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journal article

Palatalization in Lakhota[*]

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Abstract

This paper is an attempt to provide an analysis of palatalization in Lakhota, a process that is marked by some very peculiar phenomena. Both the vowels *i* and *e* appear to cause palatalization in Lakhota, but in entirely different environments. This 'complementary distribution' has led Shaw (1980) to suggest that this process was once unified and has since been fragmented into two distinct parts. The vowel *e* only causes palatalization in Lakhota if it is derived from the vowel /a/ by ablaut, a vowel change caused by certain enclitics. A remarkable feature of ablaut is that it is limited to the combination of specific stems with specific enclitics, indicating that it is morphologically regulated. This analysis investigates the historical sources of both ablaut and palatalization, and determines that ablauting /a/ descends from Proto-Siouan **i* and **e*. Based on Shaw's suggestion that palatalization was once a unified process, an account of palatalization and ablaut is given for the various stages of the history of Lakhota. This analysis makes use of Vowel Place Theory, Combinatorial Specification and phonologically conditioned allomorphy in order to account for both the historical and the modern data.

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1 Theoretical background

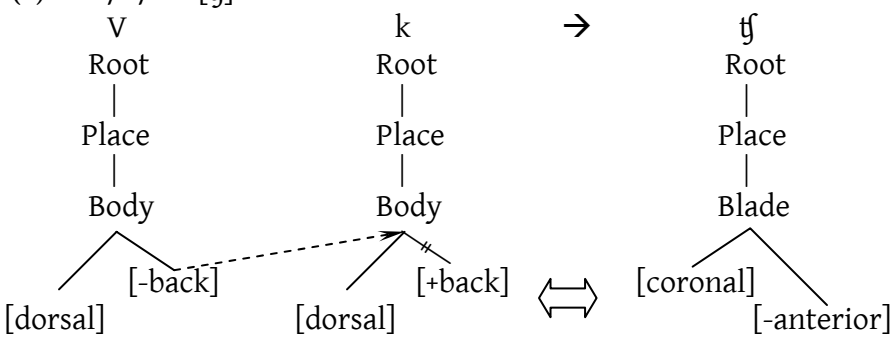
1.1 Palatalization and feature representation

Palatalization is a fairly common process in the languages of the world, but its representation, and hence its precise nature, remain a highly contested issue (Hume 1994). There is no widely accepted method of representing palatalization, and it is often used to argue for or against a particular theoretical notion or system of representation. The first part of this paper is an investigation of three different theoretical frameworks and their respective views on palatalization.

1.1.1 Revised Articulator Theory (RAT)

RAT is an updated version of the older and more widely accepted Articulator Theory, where features represent the physical movements of the various articulators of the vocal tract (Halle, Vaux & Wolfe 2000). In this theory the vowels and consonants are represented by different sets of features, indicating that vowels and consonants are assumed to be intrinsically dissimilar, and that the articulator movements that distinguish vowels from one another are of a different nature than those that distinguish consonants from one another. Among the major postulates that set RAT apart from previous theories is the fact that designated articulators are always indicated by features, rather than nodes; spreading is implemented at the level of terminal nodes, not intermediate nodes; and features are fully specified in underlying representations (Halle et al 2000: 388). RAT makes use of both binary and monovalent features, but the majority of the features are binary. When it comes to palatalization, RAT requires the use of an equivalency relation between the Tongue Body features [dorsal, -back] and the Tongue Blade [coronal, -anterior] (Calabrese 1993). This equivalency relation is a way of stating that these two sets of features indicate essentially the same tongue position. Thus the tongue position of *i* is said to be more similar to that of *ʧ* than *k*, so that palatalization is seen as a process of articulatory assimilation. In the diagram below, the large double-sided arrow indicates the equivalency relation.

(1) /k/ → [ʧ]

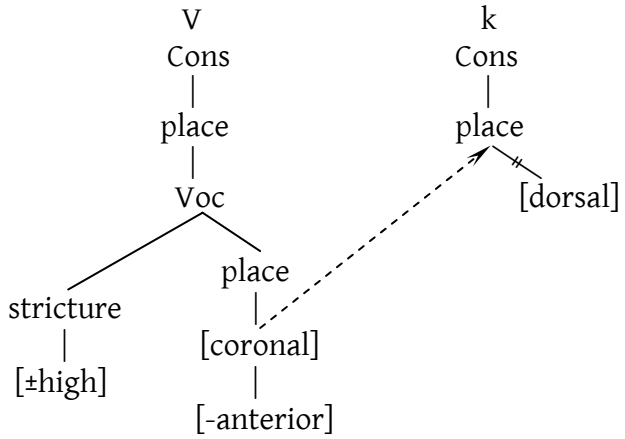


Revised Articulator Theory has some obvious problems in representing palatalization because of this equivalency relation. Although this relation is widely accepted, it requires a considerable amount of complexity to represent a very common process. There are other problems as well. If *k* gains the feature [-back], it should simply become *kʲ* without undergoing the more drastic change to *ʧ*. We are forced then to assume that if *kʲ* is not an available allophone, then the equivalency relation will automatically provide *ʧ*. Generally speaking this is not too problematic because there is historical evidence that palatalization often begins as a simple change of *k* to *kʲ*, and only at a later stage does *kʲ* become *ʧ* (Foley 1977). This being said, the representation at hand is still less than ideal in a situation where *k* synchronically becomes *ʧ* because we are forced to assume that the segment goes through an intermediate stage where it is interpreted as *kʲ*. This problem is dealt with very effectively in Vowel-Place Theory, the next theory we will look at.

1.1.2 Vowel Place Theory

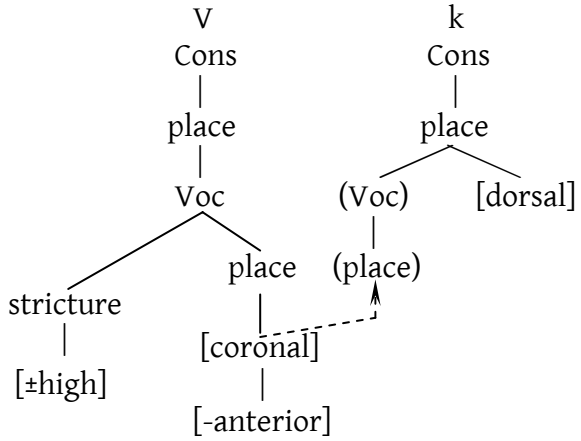
This theory of place features suggests that vowels and consonants should share the same sets of features based on the fact that they are produced with the same articulators. Thus vowels are described using features normally reserved for consonants. For example, the high front vowel *i* generally delineated by the features [+high, -back] would be described as being [coronal, –anterior]. Due to the fact that a large number of consonantal nodes and features are monovalent, most V-Place Theory features are monovalent, but binary features are permitted as well. This type of configuration lends itself very well to palatalization, but is problematic in dealing with other phonological phenomena. In V-Place Theory, the type of palatalization seen in Lakhota is usually referred to as coronalization, because it is the coronal feature that spreads (Hume 1994: 142):

(2) /k/ → [ʧ]



V-Place Theory makes a distinction between coronalization, as seen above, and "palatalization". In "palatalization" a Vocalic node is generated for the [coronal] feature below the Consonantal place node. Thus the [dorsal] feature is not forced to dissociate, and the complex segment *kʲ* is realized.

(3) /k/ → [kʲ]



In V-Place Theory "palatalization", as seen here, is the manifestation of vowel features on a consonant. Coronalization, on the other hand, requires that a vowel feature be reinterpreted as a consonantal feature. Thus the diagram seen in (2) is slightly more complex than it appears – it requires the reinterpretation of a feature – but this is perfectly acceptable within the confines of the theory, and does not represent nearly as dramatic a change as the equivalency relation required in RAT. Thus, some languages might go through a stage of "palatalization", fol-

lowed by the loss of the Vocalic node on the consonant, which would result in *tʃ*. This theory also allows for the possibility that *k* may not go through an intermediate *kʲ* stage, so that *tʃ* is realized directly by means of articulatory assimilation.

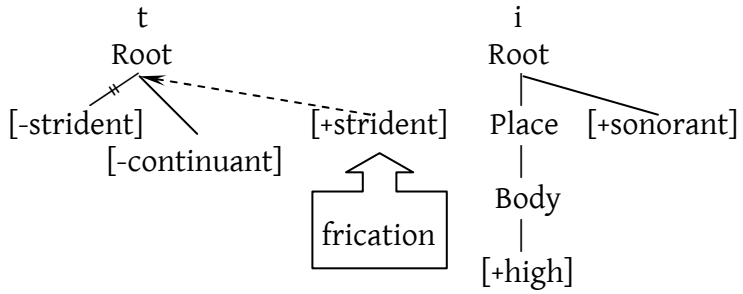
It should be noted here that in this paper the term 'palatalization' will hencefoward refer only to the process that changes *k* to *tʃ* (Hume's coronalization), and the term coronalization will not be used at all. I have put "palatalization" in quotes above where it is used in the exclusive sense of V-Place Theory, referring only to the development of a co-articulated off-glide *ʲ*.

V-Place Theory makes no claims about underspecification as RAT does, and V-Place Theory allows intermediate nodes to spread (as seen above), which RAT strictly prohibits. These facts make V-Place Theory easier to use in exploring Lakhota palatalization, as it makes no strong claims that limit the types of analyses that might be used in explaining the data.

1.1.3 An auditory analysis

A third option to the other two theories mentioned above is that palatalization, at least in some instances, could be interpreted as a form of stop assibilation. Assibilation is the process where a consonant, such as *t*, becomes strident *ts* preceding the vowel *i*. It has been shown that the frication following a voiceless stop lasts longer if the stop is followed by a high vowel than if it is followed by a low vowel. This is because the stricture between the tongue and the roof of the mouth is much narrower for high vowels than for low vowels (Kim 2000). It is argued that this lengthened frication, which shares many of the characteristics of strident fricatives such as *s*, results in the insertion of the feature [+strident] into the feature geometry of the stop. The stop then assibilates, and becomes an affricate, such as *ts*, if the grammar permits such a segment, otherwise the segment generally becomes *s*, and loses its [-continuant] feature altogether. The insertion of the feature [+strident] is based purely on auditory similarity, and is in no way based on articulatory assimilation. Here is an illustration of this process (Kim 2000: 102). The large arrow indicates that the combination of the features [-strident, -continuant] preceding [+sonorant, +high] results in the insertion of the feature [+strident].

(4) /t+i/ → [ʦ]



This lengthened frication has only been shown to occur with high vowels, and only when the high vowel follows the stop, not when it precedes it. This is problematic for Lakhota, where palatalization only occurs when a high vowel precedes the voiceless velar stop *k* (see section 3.1 below).[†]

What remains to be explained is how stop assibilation might result in palatalization. It may be conjectured that, if a stop such as *k* underwent assibilation, it would ideally become the affricate *ks*[‡]. If the consonantal inventory of the language in question did not possess such an affricate then it might replace the *k* with a segment which is faithful to the [+strident] feature. The next most ideal segment would be *ʦ*, and if that was also unavailable (as it is in Lakhota), then *ʧ* could be inserted in order to fulfil the requirement. Another possibility is that the feature [+strident] could be added to an existing segment, such as *k* or *t*, rendering a new complex segment which might eventually become a phoneme (this occurred in Italian and Old French; Robert Murray, p.c.). In Lakhota *ʧ* is the only segment containing both the [-continuant] and the [+strident] features (see section 2.2 below for the complete Lakhota consonant inventory). By this analysis palatalization would be the result of three factors: stop assibilation, faithfulness to the feature [+strident], and a disallowance of the featural combinations constituting *ks* (*[dorsal, +strident]) and *ʦ* (*[-continuant, -distributed]).

As mentioned above, this liberal application of Kim's stop assibilation analysis doesn't work for the Lakhota data because the vowel responsible precedes rather than follows the stop in question. , Kim mentions a phenomenon in Japanese that challenges some of the above as-

[†] In Lakhota *t* does in fact undergo assibilation to become *ʧ* (Shaw 1980), but that does not necessarily speak for the case of *k*.

[‡] The existence of an affricate *ks* is widely contested, but that is not important here. If the feature [+strident] cannot combine with *k* we would expect the same result as is being predicted here, that is, that the grammar will search for any [+strident] consonant so that the inserted feature can be realized.

sumptions. The Japanese consonantal inventory contains both *ʦ* and *ʧ* as allophones of /t/ (Kim 2000: 90).

(5) a. /tat+u/ [taʦu] 'to stand' + PRES
b. /tat+i+mas+u/ [taʧimasu] 'to stand' + POLITE + PRES

If assibilation is simply the insertion of the feature [+strident], then the grammar should be satisfied with the segment *ʦ* in both of the forms seen in (5). Instead, we see that *ʦ* is used in front of *u*, while *ʧ* occurs when /t/ precedes *i*. The reason for this incongruity is unclear, and suggests that the matter needs to be investigated further before we can make any additional conclusions about stop assibilation.

1.1.4 Which theory is best?

Obviously each system has its merits and its detractions, but after reviewing the above three frameworks it is clear that one is superior for representing the data at hand. Since V-Place Theory simplifies the representation of palatalization, it will be the featural theory of choice for this paper. The auditory analysis of palatalization, while interesting, has not been sufficiently investigated for use in a paper such as this. It is offered here primarily as a point of interest, and as a potential area of future research for palatalization in general.

1.2 Some theoretical assumptions

In addition to my theoretical investigation there are other points of theory that I have used in this paper that are not governed by feature representation. The use of combinatorial specification is especially controversial because it involves an additional degree of abstractness, and it is not well-known in the field of phonology. Nonetheless, I have found this concept very useful for accounting for some of the data, and thus retain it as a key concept in this analysis.

1.2.4 Combinatorial specification

Combinatorial specification is the idea that features can combine in numerous different configurations in order to create different distinguishable segments. That is, if a language has the features [+high] and [+low], then four combinations are possible[§]: [+high], [+low], [+high, +low], and an underspecified combination that has no features. Thus if a language has *n* features, the

[§] Only four combinations are possible if we include only the positive feature values.

number of possible featural combinations is 2^n. This gives a huge number of possible featural combinations, most of which are not attested in natural language. The reason for this is that there are constraints against certain combinations of features, and so only a subset of the many possible combinations are actually realized (Archangeli & Pulleyblank 1994: 52-4).

Combinatorial specification is not useful for representing palatalization, but it is very helpful for explaining and representing opacity. In the course of this analysis Combinatorial specification will be used to distinguish between vowels that have the same phonetic realization, but behave differently in the grammar. This type of opacity is seen in Ainu (as seen in section 7.3.1) and Greenlandic (Underhill 1976) as well as Lakhota. Opacity is generally the result of historical processes, such as vowel mergers, where two vowels become phonetically identical, but due to vestiges of the older vowel system they remain phonologically independent. Whether or not combinatorial specification is a psychological reality or merely a convenient formalism is an issue that will not be dealt with in this paper, and is left to the reader to decide for him or herself.

1.2.5 Optimality theory

Phonologists who use Optimality Theory (OT) generally operate under the assumption that both segmental and prosodic phonology are governed by a set of violable partially-ranked constraints. Although it has proven valuable for explaining a wide range of phonological phenomena, OT is not ideal for analyses of featural interactions because it is highly dependent on the feature theory used to interpret the data. Furthermore, the inclusion of segmental phonology under the domain of OT has recently been challenged (McMahon 2003), suggesting that it be reserved strictly for prosodic phenomena. The most important part of this work will be to account for the diverse environments of Lakhota palatalization in terms of features; an OT analysis will naturally fall out of any given featural representation. Therefore OT tableaus and constraints will not be provided in this paper, as they are not required to illustrate the processes in question. Nonetheless, the following analysis could easily be cast into a constraint-based format if one desired to interpret it in these terms.

2 The Lakhota language

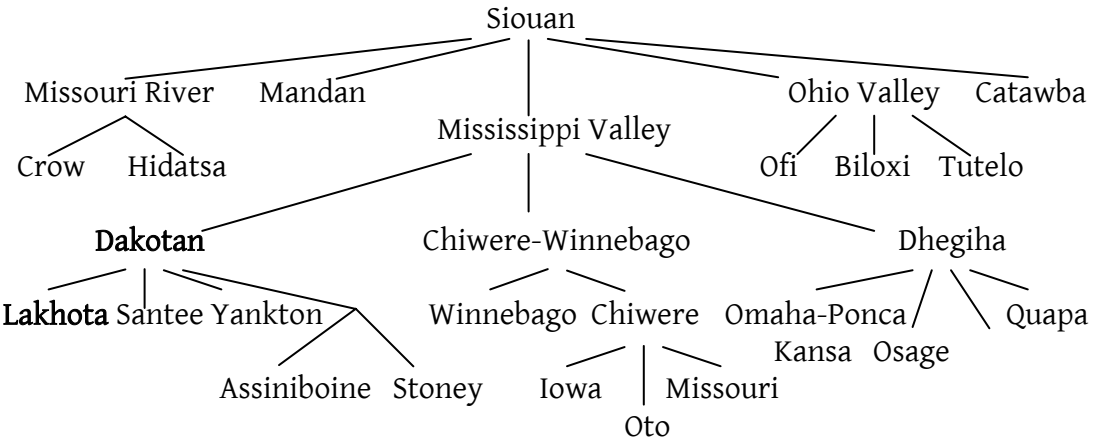
Lakhota, also known as Teton Dakhota, is spoken primarily in South Dakota, but there are also some speakers in North Dakota and Saskatchewan. Lakhota belongs to the Siouan family of

languages, and is one of the three main dialects of Dakhota, the other two are Santee Dakhota and Yankton Dakhota.

2.1 Genetic classification of Lakhota

The following is a diagram of the Siouan family of languages (Shaw 1980: 3):

(6) The Siouan Family



Lakhota is also related to Stoney, spoken in Alberta, and Assiniboine, spoken in Saskatchewan and Manitoba. These two dialects, as well as Yankton Dakota, are sometimes referred to as Nakota. The [l]:[d]:[n] sound correspondence seen in the names Lakhota, Dakota and Nakota is regular throughout these three dialects, and comes from the Proto-Siouan segment *r. Lakhota is spoken by roughly 20 000 people, and is still being learned by children as a first language. Besides this, it is taught in grade schools, universities and colleges.

2.2 Phonemic inventory of Lakhota

Lakhota has five oral vowels and three nasalized vowels:

(7) i ĩ u ũ

e o

a ã

Below is the consonant inventory:

(8) Lakhota Consonant Inventory

Labial	b	pʰ	p	pʔ				m		w
Dental		tʰ	t	tʔ						
Alveolar					s	sʔ	z	n	l	
Alveopalatal		ʧʰ	ʧ	ʧʔ	ʃ	ʃʔ	ʒ			j
Velar		kʰ	k	kʔ	x	xʔ	ɣ			
Pharyngeal			ʔ		h					

Shaw (1980: 17) notes that *b* is usually an allophone of /p/ in Lakhota, occuring only before [l], but that there are three instances where *b* occurs in other environments, forcing us to include it as a phoneme. Ingham (2001: 2) states that the velar fricatives are in fact uvular, but, in keeping with Shaw and Boas & Deloria (1941: 4-5), this analysis will assume that phonologically they are [dorsal].

In addition it may be useful to give the assumed V-Place Theory feature values for the Lakhota vowels. Five-vowel inventories are very common cross-linguistically, and in this respect Lakhota happens to be nearly identical to Maltese Arabic, a language that Hume has dealt with extensively in her work. The only difference is that Maltese Arabic does not contain any nasal vowels, which can be accounted for in Lakhota by adding the feature [nasal] where recquired. This is the underspecified version of the Maltese Arabic vowel inventory, and is assumed for Lakhota as well (Hume 1994: 156).

(9)	i	e	a	o	u
coronal	+	+			
dorsal					
labial				+	+
pharyngeal			+		
high	+	-		-	+

Hume notes that the back vowels can be distinguished by either the feature [dorsal] or [labial], but it is not required that they be specified for both. All of the features given here are monovalent except for [±high].

2.3 Lakhota morpheme boundaries

It has been proposed that Lakhota has four morpheme boundaries (Chambers 1978, Shaw 1980):

(i) the morpheme boundary '+'

(ii) the lexical derivation boundary '%'

(iii) the enclitic boundary '='

(iv) the word boundary '#'

For the purposes of this paper I have merged the lexical derivation boundary with the morpheme boundary, so that they are both represented by '+'. I have done this because the lexical derivation boundary plays no significant role in the palatalization data.

3 Palatalization caused by *i*

3.1 The *i*-palatalization data

The palatalization of the three velar phonemes /k, kʰ,kˀ/ (henceforth /k/) is well-documented in Lakhota. This paper draws primarily on Shaw (1980) for data, and relies somewhat on her original analysis of the phenomena. In Lakhota, the voiceless velar stop /k/ is manifested as the voiceless alveopalatal affricate *ʧ*[**] when it is preceded by the high front vowel *i*, and sometimes by the mid front vowel *e* (we will look at *e*-palatalization in section 4). All data from Shaw (1978: 228-229).

(10) a. ma-kʰute — 'he shoots at me' (3 (null) + me + shoot at)
me shoot at

wa-kʰute — 'I shoot at him'
I shoot at

b. ni- ʧʰute — 'he shoots at you'
1.S shoot at

/mni- kˀa- pi/ — [mniʧˀapi]
water dig PL — 'well'

This process will not occur if the *k* is followed by another consonant:

(11) a. /ni+ kʃu + pi/ — [nikʃupi]
1.S pile on PL — 'they pile on you'

b. /mi + kte + pi/ — [miktepi]
mine kill PL — 'they are killing mine'

[**] /kʰ/ and /kˀ/ become *ʧʰ* and *ʧˀ* respectively.

Palatalization does not occur in intransitive verbs, as seen in (12)a, or in 'dependent verb stems', a class of verbs that never occur without being affixed onto a stem, as seen in (12)b. These 'dependent verb stems' never occur unaffixed because they presuppose an embedded clause, for example *kʰiya* 'to cause' requires the presence of another verb in order to indicate the action that is being caused.

(12) a. ma + kĩza 'I squeak'
me squeek

ni+kĩza 'you squeak'
1.S squeek

b. mani + kʰiya 'making walk'
walk + causative

o + sni + kʰo 'he portends bad weather'
LOC + cold + prophesy

Finally, *i* does not palatalize *k* if the *k* belongs to an enclitic:

(13) a. mni = kĩ 'the water'
water the

b. ohiti = ka 'rather furious'
furious rather

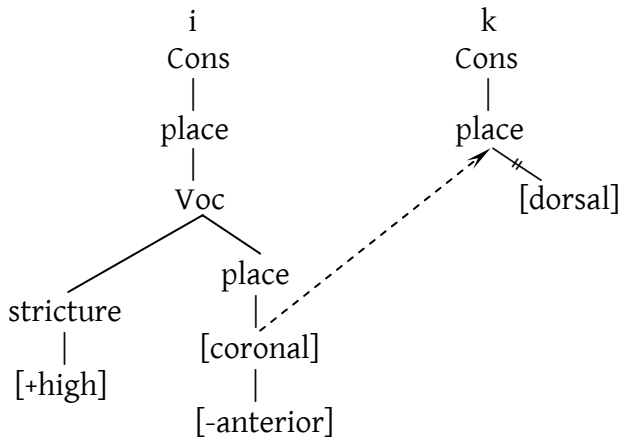
The fact that *i* does not cause palatalization in enclitics suggests that this phenomenon is constrained to the domain of the prosodic word, or the prosodic phrase. It does not affect the clitic group, as part of a higher level of prosodic organization that includes function words such as enclitics (Gussenhoven and Haike 1998).

3.2 Featural representation of *i*-palatalization

A featural representation of palatalization in V-Place Theory was given above in (2). In this representation the spreading of the [coronal] node was seen to cause palatalization. This is also true for Lakhota, but in addition we must point out that only *i* causes palatalization, not *e*, which is also [coronal] (the facts on *e*-palatalization are presented in the next section). Thus we must look to the feature that distinguishes *i* and *e*: the stricture feature [±high]. Since *i* is [+high] while *e* is not, we must conclude that in order for the [coronal] node to spread, the

vowel must have the stricture feature [+high]. This is a necessary condition for palatalization in Lakhota.

(14) A V-Place Theory Representation of Palatalization in Lakhota



If the feature [+high] is not present then spreading will not occur, and palatalization will not take place.

3.3 Residual issues

We have not dealt with the fact that only *k* undergoes palatalization, while the velar fricatives *x* and *ɣ* have not been mentioned. Unfortunately neither Shaw nor Boas & Deloria address this issue, and no data is immediately available from those sources. Perhaps it is simply that these segments do not occur in a palatalizing environment in Lakhota. It should be noted that Lakhota lacks *g*, the voiced counterpart of *k*, so it is not relevant to this data. Nonetheless, in Stoney *g* is palatalized to *ʤ*, indicating that this process does not seem to be limited to voiceless stops (Bellam 1975: 8).

4 Palatalization caused by *e*

4.1 The *e*-palatalization data

Palatalization caused by *e* is far more complicated than that caused by *i*, because of the unique conditions under which it applies. In fact, the phoneme /e/ never causes palatalization. The mid front vowel *e* only causes palatalization when it is derived from an underlying /a/ or /ã/ by ablaut. This requires us to closely scrutinize the ablaut process, so that we might gain a deeper understanding of the intersection of these two processes in Lakhota.

4.1.1 Vowel ablaut

The primary conditioning environment of vowel ablaut is morphological; when certain enclitics combine with a stem they cause stem-final /a/ and /ã/ to manifest as *e*:

(15) a. eja 'to say'
b. eje-ʃni 'he didn't say it' (to say – NEG)

The morphemes that cause *e*-ablaut are as follows:

(16) Enclitics causing *e*-ablaut (Shaw 1980: 129-31)

a.	ʃni	'negative'
b.	xʧa	'augmentative'
c.	la	'diminutive'
d.	ka	'qualifier'
e.	ja	'adverbial suffix'
f.	ʔ	'sentence terminal marker'
g.	so	'conversational interrogative'
h.	sʔa	'habitual, regularly'
i.	sʔe	'as if, as though'
j.	kĩ	'determiner: the'
k.	kʔũ	'determiner: the aforesaid'
l.	kʔejaʃ	'but'
m.	kʔeʃ	'optative'
n.	e	'predicative'

In addition to *e*-ablaut, there are two enclitics that cause stem-final /a/ and /ã/ to become *ĩ*, and one that causes them to become *i* (Shaw 1980: 141-43).

(17) a. Enclitics causing *ĩ*-ablaut:

i. na 'and'
ii. kta 'future'

b. Enclitic causing *i*-ablaut

i. ye 'imperative request particle'

There is are clear syntactic or phonological criteria that separate any of these enclitics from those that do not cause ablaut. Here are the non-ablauting enclitics for comparison (Shaw 1980: 134-5).

(18) Enclitics that do not cause ablaut

a.	eʃ	'in spite of'
b.	ʧʰãke	'because, therefore'
c.	yũkʰã	'and then'
d.	ʧʰa	'indefinite clausal determiner'
e.	wã	'indefinite noun determiner'
f.	itʰo...ke	'I suppose I should do...thus'
g.	kʰeʃ	'but always, whenever'
h.	ʃna	'habitual'
i.	pi	'plural'
j.	he	'interrogative'
k.	ʃ	'adversative'
l.	e	'female permissive imperative'
m.	o	'male imperative'
n.	ʃkʰa	'quotative: it is said'
o.	hã	'continuative'
p.	kel	'manner adverbial suffix'

There are two other environments in which ablaut occurs. The first of these is when a stem is affixed by a 'dependent verb stem' (this class of stems was mentioned above in section 3.1) (Shaw 1980: 139).

(19) a. /apʰa + kʰiya/ → [apʰekʰiya] 'he causes him to hit it'
to strike to cause

b. /yatkã + kapĩ/ → [yatkekapĩ] 'he is reluctant to drink'
to drink to be reluctant

Finally, ablaut is seen when a verb is nominalized and becomes a noun. Nominalization is often accompanied by other morphemes, such as the instrumental prefix 'i-' seen here (Shaw 1980: 259):

(20) a. kaɣa 'to make'
b. iʧaɣe 'instrument'

c. yatkã 'to drink'
d. iyatke 'cup'

Shaw argues that this third ablaut environment is in fact not ablaut at all, but rather is due to a nominalizing enclitic suffix '-e', which in turn causes the deletion of stem-final *a* as seen in other parts of the grammar.

The ablaut phenomenon is further complicated by the fact that it is realized only in certain stems. That is, an ablauting enclitic must suffix onto an ablauting stem in order for ablaut to occur. This indicates that Lakhota has very specifc requirements about both the ablauting morpheme and the ablautee, suggesting that this process is no longer productive in the language. The next section will look at the distribution of ablauting and non-ablauting stems in Lakhota.

4.1.2 Shaw's analysis of ablauting and non-ablauting stems

Out of 125 a-final stems investigated by Shaw, she found that 67 were ablauting and 58 were non-ablauting. There is no synchronic phonological, morphological, prosodic or semantic explanation for this discrepancy (Shaw 1980: 156-7), but there is some historical evidence suggesting that ablaut is the result of a vowel merger, or even a series of vowel mergers, which will be discussed below in section 5.

Aside from the ablauting / non-ablauting classification, it has long been thought that Lakhota stems are divided into two types. The first type are known as C-final stems, which are thought to have the underlying form /CVC/, with an *a* epenthesized stem-finally when these stems appear in isolation. The reason for this supposition is fourfold:

(i) all of these stems end in *a*

(ii) when these stems occur in compound words, the final *a* is deleted

(iii) when these stems are reduplicated, the final *a* is deleted

(iv) these stems are irregularly stressed (they are trochaic rather than iambic)

Here are some regular stems and their reduplicated forms compared with those of some 'CVC' stems. (In Lakota reduplication is used to give distributive, repetitive or intensive meanings (Ingham 2001: 18)). (Data from Shaw 1980: 120):

(21)	Stem	Reduplicated	
	a. sni	sn**i**-sni	'to be cold'
	kĩjã	kĩj**ã**-jã	'to fly'
	gmigma	gmigm**a**-gma	'to be spherical'
	b. xapa	xap-xapa	'to rustle'
	ʧeka	ʧek-ʧeka	'to stagger'
	nũpa	nũp-nũpa	'two'

Here are some unaffixed 'CVC' stems, along with their appearance in lexical compounds (Shaw 1980: 32-33):

(22)
a. ʧʰápa 'beaver'
b. ʧʰap+kʰúwa 'he is beaver hunting' (beaver+hunt)

c. ʃũka 'dog'
d. ʃũk+mánitu 'wolf' (dog+wilderness)

The data below shows the alternating stress patterns seen in regular and 'CVC' stems (Shaw 1980: 32, 149, 154-55).

(23)
a. ʧʰapʰá 'to stab, pierce'
zujá 'to go on a war party'
toná 'to be how much'
apʰá 'to strike, hit'

b. ʧéka 'to stagger'
júza 'to take hold of'
tópa 'be four'
sápa 'to be black'

There is one other point that distinguishes the 'CVC' stems from other Lakhota stems, that is that the second consonant in these stems is limited to being a voiceless unaspirated stop or affricate, or a voiced fricative: /p, t, ʧ, k, z, ʒ, ɣ/. It should be noted that these consonants do not form a natural class that distinguishes them from Lakhota's other consonants.

Regular stems take two forms, either C(C)V or C(C)VC(C)V. The final vowel is generally preserved in reduplication and compounds, and is always stressed when the stem appears in isolation. Given these facts, one might hypothesize that epenthesized *a* might undergo ablaut while an underlying /a/ does not. Unfortunately the facts do not support this hypothesis, in fact they resolutely reject it. Shaw found six classes of stems ending in *a* and *ã* based on (i) whether stems patterned as 'CVC' (using the four criteria given above) and (ii) whether they underwent ablaut or not. Here is a table summing up Shaw's findings (the shaded rows represent stems ending in *ã*):

(24) Summary of Shaw's findings

	Pattern as 'CVC'	Undergo Ablaut	Number of Stems	Percentage of Total
Class 1	-	-	23	18.4%
Class 2	-	-	18	14.4%
Class 3	-	+	34	15.9%
Class 4	-	+	9	7.2%
Class 5	+	-	17	13.6%
Class 6	+	+	24	19.2%
Total			125	

Since Classes 1 and 2 and Classes 3 and 4 pattern together, merging these classes gives us a more concise representation of the data. (These sets of classes are only distinguished by the feature [+nasal], so merging these classes is done on the assumption that nasality is not an important aspect of the ablaut process).

(25) Summary of Shaw's findings with stem-final *a* and *ã* merged

	Pattern as 'CVC'	Undergo Ablaut	Number of Stems		Percentage of Subtotal
Classes 1 & 2	-	-	41	Subtotal:	48.8%
Classes 3 & 4	-	+	43	84	51.2%
Class 5	+	-	17	Subtotal:	41.4%
Class 6	+	+	24	41	58.5%
Total			125		

This data tells us that of the 125 stems that Shaw investigated, roughly two thirds (84 out of 125, 67.2%) are considered to be regular, while the other third (41 out of 125, 32.8%) are of the 'CVC' type. What is even more interesting is that roughly half of each type of stem undergoes ablaut (see Percentage of Subtotal column). This suggests that whether a verb is 'CVC' or not is a poor indicator of whether or not it is subject to ablaut. This fact is also reflected in Shaw's total findings: 67 undergo ablaut (53.6%), while 58 do not (46.4%). The conclusion that can be drawn from this is that the classification of the stem according to other phonological criteria is in no way correlated with its status in regard to ablaut, and hence in regard to palatalization.

4.1.3 Ablaut and palatalization

All of this information becomes important when we see that only an *e* derived from ablaut causes palatalization (Shaw 1978: 232):

(26) a. xʔe 'it is rough'
b. xʔe=ka 'it is roughish'

c. sapa 'it is black'
d. sape=ʧa 'it is blackish'

Lakhota stems ending in *a* and *ã* that do not undergo ablaut do not cause palatalization:

(27) a. tãka 'it is large'
b. tãka=ka 'it is largish'

In section 3 we saw that *i* does not cause palatalization in enclitics, and in (26)d we saw that *e* does cause palatalization in enclitics. This 'complementary distribution' is very remarkable, and the reason for it is as yet unknown. Shaw postulates that perhaps these two operations were at one time part of one widespread operation, and have since diverged so that they now occur in dichotomous environments. She refers to this process of divergence as 'rule meiosis'.

5 Historical data

The Proto-Siouan data comes from Wolff (1950a-c, 1951), who used comparative methods to create a basic outline of the consonant and vowel changes that have taken place in the evolution of the modern Siouan languages. His reconstruction was focused on stems, so there is at present no historical data on enclitics.

5.1 Changes in vowel height

The reconstructed data indicates that vowel changes have taken place in the history of Lakhota and the other Siouan languages. Wolff did not investigate unstressed vowel changes because he felt he did not know enough about the phonological systems of the individual languages to conduct a proper investigation (Wolff 1950c: 168). He did note however, that generally speaking, all stressed Proto-Siouan vowels remain identical in modern Lakhota. The following data illustrates this.

(28)	Proto-Siouan	Lakhota	
a.	*umása	máza	‘metal’
b.	*tápe	tápa	‘ball’
c.	*kʲŭ́k-	ʃŭ́ka	‘dog, horse’
d.	*tukã́	tũkã́	‘grandfather’
e.	*isí	síha	‘foot’
f.	*wahú	hú	‘bone’

In some Lakhota stems stress has shifted from its Proto-Siouan location. This stress shift is sometimes correlated with a vowel change; for example, Proto-Siouan unstressed stem-final **i* sometimes became stressed [é] in Lakhota.

(29)	Proto-Siouan	Lakhota	
a.	*kʲáki	ʃaké	‘hand’
b.	*sĩ́ti	sĩté	‘tail’
c.	*áti	até	‘father’
d.	*ʃã́ti	ʧãté	‘heart’
e.	*ʃákʲi	ʧaʒé	‘name’

Furthermore, unstressed Proto-Siouan *e* becomes unstressed *a* in Lakhota:

(30)	Proto-Siouan	Lakhota	
a.	*i-tã́ke	tã́ka	‘sister’
b.	*kã́te	kã́ta	‘plum’
c.	*ʃápe	ʧʰápa	‘beaver’
d.	*tape	tápa	‘ball’

If a stem did not undergo stress shift, then the unstressed stem-final **i* has become *a* in Lakhota.

(31)	Proto-Siouan	Lakhota	
a.	*xóti	xóta	‘gray’
b.	*ʃúti	lúta	‘red’
c.	*péti	péta	‘fire’
d.	*rúti	yúta	‘to eat’
e.	*sépi	sápa	‘black’

5.2 Vowel mergers in Proto-Siouan

The data in 29 and 30 seem to conspire to create the data in 31. *i has become [é] in some instances, but *a* in others. At the same time **e* has become *a*. One possible interpretation of this data is that two vowel mergers took place, along with a prosodic stress shift that took place in

between the two mergers. For the sake of clarity, this proposal is laid out here in point form and in chronological order:

(i) Every unstressed stem-final **i* becomes *e*

(ii) A stress shift occurs and some unstressed *e*'s become [é]

(iii) Every unstressed stem-final **e* becomes *a*

Steps (i) and (iii) represent partial vowel mergers, where an unstressed vowel lowered to become identical with another vowel already existing in the phonological system. Stressed vowels remained unchanged throughout the history of Lakhota, so they are not included in the following representation:

Vowel Merger 1: *i, *e > e

Vowel Merger 2: *e, *a > a

It is important to remember that these were not complete vowel mergers within the language, they only affected one particular environment: the unstressed stem-final position.

5.3 Further evidence of vowel mergers

The hypothesis that successive vowel mergers occurred in the history of Lakhota makes some predictions. First, we might expect to be able to reconstruct a period in the history of the Siouan languages where the first vowel merger had taken place, but the second one hadn't. Referring to the Siouan genetic classification seen in section 2, we note that Lakhota stems from the Mississippi Valley sub-grouping. When we compare the modern cognates for the stem **sépi* 'black', we see that the Mississippi Valley branch shows a distinct pattern from the other Siouan branches (Missouri River, Mandan and Ohio Valley). The data is given below:

(32)	Mississippi Valley			Other Siouan Branches	
a.	Winnebago	sep	g.	Crow	ʃipite
b.	Chiwere	Θéwe	h.	Hidatsa	ʃipiʃátʃ
c.	Kansa	sábe	i.	Mandan	psi
d.	Omaha-Ponca	sábe	j.	Ofi	iftépi
e.	Osage	Θábe	k.	Biloxi	sepí
f.	Lakhota	sápa	l.	Tutelo	asépi

The word-final vowel in nearly all of the Mississippi Valley languages is *e*, while the corresponding vowel in the other branches is *i* in all cases. Lakhota is the only Mississippi Valley language that clearly deviates from the pattern, displaying the word-final vowel *a* instead of *e*. This suggests that the second vowel merger took place after the Dakotan branch split off from

the Mississippi Valley group. Thus we have two vowel mergers that we must reconstruct for two distinct phases in the history of Lakhota.

Vowel mergers also allow us to account for opacity in the modern grammar. Recall section 4.1.2 above, where it was mentioned that there is no conditioning factor, phonological or otherwise, that allows us to distinguish ablauting stems from non-ablauting stems. If a vowel merger was responsible for creating these conditions then we expect to find differences in the historical derivations of ablauting and non-ablauting stems. In (26d) we saw that the Lakhota stem *sapa* 'to be black' undergoes ablaut, and (32) we see the data used by Wolff to reconstruct its Proto-Siouan form **sépi* 'black'. The fact that this stem both undergoes ablaut and historically ends in **i* could be coincidental, but it seems much more likely that the stem-final **i* is the source of the ablaut. I propose that all ablauting stems share the same historical derivation as *sapa* 'to be black', meaning that they all originally had a stem-final **i* which has since become *a* due to the two proposed partial vowel mergers. These partial vowel mergers have also made the source of palatalization opaque. In modern Lakhota only *i* causes palatalization, except in ablaut environments, where *e* can have the same effect (see section 4). We can unify our account of Lakhota palatalization if we assume that **i* was originally responsible for palatalization in the ablaut environments.

Further to this argument, in (27) above we saw that *tãka* 'large' did not undergo ablaut, and hence palatalization did not occur. Our hypothesis predicts that *tãka* does not share the same lineage as *sapa* 'black', even though the two stems appear similar in their modern form. Here are the cognates of Proto-Siouan **xtã* 'large' from the Siouan languages.

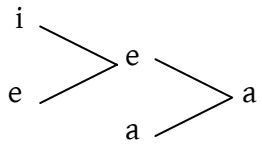
(33)	Mississippi Valley			Other Siouan Branches	
a.	Winnebago	xaté	g.	Crow	isá
b.	Chiwere (Iowa)	xą̃ɲe	h.	Hidatsa	raxtapi
c.	Chiwere (Oto)	xą̃ʤe	i.	Mandan	xtéʔere
d.	Omaha-Ponca	tãgá	j.	Ofi	itő
e.	Osage	tő́ga	k.	Biloxi	tã
f.	Lakhota	tãka	l.	Tutelo	itãi

This data is less clear, but it is evident that we are dealing with a different pattern than that seen in (32). By comparing (32d-e) with (33d-e) and we can conclude that the stem-final *a* of *tãka* 'large' probably came from Proto-Siouan *a. This explains why it fails to undergo ablaut

and to cause palatalization. The nature of the origin of ablaut and *e*-palatalization will be discussed in section 6 and 7 below.

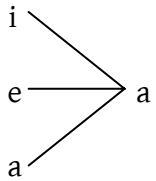
To conclude this section we will illustrate the proposed partial vowel mergers in diagram format. The first diagram indicates the time of each merger. It must be remembered that each merger only affected unstressed stem-final vowels (P-S is Proto-Siouan, P-MV is Proto-Mississippi Valley and D is Dakota):

(34) Stage: P-S P-MV D



For the purposes of describing the situation in modern Lakhota, this diagram can be summarized in a simplified version:

(35)



That is to say that all of the unstressed non-back Proto-Siouan vowels have been merged to *a* in Lakhota, which explains why there are so many stems that end in *a.*

5.4 A refutation of the /CVC/ analysis

In the description of Shaw's analysis of ablauting and non-ablauting stems (section 4.1.2), it was mentioned that many Siouanists have assumed that some Lakhota stems are of the underlying shape /CVC/, with an epenthetic *a* (sometimes called a stem-formative) added stem-finally in order to produce the optimal CV syllable structure. The proposal of a series of partial vowel mergers contradicts the widely-accepted /CVC/ analysis, so this topic deserves some discussion.

5.4.1 Chambers' analysis

In his analysis of the Lakhota stress pattern, Chambers suggests that "Proto-Siouan roots came to be reanalysed in Dakota[††] as monosyllabic" which meant that stress shifted from the second syllable to the first (Chambers 1978:17). The result of this was that the final vowels underwent reduction and were eventually neutralized to "the least marked vowel in the inventory": *a.* In support of his claim Chambers gives the following data, taken from Mattews (1970) and Wolff (1950c):

(36)	Proto-Siouan	Lakhota	
a. *í > a	*xapí	ɣápa	'strip, pull off'
b. *i > a	*kˀési	kˀéza	'scratch'
	*péti	pʰéta	'fire'
	*rúti	yúta	'eat'
	*wãki	wãká	'lie, be'
c. *é > a	*tˀé	tˀá	'die'
	*hãské	hãska	'tall'
d. *e >a	*xóte	xóta	'gray'
	*rúʃe	yúza	'grasp'
	*ʃóte	ʃota	'muddy'
	*tape	tʰápa	'ball'
	*wyéxe	ʧʰéɣa	'kettle'
e. *ó > a	*xró	xná	'rattle'

While we recognize that this set of data is not meant to be exhaustive, it shows an interesting bias. There are nine different words where an unstressed vowel has neutralized to *a*, but only four words where a stressed vowel has done the same. This ratio is even more exaggerated if we call into question some of the reconstructed forms given in the data. The most suspicious forms are **xapí* 'strip, pull off' (36a), taken from Matthews (1970), and **hãské* 'tall' (36c), taken from Wolff (1950c). First let us consider **xapí* 'strip, pull off', which has the following cognates (Mattews 1970:108):

(37)						
	a.	Lakhota	yuɣápa	d.	Hidatsa	ruxapí
	b.	Mandan	xáp	e.	Crow	ruxapé
	c.	Osage	ðixábe			

Here we can see that Lakhota, Mandan and Osage, which come from two different branches of the Siouan family, pattern together, while Crow and Hidatsa, which both come from the same

branch, follow an opposing pattern. Matthews assumes that Crow and Hidatsa represent the Proto-Siouan stress pattern despite that fact that a greater variety of languages show a different pattern. I propose the reconstructed form **xápi* 'strip, pull off', requiring this word to be included in (36b) rather than (36a).

As for the proto-form for 'tall', Chambers has chosen to use Wolff's reconstruction **hãské* rather than Matthews', which is **hãʃki*. Here is a list of the cognates (Wolff 1950c:176, Matthews 1970:106).

(38)	a.	Lakhota	hãska	d.	Hidatsa	hátʃki
	b.	Mandan	hãʃka	e.	Crow	hátʃke
	c.	Biloxi	Naské			

Only one of these cognates has word-final stress, while the rest show word-initial stress, indicating that Matthews' reconstruction is most likely correct. Thus **hãʃki* 'tall' should be included in (36b) rather than (36c).[‡‡]

The revision of these reconstructed forms (now given as **xápi* 'strip, pull off' and **hãʃki* 'tall') means that there are now eleven examples of the neutralization of unstressed vowels, while there are only two examples of stressed vowels undergoing the same process. Furthermore, these two stressed vowels both belong to monosyllabic words.[§§] It is also important to note that all of the unstressed vowels are either **i* or **e*. From these observations we can conclude that Chambers' generalization was too broad, and that it needs to be narrowed in order to accurately account for the facts. The vowel merger hypothesis makes just such a generalization.

Another problem with Chambers' analysis is that it relies on the assumption that stress was completely regular in Proto-Siouan, and was never used phonemically. Wolff, who dealt specifically with the reconstruction of Proto-Siouan, made precisely the opposite assumption: "stress appears phonemic in all existing Siouan languages... [and] is therefore reconstructed as phonemic for Proto-Siouan" (Wolff 1950c:172). If Chambers' analysis is correct, then we must

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[††] Recall that Teton Dakota, referred to here simply as Dakota, is another name for Lakhota.

[‡‡] Whether the final vowel is reconstructed as **i* or **e* is not important according to the vowel merger hypothesi s, which proposes that predicts that *a* is the reflex of both vowels in modern Lakhota. Nonetheless, **i* seems to be the more likely candidate, based on the Hidatsa form: *hátʃki*.

[§§] The history of monosyllabic roots will have to be closely investigated in order to make any insightful comments in this area. It is particularly interesting to note that the vowel *o neutralized to *a* in (1e), as back vowels thought to remain intact under the vowel merger hypothesis.

assume that every branch of the Siouan family developed phonemic stress independently: a highly unlikely proposition. There is in fact evidence that refutes this claim, which will be closely examined in the next section.

5.4.2 Shared irregularities in Osage and Lakhota

This data is offered as evidence against Chambers' assumption that stress was not phonemic in Proto-Siouan. If Chambers' hypothesis is true, then we would expect to see a general trend of stems shifting from iambic to trochaic in the Dakotan languages, but not in any other Siouan language. This hypothesis is falsified based on the fact that Osage, a language belonging to the Dhegiha branch of the Mississippi Valley group, shares a set of irregular stems with Lakhota. Wolff (1950c:172) noticed that the Osage and Lakhota stress patterns are mirror images of each other, even in their irregularities, indicating that the irregularities must stem from a common ancestor language.

(39)	Osage	Lakhota	
a.	mőge	makú	'chest'
	hőbðe	hãmdé	'to dream'
	ábe	apé	'leaf'
	Θíʧe	Sĩté	'tail'
	húxpe	hoxpá	'to cough'
	ʃáge	ʃaké	'hand', 'claws'
	ʧeʃíbe	ʃupé	'intestines'
	ðőʧe	ʧãté	'heart'
	ðéΘe	ʧezí	'tongue'
	ðáxi	ʧaɣú	'lungs'
b.	ákikipa	akípa	'to meet'
	xémõge	xewã́ke	'frost'
	úðage	ojáka	'to tell'
	ðápõga	ʧapã́ka	'mosquito'
	mőhĩΘpe	ãspé	'axe'
	íΘagðe	sagjé	'cane, stick'
	áʃka	aʃkádã	'near'

When we compare the irregular (/CVC/) Lakhota verbs to their Osage cognates, we find that the Osage forms are also irregular, as seen below:

(40)

Osage	Lakhota	
tabé	tápa	‘ball’
ðaʧé	yúta	‘to eat’
gðeʒé	hdéza	‘spotted’
hõbé	hą̃pa	‘moccasin’
nõbá	nų̃pa	‘two’

If Chambers’ hypothesis is correct then we expect to find irregularly-stressed stems only in the Dakotan family, where roots have been reanalyzed as /CVC/. The fact that the Osage cognates are also irregular indicates that Chambers’ analysis is flawed, suggesting instead that the source of the irregular stress patterns is the proto-language itself.

5.4.3 Epenthesis vs. truncation

The primary reason that Chambers and others have suggested that certain roots are /CVC/ is that the final vowel of these stems does not surface when they are morphologically compounded or incorporated. This proposal requires a constraint that prohibits a CVC root from occurring word-finally (*CVC#), and a process of stem-formation that suffixes an epenthetic [-a] to the root. I propose instead that these stems take the underlying form /CVCV/, that they are lexically stressed on the first syllable, and that there is an independent process of truncation which deletes an unstressed final vowel in compounds and incorporated forms. Let us revisit the four criteria that determined whether or not a stem is ‘CVC’ (from section 4.1.2):

(i) stem ends in *a*

(ii) stem does not have final *a* in compounds or incorporated forms

(iii)first syllable of stem is reduplicated

(iv)first syllable of stem is stressed

While a /CVC/ analysis neatly accounts for all of these phenomena, it fails to account for the fact that an apparently epenthetic [-a] only undergoes ablaut on certain roots (section 4.1.2). In order to account for this fact, a /CVC/ analysis is forced to stipulate a feature [±ablaut] which is associated with every /CVC/ root. The vowel merger hypothesis, on the other hand, provides a concise account of the historical source of ablaut while remaining true to Wolff’s observation that stress was most likely phonemic in Proto-Siouan. Thus the vowel merger hypothesis neatly accounts for criteria (i) and (iv), as well as providing insight into the ablaut facts.

In order to account for criteria (ii) and (iii), however, the vowel merger hypothesis requires some additional theoretical structure. I propose that criterion (ii) is the result of a prosodically governed truncation process which deletes a final unstressed vowel in compounds and incorporated forms, as mentioned above. Criterion (iii) concerns reduplication, a process which is often thought to operate independently of other phonological processes. Recall the reduplication data from (21) above, where we saw that the reduplicant is always a single syllable. From this fact we might draw the conclusion that reduplication is also prosodically governed. If this is the case, we might expect reduplication to be sensitive to underlying prosodic information, such as lexical stress. This appears to be the case: reduplication targets the final syllable of regular roots, but targets the lexically-stressed syllable of irregular roots. Making reference to prosodic properties allows us to maintain a relatively unified view of truncation and reduplication while still upholding the vowel merger hypothesis.

There is still one problem for the vowel merger hypothesis: the fact that the irregular roots do not retain their lexical stress when they are compounded or incorporated (see (22) above). One possible explanation for this fact is to suggest that lexical stress is neutralized in derived environments. This is yet another area that requires further research.

6 A diachronic analysis

This paper will offer both a diachronic and a synchronic analysis of the data. The synchronic analysis will take a historical perspective, and attempt to incorporate the historical data by providing a brief synchronic analysis of Lakhota at each stage of its historical development. Because the synchronic analysis draws heavily on the diachronic one, the diachronic analysis will be given first.

6.1 The origin of ablaut and palatalization

The first question to answer is that of the original source of both ablaut and palatalization, in order to determine how they are related to each other. It seems clear that ablaut represents frozen or fossilized forms of words, 'old' pronunciations that have been preserved from before the second vowel merger took place.

6.1.1 Ablaut

Here is a conjectural historical representation of *sape=ʃni* 'it is not black'. It is composed of the stem *sapa* 'to be black' (from (26) above)[***] and the negative enclitic *ʃni*. A fossilized form is indicated by italicized letters, and a dash indicates that the language uses the fossilized form in the modern context.

(41)

Stage 1	Proto-Siouan	sapi	sapiʃni
Stage 2	Proto-Mississippi Valley	sape	*sapeʃni*
Stage 3	Lakhota	sapa	-

Thus we can see that the Stage 2 form of *sapeʃni* has been fossilized while the unaffixed stem has continued to change. We recall the fact that certain enclitics cause ablaut to take the form of *ĩ* and *i* (see (17) above). This gives us a 'window' from modern Lakhota all the way back to Proto-Siouan, which lets us see a part of the older form of the language that has been lost in all other environments. This simply means that these forms were fossilized at Stage 1 instead of Stage 2. The following example uses the stem *apʰa* 'to strike' and the enclitic *ye* 'imperative request particle'. We will assume that the stem-final *a* of *apʰa* is descended from **i*, although it could be descended from **e*. (*apʰi=ye* 'please hit it' from Shaw 1980: 142).

(42)

Stage 1	Proto-Siouan	apʰi	*apʰiye*
Stage 2	Proto-Mississippi Valley	apʰe	-
Stage 3	Lakhota	apʰa	-

6.1.2 Palatalization

Palatalization was also fossilized in the encliticised forms. The proposed history of */sapa=ka/* → *sapetʃa* 'it is blackish' (derived from *sapa* 'to be black' and *ka* 'quantifier') is seen here:

(43)

Stage 1	Proto-Siouan	sapi	sapi*tʃa*
Stage 2	Proto-Mississippi Valley	sape	*sape-*
Stage 3	Lakhota	sapa	-

As we can see here, the enclitic was fossilized in Stage 1, but the stem wasn't fossilized until Stage 2.

[***] The form *sape=ʃni* was not introduced before, but follows from the other data given. Although the proper proto-form of *sapa* is *sepi, I have left out the vowel change in the first syllable for simplicity.

This analysis requires that we assume *i* caused palatalization in more environments in Proto-Siouan than it does in modern Lakhota. As you may recall from section 3.1, *i* does not cause palatalization across the '=' enclitic boundary, but in section 4.1.3 we saw that *e* derived by ablaut only causes palatalization in this environment. This conspicuous state of affairs suggests that both processes stem from one common process, as has been suggested by Shaw, who proposes that a single palatalization rule underwent 'meiosis' to become two separate rules which operate in different environments. When **i* became **e* the cause of palatalization became opaque; it appeared as though both *i* and *e* were both palatalization triggers in the root-final environment. At this point in time Lakhota speakers could have generalized the pattern, allowing both **i* and **e* to cause palatalization, but instead their language took a more conservative turn. The vowel **i* was maintained as the sole trigger of palatalization, only now its domain of influence was restricted to the prosodic word (it could longer cause palatalization across the '=' enclitic boundary). This restriction was made to ensure that there wouldn't be any confusion about the status of **e* with regard to palatalization.

One effect of restricting the environment of productive palatalization is that in some cases underlying /k/, which had become *ʧ* in Proto-Siouan, was now pronounced as *k*. The historical development of **i* and **í* is given below, along with the simultaneous developments of their palatalization environments.

(44) The development of **i* and **í* in /...V=k.../ sequences

		*i	/..i=k../	*í	/..í=k../
Stage 1	Proto-Siouan	i	..i=ʧ..		..í=ʧ..
Stage 2	Proto-Mississippi Valley	e			
Stage 3	Lakhota	a	..e=ʧ..	í	..í=k..

Here we can see that palatalization caused by **í* was effectively 'undone' in the Proto-Mississippi Valley stage of Lakhota's development; this type of change is known as the 'Duke of York effect', where a segment undergoes a change only to revert back to the earlier form at a later stage. It has been claimed that the Duke of York effect never occurs, so this analysis is controversial and may require revision. It should be noted that there are only a few stems that end in [í] in modern Lakhota, so this process would have been very rare, if it occurred at all.

6.1.3 A historical problem in English

The question that remains is one of theoretical debate: how do we represent these historical changes? A similar problem exists in English. There are a number of English plurals which reflect an older state of the language.

(45) a. goose [gus] geese [gis]
b. tooth [tuθ] teeth [tiθ]

Historically the English plural was formed by adding the suffix [-i]:

(46) a. *gōs *gōsi
b. *tōθ *tōθi

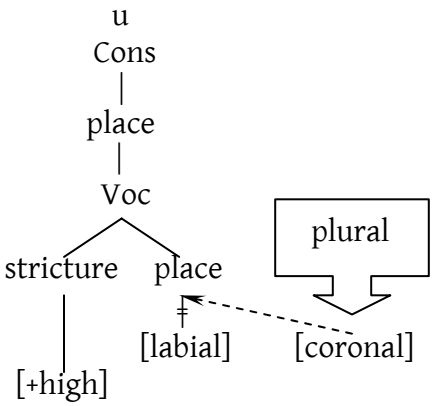
Old English was subject to a type of vowel harmony called umlaut, where a front vowel sometimes caused other vowels to become fronted. In the case of English, the plural marker [-i] caused the root vowel to become fronted. Some time later, the plural marker was lost altogether, which in turn was followed by two independent processes: front vowel unrounding, and the Great Vowel Shift. The result of these historical developments is the modern English forms we see in (45), where the root vowel is fronted in the plural forms.

The question is how to represent English irregular plurals in the modern grammar. We could simply state that these 'irregular' forms are memorized separately in the lexicon, and that they no longer undergo any morpho-phonological processing before being produced. That is, there is a lexical item /gus/ for the singular form, and a lexical item /gis/ that is accessed when the plural form is required. This account is not problematic because there are very few irregular plurals in English, so storing them as separate lexemes does not greatly increase the memory load, nor does it create a large degree of duplication in the lexicon. Bybee (2001) suggests that these forms are preserved as irregularities due to the fact that they are (or were at one time) high-frequency tokens, and as such were privileged enough to receive their own lexical entry. This lexical entry is closely associated with the singular form however, and would not normally be subject to semantic or phonological changes that did not affect the singular form as well.

The second option we have for representing these irregular plurals is assuming that there is still an active phonological process in English that acts only on this very small class of roots. What has been proposed is that a floating feature [coronal] is introduced to the root

when it is pluralized. This floating feature is the vestige of the plural marker *-i* that existed in old English. Although the segment is gone, one of its autosegmental features remains. Here is an illustration of this process (Roca and Johnson 1999: 164-5).

(47) English irregular plural formation: /gus/ → [gis]



The result of this process would actually render /u/ as *y*, but in English we assume that there is a constraint *[labial, coronal], which prevents *y* from being pronounced by forcing the [labial] feature to dissociate.

This problem in English is very similar to that of Lakhota, where an opacity arising from a historical situation can be analysed as either part of the lexicon, increasing the work of the memory, or as the result of a limited phonological process, increasing the abstractness of the grammar. A diachronic analysis would be more likely to make the former assumption, while a synchronic generative analysis would make the latter.

7 A synchronic analysis

One of the primary reasons for constructing a synchronic analysis for palatalization in Lakhota is that the ablaut phenomenon is not limited to just a few stems as the irregular English plural is. As mentioned above in section 4.1.2, 67 of the stems investigated by Shaw undergo ablaut, and there are 14 enclitics that cause ablaut (seen in (16) above). This means that a Lakhota speaker would have to memorize at least 938 forms in addition to the stems and enclitics of the language (67 x 14 = 938). By comparison, if the speaker memorizes only the base forms then there are only 81 words to memorize (67+14 = 81).

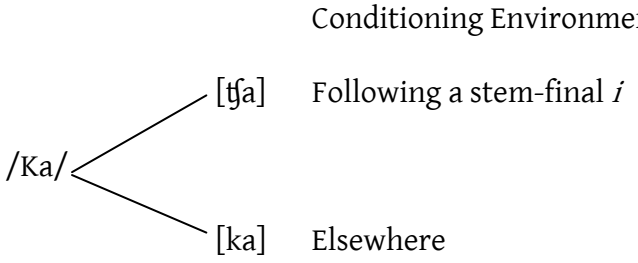
7.1 Palatalization in Proto-Siouan

It is very important to state at the outset that this analysis assumes **i* caused palatalization across both the enclitic boundary '=' and the morpheme boundary '+' in Proto-Siouan. At this stage palatalization was never caused by **e*. It was the first vowel merger, where **i* became *e*, that created the opacity which led to the complementary distribution we see in this process today.

7.1.1 Phonologically conditioned allomorphy

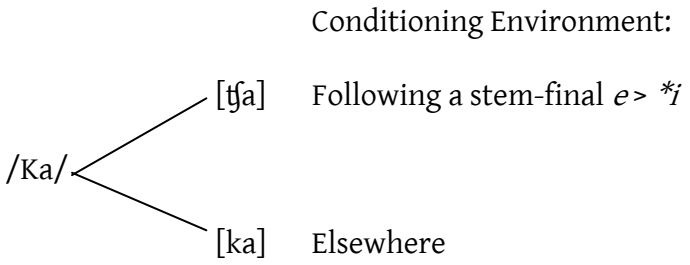
In (43) above we saw that palatalization was fossilized in the enclitics at the time of Proto-Siouan, but the vowel *e* itself did not become fossilized until the Proto-Mississippi Valley Stage. There is the possibility that in the Proto-Siouan stage, the enclitics beginning with *k* were subjected to phonologically conditioned allomorphy. That is, the enclitics beginning with *k* became reinterpreted as two different allomorphs depending on the preceding stem-final vowel. If the stem-final vowel was **i*, then the allomorph beginning in *ʧ* was used, and if the stem-final vowel was anything other than **i*, then the allomorph beginning with *k* was used. In this way palatalization was fossilized independently from the vowel mergers. After the vowel mergers took place, the allomorphs beginning in *ʧ* continued to occur with the stems that had ended in **i*. There are five ablaut-causing enclitics beginning with *k* in modern Lakhota: *ka* 'qualifier', *kĩ* 'determiner: the', *kʔũ* 'determiner: the aforesaid', *kʔejaʃ* 'but' and *kʔeʃ* 'optative'. This analysis argues that these five morphemes each have a corresponding allomorph beginning with *ʧ* that is still used with those stems that ended with **i* in Proto-Siouan. This allomorphy is illustrated here with qualitiative enclitic 'ka'. A capital /K/ is used to indicate that this segment is conditioned by allomorphy.

(48) Phonologically conditioned allomorphy in Proto-Siouan



The *ʧ* allmorphs eventually became associated with the lexical stems they regularly occurred with, rather than the conditioning phonological environment. Thus the allomorphy that was once phonologically conditioned became lexically conditioned, so that stems ending in **i* selected the *ʧ* allomorph while the *k* forms remained the default. After the vowel merger **i* > *e* took place, the following situation developed:

(49) Lexically conditioned allomorphy in Proto-Siouan



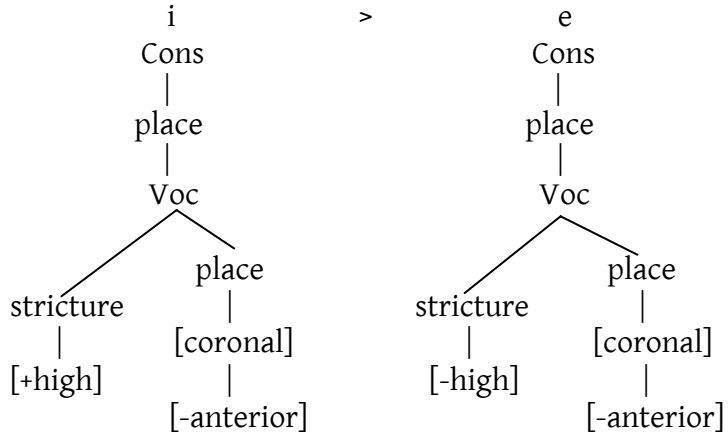
The stems that chose the *ʧ* allomorph in Proto-Mississippi Valley are (for the most part) the same stems that undergo ablaut today. That is, the allomorphy has been entered into the lexicon so that certain stems will cause the *ʧ* allomorph to manifest. Thus modern ablaut occurs only to stems that ended with an **i* in Proto-Siouan.

7.1.2 Rationale for the floating feature [coronal][†††]

This account will represent diachronic vowel change as the minimal addition or deletion of features required in order to change one vowel into another. The first vowel merger saw unstressed **i* become *e*. Here is a representation of this change:

[†††] [coronal] is technically a node, so the terms floating feature and floating node will be used interchangeably from this point forward.

(50) Featural representation of **i* > *e*

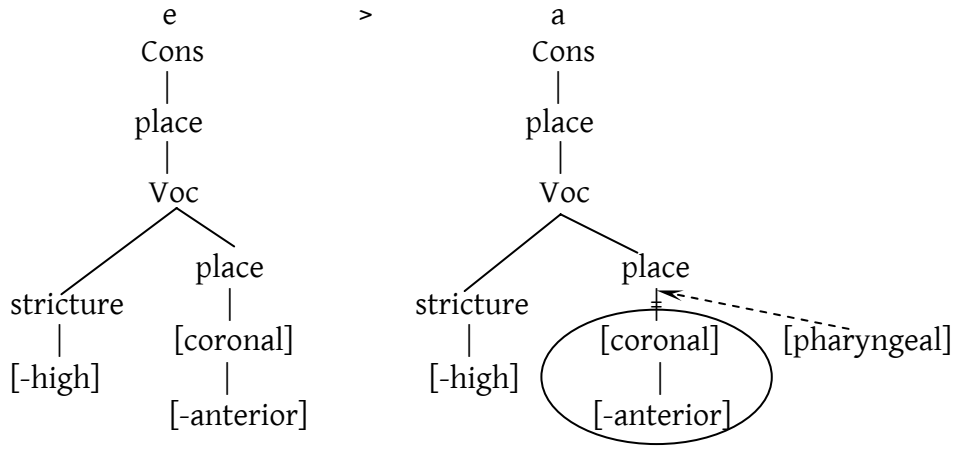


The only change that occurred is that the stricture feature [+high] became [-high], lowering **i* to *e*. The precise reason for this change is unknown, and remains the work of phoneticians and sociolinguists aiming to determine the causes of these types of changes. Certainly it is not hard to imagine that there might be a 'lowering' influence on unstressed vowels, similar to the centralizing trend in unstressed English vowels. Technically *a* is Lakhota's only central vowel, so perhaps these two processes are more similar than they outwardly appear.

After this change occurred, a great deal of confusion must have ensued. **i* continued to cause palatalization, but now it appeared as though *e* was causing palatalization as well, due to the phonologically conditioned allomorphy mentioned above. In order to simplify the situation, palatalization caused by *i* was restricted to the domain of the prosodic word. This analysis argues that *e*-palatalization was never productive in the history of Lakhota, while *i*-palatalization has always been productive. The merger of **i* > e and the subsequent reinterpretation of palatalization would have occurred in Proto-Mississippi Valley.

After the Dakhota branch separated from the Mississippi Valley group, the second vowel merger occurred. This time **e* became *a*, as shown in the following representation:

(51) Featural representation of *e > a



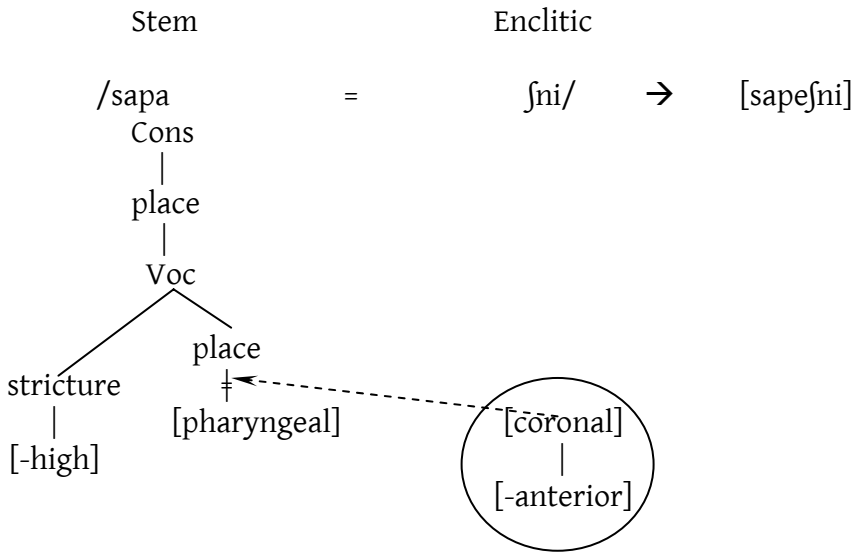
The introduction of the feature [pharyngeal] created a conflict in the vowel structure, and the [coronal] node was forced to dissociate. The circle around the [coronal] node indicates that after it was dissociated it became a floating feature, that is, it was not completely deleted from the featural representation of the vowel. At this point the floating feature [coronal] could only link to the vowel *a* if an enclitic or 'dependent verb stem' suffixed onto the stem. In phonological terms, the floating feature was prohibited from linking to a vowel that was next to a word boundary '#'. If the vowel was followed by either the enclitic boundary '=' or the morpheme boundary '+', then it could link to the stem-final vowel. These conditions are still present in the modern grammar. It should be noted that when the floating [coronal] feature links to the vowel *a*, the [pharyngeal] node is dissociated, and the vowel is realized as *e*. This is precisely the opposite of the procedure seen in (51).

One other significant change took place before the state of modern Lakhota was reached. The floating feature [coronal] was 'transferred' from stem-final *a* to certain high-frequency enclitics and the 'dependent verb stems'. This 'transfer' of a floating feature was a reinterpretation of the location of the floating feature, so that it became associated with the environments where it was regularly seen to operate. The enclitics that received the 'transferred' floating feature cause ablaut in modern Lakhota while the other enclitics do not. So, when an enclitic carrying the floating feature [coronal] suffixes onto a stem-final /a/ the floating feature docks on the vowel and it is realized as *e*.

7.2 Featural representation of ablaut in Lakhota

Modern ablaut is illustrated here using the stem *sapa* 'to be black' and the enclitic *ʃni* 'negative' (*sape=ʃni* 'it is not black').

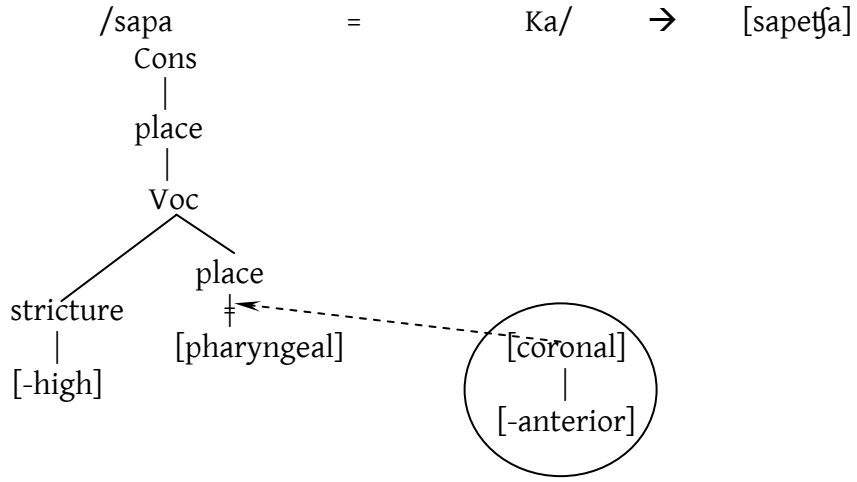
(52) Featural representation of ablaut



Simply stated, when an ablaut-causing enclitic, such as *ʃni* 'negative', suffixes onto a stem such as *sapa* 'to be black', the result is *sapeʃni* 'it is not black'. The vowel change is due to floating [coronal] node, which docks to the stem-final /a/, forcing the [pharyngeal] feature to dissociate.

As for the case of those ablaut-causing enclitics that begin with *k*, they were subject to phonologically conditioned allomorphy in Proto-Siouan, as mentioned above. Thus each of these enclitics has a palatalized variant beginning with *ʧ* in the place of *k*. The floating feature 'transferred' to the palatalized allomorph, so that it appears that ablaut and palatalization occur simultaneously in the modern grammar. Using the example /sapa=Ka/ → *sapeʧa* 'it is blackish', we see that the stem *sapa* arbitrarily forces the choice of the *ʧ* allomorph.

(53) Featural representation of ablaut and palatalization



The only data left to account for is the fact that some stem-final /a/'s undergo ablaut, while others do not. This requires the notion of combinatorial specification.

7.3 Distinguishing ablauting and non-ablauting stems

In order to delineate the concept of combinatorial specification clearly we will go through an interesting case in Ainu (Archangeli & Pulleyblank 1993: 98-101). This situation is very similar to Lakhota's and combinatorial specification seems to be a well-justified way of solving the problem, even if it does involve a more abstract solution.

7.3.1 Combinatorial specification in Ainu

As indicated in the above analysis, there seem to be two types of stem-final *a* in Lakhota, one descended from Proto-Siouan **i* or **e*, and the other from *a. In the Ainu language of northern Japan, *a* also shows effects which are probably the result of historical processes. These effects are seen in a dissimilation process found in the language, where the transivitizing verbal suffix surfaces as either *i* or *u*. If the stem contains a front vowel, the suffix will dissimilate to become the back vowel *u*, and if the stem contains a back vowel, the suffix will surface as *i*. Ainu's vowel inventory consists of [i, e, a, o, u].

(54) a. pir-u 'to wipe'
ket-u 'to rub'

b. hum-i 'to chop up'
pok-i 'to lower'

When a stem contains the vowel *a*, the suffix will surface as either vowel, depending on which stem it is affixed to:

(55) a. ram-u 'to think'
rap-u 'to flutter'

b. kar-i 'to rotate'
sar-i 'to look back'

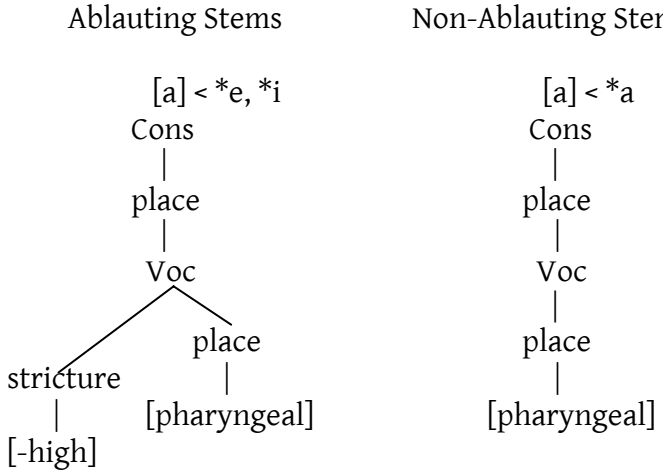
To explain this pattern, Archangeli and Pulleyblank have suggested that there is more than one type of *a* in Ainu. They suggest that the *a* seen in the first two stems, which they refer to as a_1, is only marked with the feature [+low][‡‡‡], thus patterning with the other non-back vowels so that the suffix surfaces as *u*. The other *a*, a_2, is delineated by the additional feature [+back], so that the suffix dissimilates to surface as the non-back vowel *i*. Thus the two types of *a* are distinguished by combinatorial specification – they are phonetically identical yet phonologically different. This is possible because the Ainu vowel inventory only has one low vowel. Perhaps at one time it had two low vowels, one that was back and one that was non-back, which merged at some point to create the opaque situation we see in the language today.

7.3.2 Combinatorial specification in Lakhota

This brings us back to Lakhota, which shows a similar type of opacity. We see this opacity in the ablaut process, which affects certain stems and not others. We will assume that Lakhota also has two types of phonological *a*, but marked differently from those of Ainu. In Lakhota, we will assume that stem-final /a/'s descended from Proto-Siouan **i* and **e* are marked with a [-high] stricture feature as well as the necessary [pharyngeal] feature; all other instances of *a* are marked only with the [pharyngeal] feature. The [-high] stricture feature is present on *a*'s descended from **e* because **e* was necessarily marked with this feature in order to distinguish it from **i*. When **e* became *a*, this feature did not conflict with the [pharyngeal] designation, and so it wasmaintained in the feature geometry, as seen in (51) above.

[‡‡‡] Archangeli & Pulleyblank use the more common Articulator Theory features. The feature [+low] is equivalent to [pharyngeal], and [+back] is equivalent to [dorsal]. The dissimilation in question would be referred to as [dorsal] dissimilation in V-Place Theory. If the root vowel has a [dorsal] feature then the suffix cannot have a [dorsal] feature, and if the root vowel does not have a [dorsal] feature, then the suffix must have a [dorsal] feature.

(56) Combinatorial specification of *a* in Lakhota



It is assumed that the floating [coronal] node cannot dock onto a vowel unless a [-high] stricture feature is present. This seems to be in opposition to the condition stated for *i*-palatalization, where the [coronal] node is prohibited from spreading unless there is a [+high] stricture feature in the same feature matrix. The difference between these two conditions is that the former is a condition on the receiving segment, while the latter is a condition on the spreading segment. This leaves us with another small problem. The vowels *e* and *o* are also marked with a [-high] stricture feature. Thus we must state that the floating [coronal] node cannot link onto a vowel that is already marked as [coronal], protecting *e*, nor can it link onto a vowel that is marked [labial], preventing *o* from undergoing ablaut.

7.4 Residual Issues

7.4.1 Ablauting *ã*

Although it was mentioned earlier in this paper, the present explanation has not dealt with the fact that many of the *a*'s that undergo ablaut are nasal. Most likely those stems that end in word-final *ã* and undergo ablaut in the current grammar are derived from *ĩ (there have never been any mid nasal vowels in the Siouan languages). When the **i* > e merger occurred, perhaps *ĩ, which was prohibited from becoming a mid vowel while retaining its nasality, became *ã* and has remained as such in the modern lexicon.

7.4.2 Analogical paradigm leveling

Shaw notes that while all of the Dakhota languages have ablaut, different stems and different enclitics are involved in each dialect. The best explanation for this is that since these languages have diverged, analogical leveling has occurred within each of them. Where one dialect has allowed more stems to undergo ablaut, another may have begun to shrink the class of ablauting stems. Nonetheless, there are certain stems and enclitics that undergo ablaut in all of the extant languages, indicating a common origin for this phenomenon.

7.4.3 Enclitics causing the ablaut vowels *i* and *ĩ*

The enclitics that cause ablaut to appear as *i* and *ĩ* (see section 4.1.1) must have an additional floating feature [+high], that causes the [-high] node of stem-final *a* to dissociate. This will not be illustrated here, as it is peripheral to the main arguments.

7.4.4 The nominalization floating feature

In section 4.1.1 we noted that a nominalization process also appears to cause ablaut, but that Shaw provided an analysis which considered nominalization to be provided by a morpheme [-e]. I propose that nominalization is in fact caused by another floating feature [coronal], unrelated to the floating feature that causes ablaut. The nominalization floating feature is similar to the irregular English plural in that it is not associated with a morpheme. Nominalization and ablaut have already been identified as separate morphological processes by Shaw; this analysis simply aims to unify the phonological representation of both processes, which is desirable since they both have the same input and output. This analysis also simplifies the representation of nominalization: it is now considered to be the result of the addition of a single autosegmental feature rather than the addition of a whole segment.

8 Conclusion

Although the synchronic analysis offered in this paper is largely speculative, it offers a unique perspective on the palatalization and ablaut phenomena seen in Lakhota. Taking the historical data into account has been pivotal in formulating this analysis, and hopefully has shed a considerable amount of light on this subject. There are other possible synchronic analyses, including Shaw's, which simply states that stems and enclitics are marked as [±ablaut] depending on how they behave in a given dialect. This analysis has attempted to make use of the many advances in phonological theory that have taken place since Shaw's (1980) presentation of the

data. Ultimately more research needs to be done in many of the relevant subfields in order to confirm or disprove the analysis given here. First and foremost is the need for more research on the extant Siouan languages, so that a comprehensive reconstruction of Proto-Siouan can be initiated. Also, a detailed report of the morphological and phonological processes at work in each of the Siouan languages would be essential to understanding how palatalization may have operated and evolved in the history of the Siouan language family in general. Palatalization remains an area of controversy and intense debate, and only by investigating the constraints governing its implementation in languages such as Lakhota will we eventually come to a greater understanding of this deceptively complex process.

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