; clusters such as these are more or less marked depending on how closely aligned they are in the prosodic hierarchy. Herok and Tonelli (1979) consider the example of nasal assimilation in Italian and German across increasingly high prosodic levels. If there is a boundary between the NC cluster, the cluster is less marked the higher the boundary is, as demonstrated by Herok and Tonelli’s illustration that nasal assimilation before stops becomes more obligatory the lower on the prosodic hierarchy the boundary is. At morpheme boundaries, assimilation is required even in formal speech, whereas at clitic/word boundaries it is required only in casual speech, and between two stressed words it is possible in casual speech but never required (Herok and Tonelli 1979:48).

In terms of markedness, ill-formed clusters will be least marked when the prosodic division between them is highest, e.g., when the segments belong to different prosodic words, and most marked when the prosodic division between them is the lowest, e.g., if the segments belong to the same syllable or even the same mora. I represent this graphically in (32). (### represents a prosodic word boundary, # represents a clitic boundary, + represents a morpheme boundary, . represents a syllable boundary.)

(32) Ranking of NC̥ clusters.

\[
\begin{align*}
*N##C̥ & >> *N#C̥ & >> *N+C̥ & >> *N.C̥ & >> *(NC)̥ \\
\text{least marked} & & & & \text{most marked}
\end{align*}
\]

(32) shows that ill-formed clusters are more marked the lower the prosodic boundary separating them, with clusters across prosodic word boundaries being the least marked and tautosyllabic clusters, most specifically those attached to the same mora, i.e., in a complex coda, being the most marked. It is this last, most highly marked, context in which we find /Ns/ sequences in Blackfoot, at least without the assumption of syllabic /s/.
Many authors have noted processes by which languages alter NC̆ clusters. In more recent years, this has been formulated as the constraint \(*NC̆\) (Pater 1999).

(33) \(*NC̆\): No nasal/voiceless obstruent sequences.

However, as discussed in this section, not all NC̆ clusters are equally marked, with the most marked context being tautosyllabic NC̆ clusters. To capture this generalization, I will propose the constraint \(*NC̆]\σ\).

(34) \(*NC̆]\σ\): Nasals and voiceless obstruents should not be attached to the same mora.14

This constraint is similar to the \(*NC̆\) constraint, but takes into account that these clusters are more marked the lower the prosodic category by which they are dominated. Thus we would expect that the universal ranking of these two constraints would be \(*NC̆]\σ\ > > \*N.C̆\, because nasal-voiceless obstruent clusters are less marked if they are separated by a syllable boundary.

Languages use several different strategies for reducing the markedness of such clusters, as outlined in Kager (2001). One of these is deletion of one or the other segment, so that instead of an NC sequence, only the N or the C is left. Another is coalescence, in which the features of both segments merge to form a single segment, as in Indonesian (Halle and Clements 1984). Voicing assimilation is also common, where a voiceless stop or fricative becomes voiced after a nasal. Blackfoot does not employ any of these strategies for reducing the markedness of these clusters. Neither the nasal nor the /s/ is ever deleted, and Blackfoot has no voiced obstruents, which means the /s/ is never voiced. Because Blackfoot does not use any of these phonological or phonetic strategies, it stands to reason that some prosodic factor may be reducing the markedness, especially since Blackfoot does not have the less marked nasal-stop clusters.

The nonexistence -NC̆ codas except before geminate /ss/ in Blackfoot suggests that the long /s/ clusters in (31) should be syllabified in some other way. (31) is repeated here as (35).

14. The reader may note that \(*NC]\σ\ and (NC)σ are not \textit{a priori} identical. It is theoretically possible to have a nasal which is attached directly to the syllable node followed by a final /s/ attached to a mora. I do not consider this possibility in the following discussion for the sake of simplicity, since this type of structure would be eliminated by the \textit{PrSeq} constraint.
The Status of Blackfoot

(35) -Nss- clusters in Blackfoot.

a. otáí’nssi [otɛ́jʔnsːi] . . . when he died (229)
b. iikómmsspika’pssiwa [iːkómqpsːikpsːiw] he’s a burden (165)
c. sooyikkinnssimoyiiksi [sojikmsimoiikʰ] poisonous plants (218)

Syllabifying these clusters as a nasal coda preceding a syllabic /ss/, eliminates highly marked codas and complex syllable margins. The syllabification of the nasal to the coda of the preceding syllable is supported by the occasional epenthesis of a glottal stop between the nasal and the geminate /ss/. Since /’/ almost always appears in coda position, this suggests that the nasal, too, must be a coda. This is a case where it may not be as relevant to talk about the emergence of the unmarked (McCarthy and Prince 1993) as the emergence of the less marked. In many cases not all violations of a certain constraint are equally marked. Certainly a syllabic /s/ is marked, but I believe that, for the reasons outlined in this paper, in Blackfoot it is less marked than certain other aspects of syllable complexity and structural markedness. (36) lists several examples of -CssC- clusters in Blackfoot that support the proposal of syllabic /s/.

(36) -CssC- clusters in Blackfoot.

a. a.wóí’.ss.taaks.sin cross (16)
b. sáóh.pa.po.kai’.ss.toot air it outside! (200)
c. ó.mah.kss.ks.sii.naaw toot big insect (86)
d. ii.kóm.ss.pi.ka’.ps.si.wa he is hard to take care of (165)
e. ik.kss.pi.ii.sa hit him on the head! (45)
f. is.spay.ss.too mule deer (87)
g. is.stss.káán dust (88)
h. ni.tssks.kaa.ki I measured (225)
i. om.ss.ta.kisteal a portion/share of (165)
j. no.á.pss.pi my eye (128)

As shown in (36), -CssC- clusters in Blackfoot occur with some regularity, and occasionally occur as part of an even longer cluster, such as in the -CCssCss- cluster in (c). Since words such as those in (36a-c) would not be disqualified by the *NC̥σ constraint, other well-formedness constraints are necessary to arrive at syllabifications with syllabic /ss/. A full account of syllabic /ss/ in all possible situations is beyond the scope of this paper, but sonority sequencing and markedness constraints on syllable complexity
would surely play a role in such an analysis. I believe that instances of -kssC- and -tssC- are better analyzed as, e.g., /tssC/ rather than /t’sC/, since they have the same distribution as -’ssC-, -hssC-, -NssC- clusters, etc. However, it may be possible to analyze some clusters as -k’sC- or -t’sC- and because the disqualification of candidates involving these codas uses different constraints than the disqualification of codas involving nasals, the example tableau in (37) focuses on the geminate /ss/ in the root omsstaki, ‘steal a portion/share of (e.g., food, money, etc.).’ Syllable nuclei are bolded. \( s_{\mu}L \) represents an underlyingly long /s/.

(37) Tableau for *omsstaki, ‘steal a portion/share of (e.g., food, money, etc.).’

<table>
<thead>
<tr>
<th>/o m s_\mu s_{\mu} ta_{\mu} ki_{\mu}</th>
<th>*NC| ( s_{\mu}L )</th>
<th>MAX-M</th>
<th>PRSEQ</th>
<th>*COMPLEX</th>
<th>NoCoda</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ( o_{\mu} ms_{\mu} s_{\mu} ta_{\mu} ki_{\mu} )</td>
<td>*!</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b. ( o_{\mu} m_{\mu} s_{\mu} ta_{\mu} ki_{\mu} )</td>
<td>*</td>
<td>*!</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. ( o_{\mu} m_{\mu} sta_{\mu} ki_{\mu} )</td>
<td>*</td>
<td>*!</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. ( o_{\mu} m_{\mu} s_{\mu} ta_{\mu} ki_{\mu} )</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(37a-c) show possible syllabifications without syllabic /s/, while (37d) shows an analysis with syllabic /s/. Candidate (a) is disqualified because of the markedness of the first coda. Candidate (a) also violates *COMPLEX because it contains a complex coda in the first syllable. Candidate (b) is eliminated because it violates PRSEQ by having an initial moraic segment followed by a nonmoraic segment in a complex onset, in addition to violating *COMPLEX and NoCoda. Candidate (c) is disqualified because it violates MAX-M by deleting the mora associated with the /s/, as well as violating *COMPLEX and NoCoda. Candidate (d), on the other hand, contains no complex syllable margins whatsoever, and so is the optimal candidate. While it is uncertain whether VNssC sequences should be syllabified as V.Nss.C or VN.ss.C, i.e., whether it is more marked for a syllable to have a coda, or to have a syllable with an onset of higher sonority than its nucleus, the presence of an optional epenthetic glottal stop between the nasal and the geminate /ss/

15. I have assumed here a Weight-by-Position rule for Blackfoot whereby coda consonants are assigned a mora if they are not associated with an underlying mora (Hayes 1989). However, whether or not this is the case is irrelevant to the constraint rankings in (37).
suggests that VN.ss.C is the correct syllabification. Most likely the opposite is true for stops: they are probably syllabified as the onsets of the syllabic /ss/. This follows from the cross-linguistic preference for higher-sonority codas and lower-sonority onsets.

**Summary of OT Analysis**

This section has presented OT analyses of several peculiar distributions of /s/. Proposing extrasyllabicity to /s/ would explain why it is the only consonant that can participate in complex onsets. If moraic /s/ is parsed to a higher level than the syllable (e.g., the prosodic word), this would mean that complex syllable margins would not exist at the syllabic level (Rosenthal and Van der Hulst 1999). It also appears that several constraints, including *N[C̥], and *COMPLEX, suggest the Blackfoot has syllabic /s/. Since /s/ has a similar distribution to vowels in Blackfoot, especially in the ability of /ss/ to occur between consonants, a property it shares with vowels but not other geminates, it seems likely that nonmoraic onset /s/ is equivalent to /w/ or /j/: the non-moraic equivalent of an inherently moraic segment. The task of accounting for the distribution of /s/ in Blackfoot still requires further research, but as outlined in this section, initial results show that it is possible to account for several peculiarities of /s/ within the framework of Optimality Theory by positing that /s/ is inherently associated with a mora.

**Conclusion**

This paper has explored several peculiarities of the phoneme /s/ in Blackfoot. The main claim examined here is that /s/ in Blackfoot is inherently associated with a mora, and I have shown how this assumption explains many complex issues in Blackfoot phonology. The possibility of extrasyllabic /s/ was discussed, as well as how moraic /s/ makes that extrasyllabicity less marked than if /s/ were not tied to a mora. This extrasyllabicity means that complex onsets involving /s/ are not actually complex at the syllabic level. Since the proposal of a moraic /s/ in Blackfoot predicts that it should be able to form a syllable nucleus, I also discussed syllabic /s/ in Blackfoot, and how this hypothesis explains the apparent cases of tautosyllabic geminates seen in words like iikómskika’pssiwa, ‘he is hard to take care of.’ This parallels Derrick’s (2007) claim of a syllabic /s/ in Blackfoot. Root-initial alternations
between [ss] and [iss] were discussed, which supports the idea of moraic /s/ in Blackfoot, since surface [s] is always in a weight-beari-

This paper has proposed the Copy Theory of Geminates, whereby geminates receive extra length by copying themselves, producing a sequence of two identical segments. This framework divorces moraicity from gemination, and thus allows us to derive both long and short moraic segments, a desirable outcome, since both nonmoraic geminates (Hume et al. 1997) and short moraic segments (coda consonants in heavy CVC languages) are attested. This proposal requires significant further research to determine if it can account for all of the data already explained by the moraic theory of geminates, but at the very least, it seems a desirable beginning, since moraicity and gemination are not always co-occurring. The proposal of syllabic /s/ provides a solution to the problem of syllabifying long strings of consonants in Blackfoot, which otherwise cannot be syllabified by any universal principles. By treating /s/ as syllabic and /ts/ and /ks/ as affricates, principles such as sonority sequencing and Vennemann’s (1988) syllable contact law can be obeyed, and universal principles can be used to syllabify Blackfoot words. This is not the only possible way to treat Blackfoot syllable structure, but this paper takes the position that positing /s/ as syllabic in Blackfoot is useful and theoretically motivated.

I also offered an OT analysis of moraic /s/ in Blackfoot, and how extrasyllabicity, moraicity, and syllabicity of /s/ can be represented through OT constraints. I proposed the PROSODICSEQUENCING constraint to account for why moraic /s/ could not participate in complex onsets at the syllabic level, why I believe this constraint is preferable to the usual *ONS-M constraint, and how this constraint accounts for the extrasyllabicity of word-initial moraic /s/ in Blackfoot. Another constraint introduced was the *NC̥σ constraint, which militates against nasal + voiceless stop codas. This constraint is relevant in Blackfoot because it supports syllabic /s/, the lack of which would result in a number of complex NC̥ codas. The theoretical claims set forth in this paper have numerous implications for Blackfoot phonology, Optimality Theory, and linguistic theory in general. Blackfoot syllable structure is understudied, and few authors have attempted any comprehensive system for syllabifying words (Kaneko 1999). By assuming syllabic /s/ in Blackfoot, it becomes possible to syllabify any Blackfoot word by using universal markedness principles. The proposal of moraic /s/ explains why only /s/ can form complex onsets, and why /s/ can act
as a syllable nucleus. In addition, I have proposed two new constraints, \textsc{prosodicsequencing} and \textsc{\*n[\textcircled{c}]}\textsubscript{o}, to account for the behavior of /s/ in Blackfoot. These constraints have implications cross-linguistically. Both are intended to function in every language. While I have based them on cross-linguistic tendencies, it is still necessary to actually apply them to phonological processes in other languages, since they make predictions that can be tested.

Several issues brought up in this paper have implications for linguistic theory in general, not just for Blackfoot. The proposal of an inherently moraic consonant has interesting implications cross-linguistically, and the claim of moraic /s/ in Blackfoot predicts syllabic /s/. Most languages with syllabic consonants utilize the most sonorous ones, as in English syllabic sonorants in words like \textit{table}, \textit{button}, or \textit{rhythm}. Blackfoot may be a counterexample to Zec’s (1995) claim that any language with syllabic obstruents will have syllabic sonorants.\textsuperscript{16} Thus the fact that Blackfoot has no syllabic nasals but does have a syllabic /s/ presents an interesting case study in syllabic consonants. As for moraic /s/, I am unaware of any previous claims regarding underlying moraicity for a consonant phoneme in any language, though all vowels are held to be underlyingly moraic in all languages. This moraicity explains why Blackfoot violates Zec’s universal hierarchy. While more research needs to be done, positing an underlying mora for the phoneme /s/ in Blackfoot offers explanation for the unusual distribution of /s/ and /ss/ in Blackfoot.

\textbf{References}


\textsuperscript{16} Another explanation would be to suggest that /s/ is a sonorant in Blackfoot, and is higher on the sonority scale than nasals.


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