

AN OPTIMALITY THEORETIC ACCOUNT OF NAVAJO PREFIXAL SYLLABLES

by

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To Hap the safety dog, Cato the perma-pup, Chancie the magnificent;

To the greatest horses in the whole world: Shorty Smiley and Matteo Montoya;

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ABSTRACT

Navajo is a Southern Athapaskan language spoken by approximately 160,000 people in Arizona and New Mexico. This dissertation examines the syllable structure alternations in the prefixes of the Navajo verb. Specifically, the distribution of open and closed syllables in the verbal prefixes are at issue. This distribution is seen to follow from the interaction of constraints on phonological well-formedness including Markedness, Faithfulness and Alignment constraints, under Optimality Theory. The dissertation makes the following empirical and theoretical points.

Empirically, the analysis is based on a description of the surface forms of the Navajo verb, without recourse to diachronic or comparative data. In this respect, the analysis is in line with the kind of reasoning that would have to be undertaken by the language-learner, and which must form some part of the phonological knowledge of native speakers of this language. Furthermore, the analysis is undertaken without reference to the specialized terminology which permeates linguistic analyses of Navajo in particular, and of the language family in general. Thus the description and analysis of the data are presented in such a way that a non-specialist in the language family might understand the data and analysis.

Theoretically the analysis shows the utility of Optimality Theory in dealing with the complex interactions between morphology and phonology that characterize this language. It is demonstrated that the interaction of cross-linguistically motivated constraints on well-formedness results in the attested surface patterns. It is further argued that this analysis fills out a typological prediction of Optimality Theory by attesting one of the possible rankings of Markedness, Faithfulness and Alignment constraints.

The basics of Navajo syllable structure, and of Optimality Theory are presented first, followed by a discussion of the fundamental morphological and phonological properties of the system. A set of Navajo verbal paradigms is then analyzed and input forms of the morphemes

which participate in syllable structure alternations are derived. The Optimality Theoretic analysis is presented, and the dissertation concludes with a discussion of the issues raised, and of a set of alternative analyses of the same data.

CHAPTER 1: INTRODUCTION

1.0 INTRODUCTION

Navajo is a Southern Athapaskan language spoken by approximately 160,000 people in Arizona and New Mexico (Benally and McCarty 1990, McCarty 1992).

Although it has been among the most widely documented and studied of the languages native to North America, Navajo's complex verbal morphology remains the subject of much scholarly attention (cf. Cook and Rice 1989, Courtney and Saville-Troike 1997, Hargus 1997, Hargus and Tuttle 1997, Hoijer 1945, LaMontagne and Rice 1995, Kari 1973, McDonough 1990, Meek 1997, Rice 1983, 1987, Sapir 1967, Saville 1968, Saville-Troike 1995, Speas 1984, Stanley 1969, Willie 1991, Wright 1984, Young and Morgan 1951, 1987, 1992, Young 1995). This dissertation addresses certain phonological properties of the Navajo verb which have been unaccounted for within synchronic Generative Phonology. In particular, I describe a number of Navajo verb paradigms, and account for the distribution of open and closed syllables in the verbal prefixes. The forms below illustrate the kind of data addressed here.

In a Navajo verb, prefixes generally surface in open syllables. This is illustrated in the forms below, where periods indicate syllable boundaries, and a hyphen separates prefixal material from the verb stem.

(1) Navajo Verbs: Prefixes in Open Syllables¹

Verb	Gloss
a. ši.ʃi. - č'it	's/he (4th) is scratching me'
prefixes - stem 'scratch'	
b. ni.ši. - č'it	'I am scratching you'
prefixes - stem 'scratch'	

There are two cases in which closed syllables may occur in the Navajo verb prefixes. Certain consonantal prefixes may surface as syllable codas if doing so will result in that prefix occurring to the immediate left of the verb stem. Other consonantal prefixes may surface as syllable codas if doing so will result in that prefix occurring to the immediate left of another prefix. This is illustrated below.

¹All data in this dissertation are presented in phonemic transcription using IPA symbols, with the following exceptions. First, nasalization of a vowel is marked by the nasal hook rather than the tilde. This renders the diacritics on forms with both high tones (marked by an acute accent) and nasalization more legible. Second, the symbol 'c' is used in referring to the series of alveolar affricates. Third, the symbol 'X' is used in referring to the series of lateral affricates.

(2) Navajo Verbs with Closed Prestem Syllables:

Align with Stem: /š/, /l/, /s/, /ʌ/

Verb	Gloss
a. te:š. - ʔe:ʔ prefixes- stem 'be'	'I will be'
b. yí.ní. - ʔal prefixes - stem 'eat'	'you ate it (as meat)'
c. ʔis.- ʔá prefixes -stem 'handle object'	's/he (4th) keeps it'
d. ní. - cé:h prefixes-stem 'scrape object'	'you scrape a hide in order to soften it'

(3) Navajo Verbs with Closed Pre-Prefixal Syllables.

Align with Prefix: /ž/.

Verb	Gloss
a. šiž.to:.- č'iʔ prefixes- stem 'scratch'	'I will be scratched'

The prefixes which occur as codas of the prestem syllable only occur as codas in that position: else, they always surface as syllable onsets. Those prefixes which can close a syllable outside of the prestem only occur as codas when doing so results in their immediately preceding some other prefix. No closed prefixal syllables occur in Navajo except those created as a result of these two types of positional pressure on prefixes.

The syllable structure alternations described here constitute one of the many phenomena which result from an interleaving of phonological and morphological requirements in the grammar of Navajo. Restrictions on the position of a prefix in the string come from the morphology of the language, whereas restrictions on surface syllable shapes come from the phonological component of the grammar. The morphology and phonology of Navajo interact with each other in ways that can only be captured by a theory that allows both phonological and morphological pressures to be simultaneously expressed in the grammar. Optimality Theory (McCarthy and Prince 1993a,b, McCarthy 1995, Prince and Smolensky 1993, et al.) therefore provides a useful vehicle for accounting for these alternations. Unlike previous approaches to phonological and morphological theory, Optimality Theory predicts that phonological and morphological requirements can be interrelated with each other in the grammar of any language.

This dissertation describes and accounts for the facts outlined above. The remainder of this section is organized as follows. The theoretical goals of the dissertation are described in subsection 1.0.1, and the empirical goals in subsection 1.0.2.

1.0.1 The Theoretical Goals of the Dissertation

In this section, the theoretical goals of this dissertation are articulated. The dissertation is intended to be a contribution to the literature in Optimality Theory. The generalizations addressed here, the distribution of closed syllables in the Navajo verb, have been neither fully identified nor accounted for in the literature. McDonough (1990) provides a crucial starting point for this analysis, by noting that closed syllables in the Navajo verb are generally restricted to the stem and the

prestem syllable. This observation, along with the additional generalization that closed syllables may occur outside of these two positions under certain circumstances (which are described in detail in chapter three, and accounted for in chapter five, of this dissertation), provide the foundation upon which the analysis presented here is based. The theoretical contribution of this work is to provide an account for this distribution based upon the interaction of universal phonological constraints governing phonological markedness, faithfulness of words to their input forms, and morphological constraints governing the positioning of affixes in a string.

This dissertation confirms the utility of an Optimality Theoretic approach to the interaction between phonology and morphology. A formerly intractable system, that of the prefixes of Navajo, is given a simple treatment by means of constraint interaction, utilizing well understood, cross-linguistically motivated phonological markedness constraints such as ONSET and NOCODA in conjunction with constraints of the Correspondence and Generalized Alignment schemata. No new theoretical machinery need be posited.

This is an important finding, especially in light of the preponderance of suggested innovations to Optimality Theory. The fact that the simplest version of the theory, which assumes universal constraints and language-specific strict rankings, readily accounts for such a complex system as Navajo suggests that recent theoretical proposals to abandon these assumptions may not be warranted. Neither parochial constraints (Elzinga 1996, Hammond in press, Russell 1995) nor parochial rankings (Tranel 1994, Blevins and Inkelas 1997) need be posited in the analysis presented here. Similarly, theoretical innovations which circumvent the assumption of strict

ranking of constraints, such as Sympathy Theory (McCarthy 1997, Itô and Mester 1997) and Local Conjunction (Smolensky 1995) are unnecessary.

Furthermore, the analysis given in this dissertation fleshes out the factorial typology or morphophonological interaction generated by Optimality Theory. A technical discussion of this typology is presented in section 1.3 of this chapter, after the machinery of Optimality Theory is reviewed in detail. Informally, the argument goes as follows.

Optimality Theory provides three types of well-formedness constraints on output forms in a language: faithfulness constraints, which govern the mappings between input and output representations; markedness constraints, which govern the occurrence of typologically marked surface representations; and alignment constraints, which govern (among other things) the position of morphemes in a string. In simple terms, phonology is governed by faithfulness and markedness constraints, while morphology is governed by alignment constraints.

There are six possible rankings of these three constraint types. They are previewed below. Each ranking ought to be instantiated in a (at least one) language, if the predictions of Optimality Theory are to be borne out.

(4) Possible Rankings of Faithfulness, Alignment and Markedness

Constraints:

1. FAITHFULNESS >> MARKEDNESS >> ALIGNMENT.
2. FAITHFULNESS >> ALIGNMENT >> MARKEDNESS.
3. ALIGNMENT >> FAITHFULNESS >> MARKEDNESS.
4. MARKEDNESS >> ALIGNMENT >> FAITHFULNESS.
5. MARKEDNESS >> FAITHFULNESS >> ALIGNMENT.
6. ALIGNMENT >> MARKEDNESS >> FAITHFULNESS.

While rankings one through five above have been attested in the Optimality Theoretic literature, the analysis in this dissertation instantiates the ranking given in six. Thus, this analysis fleshes out the factorial typology generated by Optimality Theory. This typology is revisited and explored in detail in section 1.3.

Finally, the analysis presented here confirms the importance of Generalized Alignment (McCarthy and Prince 1993b) for the characterization of morphophonological phenomena in Navajo. Generalized Alignment is formally defined and exemplified in section 1.2.2.2 below. It is a constraint schema which is used to formulate constraints of the sort that require adjacency between edges of different grammatical and phonological elements. The grammatical elements of interest in this dissertation are "stem", "prefix" and "word". It is shown in chapters four and five of this dissertation that each of these grammatical categories is crucially referred to in an Alignment constraint. Thus, Navajo manifests the full range of Alignment requirements predicted under Generalized Alignment, a result that is unaccounted for under a theory that does not include this constraint schema.

1.0.2 The Empirical Goals of the Dissertation

In this section, the empirical goals of the dissertation are articulated, and the descriptive challenges faced by this project are outlined. This dissertation describes the prosodic properties of the Navajo verb in a manner which focuses exclusively on generalizations about surface forms in the synchronic phonology of the language.

In examining the observable regularities in the Navajo verb as a synchronic object whose shape is determined by constraints on surface patterns, a number of terms and approaches taken by previous scholars of this language family will be avoided in this thesis. The terminology of Athapaskanist literature has proven itself to be quite useful for the approaches to which it has been put to work, which have been overwhelmingly comparative and historical in nature (cf. Aberle and Dyen 1974, Cook 1981, 1989, Hargus and Tuttle 1997, Hoijer 1945, 1945-1949, Kari 1978, 1979, Krauss and Leer 1976, 1981, Leer 1979). This dissertation takes an explicitly synchronic and universalist tack, however. For synchronic, generative phonology, much of the Athapaskanist terminology obfuscates the facts. For example, in this dissertation, I use the terms "prefix" and "proclitic" to describe two sets of affixes in Navajo. The Athapaskanist terms for these two sets of objects is "conjunct prefix" and "disjunct prefix", respectively. The Athapaskanist terminology derives from a paper written by Li (1933) about the Athapaskan language Chipewyan, and it has been utilized by researchers working on languages of this family ever since (cf. Hargus 1997). The distinction between "disjunct" and "conjunct" prefixes is necessary for Navajo, a fact which is motivated in detail in chapter two of this thesis. However, from a universalist perspective it is clear that the "disjunct" prefixes of Navajo are actually best described as clitics, and the "conjunct" prefixes as true prefixes. It is shown in chapter two that the Navajo clitics

clearly class with stems in terms of their phonological properties, and not with prefixes. Proclitics occur to the left of a stem plus prefix cluster. Their position and their phonology conspire to suggest that the so-called "disjunct prefixes" of Navajo are clitics, and the "conjunct prefixes" are prefixes in the traditional sense.

There are a number of additional Athapaskanist staples which will be referred to in traditional linguistic terms rather than in the more specialized terminology of the Athapaskanist. For example, there is a set of consonantal alternations involving affrication (or deaffrication) and glottalization (or deglottalization)² of consonants, and certain other effects that occur in particular environments, all of which would have at some point in the history of the language have been left-adjacent to the segment /t/. This set of alternations is referred to in the Athapaskanist literature as "the D-Effect"³. With respect to the synchronic phonology of Navajo, however, the hypothetical /t/ of the D-Effect never surfaces. Instead, the consonant mutations attributed to it are the only data from which the child has to draw when acquiring her language. Therefore, rather than referring to a "D-Effect", consonantal mutations will be noted as such when they occur in the data.

The empirical goal of this dissertation, then, is to accurately describe the full range of syllable structure alternations that occur in the prefixes of the Navajo verb,

²Analysis of the alternations involved strongly suggests that the relevant phenomena are affrication and glottalization, not the reverse. Since these alternations are not a part of the analysis given in this dissertation, the evidence for the directionality of the alternations is not given here.

³There is no voicing distinction in the stop consonants of Navajo. Instead, stops are differentiated by aspiration, glottalization, and lack of either of these gestures (Cook and Rice 1989, de Reuse 1994, etc.). Since the unaspirated voiceless alveolar stop is most accurately transcribed as a "t" rather than as a "d" in IPA notation, "t" is used here. This sound is written with a "d" in the practical orthography of Navajo, however, and this is why the phenomenon being discussed here is referred to as the "D-effect".

and to do so on the basis of surface generalizations. This is accomplished by recording and working from surface forms of verbs and deriving input forms based on generalizations that are available from close examination of these forms.

The remainder of this chapter provides a brief background for understanding the theory and data invoked, and previews the organization and substance of the dissertation. The chapter proceeds as follows. First, the notion of the syllable is introduced, and its relevance to the phonology of Navajo overviewed in section 1.1. Second, section 1.2 describes the basic assumptions and machinery of Optimality Theory. Section 1.3. returns to the factorial typology described above, and examines it in detail. Finally, the structure of the remaining chapters of the dissertation is previewed in section 1.4.

1.1 INTRODUCTION TO SYLLABLE THEORY

This section introduces the notion of the syllable as it is understood in generative phonology by demonstrating its importance to the phonology of Navajo. The phonemic inventory of Navajo is described in section 1.1.1. The relevant principles of syllable theory and its importance for characterizing the distributional restrictions on consonants and vowels in this language are then outlined in section 1.1.2.

1.1.1 Phonemic Inventory

In this section, some basic facts about the phonemic inventory of Navajo are introduced. The first chart illustrates the consonant inventory of this language. Note that for stops and affricates, sounds are differentiated according to the glottal contrasts "aspirated", "unaspirated" and "glottalized". Voicing is only distinctive for

fricative consonants in Navajo (cf. Rice 1989). The lateral sounds /l/ and /ɭ/ are fricatives, and not liquids (cf. de Reuse 1994).

(5) Navajo Phonemic Inventory: Consonants (adapted from Young and Morgan, 1987:xiii)⁴

	Labial	Coronal			Dorsal	Glottal
		Apical	Laminal	Lateral		
Stops						
Unaspirated	p	t			k	ʔ
Aspirated		t ^h			k ^h	
Glottalized		t'			k'	
Fricatives						
Voiced		z	ʒ	l	y	
Voiceless		s	ʃ	ɬ		h
Affricates						
Unaspirated		c	ɟ	ɮ		
Aspirated		c ^h	ɟ ^h	ɮ ^h		
Nasals						
Plain	m	n				
Glottalized		'n				
Glides	w		y			

⁴Navajo also utilizes labialized stops, these occur most frequently preceding the round vowel, but they may occur elsewhere also. Labialization is noted in the data by a superscripted 'w'. Note that the official orthography of Navajo uses the symbols 'b', 'd', and 'g' to refer to the voiceless unaspirated stops; 'ts', 'dz' and 'ts'' to refer to the apical affricates; 'tɬ' 'dɬ' and 'tɬ'' to refer to the laminal affricates; and 'sh' 'zh' 'ch' and 'zh' to refer to the coronal fricatives.

The forms below show that glottal state is crucial in reflecting the contrasts found in the stop consonants of Navajo. The forms in (a-b) are a minimal pair for aspiration versus glottalization of the coronal-apical affricate. With (c), these forms create a near-minimal triplet. Comparison of forms (d-e) shows that aspirated consonants contrast with plain ones in Navajo.

(6) Glottal Contrasts in Navajo

	Standard Spelling	Pronunciation	Gloss
a.	tsin	[c ^h in]	'log, stick, tree'
b.	ts'in	[c'in]	'bone'
c.	dził	[cił]	'mountain'
d.	dé:h	[té:h]	'tea'
e.	té:h	[t ^h é:h]	'valley, deep water'

The vowel inventory of Navajo, which is given below, is quite unusual from a typological point of view. This is because it is asymmetric. There is a distinction between the high and the mid vowel for vowels articulated in the front, and there is no low front vowel. By contrast, the mid back vowel [o] contrasts with the low back vowel [a], but there is no phonemic high back vowel. When [o] occurs following an aspirated stop, it is usually raised to approach cardinal [u], but this distinction never signals a meaningful difference in Navajo words.

(7) Navajo Phonemic Inventory: Vowel Qualities

	Front	Back
High	i	
Mid	e	o
Low		a

Each of the Navajo vowels may occur long or short, nasal or oral, and high or low in tone. Contour tones, including rising or falling contours, may occur on long vowels, but not on short ones. There are no nasal contours on vowels. Vowels are either nasal or oral, regardless of their moraicity. These facts are demonstrated in the data below. In each of the verbs below, it is the stem which determines the basic meaning of the word. Stems are underlined in the data presented here. The first data set shows that nasalization is contrastive for verb stems in Navajo.

(8) Contrastive Nasalization in Navajo.

Stem	Surface Form	Gloss
a. $\check{c}^h i\text{?}$	na:š - <u>$\check{c}^h i\text{?}$</u>	'I scout the enemy'
b. $\check{c}^h i\text{?}$	piʔni:ł - <u>$\check{c}^h i\text{?}$</u>	'I am starting to give birth'
c. $h\acute{e}:s$	naš - <u>$h\acute{e}:s$</u>	'I crank it (as an old car)'
d. $h\grave{e}:s$	ha - <u>$h\grave{e}:s$</u>	'an area itches'
e. $\text{?}\acute{a}$	naníł - <u>$\text{?}\acute{a}$</u>	'you hold slender object across'
f. $\text{?}\acute{a}$	pik'iʔo:z - <u>$\text{?}\acute{a}$</u>	'use up the whole day'
g. $\check{z}o:t$	$\text{?}i:l$ - <u>$\check{z}o:t$</u>	'slides away, disappears'
h. $\check{z}o:t$	$h\acute{o}:$ - <u>$\check{z}o:t$</u>	'it becomes harmonious'

The next set of forms shows that tone is contrastive in Navajo verb stems. These forms contain verb stems that differ only with regard to tone, and which have different meanings.

(9) Contrastive Tone in Navajo.

Stem	Surface Form	Gloss
a. $\check{c}^h i:t$	atił náhotitiš - $\check{c}^h i:t$	'I start to fidget'
b. $\check{c}^h i:t$	pitis - $\check{c}^h i:t$	'I release my grasp on it'
c. $pe:h$?aná - $pe:h$	'swim away out of sight'
d. $pé:h$	yi: - $pé:h$	'it is turning gray'
e. $?a:t$	yiš - $?a:t$	'I send him on an errand'
f. $?á:t$?atah yiš - $?á:t$	'toss or drop in a flat flexible object'
g. $k^h o:h$?api - $k^h o:h$	'a canyon extends away'
h. $k^h ó:h$	na:tiš - $k^h ó:h$	'I am starting to vomit again'

Finally, the forms below demonstrate that length is contrastive for all vowel qualities in verb stems as well.

(10) Contrastive Length in Navajo.

Stem	Surface Form	Gloss
a. 'nih	?ate:s - 'nih	'there is a clap of thunder'
b. 'ni:h	tiš - 'ni:h	'I blink in disdain'
c. k'e?	ne:z - k'e?	'stops hurting'
d. k'e:?	?ahání - k'e:?	'slice object in two'
e. k ^h at	níséł - k ^h at	'I started to sew'
f. k ^h a:t	?i: - k ^h a:t	'it falls away out of sight'
g. žoh	yiš - žoh	'it is moistened'
h. žo:ž	há: - žo:ž	'it comes falling out (as sticks)'

These facts are summarized below. Length and tone are contrastive in vowels, and long vowels may surface with tonal contours. Nasalization is contrastive as well, but no nasal contours occur on Navajo vowels.

(11) Navajo Phonemic Inventory: Suprasegmental Vowel Contrasts

Length	Tone	Nasalization
Short	High or Low,	Nasal or Oral
Long	Rising or Falling	No Contours

Navajo diphthongs display an unusual property in that they may be either short or long. Short diphthongs are comprised of two short vowels. Long diphthongs contain one long vowel and one short vowel. There are no 'triphthongs' in Navajo. This suggests that Navajo tolerates trimoric syllables, a property which is unusual cross-linguistically (though one that is shared at least by English, as pointed out in Hammond 1997b). Long diphthongs in Navajo which contain the same two vowel qualities (for example [a] and [i]) may contrast depending on whether the first or second element is long (so [a:i] contrasts with [ai:], for example). The attested diphthongs are given below.

(12) Navajo Phonemic Inventory: Diphthongs

Short	Long
ai	a:i or ai:
ei	ei:
oi	oi:
ao	*

Forms containing each of these diphthongs are given in the following chart.

(13) Forms Containing Diphthongs.

Diphthong	Form	Gloss
a. ai	h <u>ai</u>	'winter'
b. oi	hast ^h <u>ói</u>	'elders (particularly men)'
c. ei	teǎjiʔé:ʔ	'blouse'
d. ao	sil <u>âo</u>	'soldier'
e. ai:	łozitk <u>ai:</u>	'light colored squirrel'
f. a:i	č'il tika <u>í</u>	'lettuce'
g. oi:	pip <u>ói:</u>	'boyfriend'
h. o:i	ʔak'a tíc ^h <u>ói</u>	'vaseline'
i. ei:	pí:n <u>éi:</u>	'it is frisky'

With these facts in mind, the next section outlines the assumptions underlying syllable theory, and motivates the relevance of the syllable in Navajo phonology.

1.1.2 Syllable Theory

This section introduces the construct "syllable" in generative phonology. This construct is first defined in 1.1.2.1, and the phenomena accounted for by the syllable are explained in 1.1.2.2.

1.1.2.1 Defining the Syllable

Syllables are phonological structures which organize individual sounds into larger units based on the nature of those sounds, and on their linear position with respect to each other. For purposes of this dissertation, it is the arrangement of consonants and vowels into syllables that is relevant. Much finer-grained

distinctions are utilized in the languages of the world (cf. Imdlawn Tashlhiyt Berber (Dell and Elmedlaoui 1985) and Bella Coola (Bagemihl 1991) for extreme examples, English (Hammond 1997b) for a less extreme one). These distinctions are not necessary for understanding the data or analysis presented in this dissertation, so they are not discussed here.

1.1.2.2 Evidence for the Syllable

There are restrictions on the arrangement of consonants and vowels that are common to all words of Navajo. In this section, it is demonstrated that these restrictions are accounted for by positing that all segments in a well-formed Navajo word must surface in well-formed syllables. The section begins with a description of restrictions on the distribution of consonants in words in section 1.1.2.2.1, and continues to present evidence about the distribution of vowels in section 1.1.2.2.2.

1.1.2.2.1 Consonant Restrictions

Navajo words are always consonant-initial. Furthermore, any consonant can occur word-initially⁵, as illustrated below.

⁵Except for the glottalized nasal /'n/. The glottalized /'n/ always has its historical roots in a /tn/ sequence (Young 1995). From a synchronic point of view, the limited restriction of 'n must simply be stipulated. It occurs only in verb-stem-initial position, as in the verb *dajis'na'* [taʃis - 'na'] 'they arrived crawling'.

(14) Consonant-Initial Words

Consonant	Word	Gloss
a. p	pa:ʔ	'warrior girl'
b. t	tipé	'sheep'
c. t ^h	t ^h ó	'water'
d. t'	t'eš	'charcoal'
e. k	kat	'juniper'
f. k ^h	k ^h e	'shoe'
g. k'	k'aiʔ	'willow'
h. ʔ	ʔiʔi:ʔa	'sunset'
i. s	sin	'song'
j. š	šaš	'bear'
k. z	zas	'snow'
l. ž	ẓ̌iʔi:	'raven'
m. ʎ	ʎaʎjiʔ	'October'
n. ǰ	ǰátí	'antelope'
o. č ^h	č ^h a	'weeping, crying'
p. c	ce:h	'elk'
q. c ^h	c ^h ak	'fringe'
r. c'	c'ah	'sagebrush'
s. č'	č'il	'plant, weed'
t. ʎ	ʎát	'mold, lichen'
u. ʎ ^h	ʎ ^h ah	'salve, ointment'
v. ʎ'	ʎ'ízi	'goat'

w. n	náni:t	'sideways'
x. m	mąʔi:	'coyote'
y. l	lók'a:ʔ	'reed'
z. ʃ	ʃi:ʔ	'horse'
aa. w	wóláč ^h i:ʔ	'red ant'
bb. y	yá	'sky'
cc. h	haʃ	'club'

The fact that all words in Navajo begin with a consonant follows from two assumptions about syllable structure in this language. The first assumption is that all sounds must surface in well-formed syllables⁶ in a Navajo word. This assumption follows from the principle of Syllabic Licensing (Itô 1986, Selkirk 1982), which proposes that it is universally true that words in any language will be exhaustively composed of well-formed syllables. The second assumption is that all syllables must be consonant initial. This is a common, though not a universal restriction on syllable shapes. Finally, the fact that any consonant can occur in word-initial position follows from the cross-linguistic observation that syllable-initial consonants are typically unrestricted in the languages of the world.

None of the forms given above begin in a sequence of consonants. If word-initial consonant clusters are avoided in Navajo, this constitutes evidence for the importance of the syllable to the phonology of this language. This is because in the unmarked case, languages avoid including more than one segment in any syllabic

⁶The meaning of the construct "well-formed syllable" is difficult to determine under Optimality Theory, where syllables which violate certain well-formedness constraints may surface anyway, if they are the best alternative for a particular constraint hierarchy and input form. The specifics of this claim within Optimality Theory are elaborated in chapter four.

position. A word-initial consonant cluster would require that the left margin of the word-initial syllable contain two segments, rather than one. As illustrated below, the only apparent consonant cluster which can occur word-initially is [nC]⁷. Notice in the forms below that the [n] in a word-initial [nC] sequence may bear a high tone. Preconsonantal [n] is the only consonant of Navajo that may bear a high tone. No prevocalic [n] ever bears a high tone. In this respect, preconsonantal [n] patterns with vowels (which always bear tone) and not with consonants. These facts follow from an additional assumption: that preconsonantal [n] may be its own syllable.

(15) Forms Beginning in [nC]

	Form	Gloss
a.	ḡt ^h is ^h ah	'corner in hogan'
b.	ḡtíšč ^h íʔ	'pine tree'
c.	ḡto:łóhí	'green yucca fruit'
d.	ḡló	'hail'

The fact that [n] in this position can bear tone is evidence that it is not part of a complex left syllable margin. It is generally the case that syllable peaks are tone-bearing units, and it appears never to be the case that elements in the left margin, or onset, of the syllable bear tone⁸. Because [n] can be syllabic, these forms are consistent with the view that no complex syllable margins may occur in Navajo.

Similarly, properties of word-final consonants are explicable on the assumption that Navajo words are exhaustively syllabified. There are two sources of evidence here. The first is the presence or absence of word-final consonant clusters.

⁷There are no word-initial 'nC sequences.

⁸This fact follows from the view that tone bearing units must be moraic (Peng 1992), and onsets are never moraic (though cf. Davis 1988, Everett and Everett 1984 for evidence that onsets may contribute to syllable weight).

If consonant clusters are avoided word-finally, this would be accounted for by the notion that Navajo syllables cannot surface with complex margins. The second source of evidence comes from restrictions on the types of consonants which may end a word. It is typical cross-linguistically for the types of consonants which can occur on the right edges of syllables to be more restricted than are those that can occur on the left edges. Examination of the word-final consonants of Navajo confirms that syllable structure is important to the phonology of this language.

There are no Navajo words containing word-final consonant clusters⁹. This confirms the hypothesis that syllable margins (both left and right) in Navajo may not contain multiple segments. As the forms above have demonstrated, vowel-final words (such as *nto:łóhí* 'green yucca fruit' and *níló* 'hail') are acceptable in Navajo. Word-final consonants are limited to non-velar fricatives, nasals and unaspirated stops. This is illustrated below.

⁹I have found no word-final Cn sequences in Navajo. There are three possible ways in which a word-final Cn sequence could occur. First, a stem of the shape /ŋ/ could occur with a consonantal prefix. There are, however, no Navajo stems of the shape /ŋ/. Second, a consonant-final stem could be followed by an enclitic of shape /n/. There are no enclitics of this shape, however. Third, a stem could end in a Cn sequence. But all Navajo stems are well-formed syllables, and there are no complex syllable margins in this language. Therefore, such a stem would be ungrammatical. Therefore, no word-final Cn sequences are possible in this language.

(16) Word Final Consonants

Consonant	Form	Gloss
a. s	sis	'belt, sash'
b. š	niʔč'oš	'earthworm'
c. z	pini:k'i:z	'side of his/her face'
d. ž	ža:ž	'knot'
e. l	pini:ʎ ^h o:l	'its bridle'
f. ʎ	tiʎ	'blood'
g. h	c ^h ah	'awl'
h. ʔ	ʎi:ʔ	'horse'
i. k	teg	'up'
j. t	ʔot	'eagle trap'
k. n	sin	'song'

These forms show that non-velar fricatives, nasals and unaspirated stops can occur word-finally. This suggests that Navajo restricts the types of segments that can occur in the right margin of the syllable. If this is true, and if no consonant clusters can occur in syllable margins, then word-medial consonant clusters should always contain either a non-velar fricative or an unaspirated stop as their initial member. This is because any preconsonantal consonant would have to be syllabified as on the right edge of the preceding syllable: it could not be syllabified as a complex onset of the following syllable.

This prediction is confirmed in the data below. Word-medial consonant clusters containing two consonants are given below. All licit word-final segments

except [t] and [k] are found as the first member of word-medial consonant clusters, and no segments which are not licit word-finally are found in this position.

(17) Forms Containing Two-Consonant Clusters.

Cluster	Form	Gloss
a. sC	ńt ^h ɪsʌ'ah	'corner in hogan'
b. šC	ńtɪš ^h ɪ:ʔ	'pine tree'
c. zC	teizl ^o :z	'they came leading it'
d. žC	yižpiž	'she braided it'
e. lC	yɪl ^o :ž	'he came creeping'
f. ʎC	ʔo:ɫpas	'he's driving along'
g. hC	woh ^h ča	'you two are crying'
h. ʔC	niʔ ^h č'oš	'earthworm'
i. nC	c ^h ɪntit'ini:	'ground squirrel'

These forms show that the first element of a word-internal consonant cluster is always a non-velar fricative, an unaspirated stop or a nasal, but the second consonant in the cluster can be any consonant. This is explained if it is assumed that only one consonant can occur in any syllable margin, and word-internal consonant sequences are always heterosyllabic.

The facts presented in this subsection are summarized in the chart below.

(18) Syllable Structure Generalizations

Environment	Consonants	Nasals
Word-Initial	All words are C-initial. Any C may occur.	nC, ńC, nV *ńV
Word-Final	Some words are C-final. A subset of Cs may occur.	Vn, *Cn
Word-Medial	Clusters: Licit word-final C followed by any C.	VnCV, VCnV

These facts are all consistent with constraints on syllabification which require all syllables to be consonant-initial, and allow a subset of consonants to occur in syllable-final position; together with the assumption that words must be exhaustively syllabified on the surface. Furthermore, the facts about word-initial /n/ suggest that the nasal may, in some cases, constitute a syllable of its own. Syllabic /ŋ/ never occurs in the prefixes of Navajo, however, so it is not treated here. With these facts in mind, the distribution of vowels in Navajo words is taken up next.

1.1.2.2.2 Vowel Restrictions

The vowel and diphthong inventories of Navajo are repeated below.

(19) Navajo Phonemic Inventory: Vowel Qualities

	Front	Back
High	i	
Mid	e	o
Low		a

(20) Navajo Phonemic Inventory: Diphthongs

Short	Long
ai	a:i or ai:
ei	ei:
oi	oi:
ao	*

There are no vowel-initial words¹⁰ in Navajo, though vowel-final words occur freely. This was taken above as evidence for a constraint that Navajo syllables must be consonant-initial. If this is the case, and if Navajo words must be exhaustively syllabified on the surface, it must also be the case that word-internal vowel sequences must be limited to those that can surface as the peak of a single syllable. Since the only word-internal vowel sequences that surface in Navajo are those given in table (#1) above, I assume that these sequences are syllabifiable as diphthongs. If they were not, a free distribution of vowel clusters word-internally would be expected. In fact, no word internal vowel clusters are found except those listed as the diphthongs above. Note that these diphthongs represent a very small subset of all possible vowel-vowel sequences. Note also that at most two vowel qualities may surface adjacent to each other in a word. There are no cases where three vowel qualities surface without an intervening consonant. This fact is predicted if it is assumed that Navajo words must be syllabified, that syllables must be consonant-initial, that vowels must be syllabified as peaks, and that no more than

¹⁰There is, however, an unfortunate convention in the practical orthography of the language to omit a word-initial [ʔ]. Word-initial glottal stops are always pronounced.

two vowel qualities can surface in a peak. All of these assumptions are quite typical of syllables cross linguistically.

The facts presented in this section so far are summarized below. Syllables are always consonant-initial, but may be consonant or vowel final. For both consonant and vowel-final syllables, there are three possible syllable types. Syllables may contain short vowels, long vowels, or diphthongs. Diphthongs may contain at most two vowel qualities, with at most one of those two vowel qualities surfacing as long.

(21) Navajo Syllables

	Short Vowel	Long Vowel	Diphthong
V-Final	CV	CV:,	CVV, CV:V, CVV:
C-Final	CVC	CV:C	CVVC, CV:VC, CVV:C

The facts discussed in this section represent the range of distributional evidence for the relevance of the syllable to Navajo phonology. All of these facts are accounted for by assuming that Navajo words must be exhaustively syllabified on the surface.

Throughout this dissertation, the Moraic Theory of syllable structure (Hayes 1989, Hyman 1985, Itô 1986, McCarthy and Prince 1986) is assumed. Nothing about the analysis rests on the particular qualities of moraic representations of syllable structure, as opposed to CV or X representations (cf. Steriade 1991 for an overview and critique of these approaches), however.

In summary, syllables account for a variety of phenomena in Navajo. Navajo restrictions on the distribution of consonants and vowels in words are explicable only

by assuming that words must be exhaustively syllabified on the surface. Motivation of particular constraints on the syllable structure of Navajo form a large part of the analysis presented in chapters four and five of this dissertation. With this in mind, the next section introduces the theoretical framework under which this analysis is proposed, that of Optimality Theory.

1.2 INTRODUCTION TO OPTIMALITY THEORY

This section introduces the specific theoretical apparatus under which the arguments contained in this dissertation are framed. The basics of the theory are described in section 1.2.1 then three families of Optimality Theoretic constraints are introduced in section 1.2.2. These are the Markedness constraints, the Alignment constraints, and the Faithfulness constraints. Within the faithfulness family of constraints, both "Containment" and "Correspondence"- based constraints are described. Finally, the section is summarized in section 1.2.3.

1.2.1 The Basics of Optimality Theory

Optimality Theory posits a putatively universal set of constraints¹¹ on the well-formedness of outputs. All constraints are surface-violable, however. This means that forms may surface in a language even if they violate some number of these well-formedness constraints. In any language, the constraints are ranked with respect to one another, and the rankings form the phonological grammar of that language. A form which satisfies the highest ranked constraints will be selected by the constraint hierarchy, regardless of the number of lower-ranked constraints it violates.

¹¹Whether or not it is the constraints themselves or the constraint schemata which are universal is an open question. See Hammond (1997a) for discussion on this point.

Candidate outputs are produced by a function referred to as GEN which maps input representations to a (putatively) infinite number of possible surface forms. The candidate outputs are evaluated in parallel, and the representation that results in the fewest violations of the highest ranking constraints is selected. The evaluation of candidate outputs is represented via tableaux such as the one below, in which a subset of the outputs is depicted and violations of the posited subset of the constraint hierarchy are calculated. Violations are indicated by asterisks, and lethal violations (those that result in the discarding of a particular candidate) are indicated by exclamation points. Optimal candidates are denoted by the "pointy finger" icon (☞).

(22) Sample tableau

	/Input/	'gloss'
	Candidates	Constraint X Constraint Y
(a)	candidate _a	*!
☞ (b)	candidate _b	*

In the tableau above, candidate (b) is preferred over candidate (a) because only (b) satisfies the higher ranked constraint, Constraint X. The fact that candidate (b) violates Constraint Y is irrelevant to its selection, because Constraint Y is dominated by Constraint X. Optimal candidates need not satisfy all constraints. They simply must satisfy more of the higher-ranked constraints than any other candidate outputs.

It is also possible for constraints to be represented in blocks where there appears to be no evidence in the language for their relative ranking. These blocks may be ranked with respect to other constraints which are active in the language. In

the tableaux, a double line separating constraint columns represents a ranking which can be motivated by the facts under discussion, and in which the constraint represented in the leftmost column dominates all constraints to its right. Columns not separated by double lines represent constraints for which ranking arguments are unavailable. It is never argued in the analysis presented in this dissertation that constraints are actually unranked with respect to each other in a grammar (that is, there are no "crucially" unranked constraints), though such a possibility has been explored in other work in Optimality Theory (cf. Fitzgerald 1994, Rose 1997). This is illustrated in the tableau in (23).

(23) Tableau showing constraints X and Y outrank Z:

/Input/ 'gloss'

	Candidates	Constraint X	Constraint Y	Constraint Z
(a)	candidate _a			*
(b)	candidate _b		*!	
(c)	candidate _c	*!		*
(d)	candidate _d			**!

In the example above, there is no evidence for the ranking of Constraints X and Y with respect to each other, because the optimal candidate in (a) satisfies both of them. The fact that this candidate violates Constraint Z once does not prevent it from being selected as optimal. Candidates (b-c) each violate one of the top ranked constraints, so each is eliminated. Candidate (d) is eliminated because it violates the lower ranked Constraint Z more than does candidate (a). This example shows the gradient nature of constraint violation: not only does it matter whether or not

constraints are violated, it also matters how many times they are violated. The optimal candidate will always be the one containing the fewest violations of the highest ranked constraints. No number of violations of a lower-ranked constraint will overpower a single violation of a higher-ranked one. This system therefore accounts for phonological generalizations in any particular language through "strict" ranking of constraints.

1.2.2 The Constraints

As mentioned above, constraints in Optimality Theory are simply statements of well-formedness of output strings. There are three types of constraints in Optimality Theory: Markedness Constraints, which are described in section 1.2.2.1, Alignment Constraints, presented in 1.2.2.2, and Faithfulness Constraints, introduced in 1.2.2.3. It is the interaction of constraints from these three groups which result in the surface patterns observed with respect to the syllable structure of the Navajo verb.

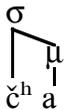
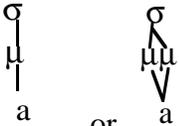
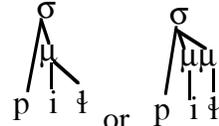
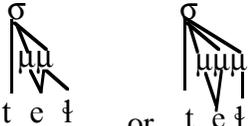
1.2.2.1 Markedness Constraints

Markedness constraints are statements about universally preferred or dispreferred phonological structures. Two markedness constraints which will play a crucial role are introduced here. The licit syllable types¹² for Navajo are reviewed below. Note that onsetless (or vowel-initial) syllables are never attested on the surface, but closed (or consonant-final) syllables are tolerated¹³.

¹²Excluding diphthongs, which are unproblematic for the constraints to be described here.

¹³The symbol "μ" in these representations is the mora of Moraic Theory. The mora is a unit of weight which determines whether a syllable is light (monomoraic), heavy (bimoraic) or superheavy (trimoraic). As noted in section 1.1.2.2.2, moraic theory is assumed throughout this dissertation, though nothing about the analysis crucially

(24) Syllable Structures

Syllable Type and Navajo Word Representation	
a. CV <u>č^ha</u> 'crying, weeping'	
b. V or V: *ungrammatical!	
c. CVC <u>pił</u> 'sleepiness'	
d. CV: <u>to:č^hah</u> 's/he will cry'	
e. CV:C <u>té:ł</u> 'crane'	

Onsetless syllables are argued to be a 'marked' or dispreferred syllable type on a number of accounts. First, some languages (i.e. Western Apache, cf. Fountain 1995, de Reuse 1994 and Tohono O'odham, cf. Fitzgerald 1997) do not allow onsetless syllables at all. Second, for languages which do allow onsetless syllables, their distribution in words may be limited. This is the case for Axininca Campa (Spring 1990, McCarthy and Prince 1993a), for example, where vowel-initial syllables are limited to word-initial position. Finally, any language allowing onsetless syllables also allows onsetful ones, but not vice-versa.

rests on it.

In Optimality Theory, marked structures are marked because there is a universal well-formedness condition that bans them. If onsetless syllables are marked, there must be a constraint that states that they are to be avoided. This constraint is usually formulated as ONSET (Prince and Smolensky 1993:16), which is formulated below.

(25) Markedness Constraint: Onsetless Syllables.

ONSET: Syllables must have onsets.

Similarly, closed syllables are avoided altogether in some languages (cf. Hawaiian, Blevins 1995). In other languages, closed syllables occur only in certain positions in words, while open syllables are allowed everywhere. For example, word-final closed syllables tend to be preferred in a number of languages (cf. Tohono O'odham, Fitzgerald and Fountain 1995, Makassarese, McCarthy and Prince 1994). Finally, all languages that allow closed syllables also allow open syllables, but not vice-versa. These facts suggest the existence of a markedness constraint banning closed syllables. This constraint is usually formulated (cf. Prince and Smolensky, 1993:85) as below.

(26) Markedness Constraint: Closed Syllables

NOCODA: Syllables must not have a coda.

The constraints ONSET and NOCODA are never directly in competition with each other, but in certain contexts they will have the same force¹⁴: if there is a consonant, it should be an onset, and not a coda. The interaction between these constraints is illustrated below. The candidate in (a) satisfies both constraints, so it is

¹⁴With respect to the syllabification of word-medial consonants, these constraints appear to be redundant. Word-initial and word-final contexts require the existence of each constraint independently of the other, however.

selected as optimal. The candidate in (b) violates the NOCODA constraint, because its first syllable is closed by a consonant. The candidate in (c) violates the ONSET constraint because its second syllable is onsetless. The (c) candidate also violates NOCODA, so it is doubly marked, once by each constraint.

(27) Constraint Interaction: ONSET and NOCODA

INPUT: CVCCV

	Candidates	ONSET	NO CODA
☞ (a)	CV.CCV		
(b)	CVC.CV		*!
(c)	CVCC.V	*!	*

This tableau provides no ranking argument for these two constraints. As long as both of them are higher ranked than any constraint that would mark the candidate in (a), (a) will be selected as optimal.

For Navajo, it is clear that ONSET must be very highly ranked, because it is never violated on the surface. NOCODA, on the other hand, is surface-violable, so it must be lower ranked. The specific ranking of these markedness constraints is left to the analysis in chapters four and five of this dissertation. For now, the important claim is that these constraints are active in the phonology of Navajo, and the next section turns to the Alignment family of constraints.

1.2.2.2 Alignment Constraints

Alignment constraints differ from markedness constraints in that alignment is a single schema, which takes a pair of elements and requires that they occur in a particular position with respect to each other.¹⁵ Alignment constraints are crucial to

¹⁵Whether markedness constraints might conform to a particular schema in Optimality

the analysis at hand because they provide a mechanism for accounting for ordering of affixation and other positional effects of prefixes in the word. The alignment schema given below was introduced by McCarthy and Prince (1993b) as "Generalized Alignment".

This schema requires two arguments, each of which is taken from the set of phonological or grammatical categories that are available to languages. An edge, right or left, of each argument is selected, and alignment is satisfied when these two edges are adjacent in a candidate representation. When these two edges are not adjacent in a candidate, the alignment constraint is violated by that candidate.

(28) Generalized Alignment:

$\text{Align}(\text{Cat1}, \text{Edge1}, \text{Cat2}, \text{Edge2}) =_{\text{def}}$

$\forall \text{Cat1} \exists \text{Cat2}$ such that Edge1 of Cat1

and Edge2 of Cat2 coincide,

where

$\text{Cat1}, \text{Cat2} \in \text{PCat} \cup \text{GCat}$.

$\text{Edge1}, \text{Edge2} \in \{\text{Right}, \text{Left}\}$

Violations of alignment constraints are evaluated gradiently, by counting the distance between the two relevant edges in terms of some phonological element. In this dissertation, alignment is calculated in terms of segments¹⁶. The number of segments between the two edges specified in an alignment constraint is always equal to the number of violations of the alignment constraint, such as that proposed in (29).

Theory is an open question. There is no *a priori* reason to believe that they couldn't do so.

¹⁶More precisely, alignment violations in this dissertation are counted in terms of root nodes. The distinction between 'segment' and 'root node' is irrelevant to the analysis given here.

This is illustrated in (30) below, where candidate (a) has perfect alignment of X and Y, candidate (b) has one segment intervening between X and Y, and candidate (c) has two segments intervening between X and Y.

(29) Alignment constraint:

ALIGN{Y, LEFT, X, RIGHT}: Align the Left edge of any element Y with the Right edge of any element X.

(30) Constraint Evaluation: ALIGN-X

INPUT: /X, A, Y, B/

	Candidates	ALIGN-X
☞ (a)	A <u>X</u> Y <u>B</u>	
(b)	<u>X</u> A <u>Y</u> B	*!
(c)	<u>X</u> A <u>B</u> <u>Y</u>	**!

Note that the quantifiers in the alignment schema occur in a fixed order, with the universal quantifier preceding the existential quantifier. This means that for any output containing the element which is referred to in the first argument of the alignment constraint, proper alignment must hold. If the second argument of the constraint does not occur in an output candidate, then the constraint is violated. Conversely, if the first argument of the alignment constraint does not occur in an output candidate, then the alignment constraint cannot, in principle, be violated. This is illustrated below, with the Alignment constraint formalized in (31).

Any morpheme which surfaces as a prefix under all phonological conditions must be subject to an alignment constraint similar to the one below. If it were not, it would demonstrate varying positions in the word depending upon which position

best satisfied the highest ranked markedness constraints in a particular language (see Fulmer 1997 for just such a case).

(31) ALIGN PREFIX

ALIGN PREFIX {Prefix, Right, Word, Left}: For every prefix,
the right edge of the prefix is aligned with the left edge of some word.

In the tableau below, the candidate in (a) satisfies the Alignment constraint because the right edge of the prefix is aligned with the left edge of the word. Candidate (b) satisfies the alignment constraint because it contains no instance of the prefix. Therefore, in the same way that an implicational statement with a false premise is true, the Alignment constraint is vacuously satisfied. The manner in which a candidate like (b) might be ruled out is discussed in the section on faithfulness constraints below¹⁷. Candidates (c-e) all violate the Alignment constraint. In (c,e) the constraint is violated because the prefix is improperly aligned with the word. In (d) there is no word for the prefix to align with, and so the constraint is violated.

¹⁷The solution to this problem will differ depending on whether a containment or a correspondence view of faithfulness is taken.

(32) Tableau Illustrating the Evaluation of ALIGN PREFIX.

input: {Prefix, Stem}

	Candidates	ALIGN PREFIX
☞ (a)	Prefix + Stem	
☞ (b)	Stem	
(c)	Stem + Prefix	*!
(d)	Prefix	*!
(e)	St + Prefix + em	*!

The results of this constraint for Navajo are apparent from the forms given below. If morphemes are presumed to be unordered in the input¹⁸, this type of constraint provides the order of morphemes in the output (Akinlabi 1996, Donohue 1997, Potter 1996, Tuttle and Hargus 1997). The evaluation in (35) shows how this constraint interacts with the markedness constraints of Navajo to produce the appropriate output form for a verb such as šóč'it 'S/he should scratch me'. The relevant alignment constraints are presented in (33-34) below.

¹⁸More properly, regardless of whether or not morphemes are ordered in the input.

(33) ALIGN OPTATIVE

ALIGN OPTATIVE {Optative, Right, Word, Left}: For every optative prefix, the right edge of the prefix is aligned with the left edge of some stem.

(34) ALIGN OBJECT

ALIGN OBJECT {Object, Right, Word, Left}: For every object prefix, the right edge of the prefix is aligned with the left edge of some stem.

The morphemes in question are /ó/ 'optative', /š/ 'first person object', and /č'id/ 'scratch'. The input to the tableau is assumed to be an unordered set of these morphemes and no candidates are considered which omit any of the input elements from the output string. This is because the constraints which would mark such candidates are presented in the next section. The tableau shows that using the constraints ALIGN OPTATIVE, ONSET and ALIGN OBJECT, the right result is obtained for this form. The candidates in (b) and (c) misalign the optative marker, and so are excluded. The candidates in (d) and (e) create onsetless syllables, and so are also excluded. Note that this tableau provides only one ranking argument: comparison of forms (a) and (d) show that ALIGN OBJECT must be ranked below ALIGN OPTATIVE and ONSET. If it were not, candidate (d) would be incorrectly selected.

(35) Tableau Illustrating the Evaluation of ALIGN PREFIX.

input: {/ó/ 'optative', /š/ 'first person object', /č'it/ 'scratch'}

	Candidates	ONSET	ALIGN OPT.	ALIGN OBJ.
☞ (a)	šó.č'it			*
(b)	č'i.toš		*!	*
(c)	č'it.šó		*!	*
(d)	óš.č'it	*!	*	
(e)	ó.č'itš	*!		*

(36) Ranking: ONSET, ALIGN OPTATIVE >> ALIGN OBJECT

In summary, alignment constraints take the form of a universal schema with two arguments, and a fixed quantificational order. The arguments are drawn from the set of available phonological and morphological categories. Alignment constraints may interact with markedness constraints in order to produce outputs containing, for example, onsetless syllables (if a constraint aligning the left edge of a vowel-initial morpheme with the left edge of the prosodic word dominates ONSET, this result could be obtained). These constraints will also be seen to interact with constraints governing the mapping between input and output strings. Faithfulness constraints govern this mapping, and are discussed next.

1.2.2.3 Faithfulness Constraints

Faithfulness constraints determine the degree of fidelity required of the surface forms of words to their input forms. One assumption of Optimality Theory is that faithfulness is maximized whenever possible, and that any differences between output and input strings are dispreferred. Correspondence Theory (McCarthy 1995, McCarthy and Prince 1995) provides the machinery to implement this concern for

faithfulness in Optimality Theory. The underpinnings of Correspondence Theory are presented in section 1.2.2.3.1 below, and the relevant Correspondence constraints are introduced in 1.2.2.3.2.

1.2.2.3.1 Correspondence Theory

The analysis presented in chapters four and five of this dissertation assumes a Correspondence Theoretic view of faithfulness, though nothing about the analysis depends on utilizing Correspondence Theory rather than the "containment" based faithfulness constraints PARSE and FILL (cf. McCarthy and Prince 1993a, Prince and Smolensky 1993). The difference between these two approaches is briefly outlined below.

In the original formulation of Optimality Theory, "containment" was presented as a restriction on the function GEN, the mechanism which was responsible for creating the infinite number of output candidates to be compared to the input string. Containment ensured that no material be added or deleted from the input in any output candidate. Epenthesis was construed as the presence of a prosodic terminal node bearing no featural content in some output. Deletion was construed as the failure to incorporate a segment into the prosodic structure of the word. Since epenthesis and deletion each create surface forms which differ from the underlying ones, each phenomenon was stipulated to result in the violation of a faithfulness constraint. In particular, the containment-based constraint barring epenthesis, FILL, is formalized below, as is the containment based constraint barring deletion, called PARSE-SEGMENT.

- (37) Containment-Based Faithfulness Constraints PARSE-SEGMENT (McCarthy and Prince 1993b:14) and FILL (Prince and Smolensky 1993:25).

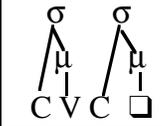
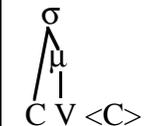
PARSE-SEGMENT: Segments are syllabified.

FILL: Syllable positions are filled with segmental material.

Each of these phenomena is illustrated in the tableau below, using the standard notation. Epenthetic segments are indicated by the box, and unparsed segments are set off by angled brackets.

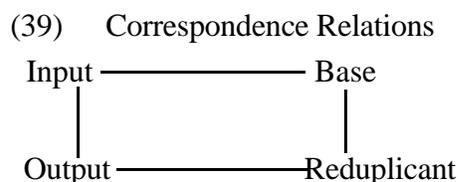
- (38) Tableau Illustrating Containment-based Faithfulness.

INPUT: {CVC} 'GLOSS'

	Candidates	PARSE-SEGMENT	FILL
II (a)			
(b)			*!
(c)		*!	

The syllable in (a) satisfies both of the faithfulness constraints, therefore it is selected as optimal by the sub-hierarchy here. The syllable in (b) contains an epenthetic element, signified by the box icon. This element would be interpreted as a vowel because it is associated to a mora. The syllable in (c) contains an unparsed segment, set off by angled brackets. While this segment has not been deleted from the representation, it would not be pronounced when the syllable was uttered. This is because it is not associated with the syllable.

Correspondence Theory (McCarthy 1995, McCarthy and Prince 1995) was originally suggested as an attempt to unify faithfulness of the sort discussed above with phenomena found in reduplication systems. In reduplication, the reduplicant must match the segmental melody of the base. This was viewed as being similar to the way in which an output form of a word must match the segmental melody of its input. This relationship is schematized below.

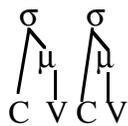


Rather than formalizing the similarities among these relationships in terms of Containment, a new framework was suggested¹⁹. Under this account, the constraint against absolute insertion and deletion of segments was removed from GEN, and candidate outputs such as those given below were allowed.

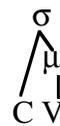
(40) Possible Candidates under Correspondence Theory:

input or base: CVC

Output or Reduplicant:



Insertion



Deletion

The manner in which faithfulness is calculated under Correspondence Theory requires that all segments in the Input/Base and in the Output/Reduplicant be assigned

¹⁹No move was made to generalize Containment theory, and it is difficult to determine whether such a tack would have ultimately been productive. It is, however, logically possible.

(arbitrary) indices. Two segments are in a Correspondence relation (defined formally below), if they share the same index²⁰.

(41) Formal Definition of Correspondence (McCarthy 1995)

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

Under Correspondence Theory, then, the fact that epenthesis and deletion between input and output forms of a word are always driven by concerns about syllabification is no longer directly captured. Correspondence Theory allows the formal possibility of epenthesis or deletion occurring in order to satisfy any Markedness or Alignment constraint which dominates the relevant Correspondence constraint. Furthermore, Correspondence Theory makes no explicit parallel between the parsing of segments into syllables and the parsing of syllables into feet. As a result, constraints such as PARSE-SEGMENT, discussed above, are required in a Correspondence based account as well as in a Containment based one. Under Correspondence Theory, at least as it has been developed to this point, there is no formal relationship between pressures for faithfulness and pressures for exhaustive prosodic parsing of a word²¹.

²⁰Unfortunately, no explicit theory of indexation has been developed under a Correspondence framework. It is assumed that all possible indexations of output strings are produced in the candidate set, and that a speaker may entertain any of an infinite variety of possible indexations for any given input string. The constraint set is responsible for selecting the optimal candidate under any indexation conditions.

²¹But cf. Beckman 1997, and Fountain 1997b for proposals to extend Correspondence Theory in exactly this direction.

The next sections explore the basic Input-Output Correspondence constraints so far proposed in the literature. These constraints are crucial to the analysis that follows in chapters four and five of this dissertation²².

1.2.2.3.2 Input-Output Correspondence

Both insertion and deletion of segments²³ in the surface forms of words compared to their underlying forms constitute violations of faithfulness. Under correspondence theory, epenthetic segments are not identifiable representationally. That is, epenthetic segments are formally indistinguishable from underlying segments if one is only able to view the surface form of a word. The Correspondence constraint barring epenthesis of segments is referred to as DEP_{IO}, where the subscripted I and O refer to the two strings "input" and "output", respectively.

- (42) Correspondence Constraint Barring Epenthesis (McCarthy 1995, McCarthy and Prince 1995).

DEP_{IO}: Every element in the Output has a correspondent in the Input.

This constraint is violated any time an element in a candidate output has an index which differs from the indices assigned to the elements in the input string. Its mirror-image constraint, MAX_{IO}, marks any representation in which the output string does not contain a correspondent for every element of the input string. That is, it bans deletion of segments.

²²As already noted above, there is no reason, however, to prefer Correspondence constraints over Containment-based ones for the data presented in this dissertation. ²³Since this dissertation contains no account of featural alternations that may violate faithfulness constraints in the featural domain, the only constraints discussed here will be those relevant to the prosody of the word. See Causley 1997 for discussion of featural correspondence in Optimality Theory with respect to Navajo.

(43) Correspondence Constraint Barring Deletion

MAX_{IO}: Every element in the Input has a correspondent in the Output.

Compare the constraint MAX_{IO} with PARSE-SEGMENT. PARSE-SEGMENT requires that segments be syllabified, while MAX_{IO} says nothing about the syllabic structure of output forms. Therefore, PARSE-SEGMENT is still required in the universal constraint set under a Correspondence or a Containment model. Note that under correspondence theory, however, the constraint PARSE-SEGMENT becomes a simple Markedness Constraint, and no longer refers to faithfulness between inputs and outputs.

The syllable structure constraints of Navajo suggest that the markedness constraint requiring syllables to be consonant-initial (ONSET) must dominate at least one of the correspondence constraints (MAX_{IO} or DEP_{IO}) given here. This ranking would ensure that no onsetless syllables occur on the surface, regardless of the shape of the input. The interaction of the markedness constraint barring closed syllables (NOCODA) with the correspondence constraints is more complex, and is taken up in detail in chapters four and five.

1.2.3 Summary of Optimality Theory

In this section Optimality Theory has been introduced, and the three constraint families within Optimality Theory have been described. Optimality Theory is a constraint-based, non-derivational approach to phonology which assumes a universal set of constraints on phonological well-formedness, and language-specific rankings of those constraints. These language-specific rankings form the phonological grammar of a particular language, and ranking is strict. This means that

no number of violations of lower-ranked constraints can ever conspire to overpower violations of higher-ranked constraints. Constraints may refer to markedness, alignment or faithfulness of candidates with respect to a given input representation. Morphological concerns are expressed via alignment constraints, while phonological ones are expressed via markedness and faithfulness constraints. The next section returns to the factorial typology outlined in section 1.1, and explores it in detail.

1.3 THE FACTORIAL TYPOLOGY REVISITED

Optimality Theory presents a strategy for characterizing typological generalizations about languages. Since grammar is conceived of as constraint ranking, it should be the case that all and only the possible rankings of the constraint set characterize all and only the set of possible languages. In this section, that prediction is explored with regard to the typological possibilities for the interaction of markedness, faithfulness and alignment constraints. All logically possible rankings of these constraint sets are given below. If the predictions of Optimality Theory are to be borne out, each of these possibilities ought to be attested in natural language.

(46) Possible Rankings of Faithfulness²⁴, Alignment and Markedness

Constraints:

1. FAITHFULNESS >> MARKEDNESS >> ALIGNMENT.
2. FAITHFULNESS >> ALIGNMENT >> MARKEDNESS.
3. ALIGNMENT >> FAITHFULNESS >> MARKEDNESS.
4. MARKEDNESS >> ALIGNMENT >> FAITHFULNESS.
5. MARKEDNESS >> FAITHFULNESS >> ALIGNMENT.
6. ALIGNMENT >> MARKEDNESS >> FAITHFULNESS.

In fact, rankings one through five above are attested in the literature. This dissertation fills out the typology by showing that the ranking in six is necessary for an analysis of Navajo. In the remainder of this section, the languages which instantiate rankings one through five are briefly reviewed.

The first ranking, FAITHFULNESS >> MARKEDNESS >> ALIGNMENT, results in a language where marked syllables are not resolved by epenthesis or deletion in morphologically simple words, but where affixes would be minimally misaligned in order to avoid the creation of additional marked syllables. Tagalog infixation requires this ranking (cf. McCarthy and Prince 1993a). In Tagalog, closed syllables are allowed in monomorphemic words, indicating that FAITHFULNESS must dominate the markedness constraint NOCODA. However, the element /um/ surfaces as either a prefix or as an infix, depending on the prosodic shape of the stem. The element /um/ surfaces as a prefix when it is added to vowel-initial stems, and as an infix when it is

²⁴In particular, DEP_{IO}. The typology ought also be instantiated for MAX_{IO}, but this work does not bear on that question.

added to consonant-initial ones. The constraint governing alignment²⁵ of this element is formalized below.

- (47) ALIGN, PREFIX, R, STEM, L: Align the Right edge of the prefix with the Left edge of the stem.

The relevant data are given below. The stem in (a) is vowel-initial, and the prefix surfaces with perfect alignment. The stem in (b), on the other hand, has an initial consonant cluster. The prefix surfaces two segments from the left edge of the word, a misalignment which results in no additional closed syllables being created on the surface. The markedness constraint NOCODA must, therefore, outrank the alignment constraint given above. Perfect alignment is sacrificed in order to avoid the creation of marked syllable types on the surface. Note that closed syllables are allowed in stems, and are not salvaged by epenthesis or deletion.

- (48) Tagalog
- | | | |
|-----|----------------|-------------|
| (a) | /um + aral/ | u.ma.ral |
| (b) | /um + gradwet/ | gru.mad.wet |

The ranking required to account for this pattern is given below. That faithfulness outranks markedness is evident from the fact that closed syllables are tolerated on the surface. That markedness outranks alignment is evident from the fact that the prefix /um/ is misaligned to avoid the creation of additional markedness violations.

²⁵McCarthy and Prince (1993a) utilize the constraint EDGEMOST for placement of the prefix. This constraint has been recast in Generalized Alignment (McCarthy and Prince 1993b) for the purposes of this discussion.

(49) Ranking for Tagalog: FAITHFULNESS >> MARKEDNESS >>
ALIGNMENT

This same ranking is attested in Afar (Fulmer 1997). In Afar, affixes are misaligned in order to salvage ill-formed syllables, but ill-formed syllables are tolerated otherwise. The Afar case is even more dramatic than is the Tagalog case discussed above, because affixes appear either as prefixes or as suffixes, depending upon the syllable structure of the base. The data given below show that for vowel-initial bases, the second person singular marker /t/ surfaces as a prefix. For consonant-initial bases, however, the same marker surfaces as a suffix. This can be accounted for under the assumption that the /t/ is subject to an alignment constraint requiring that it be a suffix. This is illustrated in (b) below. The /t/ surfaces in misaligned position (as a prefix) just in case doing so would salvage an onsetless syllable. This is shown in (a). Note, however, that vowel-initial words are generally tolerated in Afar, as evidenced in (c). This fact indicates that FAITHFULNESS dominates the markedness constraint ONSET in this language. This is illustrated below:

(50) Afar

	Input	Form	Gloss
a.	/okom + t + é/	tokomé	'you eat'
b.	/nak + t + é/	nakté	'you drink milk'
c.	/okom + é/	okomé	'I eat'

(51) Ranking for Afar: FAITHFULNESS >> MARKEDNESS >>
ALIGNMENT

The second ranking, in which FAITHFULNESS >> ALIGNMENT >> MARKEDNESS, is required for any language that tolerates marked syllables in unaffixed forms, and that also allows morpheme concatenation to create new marked syllables. English is a case of this type of language, as described below.

English allows closed syllables freely in monomorphemic words (i.e. 'word' [wɜrd]). This requires the ranking of faithfulness constraints above the markedness constraint barring closed syllables. Affixation may also create additional closed syllables in English (i.e. 'alley' [æ.li] + plural = 'alleys' [æ.liz]). This requires the ranking of the alignment constraint which refers to the plural suffix above the markedness constraint barring closed syllables. If the ranking between these two constraints (markedness and alignment) were reversed, the optimal output would be *'salley' [zæ.li]²⁶.

The third ranking, in which ALIGNMENT >> FAITHFULNESS >> MARKEDNESS, is empirically indistinguishable from the ranking FAITHFULNESS >> ALIGNMENT >> MARKEDNESS, which was described above. This is because ALIGNMENT and FAITHFULNESS are not in direct competition with each other. Each may induce violations of a markedness constraint, but neither will directly induce violations of the other. In a language with this ranking, the fact that both ALIGNMENT and FAITHFULNESS dominate MARKEDNESS would result in the language tolerating marked syllable structures in monomorphemic words (as English does), and the creation of additional marked syllable structures under morpheme concatenation (as English does). The crucial ranking for English, then, is given below.

²⁶Vowel deletion could also result from this ranking, i.e. [.liz].

(52) Ranking for English: FAITHFULNESS, ALIGNMENT >>

MARKEDNESS

The fourth type of language that is predicted above is a one in which the following ranking holds: MARKEDNESS >> FAITHFULNESS >> ALIGNMENT. In such a language, no marked syllable types would occur on the surface at all. In monomorphemes, marked syllables would be salvaged by epenthesis or deletion. In polymorphemic words, marked syllable types would be salvaged by misalignment of affixes if possible, else by epenthesis or deletion. This possibility is attested in the word-level phonology of Axininca Campa (Spring 1990, McCarthy and Prince 1993a:173) in which the constraints given below are active:

(53) Markedness Constraint:

CODACONDITION: Codas are nasals homorganic with a following consonant.

(54) Alignment Constraint²⁷:

ALIGN (STEM, RIGHT, SYLLABLE, RIGHT):]_{stem} =]_σ

In the word-level phonology of Axininca Campa, the alignment constraint is violated to avoid CODACOND violations if possible. If no misalignment could result in a form satisfying CODACOND, then epenthesis is recruited to create an open syllable. The ranking given by McCarthy and Prince 1993 is repeated below²⁸.

²⁷This constraint is formalized here using Generalized Alignment, based on the constraint posited by McCarthy and Prince (1993a)

²⁸This is a subset of the hierarchy given in McCarthy and Prince (1993a:173). The relevant faithfulness constraint was FILL in that paper, its Correspondence Theory equivalent is DEP_{IO}.

- (55) Ranking for Axininca Campa: MARKEDNESS >> FAITHFULNESS >>
ALIGNMENT

The fifth language type predicted by the factorial typology above requires the following ranking: MARKEDNESS >> ALIGNMENT >> FAITHFULNESS. Such a language would uniformly ban marked syllable structures on the surface. In both monomorphemes and in polymorphemic words, ill-formed syllables would be salvaged via epenthesis or deletion if possible, else by misalignment. This differs empirically from the preceding case as follows. In the preceding case, the optimal mechanism for repairing marked configurations is epenthesis or deletion.

Misalignment could only occur in forms where epenthesis or deletion was not an option. In the case of the ranking discussed here, misalignment would be preferred over epenthesis or deletion, and the latter repair strategies would only be allowed to surface in cases where misalignment could not result in a form satisfying the markedness constraint. This ranking is required for Lardil (McCarthy and Prince 1993, Prince and Smolensky 1993), as follows.

In Lardil, the segment /k/ cannot surface as a coda consonant. This is formalized by the markedness constraint CODACONDITION (McCarthy and Prince 1993:38), defined below.

- (56) CODACOND: Avoid [k] as a coda.

This condition is never violated on the surface, and therefore this constraint is assumed to be undominated in the language. Lardil grammar also requires that the right edges of stems align with the right edges of a syllable. This alignment constraint is formalized next, and is the same as the constraint given for Axininca Campa above.

(57) ALIGN (STEM, RIGHT, SYLLABLE, RIGHT):]_{stem} =]_σ

The undominated status of CODA COND results in the total avoidance of /k/ codas language-wide. This is enforced at the expense of the faithfulness constraint DEP_{IO}²⁹, as illustrated in the forms below. Both forms surface with acceptable codas. The form in (a) surfaces without proper alignment between the right edge of the stem and the right edge of the syllable. This shows that the markedness constraint CODA COND must dominate ALIGN. Both forms surface with epenthesis, in violation of faithfulness. The form in (b) surfaces with an extra violation of faithfulness in order to preserve proper alignment between the stem and the syllable. This shows that ALIGN must dominate FAITHFULNESS.

(58) Lardil (McCarthy and Prince 1993:36)

- | | | | |
|----|-------|--------|--------|
| a. | /yak/ | ya.ka | 'fish' |
| b. | /maɾ/ | maɾ.ta | 'hand' |

(59) Ranking for Lardil:

MARKEDNESS >> ALIGNMENT >> FAITHFULNESS

The sixth and final ranking predicted here is ALIGNMENT >> MARKEDNESS >> FAITHFULNESS. In this dissertation, it is shown that Navajo instantiates this final possibility. This is because in Navajo verbs, morphological pressures for proper alignment of affixes are respected at the expense of phonological pressures to avoid marked syllable structures. Phonological constraints governing the fidelity of input and output pairings, furthermore, are violable in favor of both the morphological constraints and the markedness constraints. Thus, the analysis presented fulfills one

²⁹Or "FILL" in Containment based Optimality Theory.

of the basic typological predictions of Optimality Theory, with respect to the interleaving of morphological and phonological requirements in grammar.

(60) Typology of Constraint Interaction³⁰

Afar, Tagalog:	FAITHFULNESS >> MARKEDNESS >> ALIGNMENT
English:	{FAITHFULNESS, ALIGNMENT} >> MARKEDNESS
Axininca Campa:	MARKEDNESS >> FAITHFULNESS >> ALIGNMENT
Lardil:	MARKEDNESS >> ALIGNMENT >> FAITHFULNESS
<u>Navajo:</u>	<u>ALIGNMENT >> MARKEDNESS >> FAITHFULNESS</u>

1.4 SUMMARY AND PREVIEW

This chapter has introduced the empirical and theoretical goals of this dissertation, and has presented the theoretical orientation that the dissertation will take. Empirically, the contribution of this work is in the thorough and complete presentation of the prosodic alternations in the Navajo prefixes based solely on the surface forms of the words. Theoretically, the contribution is the analysis of a otherwise mysterious morphophonological system utilizing correspondence, alignment and markedness constraints. The previously intractable system of syllable structure alternations is given a straightforward account under Optimality Theory. In doing so, it is shown that Navajo fulfills a typological prediction of an Optimality Theoretic approach involving markedness, alignment and faithfulness constraints. Chapter two of this dissertation introduces relevant aspects of the morphology and phonology of Navajo. Chapter three contains the motivation for all input forms

³⁰There are only five rankings given here because the ranking for English, {FAITHFULNESS, ALIGNMENT} >> MARKEDNESS incorporates two rankings, which are empirically identical to each other: FAITHFULNESS >> ALIGNMENT >> MARKEDNESS, and ALIGNMENT >> FAITHFULNESS >> MARKEDNESS.

assumed in the analysis. Chapter four presents and accounts for a set of prefixal alternations involving closed prestem syllables. Chapter five presents and accounts for a set of prefixal alternations involving closed syllables occurring outside of the prestem syllable. Chapter six reviews a number of alternative analyses, compares the results of this study with those previously proposed in the literature, provides conclusions and suggests avenues for future research.

CHAPTER 2: INTRODUCTION TO NAVAJO

2.0 INTRODUCTION

This chapter provides background on the historical context and grammatical properties of the Navajo language. The chapter is organized as follows. The Navajo language situation is described in section 2.1. The set of featural generalizations relevant to the analysis that follows are depicted in section 2.2. Section 2.3 motivates the clitic-prefix distinction, and overviews the basic properties of the morphological system of Navajo. This is especially important because only the prefixes are dealt with in the remainder of the dissertation. Therefore the distinction between prefixes and clitics must be shown to be phonologically motivated. Section 2.4. summarizes this chapter, and previews the chapters to follow.

2.1 A SHORT DESCRIPTION OF THE NAVAJO LANGUAGE SITUATION

This section contains a brief discussion of the sociolinguistic contexts in which Navajo is, and has been, spoken. The historical context of the language is described in section 2.1.1, and the language situation as it currently exists is overviewed in section 2.1.2.

2.1.1 Historically

The Navajo (Diné) language is a member of the Southern Athapaskan language family, which also includes Western Apache, Chiricahua Apache, Jicarilla Apache, Lipan Apache and Kiowa Apache. With as many as 160,000 speakers, Navajo constitutes by far the largest community of the Athapaskan languages. The presence of these languages in the American Southwest probably reflects a late

migration of Athapaskan speaking peoples from the Northwestern coast of what is now Canada, and from present-day Alaska, no earlier than 500 a.d. (Krauss and Golla 1977). The time depth from which Navajo and the other Southern Athapaskan languages split is difficult to determine, but was apparently after the migration of these peoples Southward along the Rocky mountains.

The first attempts to write the Navajo language appear to come from about 1812, and were undertaken by Don Pedro Bautista Pino, after his return to Spain (Holm and Holm 1992). Franciscan and Protestant missionaries began publishing church-related material in the early years of the twentieth century. The most successful practical orthography was developed in the 1930s by Robert Young (then an Indian Agent with the Bureau of Indian Affairs) and William Morgan, Sr. (a native speaker), and continues to be utilized by literate speakers as well as linguistic scholars (cf. Young and Morgan, 1951, 1987, 1992).

An effort was made in the years immediately prior to World War II to create a set of pedagogical materials for elementary level instruction in Navajo, but the advent of the war interrupted this endeavor. Young and Morgan published their first dictionary in 1943, and a Navajo language newspaper was published in the years between 1943 and 1957 (Holm and Holm 1992).

In the years between 1957 and 1965 federal policy towards indigenous languages aimed at obliterating them in favor of the assimilation of native peoples to mainstream American culture. During this time (and into the 1970s in some cases), the federal government ceased funding efforts at language maintenance and preservation and sponsored boarding schools in which children were severely punished for speaking any indigenous language (Zepeda and Hill 1990). Children

were often compelled to attend these schools in spite of the objections of their families, and there are stories of kidnappings of children by Bureau of Indian Affairs agents in order to enroll them in the boarding schools. There is therefore a generation of Navajo people who are now adults ranging in age from their thirties to their fifties who are far less likely to speak the language than are those in the preceding generation.

In 1966, the demonstration school at Rough Rock was established, and took as one of its stated goals the use of the Navajo language in instruction. Since then, a number of other community controlled schools have been established with at least some bilingual instruction (cf. Holm and Holm 1992, McCarty 1992, Benally and McCarty 1990). The current context of the Navajo language is overviewed next.

2.1.2 Currently

Currently there are curricula in Navajo in a number of community controlled schools on the Navajo reservation, and there are programs in the Navajo language at Northern Arizona University, and the University of Arizona. Navajo Community College also has a strong native language focus. Although the language situation continues to be perhaps the most conducive to maintenance and preservation of all of the indigenous languages of North America, it is somewhat precarious (cf. Krauss 1992). The proportion of kindergartners entering school with some knowledge of Navajo has decreased markedly in the last decade (Willie 1994), perhaps as a direct result of the boarding school experience undergone by the generation of speakers who are now likely to be parents. Nevertheless, community-based efforts at maintenance and preservation of the Navajo language continue to garner attention and accolades from activists in other indigenous communities (cf. Benally and McCarty

1990, Holm and Holm 1992, McCarty 1992, Zepeda and Hill 1990), and the language remains an important and integral part of the Navajo culture.

2.2 SOME INTRODUCTORY NOTES ABOUT NAVAJO PHONOLOGY

In this section the basics of Navajo phonology are described. Three important featural generalizations are presented. Strident harmony is described in 2.2.1, stem-initial voicing and alternations are presented in section 2.2.3, and stem-initial consonant mutation is described in 2.2.4. I describe these phenomena here, although I provide no formal analysis of them. Since the dissertation is based on surface forms of the data, and since these alternations are evident on the surface of Navajo words, it is important to outline them in advance. This is so that the reader will not be confused by seeing otherwise unfamiliar and uncommented upon patterns in the data that are presented throughout this dissertation. Formal accounts of these processes are left for future analysis, the objective of this section is to present an accurate and clear description of them.

2.2.1 Strident Harmony

A much studied consonantal harmony pattern in Navajo is commonly referred to as "strident harmony"¹ (Cook and Rice 1989, Elzinga 1995, Kari 1973, McDonough 1990, Meek 1997, Pérez 1993, Platero N.D., Shaw 1991). This phenomenon affects the following Navajo consonants, where the consonants in Set A alternate with the consonants in Set B which share the same place of articulation and voicing characteristics.

¹This is also sometimes referred to as "strident assimilation".

(1) Navajo Strident Consonants:

Set A	Set B
s	š
z	ž
c ^h	č
c	ǰ

The segments in Set A agree as to the particular manner of closure that is utilized to articulate them, as do the sounds in Set B. Set A consonants are articulated with the tongue tip, or apically, Set B consonants are articulated with the tongue body, or laminally. All strident segments in a Navajo verb surface either as apical consonants, or as laminal consonants. It is ungrammatical for a single verb to contain some apical strident segments and some laminal strident segments.

The phenomenon of strident harmony characterizes the distribution of the apical and laminal segments presented above in Navajo words. Their distribution is summarized below, for words containing only prefixes and a stem (with no pro- or enclitic elements attached). In the table below, "s" stands for any apical strident, "š" stands for any laminal strident, and "t" stands for any non-strident segment.

The form in (a) shows a stem with a laminal strident element in it. The prefixal strident consonant is also a laminal strident in this word. Form (b) shows a stem with an apical strident element in it. The prefixal strident consonant is also an apical strident in this word. Forms (c-d) show stems with no strident elements in them. Such stems may surface with either a laminal strident prefixal segment, as in (c), or with an apical strident prefixal segment, as in (d). Note that none of these

words contain strident segments that come from both sets of stridents given above.

All strident segments in a word are taken from one of these two sets, never both.

(2) Strident Harmony: Possible Configurations².

	Configuration	Form	Gloss
a.	š - š	y ⁱ š - k ^e ž prefixes - 'bend'	'it was painted'
b.	s - s	y ⁱ s-t ⁱ z prefixes + 'bend'	'it was spun'
c.	s s - t	s ⁱ s - t ^h in prefixes + 'freeze'	'I froze up'
d.	š š - t	š ⁱ š - t ^h e:h prefixes + 'set it'	'I set an animate object up at rest'

The chart below illustrates a number of non-occurring combinations of strident segments. Again, only words lacking proclitics and enclitics are considered.

Forms (a-b) represent stems containing strident segments which disagree in their manner of articulation. No such stems occur. Forms (c-d) represent words where prefixal strident segments have a different manner of articulation than do the strident segments in the stem. No such words occur. Forms (e-f) represent words in which there is more than one prefixal strident segment, and these segments disagree with respect to their manner of articulation. Again, no such words occur.

²Here and throughout this chapter data are presented as follows. Stems are separated from prefixal material by a hyphen. Clitics are separated from adjacent elements by a plus sign. No morpheme-by-morpheme glosses of the prefixal material are given. This is because the input shapes of the prefixes have not yet been established. These are motivated in detail in chapter three.

(3) Strident Segments in Navajo Words: Impossible Configurations

	Configuration	Form
a.	- š s	*
b.	- s š	*
c.	s - š	*
d.	š - s	*
e.	š s - t	*
f.	s š - t	*

The forms in (3) above illustrate the fact that within a Navajo word, all strident elements must agree for manner of articulation. The manner in which this agreement occurs is complex and requires much analysis. Prefixal stridents appear to take on the manner of articulation that is attested in the stem to which they are attached. If the stem contains no strident segments, then the manner of articulation of the prefixal stridents appears to be determined by the rightmost prefixal strident segment most (but not all) of the time. This restriction on the articulation of strident segments appears to be bound by the stem plus prefix span: it does not spread to adjacent words in a string, nor to strident segments in clitics. The interaction of proclitic elements with strident harmony is the subject of section 2.3.2.3 below. For now, these details are less important than is the main point: Navajo strident segments participate in a manner of articulation alternation, and strident segments within a single Navajo word will share the same manner of articulation: apical or laminal.

Another set of featural alternations to be found in the Navajo verb involves voicing or devoicing of the stem-initial consonant. This set of alternations is reviewed next.

2.2.2 Stem-Initial Voicing and Devoicing

The voicing characteristics of some stem initial fricative consonants depends on the morphological and semantic environment in which the consonant appears (cf. Kari 1973, Young 1995). This is illustrated in the data set below, where the stem-initial consonant is underlined. These pairs of words show that the stem-initial fricatives [s,z,š,ž,ʃ,ʒ] are subject to voicing alternations. Both the voiced and the voiceless alternate of the stem-initial consonant can occur in identical phonological environments (as in (a-b), (e-f) below). These voicing alternations appear to invoke semantic or morphological distinctions in the verbs with respect to their valance, aspectual or semantic properties.

(4) Stem-Initial Fricatives: Voiceless and Voiced.

	Voicing	Form	Gloss
a.	Voiceless	pitiyé - <u>sa</u> ? prefixes-'burp'	'I burped it'
b.	Voiced	té - <u>za</u> ? prefixes-'burp'	'I burped'
c.	Voiceless	yi - <u>šé</u> :? prefixes-'cut'	'I mowed it'
d.	Voiced	?átiš - <u>že</u> :? prefixes- 'cut'	'I shaved myself'
e.	Voiceless	tí: - <u>ʃ</u> it prefixes-'burn'	'I burned it'
f.	Voiced	pini: - <u>ʒ</u> it prefixes-'burn'	'It starts to burn'

These alternations do not appear to be phonologically induced, but instead they appear to mark syntactic-semantic alternations in the verb itself. They are not, therefore, relevant to the analysis presented in this dissertation, but the effect of these alternations will be evident in the data presented in chapter three.

2.2.3 Stem-Initial Affrication, Voicing and Consonant Mutation

The forms in this section show that in certain morphological environments, stem-initial fricative consonants may surface as affricates, stem-initial nasals may surface as glottalized nasals, stem-initial glottals may surface as [t'] and stem-initial /y/ may surface as [k]. This is accounted for in the traditional Athapaskanist literature by positing an underlying segment /t³ to the left of the stem in the alternating forms. This hypothetical underlying /t/ never surfaces as [t], but is argued to induce the alternations described above. LaMontagne and Rice (1995) account for these data synchronically by positing the affixation of a featural morpheme [-continuant] in these environments. Each of the alternations attributed to the "D-Effect" is outlined below.

The data below illustrate the fact that stem-initial fricative consonants in Navajo words may alternate between fricatives and affricates, depending upon their morphological environment. The affricated alternate typically appears in the first person dual form of the verb, as in (b,d) below. It may also occur in other environments, where it coincides with a transitivity alternation in the verb, as in (e-f).

³Note that /t/, an unaspirated stop is written as 'd' in the practical orthography. Hence the name "D-Effect", rather than "T-Effect".

(5) Stem-Initial Fricatives: Plain and Affricate.

	Frication	Form	Gloss
a.	Plain	yi - le:h prefix-'be'	'S/he is becoming'
b.	Affricate	yi: - ʎe:h prefixes-'be'	'We 2 are becoming'
c.	Plain	ti - zé:h prefixes-'belch'	'S/he is belching'
d.	Affricate	ti: - cé:h prefixes-'belch'	'We 2 are belching'
e.	Plain	sé - loh prefixes-'lasso'	'I lassoed it'
f.	Affricate	yis - ʎoh prefixes-'lasso'	'It was lassoed'

The glottalization of the nasal consonant [n] in certain morphological environments is illustrated next. This occurs in the same environments as do the affrication alternations given above.

(6) Stem-Initial Nasal: Plain and Glottalized.

	Glottalization	Form	Gloss
a.	Glottal	ni: - 'né:h prefixes-'arrive'	'We two arrive moving with household'
b.	Plain	noh - né:h prefixes-'arrive'	'You two arrive moving with household'

The alternation between [ʔ] and [tʰ] is illustrated below. This alternation is evident in first person dual forms, and in some passive constructions.

(7) Stem-Initial Glottal: Plain and [tʰ]

	Alternation	Form	Gloss
a.	/ʔ/	ní - ʔá prefixes-'bring'	'I brought it'
b.	/tʰ/	yí - tʰá prefixes-'bring'	'It was brought'

Finally, the alternation between [ɣ] and [k], which occurs in the same morphosyntactic environments as do the previously presented alternations, is illustrated below.

(8) Stem-Initial /ɣ/ ~ [k]

	Alternation	Form	Gloss
a.	[ɣ]	to - ɣaːɬ prefixes-'open'	'You two open your eyes'
b.	[k]	ti - kaːɬ prefixes-'open'	'We two open our eyes'

The consistency of the morphosyntactic environments in which these alternations occur suggest that LaMontagne and Rice's (1995) approach is correct: the alternation appears to be induced by the presence of a featural affix of some sort (cf. Akinlabi 1996 for discussion of like phenomena in other languages). Since this affix produces no alternations in the syllable structure of the prefixal span, it is not accounted for in this dissertation.

In summary, the following featural alternations have been briefly described in this section: strident harmony, stem-initial voicing and stem-initial consonant mutation⁴. The next section provides empirical support for the distinction between prefixes and clitics that is made in the chapters that follow.

2.3 CLITICS VERSUS PREFIXES IN NAVAJO MORPHOLOGY

This section motivates the distinction in Navajo between "prefix" and "clitic"⁵, and the claim that a proper account of the Navajo stem and prefix span can be given without reference to the clitics which may occur on the verb. The goal of this section is to show that the proclitic elements are of a fundamentally different type than are the prefixal elements. That is, this section motivates the conclusion that there is a difference between the Navajo prefixes and the Navajo clitics, and that a study of the verb stem and its prefixes can correctly continue abstracting away from the behavior of the clitic elements. This section is organized as follows. Section 2.3.1 focuses on the verb stems of Navajo. Section 2.3.2. focuses on the prefixes. In both sections, emphasis is placed on comparison among stems, prefixes and clitics with respect to their phonological behavior. The evidence in favor of differentiating prefixes from clitics in Navajo is summarized in section 2.3.3.

2.3.1 Stems

⁴The mutability of stem-initial consonants in Navajo flies in the face of recent proposals in Correspondence Theory by Alderete (1995) and Beckman (1996), which claim that segments in "salient" positions in a word held to higher standards of faithfulness than are elements in other positions. The Navajo stem syllable manifests all of the properties usually associated with prominent or stressed syllables. Both of these proposals suggest that elements in prominent positions should be less mutable than elements in non-prominent positions are. Navajo provides an example of a language in which it appears that just the opposite is true.

⁵These elements are traditionally referred to as "conjunct prefixes" and "disjunct prefixes" in the Athapaskanist literature (cf. Hargus 1997 for a discussion of them).

All verbs in Navajo contain a monosyllabic⁶ word-final element which conveys the basic meaning of the verb. This is illustrated in the verb paradigm below. Notice that the word-final syllable does not vary in its shape throughout the paradigm, and that the basic meaning of the word is not affected by the prefixal elements that appear on it.

⁶There is an extremely small set of putatively disyllabic stems in Navajo. These are č^hó'i 'be ugly, filthy' (cf. č^ho: 'ruin, spoil'); č'í:tí 'be few, little' (cf. č'i:t 'reduced') c'ózí 'be narrow, slender (cf. c'óz 'long-haired'), yáží 'be little' (cf. yá 'grow, mature') and zólí 'be light in weight' (cf. zol 'blow'). Each of these "stems" contains a final í, which is otherwise used as a relativizing enclitic in Navajo verbs. Furthermore, each is nearly homophonous (minus the í) with a monosyllabic stem with similar meaning. All are stative in nature, and all can be analyzed synchronically as a stem plus the enclitic [í] (cf. Young and Morgan 1992), thus salvaging the generalization that Navajo verb stems are always monosyllabic. Furthermore, each is typically used in an unprefixal form along with an obligatorily overt noun phrase: i.e. *?aški: yáží* 'little boy'.

(9) Navajo Verbal Paradigm

	Verb	Gloss
a.	yiš - č ^h a prefixes-stem	'I am crying'
b.	ni - č ^h a prefixes-stem	'You are crying'
c.	yi - č ^h a prefixes-stem	'He/she/it is crying'
d.	yi: - č ^h a prefixes-stem	'We are crying' ⁷
e.	woh - č ^h a prefixes-stem	'You are crying'

It is an oversimplification to claim that the basic meaning of the verb is only determined by its stem. This is because a given stem may convey a wide variety of meanings depending on its linguistic and extralinguistic context. This point is illustrated with two examples of verb stems: -k^ha:t and -č'it. The verbs below illustrate that the stem -k^ha:t is used to refer to a wide variety of motions, all of which have a flat or sweeping quality.

⁷Forms (a-c) are singular, (d-e) are dual in number. Plurals are not included here because plurals are formed via cliticization rather than via prefixation.

(10) Verbs with -k^ha:t

	Verb	Gloss
a.	(pitah) ?i: - k ^h a:t 'from it' prefixes-stem	'Sticks fall from leaning against a wall into a group of people'
b.	?aǰiš - k ^h a:t prefixes-stem	'I am giving someone a slap'
c.	nik ^h é + ti:ʔ - k ^h a:t clitic+prefixes-stem	'I spread it over a surface'
d.	ni + niš - k ^h a:t clitic+prefixes-stem	'I'm driving a herd to a place'

The forms below show that a single stem, in this case -č'it, can take on remarkably different meanings, depending on its tense and aspectual features. This verb stem is used to refer to scratching, or pawing motions, or to the management or manipulation of an object. When it is used as a noun, as in (c), it refers to a placenta.

(11) Verbs with -č'it

	Verb	Gloss
a.	yini: - č'it prefixes-stem	'He starts to scratch it'
b.	na:+š - č'it clitic+prefixes-stem	'I manage it or manipulate it'
c.	tipé bi:š - č'it 'sheep' prefixes-stem	'placenta of a sheep'

These variable semantics can be viewed in a number of ways, the important point here is that in spite of them the stem conveys the basic meaning of the verb as a whole.

A given verb stem will take on a variety of syllabic shapes, depending on the tense and aspectual characteristics of the inflected verb (cf. Cook and Rice 1989, Leer 1979). This is illustrated below.

(12) Stem set for 'move a solid or compact object':

	Stem	Word	Gloss
a.	ʔá	na: +š - ʔá clitic+prefix-stem	'I'm carrying it around'
b.	ʔa:h	pílák'e: +š - ʔa:h clitics+prefix-stem	'I'm handing it to him'
c.	ʔá:h	ná+háš - ʔá:h clitic+prefixes-stem	'I'm turning it around'
d.	ʔá	pa: ní - ʔá 'to him' prefixes-stem	'I gave it to him'
e.	ʔaʔ	pá ho:ʔ - ʔaʔ 'for him' prefixes-stem	'I made room for him'
f.	ʔá:ʔ	yiš - ʔá:ʔ prefixes-stem	'I'm carrying it along'

These data show that the surface shape of the stem with the basic meaning 'move a solid round object' varies depending upon the tense-aspect and modal features of the verb as a whole. Most verb stems will surface in one of five different

shapes, depending on the tense, aspectual and modal properties of the verb. Some stems, like the one above, have as many as seven surface shapes. Other stems have fewer surface alternates. Nevertheless, the segmental features of the stem are similar throughout its paradigms (cf. Leer 1979, Young 1995).

2.3.2 Prefixes

The following sections constitute evidence that the verbal prefixes of Navajo are identifiable via their phonological properties, and that these properties differentiate the prefixes from the clitics and from the stems in this language. Section 2.3.2.1. presents evidence based upon the limited range of phonemic contrasts in the prefixes as compared to the stems and clitics. Section 2.3.2.2. shows that the prefixes are subject to restrictions on the distribution of tone which are not true of the clitics, or of the stems. Section 2.3.2.3 provides an argument for the distinction between prefixes and stems or clitics based on the phenomenon of strident harmony that was described in section 2.2.1 above. The evidence presented here justifies the focus of the remainder of this dissertation on the prefixes of Navajo, without respect to the clitics. A full study of the Navajo clitics is left for further research.

2.3.2.1. The Shapes of the Prefixes

Prefixes in Navajo show an attenuated range of vowel and consonant contrasts in comparison to stems and clitics. While all vowel qualities are attested in the prefixes, as illustrated with the forms in (13) below, the occurrence of the high vowel [i] is overwhelmingly common in comparison to the others (cf. Speas 1984, Hargus and Tuttle 1997, McDonough 1990 and others). This has been taken as a

source of evidence that [i] is the epenthetic vowel of Navajo, and that many prefixes are underlyingly consonantal. This proposal is taken up in detail in the next chapter.

(13) Vowel Qualities in Prefixes

V	Surface Form	Gloss
a. i	y _i - č ^h a prefixes-'cry'	'he, she, it cries'
b. í	ná+n _i ɬ - c'in clitic+prefixes-'beat'	'you are beating up a person'
c. i:	ná+n _i l - c'in clitic+prefixes-'beat'	'we 2 are beating up a person'
d. í:	ɬ _i .-le:ɬ prefixes-'be'	'you will become'
e. ı̇	Does not occur	
f. a	ʔ _a - č ^h a prefixes-'cry'	'there is crying'
g. á	ʔ _á š - ɬé:h prefixes-'make'	'I am making it'
h. a:	Does not occur	
i. á:	Does not occur	
j. ʌ	Does not occur	
k. o	w _o h - č ^h a prefixes-'cry'	'you two are crying'
l. ó	w _ó š.-ɬe? prefixes-'be'	'I should become'
m. o:	ná+ž _o ɬ - ɬe:ɬ clitic+prefixes-'be'	'it will revert'

n.	ó:	w <u>ó</u> :.-ɬeʔ	'You should become'
		prefixes-'be'	
o.	o	Does not occur	
p.	e	Does not occur	
q.	é	s <u>é</u> - tiz	'I spin it'
		prefixes+'spin'	
r.	e:	t <u>e</u> :š.-ɬe:ɬ	'I will become'
		prefixes+'be'	
s.	é:	š <i>i</i> ?t <u>é</u> : - ʃiʔ	'I was called'
		prefixes-'call'	
t.	ɛ	Does not occur	

The gaps in the paradigm given above do not appear to be systematic, except for the fact that nasalized vowels never occur in the prefixes. Long vowels and high tones do occur in the prefixes, but these properties do not thoroughly cross-cut the vowel qualities. Furthermore, the distributional restrictions on high tones in the prefix span presented in section 2.3.2.2 below result in the neutralization of tonal contrasts in the prefixes, but nowhere else.

Nasalization is contrastive in stems and in clitics, as shown below. In this regard, clitics and stems class together with each other, separately from prefixes.

(14) Contrastive Nasalization in Stems and Clitics

Stem	Surface Form	Gloss
a. č ^h iʔ	na:š - č ^h iʔ prefixes-'scout'	'I scout the enemy'
b. č ^h iʔ	piʔni:ł - č ^h iʔ prefixes-'give birth'	'I am starting to give birth'
c. hé:s	naš - hé:s prefixes-'crank'	'I crank it (as an old car)'
d. he:s	ha - he:s prefixes-'itch'	'an area itches'
e. ʔá	naníł - ʔá prefixes-'handle S.O'	'you hold slender object across'
f. ʔá	pik'i+ʔo:z - ʔá clitics+prefixes+'handle it'	'use up the whole day'
g. žo:t	ʔi:l - žo:t prefixes-'slide'	'slides away, disappears'
h. žo:t	hó: - žo:t prefixes-'be harmonious'	'it becomes harmonious'
Clitic	Surface Form	Gloss
a. ê:	šá na:+l-niš + ê: particle clitic+prefixes-'work'+clitic	'The one that works for me'
b. leʔ	ʔa:tí na:+šâ: + leʔ particle clitic+'wish'+clitic	'I wish I were there'

Stems attest the full range of tonal contrasts for each of the four vowel qualities in the system. Clitics, like prefixes, show a contrast based on tone for some, but not all vowel qualities. This is illustrated below.

(15) Contrastive Tone in Stems and Clitics.

Stem	Surface Form	Gloss
a. č ^h i:t	atiŋ náhotitiš - č ^h i:t ? prefixes-'fidget'	'I start to fidget'
b. č ^h i:t	pitis - č ^h i:t prefixes-'grasp'	'I release my grasp on it'
c. pe:h	ʔaná - pe:h prefixes-'swim'	'swim away out of sight'
d. pé:h	yi: - pé:h prefixes-'grey'	'it is turning gray'
e. ʔa:t	yiš - ʔa:t prefixes-'handle it'	'I send him on an errand'
f. ʔá:t	yiš - ʔá:t prefixes-'handle it'	'toss or drop flat flexible object'
g. k ^h o:h	ʔapi - k ^h o:h prefixes-'extend'	'a canyon extends away'
h. k ^h ó:h	na:tiš - k ^h ó:h prefixes-'extend'	'I am starting to vomit again'

Clitic	Surface Form	Gloss
a. ʔá:	ʔá: + sé-sɪ:t clitic+prefixes-'save'	'I saved it'
b. ta:	ta: + č ^h a clitic+'cry'	'They are crying'

These forms show that tone is contrastive for every vowel quality in stems⁸, and for some in clitics. Due to the smaller number of clitics than stems in this language, it is not surprising that minimal pairs for each of the vowel qualities in clitics would not exist. This may also be the reason that tone contrasts do not occur for all vowel qualities in the prefixes.

The forms below demonstrate that length is contrastive for all vowel qualities in stems and for some vowel qualities in clitics as well.

⁸Contour tones are rare, and tend to occur across morpheme boundaries, though they are attested in stems, clitics, and prefixes.

(16) Contrastive Length in Stems and Clitics.

Stem	Surface Form	Gloss
a. 'nih	ʔate:s - 'nih prefixes-'thunder'	'there is a clap of thunder'
b. 'ni:h	tíš - 'ni:h prefixes-'blink'	'I blink in disdain'
c. k'eʔ	ne:+z - k'eʔ clitic+prefix+'hurt'	'stops hurting'
d. k'e:ʔ	ʔahání - k'e:ʔ prefixes-'cut'	'slice object in two'
e. k ^h at	níséł - k ^h at prefixes-'sew'	'I sewed it'
f. k ^h a:t	ʔi: - k ^h a:t prefixes-'fall'	'it falls away out of sight'
g. žoh	yíš - žoh prefixes-'moisten'	'it is moistened'
h. žo:ž	há: - žo:ž prefixes-'fall'	'it comes falling out (as sticks or lumber)'
Clitic	Surface Form	Gloss
a. há:	há:+š - t ^h e:h clitic+prefix-'carry her'	'I'm carrying her up and out (of a hole)'
b. ha	ha + žo:pá - ʔa + ko clitic+prefixes-'handle' +clitic	'having a hard time'

Vowel length occurs in prefixes as well, as is evident from the forms cited in (13) at the beginning this section, though it does not cross-cut all vowel qualities.

The data given so far are summarized in the chart below. All vowel qualities are attested in prefixes, but supersegmentals such as tone and length do not fully cross-cut vowel quality in prefixes. No nasalized vowels occur in the prefixes. Stems and clitics attest all vowel qualities, and contrast in length, tone, and nasalization.

(17) Vowel Contrasts in the Navajo Verb

	Vowel Quality	Syllabic Properties
Prefixes	a, e, i, o	tone and length
Stems	a, e, i, o	tone, length and <u>nasalization</u>
Clitics	a, e, i, o	tone, length and <u>nasalization</u>

Finally, there is a restricted range of consonantal contrasts in the verbal prefixes compared to clitics and stems. The only consonants that occur in the prefixes are those given in (18) below. Notice that no glottalized or aspirated consonants occur in the prefixal span⁹.

⁹While clitics attest a limited range of consonants due to their limited number, both aspirated and glottalized consonants occur in the clitics of Navajo, just as they do in stems. This is demonstrated in the following sections of this chapter.

(18) Prefixal Consonants: (w,y, l, ɬ, s, š, z, ž, p, t, n, ɲ, h, ʔ)

(19) Forms Containing Prefixal Consonants

C	Surface Form	Gloss
a. w	<u>w</u> oh - č ^h a prefixes-'cry'	'you 2 are crying'
b. y	<u>y</u> i - č ^h a prefixes-'cry'	's/he is crying'
c. l	ná+ní: <u>l</u> - c'in clitic+prefixes-'beat'	'we 2 are beating up a person'
d. ɬ	ʔo: <u>ɬ</u> - paš prefixes-'drive'	's/he is driving along'
e. s	ʔa <u>s</u> - kan prefixes-'dry'	'It is dried up'
f. š	yí <u>š</u> - č ^h a prefixes-'cry'	'I am crying'
g. z	ná+ní: <u>z</u> - c'in clitic+prefixes-'beat'	'you are beating up a person'
h. ž	yí <u>ž</u> - piž prefixes-'braid'	'she braided it'
i. t	ɥi: <u>t</u> - ɬit prefixes-'burn'	'I burned it'
j. p	<u>p</u> ini: - lit prefixes-'burn'	'It started to burn'

k. n	<u>ni</u> - č ^h a	'you are crying'
	prefixes-'cry'	
l. ʃ	ʃi - č ^h a	's/he (4th) is crying'
	prefixes-'cry'	
m. h	ta+o <u>h</u> - č ^h a	'you are all crying'
	clitic+prefixes-'cry'	
n. ?	ʔa - č ^h a	'there is crying'
	prefixes-'cry'	

Note that contrasts based on glottal state are neutralized in the prefixal span (there are neither aspirated nor ejective stops). The data below show that both aspirated and ejective stops, as well as plain ones, occur in the clitics.

(20) Glottal Contrasts in the Clitics.

C	Surface Form	Gloss
a. C	ʔa + ʃi - č ^h a	'they (4th) all are crying'
	clitic+prefix-'cry'	
b. C ^h	ni <u>k</u> ^h i + ti:ʔ - k ^h a:t	'I spread it over a surface'
	clitics+prefixes-'spread'	
c. C'	pí <u>l</u> á <u>k</u> 'e: + š - ʔa:h	'I'm handing it to her'
	clitics+prefix-'handle it'	

The total range of contrasts in the prefixes, stems and clitics of Navajo is summarized below. Vowel contrasts based on nasalization do not occur in prefixes, but do occur in stems and clitics. Consonantal contrasts based on aspiration and glottalization are neutralized in the prefixes, but are available in the stems and in the clitics.

(21) Contrasts in the Prefixal Span

	V-Quality	Syllabic Properties	Consonants
Prefixes	a, e, i, o	tone, length	No glottal contrasts
Stems	a, e, i, o	tone, length, <u>nasalization</u>	<u>Glottal contrasts</u>
Clitics	a, e, i, o	tone, length, <u>nasalization</u>	<u>Glottal contrasts</u>

These restrictions constitute the first source of evidence that the verbal prefixes of Navajo form a set that differs on phonological grounds from stems and clitics. The facts so far are consistent with cross-linguistic generalizations about inflectional morphological elements. It is quite common for such elements to manifest a smaller inventory of phonemes and a smaller set of contrasts than the language as a whole. This may have something to do with the uninteresting fact that there are fewer prefixes than stems in Navajo. However, the fact that clitics do not attest such a limited range of contrasts compared to stems argues against such an account. There are a comparable number of clitics and prefixes in Navajo, yet clitics attest a fuller range of vowel and consonant contrasts than prefixes do.

In the next section, the behavior of tone within the prefixal span is presented as the second source of evidence for the differentiation of prefixes from stems and clitics in Navajo.

2.3.2.2 The Behavior of Tone

Navajo, like most Athapaskan languages, utilizes a phonemic distinction in tone. A syllable may surface with high or low tone if it is monomoraic, and with

high, low, falling, or rising tone if it is bimoraic or longer¹⁰. While the position of high tones is generally unpredictable (it is phonemic), there is a surface restriction on the distribution of high and low tones in the prefix span of the Navajo. Any prefixal syllable to the right of a high tone surfaces as high¹¹. Licit surface distributions of high tones in the prefix span are illustrated below.

(22) Tone Spread in the Prefixal Span:

	Pattern	Form	Gloss
a.	σσ - stem	<u>yí.ní.</u> - č ^h a prefixes - 'cry'	'You cried'
b.	σσ - stem	<u>dí.ní.</u> - ʔá prefixes - 'relinquish SRO'	'I relinquish a solid roundish object'
c.	σσ - stem	<u>yí.nił.</u> - k'e' prefixes - 'cool'	'S/he is cooling it down'

(23) Impossible Distributions of Tone in the Prefixal Span¹²

	Pattern	Form
a.	*σσ - stem	Does not occur.

A span of clitics, on the other hand, may surface with a high tone followed by some number of low tones to its right. In this way, clitics differ from prefixes.

¹⁰Long diphthongs demonstrate no more tonal contrasts than do long vowels. They may surface with high, low, rising or falling tone.

¹¹The data here are taken from the dialect described in Young 1995. For some speakers (i.e. Willie, p.c.), the appropriate generalization is that any monomoraic prefixal syllable to the right of a high tone surfaces as high. Closed syllables, and syllables containing long vowels do not surface as high following another high tone for these speakers. The generalizations presented in this subsection are otherwise true for both dialects: only prefixes alternate in their tonal properties on the surface: clitics and stems never do.

¹²The first and second person dual prefixes resist tone spread, and always surface as low in tone. They are the only exceptions to this generalization.

However, any time that the leftmost clitic in a verb surfaces with high tone, all prefixes (which will of course occur to the right of the clitic) will also surface with high tones. Licit and illicit configurations of tone in the clitic plus prefix span are illustrated below.

(24) Tone Spread and Proclitics

	Pattern	Form	Gloss
a.	σ + σ - stem	ʔá + ní - lé:h clitic+prefixes-'spread'	'you are making it'
b.	σσ + σ - stem	k'éʔahi + ti: - 'ní clitics+prefixes-'call'	'address each other as relatives'
c.	σσ + stem	ʔaʔnáná + š - ʔoh clitics+prefix-'drive'	'I drive an object back and forth'
d.	σ + σσ - stem	há: + píyá - t ^h é:h clitic+prefixes-'curse'	'it is being talked out, as in breaking a curse'

(25) Impossible Distributions of Tone in the Clitic + Prefixal Span

	Pattern	Form
a.	*σ + σ - stem	Does not occur.

Verb stems always surface as either high, low, rising or falling in tone, regardless of the tonal properties of the prefixes or clitics that surface with them. There is no verb stem whose tonal properties vary from word to word, depending upon the tones of the prefixes or clitics which are affixed to it.

The facts with respect to tone spreading are summarized in the chart below. Sequences of a high tone followed by a low tone do not occur in the prefixal span in

Navajo, though such sequences can occur in the clitics, or across the prefix-stem boundary.

(26) High Tones in the Navajo Verb

Prefixal Span	*HL
Stem	√HL
Clitic Span	√HL

This phenomenon has been analyzed as follows. There is a process of left-to-right tone spread in Navajo¹³. The fact that tonal spreading is constrained to target only prefixal syllables has been accounted for by positing underlying low tones only in stems and proclitic prefixes. Prefixes which normally surface as low in tone are argued to be unmarked for tone (Kari 1973, Young 1995), and therefore susceptible to tone spreading from adjacent syllables. Regardless of the theoretical account for the tonal behavior of prefixes, the phenomenon argues for a distinction between clitics and prefixes in the verb. Note that the properties of tone in clitics is identical to the properties of tone in stems, and both are different from the properties of tone in prefixes. This distinction is further substantiated by boundaries on the phenomenon of strident harmony, which was described in section 2.2.1 above.

2.3.2.3. The Behavior of [Strident] Segments

All target segments for strident harmony are prefixes¹⁴. That is, the only segments which alternate on the surface with respect to apical versus laminal

¹³This would be captured under Optimality Theory by some kind of Alignment constraint. It is described here in derivational terms because previous analyses of this pattern have been undertaken in a derivational framework. (cf. Kari 1973, Young 1995)

¹⁴Strident harmony also seems to hold over stems in that there are no stems which contain two [strident] segments which disagree for manner of articulation. There are, however, no alternations in stems that are motivated by strident harmony. The

articulation are the prefixes. The alternations appear to be triggered either by strident consonants in the stem, or by strident consonants in the prefixes, but never by strident consonants in the clitics of Navajo. This is illustrated below.

The possible and impossible distributions of strident segments in verbs containing no clitics, which were presented in section 2.2.1, are reviewed here.

(27) Strident Harmony: Possible Configurations

	Configuration	Form	Gloss
a.	š - š	y ⁱ š - k ^e :ž prefixes - 'bend'	'it was painted'
b.	s - s	y ⁱ s-t ⁱ z prefixes + 'bend'	'it was spun'
c.	s s - t	s ⁱ s - t ^h in prefixes + 'freeze'	'I froze up'
d.	š š - t	š ⁱ š - t ^h e:h prefixes + 'set it'	'I set an animate object up at rest'

relationship between the distributional restrictions on segments in stems and the harmony effect triggered by stems on affixes is a topic worthy of exploration, but it will not be tackled here. (see Meek 1997 for one such approach)

(28) Strident Segments in Navajo Words: Impossible Configurations

	Configuration	Form
a.	- š s	*
b.	- s š	*
c.	s - š	*
d.	š - s	*
e.	š s - t	*
f.	s š - t	*

Clitic elements can surface with strident consonants that differ in their manner of articulation from other strident consonants in the same word. This is shown in (29) below, where the strident segments in the clitics are laminal in the presence of an apical prefixal strident a.; or apically in the presence of a laminal prefixal strident b..

(29) Strident Harmony Blocked in Clitics .

	Acutal Form	Harmonic Form	Gloss
a.	š _é + s̲ - t ^h ał clitic+prefix-'hit'	*š _é + š̲ - t ^h ał or *s̲ _é + s̲ - t ^h ał	'it hit against me'
b.	č ^h o: + z̲ - ʔi:t clitic+prefix+'use'	*č ^h o: + ž̲ - ʔi:t or *c ^h o: + z̲ - ʔi:t	'it got used'

Note that proclitics can contain strident segments which do not agree for manner of articulation with other stridents in the prefix plus stem span. This fact suggests two things. First, it argues that the prefixes and the clitics manifest different sets of phonological properties. Second, it is evidence that the prefix + stem span forms a phonologically definable unit. It is the domain for strident harmony. These facts are summarized in the chart below.

(30) Strident Harmony and the Prefixal Span

Span	Strident Harmony?
[Prefixes-Stem]	Yes
[Clitics+Prefixes-Stem]	No

The phenomenon of strident harmony provides the third source of evidence that the verbal prefixes of Navajo differ fundamentally from the clitics. Prefixal elements undergo strident harmony, while clitic elements do not undergo it. Stems, on the other hand, always contain strident segments which agree for manner of articulation, but do not alternate on the surface. There are no clitics which contain more than one strident segment. The fact that the stem plus prefix span forms the domain in which strident harmony is enforced is evidence that this span is a phonologically identifiable unit, separate from the clitic elements.

2.3.3 Summary of the Arguments

In this section, three arguments have been made to suggest that the Navajo prefixes differ from clitics in phonologically coherent ways. The first argument came from a study of the distribution of contrasts in the stems, clitics and prefixes of Navajo. Here it was shown that clitics share properties with stems, and not with prefixes. The second argument comes from the distribution of tone in the Navajo word. Again, it was shown that clitics share properties with stems, and not with prefixes. Finally, the third argument came from boundaries on the phenomenon of strident harmony. Here, two things were shown. First, clitics pattern differently than either prefixes or stems in that clitics can contain 'disharmonious' strident segments. Second, the prefix plus stem span is a phonologically relevant unit in Navajo. It is the domain over which strident harmony holds. These arguments lead

to two conclusions. First, clitics are more like stems than they are like prefixes in Navajo. Second, the stem plus prefix span is a phonologically definable unit in the Navajo verb. For these reasons, it is argued that an account of the phonological behavior of the stem plus prefix span of Navajo, without regard to the behavior of clitics, is coherent.

None of the arguments presented here have shown that the elements that have been referred to as clitics have the syntactic/semantic properties usually associated with clitics cross linguistically (cf. Aronoff 1976, Hargus 1997, Halpern 1995, Klavans 1985). The arguments given in this section have shown only that these elements have phonological properties more similar to those of stems than of those to prefixes. This conclusion is sufficient for the arguments put forward in this dissertation, however. The crucial property of the clitics of Navajo for the purposes of the analysis presented here is that they are distinct from the verbal prefixes on phonological grounds, and that they therefore need not be considered in an analysis of the syllable shape alternations in the Navajo prefixes.

2.4 REVIEW AND SUMMARY

A number of basic facts about Navajo phonology and morphology have been presented in this chapter. The current and historical situation of the language was briefly outlined. Three patterns of featural alternations were described. These included strident harmony, stem-initial fricative voicing, and stem-initial consonant mutation. A set of relevant properties of stems, clitics and prefixes were examined. The most important aspect of this last section was the motivation for treating the phonology of the verbal stem plus prefix cluster separately from the phonology of the clitics in Navajo. A number of sources of evidence have been brought to bear on this

subject. First, the inventory of phonological contrasts was found to be reduced in the prefixes when they were compared with either the stems or the clitics. Second, prefixes were shown to participate in a tone spread phenomena which did not affect stems or clitics. Finally, strident harmony was seen to hold within stems and across the stem plus prefix span of the verb, but not with respect to clitics. These phenomena all argue for a phonological distinction between prefixes and clitics in the Navajo verb. The analysis that follows refers only to the Navajo prefixes, and the stems to which they attach, but not to the clitics.

The next chapter motivates the input forms of the Navajo prefixes which are accounted for in this dissertation. These are the prefixes which are involved in syllable shape alternations. The goal of the dissertation is to describe and account for the syllable shape alternations that occur in the prefix span, with special attention to the appearance of closed syllables in that span. The forms motivated in chapter three provide the necessary data for generating such an account. The analysis is found in chapters four and five, and a number of alternative analyses and directions for further research are presented in chapter six, as is a discussion of how the input forms of the prefixes motivated in chapter three compare to those previously proposed in the literature on Navajo.

CHAPTER 3: MOTIVATING THE INPUT FORMS OF THE NAVAJO PREFIXES

3.0 INTRODUCTION

This chapter motivates the input forms of the Navajo prefixes that are assumed in the analysis that follows. Determining the shapes of these prefixes is no small descriptive task, and is part of the empirical contribution of this project. In previous analyses input forms of prefixes have been derived on the basis of historical and comparative evidence (cf. Cook and Rice 1989, Kari 1973, Krauss and Leer 1976, Leer 1989) or have relied on complex derivations involving extrinsically ordered, language-specific rules to get from input to output forms (McDonough 1990, Young 1995, Young and Morgan 1987, 1992). The approach taken here, and that required by Optimality Theory, is to derive input forms directly from the surface forms of words, without positing intermediate steps or complex sets of ordered rules.

This chapter is organized as follows. The basic morphological categories of concern in the analysis that follows are described in 3.0.1, and the strategy to be used in deriving the input forms of the prefixal morphemes of Navajo is outlined in 3.0.2. Section 3.1 contains the description that leads to hypotheses about the input forms of these prefixes. Section 3.2 examines evidence about the relative linear order of these prefixes with respect to each other, and to the verb stem. Section 3.3 provides a note on two types of allomorphy discovered in this chapter, and section 3.4 reviews the findings of this chapter and concludes it.

3.0.1 The Categories

Before deriving the input forms of the particular prefixes of Navajo, it is useful to note the relevant semantic and morphological categories that are marked on the verb. This section briefly outlines these categories. They include transitivity properties which can be marked by prefixation; tenses, aspects and modalities that are relevant to the sections to come; and the person categories that are marked by prefixation of the verb. The categories discussed here are not exhaustive of the expressive capacity of the Navajo verb, they are only those necessary for understanding the analysis in chapters four and five.

Transitivity properties of Navajo verbs are quite complex and manipulable, and their full description is well outside the domain of this dissertation (cf. Willie 1991 for a complete account of them). For purposes of the analysis given here, all that need be noted is that some stems may be transitivized or passivized by the selection of particular prefixes. For example, the verb below is shown in its active and passive forms.

(1) Active and Passive Verb

	Form	Gloss
a. Active	níł. - tʰɪ	'I brought an animate object'
b. Passive	yíl. - tʰɪ	'an animate object was brought'

The distinction between the active and passive forms of this verb is signaled by differences in the prefixal cluster. The voicing of the lateral segment differs between the two forms (with a voiced lateral occurring in the passive form, but a voiceless lateral in the active), and the initial consonant of the prefixal cluster differs as well (the passive begins with [y] while the active begins with [n]). These

differences mark both the number of arguments taken by the verb (this is signaled by the voicing of the lateral segment) and the nature of the person marking that accompanies each. In (a) the subject is first person, in (b) it is third person. Although the voicing properties of the lateral prefix segment do reflect differences in argument structure in this case, not all verb stems take a lateral prefix, and those that do may or may not have both active and passive forms which are distinguishable in this way.

There are five person categories that can be marked on a verb¹. The terms "first", "second" and "third person" are used in their familiar senses. Navajo also has two obviative third person forms. The first of these is referred to as the "fourth" person. The fourth person form is used in a number of pragmatically marked categories: to indicate politeness, to refer to a person to whom one can not refer directly (such as an inlaw), or to make judgments about generally right or wrong behavior. The fourth person is also used in storytelling to refer to a character who has been already been introduced in the story (Akmajian 1970, Willie 1994). An additional obviative third person category exists in Navajo, the "third person indefinite", which can be glossed as "someone" or "something" in transitive constructions, and which results in a passive interpretation for intransitive verbs (e.g. *ʔač^ha* 'there is crying'). In order to differentiate the first, second and third persons (all of which behave in similar ways in the Navajo prefix span), from the third person indefinite and fourth person (which behave differently), I will refer to the former as the "definite" person prefixes, and the latter as the "obviative" person prefixes. These are illustrated below.

¹Only singular forms are dealt with here.

(2) Person Categories in Navajo

Definite			Obviative	
First	Second	Third	Third-Indef.	Fourth

There are three number categories in Navajo: singular, dual and plural. The singular forms are analyzed here. The dual forms differ from the singulars only in the first and second persons. The dual subject markers of Navajo are described and accounted for in Fountain (1997b) and are not taken up here. Plural marking is accomplished by cliticization.

There are two aspects (perfective and imperfective), two tenses (future and non-future), one mode (the optative), and two conjugations (the so-called "Ø Conjugation" and the so-called "Si-Conjugation) which are described in this dissertation. These are the categories of interest with respect to the analysis that follows because the prefixes which signal these categories participate in the syllable structure alternations being accounted for in it.

(3) Tenses, Aspects, Mode, and Conjugations

Tenses	Future
	Non-Future
Aspects	Perfective
	Imperfective
Modes	Optative
	Non-Optative
Conjugations	Si-Conjugation
	Ø-Conjugation

The tenses, aspects and modes given here are familiar enough. The category of "conjugation" is deserving of some comment. Navajo verbs are divided into four different lexical classes, each of which surfaces with a distinct pattern of prefixation for verbs in the perfective or imperfective aspects, but which are generally not distinguished in the future tense or the optative mode. These classes are traditionally referred to as the Si-Conjugation class, the Ni-Conjugation class, the Yi-Conjugation class and the Ø-Conjugation class. Si-Conjugation verbs generally surface with a prefixal [s], Ni-Conjugation verbs with a prefixal [n], and Ø-Conjugation verbs with no marker in the relevant position. Yi-Conjugation verbs generally occur with a prefixal [yi] or [i], or with a bimoraic prefix cluster, though this class has more variability than the other three. The aspectual distinction between perfective and imperfective cross-cuts the four conjugation classes, and is briefly described below.

An example of perfective and imperfective counterparts of a single verb stem is given below. Note that the forms below differ in terms of their stem syllable and also in terms of their prefixation patterns. There is no particular prefix which signals the aspectual properties of the verb. Instead, it is the combination of the particular shape of the stem syllable, along with the pattern of subject marking, which signal the aspect of the verb. In (4) below, both verbs contain a prefixal [s] (which is underlined, and which surfaces as [š] by strident harmony in the imperfective form) on the left edge of the prefix span. This [s] marks these forms as being in the Si-Conjugation class. The first person subject is marked by [š] in the imperfective. The first person subject is marked with an [é] in the perfective form in the Si-Conjugation.

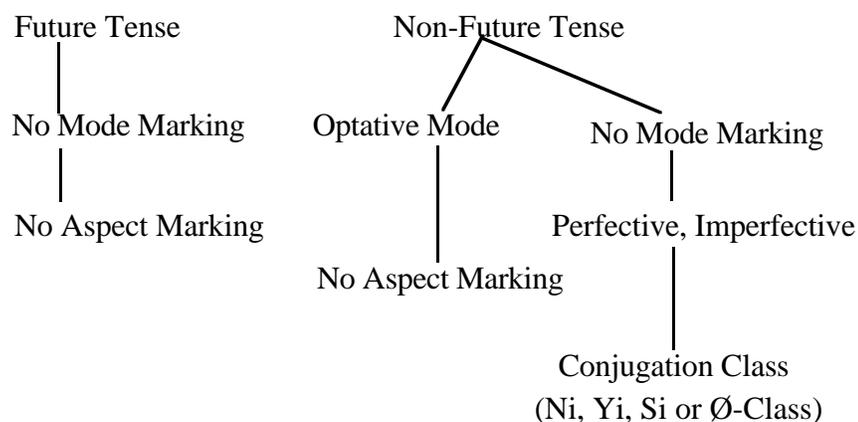
(4) Aspectual Marking on the Verb Stem: "set an animate object"

Si-Conjugation, Imperfective vs. Perfective

	Stem	Form	Gloss
a. Imperfective	t ^h e:h	tah šiš - t ^h e:h	'I'm setting an 'up' prefixes- 'set' animate object up'
b. Perfective	t ^h ı	tah sé - t ^h ı	'I set an animate 'up' prefixes- 'set' object up'

Verbs with overt tense or mode marking are generally not marked for conjugation class². Verbs with conjugation marking similarly do not usually surface with overt tense or modal prefixes. The relationships among tense, mode, aspect and conjugation marking are schematized in the diagram below.

(5) Tense, Mode, Aspect, and Conjugation in the Navajo Verb



This distribution of prefixation for temporal information may follow from the observation that the tense, mode, and conjugation prefixes of Navajo all occupy a

²A few stems can be marked for both future tense and Ni-Conjugation, or future tense and Yi-Conjugation (Willie, p.c.).

single linear position in the prefix string. There is, therefore, a tendency to mark at most one of these categories on any particular verb. With these basic categories understood, the strategy underlying the argumentation in this chapter is outlined next.

3.0.2 The Strategy

In looking at the surface forms of the simple intransitive verb paradigm in (6) below, it is not immediately obvious what prefixal material marks which semantic and morphological features of the verb. This paradigm is in the so-called \emptyset -Conjugation Imperfective: it is representative of verb stems which do not require any kind of overt tense or modal marking in the prefixal span.

(6) Navajo Verb Paradigm: Imperfective Stem: $\check{c}^h a$ 'cry'

	Person	Singular	Gloss
a.	1st	$y\check{i}\check{s} - \check{c}^h a$	'I'm crying'
b.	2nd	$ni - \check{c}^h a$	'You're crying'
c.	3rd	$yi - \check{c}^h a$	'S/he's crying'
d.	3rd, Indefinite	$\text{?}a - \check{c}^h a$	'There is crying'
e.	4th	$\check{y}i - \check{c}^h a$	'S/he's crying'

Certain hypotheses can be drawn from this paradigm. For example, it appears that the shape of the first person subject marker is $y\check{i}\check{s} -$, and that the second person subject marker is $ni -$. The partial paradigm for the Optative form³ of the same verb, given in (7) below, would lead to a different set of hypotheses about these prefixes, however.

³The optative mode is typically used in the negative. Speakers usually include periphrastic particles such as *láko* to negate the optative verb, as in *wóš^ha láko* 'I shouldn't cry'. For ease of notation, I will continue to gloss optative forms using the modal "should", and I will not include the negating particle.

(7) Navajo Verb Paradigm: Optative: č^ha 'cry'

	Person	Singular	Gloss
a.	1st	wóš - č ^h a	'I should cry'
b.	2nd	wó: - č ^h a	'You should cry'
c.	3rd	wó- č ^h a	'S/he should cry'
d.	3rd, Indef	ʔó - č ^h a	'There should be crying'
e.	4th	jó - č ^h a	'S/he should cry'

Comparison of this paradigm with the imperfective one above leads to a slightly different conclusion about the shape of the first and second person markers. In fact, two strategies could be used in analyzing these forms. One would be to assume that the prefixes were portmanteau affixes which could not be broken down into a set of subject person and number markers and a set of tense-aspect markers. If this were true, then speakers would simply memorize the prefix clusters for each of these paradigms as unanalyzed wholes.

The second strategy, and the one taken in this dissertation, is to argue that these prefixes can be broken down, and that the properties that are similar between, for example, a first person optative prefix and a first person imperfective prefix, must mark first person subject. The properties that differ between these two affixes are then taken to mark something else. On this approach, the first person subject marker is hypothesized to be /š/. Note that the second person prefix in the imperfective and optative forms given here have no segmental material in common. Therefore, no conclusion can be drawn about the input form of the second person subject marker without review of additional data. It is likely that the input forms of the second person Ø-conjugation imperfective and the second person optative are distinct from

each other, so more than one input form may be hypothesized for marking second person subjects.

The prefixes which participate in syllable structure alternations in Navajo are examined in section 3.1. In section 3.2 the linear order of each of these prefixes with respect to the others is determined. Section 3.3. concludes the chapter. With the basic categories to be dealt with thus understood, the next section derives the input form of each of the prefixes which will be accounted for in the analysis to follow.

3.1 THE PREFIXES

The prefixes to be dealt with here are the classifiers /l/ and /ʎ/, the future tense marker, the optative mode marker, the Si-Conjugation marker, and the first, second, third, third indefinite and fourth person prefixes. They are described in this order: the classifiers are presented in section 3.1.1., the tense, mode and conjugation markers in section 3.1.2., and the person markers in 3.1.3.

3.1.1 The Classifier Prefixes

This section motivates the existence of two overt classifiers in Navajo, the /ʎ/ classifier and the /l/ classifier. The semantics of each of these classifiers is briefly reviewed in section 3.1.1.1, and forms containing the lateral classifiers are given in section 3.1.1.2. It is shown that each of these classifiers surfaces as the coda of the prestem syllable, or not at all. Each of these classifiers fails to surface in forms where the prestem syllable is closed by an [s] or an [š].

3.1.1.1 The Semantics of the Classifiers

The voiced and voiceless lateral fricatives *l* and *ɬ* in the verbs below appear to signal the transitivity of the verb. While not all Navajo verbs take classifier prefixes, examples of those that do are given below.

(8) Forms Containing Overt Classifiers

Conjugation	Form	Gloss
a. Ø-Conjugation, Imperfective	niɬ.-cé:h prefixes-stem	'You scrape it'
b. S-Conjugation, Imperfective	tah siɬ.-t ^h e:h particle prefixes-stem	'You set an animate object up at rest'
c. Ø-Conjugation Imperfective	niɬ. - ɣaɬ prefixes-stem	'You are eating it (meat)'
d. S-Conjugation, Imperfective	tah ta+ʔsiɬ. - pa:ɬ particle clitic+prefixes-stem	'we put up an awning'

The verbs in (a-b) have the voiceless lateral classifier, and they are also transitive. The forms in (c-d) have the voiced lateral classifier, and are also transitive. Young (1995:11) reports that approximately 28% of Navajo verb stems take the voiceless lateral classifier, and most are either causatives or active transitives. The voiced lateral classifier appears predominantly in verbs taking one argument: i.e., intransitive, passive and reflexive verbs. As the data above show, these patterns are merely tendencies. All of the forms above are active and transitive, but (a-b) take the /ɬ/ classifier and (c-d) take the /l/ classifier. In spite of these inconsistencies, the voicing of the classifier prefix may be utilized to signal active-passive distinctions for some verb stems. The forms below show that some stems may occur with the

voiceless classifier in transitive constructions (as in (9a) below), but with the voiced classifier in passive constructions (as in (9b)).

(9) Active and Passive uses of a Single Verb Stem:

	Voice	Form	Gloss
a.	Active	yíníł.-tʰí	'S/he brought an animate object'
b.	Passive	yíł.-tʰí	'An animate object was brought'

Since each of the classifiers occurs in exactly the same phonological context above, it is clear that the voicing of the classifier is not determined phonologically. Furthermore, some verb stems do not surface with a classifier prefix at all. The paradigm below shows a verb stem that does not subcategorize for any classifier prefix.

(10) Verb Not Subcategorizing for a Classifier Prefix (Ø Imperfective)

	Person	Form	Gloss
a.	First Person	yíš - č ^h a	'I am crying'
b.	Second Person	ní - č ^h a	'You are crying'
c.	Third Person	yí - č ^h a	'S/he is crying'
d.	Third Indefinite	?a - č ^h a	'There is crying'
e.	Fourth Person	ǰí - č ^h a	'S/he is crying'

This verb is intransitive, and takes no overt classifier prefix. According to Young (1995), approximately 41% of the verb stems of Navajo take no overt classifier. Some of these are intransitive verbs, such as the one above. Others are transitive, as in the form *nei?ǎ* (*nei* - ?ǎ , 's/he's carrying around a solid roundish object'). The facts presented here show that the presence or absence of the classifier prefixes is to some extent lexically determined; that is, classifiers are subcategorized

for by particular verb stems. For some stems, classifiers may be selected to form active or passive constructions. Furthermore, there is a general tendency for the voiceless lateral to occur in transitive and active constructions, and for the voiced lateral to occur in intransitive and passive constructions.

3.1.1.2 The Distribution of the Lateral Classifiers

Representative paradigms for verbs taking /ʎ/ classifiers are given below. Notice that the /ʎ/ occurs as the coda of the prestem syllable, when it occurs. In forms with an [s] or an [ʃ] in the coda of the prestem syllable, there is no prefixal /ʎ/. The first paradigm is for a Si-Conjugation perfective verb. The /ʎ/ surfaces in the first and second person forms of the verb below. In the third, third indefinite and fourth person forms, the prestem syllable is closed by [s], and no classifier occurs.

(11) Si-Conjugation Perfective Verb with /ʎ/ Classifier.

Stem: -ʎá 'solid roundish object sits'

	Person	Form	Gloss
a.	1	séʎ - ʎá	'I kept it'
b.	2	síníʎ - ʎá	'You kept it'
c.	3	yis - ʎá	'S/he kept it'
d.	3-I ⁴	ʎas - ʎá	'Somone kept it'
e.	4	ʃis - ʎá	'S/he kept it'

The Si-Conjugation perfective verb given above shows that the /ʎ/ classifier prefix occurs as the coda of the prestem syllable, when it occurs. It also shows that

⁴In order to save space, the abbreviation 3-I is used to refer to the third person indefinite form of the verb.

the classifier may be blocked by the occurrence of [s] in the prestem syllable (in the third person, third person indefinite and fourth person forms).

The next paradigm shows a Si-Conjugation verb with a voiced lateral classifier. Note that the prefixes in the first and second person forms differ from the paradigm above, but the classifier surfaces under identical phonological circumstances. That is, the /l/ classifier surfaces when the prestem syllable is not closed by an [s] or [š]. (Note here that strident harmony is induced by the /j/ in the stem).

(12) Si-Conjugation Perfective Verb with /l/ Classifier.

Stem = -ǰo:l 'lay there'

	Person	Form	Gloss
a.	1	šiš - ǰo:l	'I lay there'
b.	2	šíníl - ǰo:l	'You lay there'
c.	3	yiš - ǰo:l	'S/he lays there'
d.	3-I	ʔaš - ǰo:l	'Someone or something lays there'
e.	4	ǰiš - ǰo:l	'S/he lays there'

This classifier surfaces only in the second person form of the verb. Elsewhere, the [š] surfaces as the coda of the prestem syllable. In Si-Conjugation perfective verbs, then, the classifiers surface as the coda of the prestem syllable unless an [s] or [š] surfaces in that position. In the latter case, the classifiers do not surface at all. The remainder of this section demonstrates that this distribution is true for all conjugations, aspects, tenses and modes.

The following paradigm contains an /ʎ/-classifier imperfective verb of the Ø-Conjugation class. Notice that the /ʎ/ surfaces as the coda of the prestem syllable in all forms except the first person singular, in which the prestem syllable is closed by an [š].

(13) Ø-Conjugation Imperfective Verb with /ʎ/ Classifier.

Stem = cé:h 'scrape a hide in order to soften it'

	Person	Form	Gloss
a.	1	yíš - cé:h	'I scrape a hide to soften it'
b.	2	niʎ - cé:h	'You scrape a hide to soften it'
c.	3	yiʎ - cé:h	'S/he scrapes a hide to soften it'
d.	3-I	?aʎ - cé:h	'Someone is scraping a hide to soften it'
e.	4	jiʎ - cé:h	'S/he scrapes a hide to soften it'

The voiced lateral classifier has an identical distribution, as illustrated by the paradigm below.

(14) Ø-Conjugation Imperfective Verb with /l/ Classifier.

Stem: -k^he:t = 'eat a roundish object'

	Person	Form	Gloss
a.	1	yĩš - k ^h e:t	'I eat a roundish object'
b.	2	niḷ - k ^h e:t	'You eat a roundish object'
c.	3	yiḷ - k ^h e:t	'S/he eats a roundish object'
d.	3-I	ʔaḷ - k ^h e:t	'Someone eats a roundish object'
e.	4	ʃiḷ - k ^h e:t	'S/he eats a roundish object'

The paradigms above show that overt classifiers occur in perfective and imperfective verbs, in Si-Conjugation verbs and in verbs with no conjugation marking. The paradigms below show that the classifiers also appear in verbs marked for future tense. The distribution is the same: the classifier surfaces unless the prestem syllable is closed by an [š] or [s].

(15) Future Tense Verb with /ʎ/ Classifier.

Stem = cé:ʎ 'scrape a hide in order to soften it'

	Person	Form	Gloss
a.	1	te:š - cé:ʎ	'I will scrape a hide to soften it'
b.	2	tí:ʎ - cé:ʎ	'You will scrape a hide to soften it'
c.	3	yito:ʎ - cé:ʎ	'S/he will scrape a hide to soften it'
d.	3-I	ʎato:ʎ - cé:ʎ	'Someone will be scraping a hide to soften it'
e.	4	šjito:ʎ - cé:ʎ	'S/he will scrape a hide to soften it'

A future tense verb with an /l/ classifier is given below. Again, the classifier surfaces unless the prestem syllable is closed by [š].

(16) Future Tense Verb with /l/ Classifier.

Stem: -k^{hi}ɬ = 'eat a roundish object'

	Person	Form	Gloss
a.	1	te:š - k ^{hi} ɬ	'I will eat a roundish object'
b.	2	tí:l - k ^{hi} ɬ	'You will eat a roundish object'
c.	3	yito:l - k ^{hi} ɬ	'S/he will eat a roundish object'
d.	3-I	?ato:l - k ^{hi} ɬ	'Someone will be eating a roundish object'
e.	4	ǰito:l - k ^{hi} ɬ	'S/he will eat a roundish object'

The final two paradigms show that the classifiers surface in verbs marked for optative mode as well. Again, they fail to surface in the first person form, where the prestem syllable is closed by /š/.

(17) Optative Mode Verb with /4/ Classifier.

Stem = cé:h 'scrape a hide to soften it'

	Person	Form	Gloss
a.	1	wóš - cé:h	'I should scrape a hide to soften it'
b.	2	wóɬ - cé:h	'You should scrape a hide to soften it'
c.	3	yóɬ - cé:h	'S/he should scrape a hide to soften it'
d.	3-I	ʔóɬ - cé:h	'Someone should scrape a hide to soften it'
e.	4	ǰóɬ - cé:h	'S/he should scrape a hide to soften it'

(18) Optative Mode Verb with /l/ Classifier.

Stem: -k^he:t = 'eat a roundish object'

	Person	Form	Gloss
a.	1	wóš - k ^h e:t	'I should eat a roundish object'
b.	2	wó:l - k ^h e:t	'You should eat a roundish object'
c.	3	yól - k ^h e:t	'S/he should eat a roundish object'
d.	3-I	ʔól - k ^h e:t	'Someone should eat a roundish object'
e.	4	ǰól - k ^h e:t	'S/he should eat a roundish object'

The distribution of the lateral classifiers is clear. Each surfaces as the coda of the prestem syllable, unless the prestem syllable is closed by an [s] or an [š]. The input forms of these classifiers are thus assumed to be /l/ and /ʎ/, and the results of this section are schematized below.

(19) Generalizations about the Classifier Prefixes

Semantics	Input Forms	Linear Position	Alternations
Transitivity	/l/ or /ʎ/	___Stem	*š/s ____

In summary, the classifier prefixes signal transitivity properties of a verb, although they have no exceptionless syntactic or semantic content. The voiced and voiceless lateral classifiers share a common distribution: each occurs as the coda of the prestem syllable, unless the prestem syllable is closed by a [s] or [š]. The next

section addresses the input shapes of the tense, mode and conjugation markers of Navajo.

3.1.2 The Tense, Mode and Conjugation Prefixes

Three prefixes are described in this section: the future tense prefix, the optative mode prefix, and the Si-Conjugation prefix. Understanding the shapes of these prefixes is crucial to the task of deriving the underlying forms of the person markers, which are taken up in the next section. The linear position of these prefixes cannot, however, be accurately described until the shapes and positions of the person prefixes have been presented. For this reason, a full discussion of the linear position of the tense, mode, and conjugation prefixes will be postponed until section 3.2, and only the input form of these prefixes will be determined in this section.

3.1.2.1 The Tense Prefix: Future Tense

A full intransitive paradigm for a future tense verb is presented below. Note that in each case, the prestem syllable is bimoraic, and the onset of the prestem syllable is [t]. No other common properties of the prefixal clusters of the verbs in this paradigm are evident.

(20) Future Tense Verb (Intransitive, Ø Classifier)

Stem = č^hah 'cry'

	Person	Form	Gloss
a.	1	<u>te:š</u> - č ^h ah	'I will cry'
b.	2	<u>ú:</u> - č ^h ah	'You will cry'
c.	3	<u>to:</u> - č ^h ah	'S/he will cry'
d.	3-I	? <u>ato:</u> - č ^h ah	'There will be crying'
e.	4	ǰ <u>ito:</u> - č ^h ah	'S/he will cry'

The same properties are observed in transitive future tense verbs, as illustrated below. In transitive future tense verbs, all third person definite forms surface with overt third person object marking. Overt third person object marking is not acceptable for verbs with first or second person subjects. The object marker surfaces as [yi], and is leftmost in the prefixal span.

(21) Future Tense Verb (Transitive, /t/ Classifier).

Stem = cé:t 'scrape a hide in order to soften it'

	Person	Form	Gloss
a.	1	te:š - cé:t	'I will scrape a hide to soften it it'
b.	2	tí:t - cé:t	'You will scrape a hide to soften it it'
c.	3	yito:t - cé:t	'S/he will scrape a hide to soften it it'
d.	3-I	?ato:t - cé:t	'Someone will scrape a hide to soften it it'
e.	4	ǰito:t - cé:t	'S/he will scrape a hide to soften it it'

The underlying form of the future tense marker is therefore taken to be a heavy syllable template, with a /t/ onset. The variability in vowel quality is shown in the sections that follow to arise from subject marking. The future tense marker always surfaces in prestem position, never further to the left. This is summarized in (22) below.

(22) Generalizations about the Future Tense Prefix

Semantics	Input Form	Linear Position	Alternations
Future Tense	$\begin{array}{c} \sigma \\ \swarrow \mu \\ \downarrow t \end{array}$	Prestem σ	None

With these facts established, the optative marker is presented next.

3.1.2.2 The Mode Prefix: Optative Mode

A representative paradigm for an intransitive optative verb is given below. Note that all of the forms of this verb contain an [ó] in the prestem syllable, though the onset and the coda (or lack thereof) in the prestem syllable vary.

(23) Optative Mode Verb (Intransitive, Ø-Classifier)

Stem = č^ha 'cry'

	Person	Form	Gloss
a.	1	wóš - č ^h a	'I should cry'
b.	2	wó: - č ^h a	'You should cry'
c.	3	wó - č ^h a	'S/he should cry'
d.	3-I	ʔó - č ^h a	'There should be crying'
e.	4	ǰó - č ^h a	'S/he should cry'

The same pattern is observed in transitive optative verbs with overt classifiers as shown below. Note that the optative marker occurs to the left of the classifier prefix, and is always the nucleus of the prestem syllable. Note that the third person form of the transitive verb in (24) below differs from the third person form of the intransitive verb in (23) above. The verb in (24) has [y] onset of the prefixal syllable in the third person form. Third person objects are always overtly marked in Navajo verbs with third person subjects. It is shown in section 3.1.3.1.3.2 of this chapter that the [y] onset in this form is a third person object marker.

(24) Optative Mode Verb (Transitive, /ʎ/ Classifier).

Stem = cé:h 'scrape a hide to soften it'

	Person	Form	Gloss
a.	1	wóš - cé:h	'I should scrape a hide to soften it it'
b.	2	wóʎ - cé:h	'You should scrape a hide to soften it it'
c.	3	yóʎ - cé:h	'S/he should scrape a hide to soften it it'
d.	3-I	ʔóʎ - cé:h	'Someone should scrape a hide to soften it it'
e.	4	ǰóʎ - cé:h	'S/he should scrape a hide to soften it it'

These facts lead to the conclusion that the optative mode is marked by a /ó/ in the prestem syllable. The optative marker surfaces as [wó] when it is word-initial, otherwise as [ó], and it occurs to the left of the classifier prefix. It does not cooccur with the future tense marker, nor with the Si-Conjugation marker. The findings presented in this subsection are summarized below.

(25) Generalizations about the Optative Mode Prefix

Semantics	Input Form	Linear Position	Alternations
Optative Mode	ó	Prestem σ	#wó or ó

The final prefix to be presented in this section is the Si-Conjugation marker. It is described next.

3.1.2.3 The Conjugation Prefix: Si-Conjugation

The paradigm below illustrates a Si-Conjugation imperfective verb. Note that the first and second person forms of this verb contain a prefixal [s] (which assimilates to [š] in the first person form), but the third, third indefinite and fourth person forms do not contain a prefixal [s]. This is because the Si-Conjugation is only marked on first and second person imperfective verbs. The third, third indefinite and fourth person forms of this verb are identical to Ø-Conjugation imperfectives.

(26) Si-Conjugation Imperfective Verb (Transitive, /4/ Classifier).

Stem = (with *tah* 'up') -t^he:h 'set an animate object up at rest'

	Person	Form	Gloss
a.	1	tah šiš.-t ^h e:h	'I am setting an animate object up at rest'
b.	2	tah síł - t ^h e:h	'You are setting an animate object up at rest'
c.	3	tah yił - t ^h e:h	'S/he is setting an animate object up at rest'
d.	3-I	tah ?ał - t ^h e:h	'Someone is setting an animate object up at rest'
e.	4	tah jil - t ^h e:h	'S/he is setting an animate object up at rest'

The paradigm above does not provide sufficient information to discern whether the input form of the Si-Conjugation marker is /s/ or /si/. In order to make this determination, Si-Conjugation perfective verbs are presented next.

The Si-Conjugation is marked on all persons in the perfective paradigms, as illustrated next. These forms show that a prefixal [s] or [si] is the marker of the Si-Conjugation, but its position in the prefix span varies. The next paradigm illustrates the pattern of Si-Conjugation perfective verbs without overt classifiers. The [s] surfaces in the prestem syllable in most cases, though it surfaces outside of the prestem syllable in the second person form. Note that the quality of the vowel following the [s] varies, and that in the third, third indefinite and fourth persons no vowel follows the conjugation marker at all. When the Si-Conjugation marker surfaces as the coda of the prestem syllable, as in the third, third indefinite and fourth person forms, it surfaces as a voiced fricative, [z].

(27) Si-Conjugation Perfective Verb (Transitive, Ø-Classifier).

Stem: -tiz 'spin wool'

	Person	Form	Gloss
a.	1	sé - tiz	'I spun wool'
b.	2	síní - tiz	'You spun wool'
c.	3	yiz - tiz	'S/he spun wool'
d.	3-I	?az.-tiz	'Someone spun wool'
e.	4	ǰiz.-tiz	'S/he spun wool'

Note that the voicing of the Si-Conjugation marker in the form above does not occur in the paradigm below, where the verb takes a †-Classifier. In all other cases, the paradigm below is identical to that given above. It illustrates a transitive Si-Perfective verb with a † Classifier.

(28) Si-Conjugation Perfective Verb (Transitive, with /A/ Classifier).

Stem: -ʔá 'solid roundish object sits'

	Person	Form	Gloss
a.	1	séł - ʔá	'I kept it'
b.	2	síníł - ʔá	'You kept it'
c.	3	yis - ʔá	'S/he kept it'
d.	3-I	ʔas - ʔá	'Someone kept it'
e.	4	jis - ʔá	'S/he kept it'

The perfective forms given above show that the Si-Conjugation marker surfaces in all person categories. It surfaces as [si], [s] or [z]. It occurs as the coda of the prestem syllable in the third person indefinite and fourth person forms in these paradigms. When it closes the prestem syllable, it blocks the occurrence of the classifier. The paradigm in (29) below differs from (27) and (28) above in that the Si-Conjugation marker closes the prestem syllable in the third person definite form, as well as in the third indefinite and fourth person forms.

(29) Si-Conjugation Perfective Verb (Intransitive, /I/ Classifier).

Stem = ʔjo:l 'lay there'

	Person	Form	Gloss
a.	1	šiš - ʔjo:l	'I lay there'
b.	2	šiníl - ʔjo:l	'You lay there'
c.	3	yiš - ʔjo:l	'S/he lays there'
d.	3-I	ʔaš - ʔjo:l	'Someone or something lays there'
e.	4	jis - ʔjo:l	'S/he lays there'

As in the paradigms given above, the Si-Conjugation marker occurs in various positions in the prefixal cluster. It may surface as [si] in any syllable, or as [s] or [z] in the coda of the prestem syllable. When it surfaces as the coda of the prestem syllable, it blocks the occurrence of the classifier prefix. It never surfaces as the coda of a syllable outside of the prestem syllable, however. The voicing of the Si-Conjugation marker varies predictably. It surfaces as [z] when it is a coda of the prestem syllable in a verb with no classifier. It surfaces as [š] when it occurs with the first person marker⁵, or when there is a laminal strident segment in the stem. Otherwise, it surfaces as [s]. These facts suggest that the input form of the Si-Conjugation marker is either /s/ or /si/. Each of these possibilities is considered next.

If the input form of the Si-Conjugation marker is /si/, then it is the case that the vowel [i] deletes in the following environments: before the stem-initial consonant (as in *yíš.ʃo:l* 's/he lay there') and before a vowel (as in *sé.tiz* 'I spun wool'). The deletion of /i/ in prevocalic position is plausible (at least where the following vowel is not [i]), since the sequence *siV is not a possible syllable in Navajo.

The deletion of [i] in prestem position is more difficult to account for, however. If the input form of the prefix is [si], then perfect alignment between this prefix and the stem can be accomplished without the deletion of the vowel. Therefore vowel deletion in this case can't be motivated by the positional requirements of the prefix. It must be motivated by the phonology. But the vowel does not delete in preconsonantal position generally: deletion only occurs when the [s] can form a coda of the prestem syllable. This suggests that deletion could not be driven by the phonology, but must be positionally motivated. This creates a

⁵See Meek 1997.

paradox. On the one hand, the deletion of an input /i/ couldn't affect the position of the Si-Conjugation marker in the prefixal string. On the other hand, deletion would have to be motivated by positional concerns, because it only occurs in a single position in the word.

Note also that open prestem syllables are freely allowed in Navajo, even when the onset of the prestem syllable is a licit coda segment. For example, the surface form *sí.ní.tiz* 'you spun wool' occurs with an open prestem syllable. If there were a constraint against open prestem syllables, this form should surface as **sín.tiz*. It does not, in spite of the fact that this is a perfectly well-formed word from the point of view of the syllable structure restrictions discussed in chapter one (cf. forms such as *ʔaya:ʔ pintaʔaniš* '(woolen) mill', in which word-medial /n/ codas are found).

Therefore, the deletion account must stipulate that the vowel of /si/ deletes in prestem position. This account misses an important generalization about Navajo prefixes, however. It was noted in chapter two that the vowel [i] is overwhelmingly frequent in the prefixal span of the Navajo verb. It will be seen throughout this chapter that the vowel [i] participates in a number of V~Ø alternations. No other vowel in Navajo participates in V~Ø alternations.⁶ Furthermore, all alternating [i]s in the prefix span, including the vowel of the Si-conjugation marker, occur in predictable syllable positions. Therefore, an epenthetic analysis of alternating prefixal [i] is possible. An alternative analysis positing deletion is considered in chapter six.

⁶Except for [a] after [ʔ]. This is explored with respect to the third person indefinite marker in section 3.1.3.2.1 below.

The previous discussion suggests that a deletion account of the alternations in which the Si-Conjugation marker is stipulative at best. An account involving underlying /s/ with epenthesis does not suffer from this problem for the following reasons. First, the absence of [si] before a vowel follows straightforwardly from syllable structure concerns. /s + V/ can always be syllabified as [sV] without epenthesis, so the insertion of [i] would not be necessary. More crucially, the failure of the [i] to occur in prestem position in some forms can be argued to follow from a constraint requiring /s/ to surface with perfect left-alignment to the verb stem. This is the tack taken in the analysis in the next chapter, and it allows a unified treatment of the Si-Conjugation marker, the classifiers, and the first person marker. Finally, the epenthesis analysis has the advantage of capturing the generalization that it is always [i] which participates in V~∅ alternations in Navajo, and never any other vowel. This is because [i] is the epenthetic vowel of the language.

The findings of this section are summarized below.

(30) Generalizations about the Si Conjugation Prefix

Semantics	Input Form	Linear Position	Alternations
Conjugation	s	Variable	s-Stem or SV

These results with respect to the linear position of this prefix are returned to at the end of this chapter, after the input shapes of the person markers of Navajo are derived. The results of this section are reviewed in the chart given below. The future tense marker is a heavy syllable template with a /t/ onset. It never alternates on the surface. The optative mode marker is a round vowel with a high tone. The optative marker surfaces with an epenthetic glide onset in word-initial position. The

Si-conjugation marker is a /s/. It surfaces as [si] when it occurs before a non-stem-initial consonant.

(31) Generalizations about the Future Tense, Optative Mode and Si-

Conjugation Prefixes:

Semantics	Input Form	Linear Position	Alternations
Future Tense		Prestem σ	None
Optative Mode	ó	Prestem σ	#wó or ó
Conjugation	s	Variable	s-Stem or sV

3.1.3 The Person Prefixes

This section motivates the input forms of the following subject prefixes: first person is usually marked by /š/, but in some paradigms is marked by /é/ or /ěš/; second person is usually marked by /n/, but in some paradigms is marked by /' / or /μ/; and third person is usually unmarked, but in some paradigms is marked by /o/. Each of these prefixes surfaces to the immediate left of the stem + classifier complex (though the first person marker /š/ always surfaces to the immediate left of the stem, and blocks the occurrence of a classifier prefix). The third person indefinite and fourth person prefixes are shown to be /ʔ/ and /j/ respectively, and occur in a position further to the left of the prefix span than do the definite person prefixes.

The object prefixes of Navajo are shown to be identical to the default subject prefixes in most cases (i.e. /š/ 'first person', /n/ 'second person', \emptyset or /y/ 'third person', /ʔ/ 'third person indefinite', but /ho/ or /ha/ 'fourth person'), and to occupy the leftmost position in the prefixal string.

This section is organized as follows. The input shapes of the definite person prefixes are motivated in section 3.1.2.1., and of the obviative prefixes in 3.1.2.2. The findings of this section are summarized in 3.1.2.3.

3.1.3.1 The Definite Person Prefixes

This section describes the surface distribution of the first, second and third person prefixes of Navajo. The first person prefixes are given in 3.1.3.1.1, the second person prefixes in 3.1.3.1.2, and the third person prefixes in 3.1.3.1.3.

3.1.3.1.1 First Person

Verbs with first person subjects are presented in section 3.1.3.1.1.1, and verbs with first person objects are given in section 3.1.3.1.1.1. The generalizations given in these two subsections are summarized and the input form of the first person marker is presented in 3.1.3.1.1.3

3.1.3.1.1.1 First Person Subject

Verbs marked for first person subjects are given in (33) below. Note that most of these verbs contain an [š] as the coda of the penultimate syllable. Two of the Si-Conjugation perfective forms contain no prefixal [š], and the quality of the prefixal vowel in these Si-Conjugation perfectives, as well as the future tense form, is [e]. Morpheme glosses are given here according to the input forms of the tense, mode and conjugation prefixes described in the previous sections. Prefixal material which is unaccounted for to this point is in parentheses in the morpheme gloss line.

(32) Forms with First Person Subjects

	Tense/Mode/ Conjugation	Form	Gloss
a.	Ø- Imperfective	yǎ́.-č ^h a (yǎ́) č ^h a (1s) 'cry'	'I am crying'
b.	Si-Perfective Ø-Classifier	sé. - tiz s (é) tiz conj (1s) 'spun'	'I spun wool'
c.	Si-Perfective ‡-Classifier	sé‡ - ʔá s (é) ‡ ʔá conj (1s) conj 'handle SRO ⁷ '	'I kept it'
d.	Si-Perfective l-Classifier (blocked by ǎ́)	šǎ́ - ʔo:l s (ǎ́) ʔo:l conj (1s) 'lay there'	'I lay there'
e.	Future	te:ǎ́ - cé:‡ tɯɯ (eǎ́) cé:h future (1s) 'scrape'	'I will scrape a hide to soften it it'
f.	Optative	wóǎ́ - č ^h a ó (ǎ́) č ^h a optative (1s) 'cry'	'I should cry'

⁷In order to save space in tables, the abbreviation "SRO" is used to refer to "solid roundish object", one of the classifications made by the so-called "handling verbs" of Navajo.

If the first person marker is /š/, the set of forms above presents several questions. First, what marks the first person subject in the two Si-Conjugation perfectives which do not contain [š]? Second, what accounts for the variability in the segments preceding [š] in the forms above? These questions are dealt with in order.

The paradigms below illustrate the range of the Si-Conjugation perfectives containing Ø or † classifiers. Note that in both paradigms, the first person singular prefixal cluster is [sé]. The prefixal [s] has been accounted for as the Si-Conjugation marker. Therefore, the first person must be marked by /é/ in these forms (33a, 34a).

(33) Si-Conjugation Perfective Verb with no Classifier.

Stem: -tiz 'spin wool'

	Person	Form	Gloss
a.	1	sé - tiz s (é) tiz conj-(?)-'spun'	'I spun wool'
b.	2	síní - tiz	'You spun wool'
c.	3	yiz - tiz	'S/he spun wool'
d.	3-I	ʔaz - tiž	'Somone spun wool'
e.	4	ǰiz - tiz	'S/he spun wool'

(34) Si-Conjugation Perfective Verb with /ʎ/ Classifier.

Stem: -ʎá 'solid roundish object sits'

	Person	Form	Gloss
a.	1	séł - ʎá s (é) ł ʎá conj-(?)-cl- 'kept'	'I kept it'
b.	2	síníł - ʎá	'You kept it'
c.	3	sił - ʎá	'S/he kept it'
d.	3-I	ʎas - ʎá	'Somone kept it'
e.	4	ʎis - ʎá	'S/he kept it'

The variability in the segments preceding the /š/ is accounted for next. In the Ø Conjugation imperfective, the [š] is preceded by [yi], *yışč^ha* 'I am crying'. Note that if the [yi] were omitted, the resulting string would not be comprised of well-formed syllables: *šč^ha. Note also that the prefixal [yi] has the default vowel quality for Navajo. Therefore it is assumed that this material is epenthetic, and not part of the first person subject marker. Similarly, the first person marker [š] is preceded by [i] in the Si-Conjugation l-Classifier form *šišjo:l* 'I lay there'. If the [i] (also bearing default vowel quality) were omitted, the string would again be unsyllabified *ššjo:l. Therefore, this [i] is assumed to be epenthetic and not underlying. These assumptions allow us to conceptualize the first person marker as /š/ in the Ø-Conjugation Imperfective, the future tense, and the optative, as well as in the Si-Conjugation perfective l-classifier verbs. Because /š/ is the form of the first person marker in this wide variety of environments, it is taken to be the default. A non-

default form of first the first person marker, namely /é/, is subcategorized for in the Si-Conjugation perfective.

First person marking in the future tense remains problematic. A future tense paradigm is presented here to illustrate this fact. Notice that the first person singular (35a) appears to be marked both by [š] and by a preceding [e]. Since the midvowel has been shown to accompany first person subject marking in the Si-Conjugation perfective forms above, and since only the first person form of the future tense verb contains a prefixal midvowel, it is assumed that the first person subject marker for future tense is /eš/.

(35) Future Tense Verb: Stem = cé:ɬ 'scrape a hide to soften it'

	Person	Form	Gloss
a.	1	<u>te:š</u> - cé:ɬ tɪɪ eš cé:ɬ fut-1s-'scrape'	'I will scrape a hide to soften it it'
b.	2	tí:ɬ - cé:ɬ	'You will scrape a hide to soften it it'
c.	3	yito:ɬ - cé:ɬ	'S/he will scrape a hide to soften it it'
d.	3-I	ʔato:ɬ - cé:ɬ	'Someone will scrape a hide to soften it it'
e.	4	ǰito:ɬ - cé:ɬ	'S/he will scrape a hide to soften it it'

Three input allomorphs for the first person singular subject marker are therefore suggested: /eš/ 'first person singular future'; /é/ 'first person singular, Si-

Conjugation perfective, \emptyset or † classifier', and /š/ 'elsewhere'. The nature of this morphologically controlled allomorphy with respect to subject marking is discussed in further detail in section 3.3 below.

3.1.3.1.1.2 First Person Object

All first person objects are marked by an [š] on the left edge of the prefix span. Object markers always occur as the leftmost prefix of the verb, as is illustrated below. Subject marking and object marking, then, can be discriminated from each other in two ways. First, subject markers may have different allomorphs depending upon the tense and conjugational properties of the verb. Object markers never vary according to the tense and conjugational properties of the verb. Second, subject markers always occur to the immediate left of the stem plus classifier complex (although the first person marker /š/ blocks the occurrence of the classifier).

Verbs with first person objects are given below. Note that all such verbs begin with [š]. The input shape of the subject markers in these forms has yet to be determined. If it is assumed that the first person object marker is isomorphic with the default form of the first person subject marker, /š/, the forms given in (36) below show that the object marker surfaces leftmost in the verb.

(36) Ø-Conjugation Imperfective: Stem = č'it 'scratch obj'

	Form	Gloss
a.	ší. - č'it (ší) č'it 1o/2s-'scratch'	'You scratch me'
b.	ši. - č'it (ši) č'it 1o/3s-'scratch'	'S/he scratches me'
c.	šiʔti. - č'it (šiʔti) č'it 1o/3is-'scratch'	'I'm being scratched' ⁸
d.	šiji. - č'it (šiji) č'it 1o/4s-'scratch'	'S/he (4th) scratches me'

Note that the first person object marker never closes the prestem syllable. This is in contrast with the default form of first person subject marking, in which /š/ always closes the prestem syllable: if the /š/ marks a subject, it closes the prestem syllable; if the /š/ marks an object, it never closes the prestem syllable. This could be accounted for in one of two ways. First, it could be posited that the first person object marker has a different input shape (i.e. /ši/) than does the first person subject marker (which is /š/). On this account, the complementary distribution of subject and

⁸Transitive verbs with overt object marking and third person indefinite subjects are passivized in Navajo. The nature of this passive marking is explored in section 3.1.3.2.1.1 below.

object marking with respect to syllabic affiliation of the [š] would be an accidental consequence of a lexical distinction between forms.

Second, it could be posited that object markers and subject markers have the same input shape, but are subject to different sorts of positional restrictions. This account would have the advantage of capturing directly the generalization that subject and object prefixes in Navajo are always similar in their segmental content (i.e., [š] occurs in both first person subject and object markers), but that their distribution on the surface differs in meaningful ways. Object markers always occur leftmost in the prefixal span, while subject markers occur further to the right. It is this second proposal that is taken up in chapters four and five, and the input shape of the first person object marker is therefore taken to be identical to the input shape of the first person subject marker. Both are simply /š/ in the input. The remainder of this subsection demonstrates that the distribution of first person object marking is identical in all other tenses, aspects, modes and conjugations.

First person object marking in the Si-Conjugation perfective is illustrated below. Note that the paradigm given here is for Si-Conjugation perfectives with \emptyset or 1 classifiers. No transitive paradigm is given for the Si-Conjugation perfectives with 1 classifiers because all 1-classifier Si-Conjugation perfectives are interpreted as passives (Young 1995), thus rendering straightforward object prefixation semantically anomalous.

(37) Si-Conjugation Perfective: Stem = t^hał 'kick object'

	Form	Gloss
a.	šisíní. - t ^h ał š s (ní) t ^h ał 1o-conj-(2s)-'kick'	'You kicked me'
b.	šiz. - t ^h ał š s t ^h ał 1o-conj-'kick'	'S/he kicked me'
c.	šiʔtis. - t ^h ał š (ʔti) s t ^h ał 1o-(3is)-conj-'kick'	'Someone kicked me'
d.	šjiz. - t ^h ał š (ji) s t ^h ał 1o-(4s)-conj-'kick'	'S/he (4th) kicked me'

The Optative paradigm is given below. Note that all forms contain a prefix-initial [š], and that the vowel [ó] immediately follows the object prefix in forms (a-b). This [ó] marks the optative mode.

(38)	Optative:	Stem = č'it 'scratch obj'
	Form	Gloss
a.	šó: - č'it	'You should scratch me'
	š ó (μ) č'it	
	1o-opt-(2s)-'scratch'	
b.	šó: - č'it	'S/he should scratch me'
	š ó č'it	
	1o-opt-'scratch'	
c.	šič'it. - č'it	'I should be scratched'
	š (?t) ó č'it	
	1o-(3is)-opt-	
	'scratch'	
d.	šič'it. - č'it	'S/he (4th) should scratch me'
	š (j) ó č'it	
	1o-(4s)-opt-'scratch'	

Finally, the future paradigm is given below. Again, all forms begin with [š], although the material to the right of the [š] varies.

(39) Future: Stem = č'it̚ 'scratch obj'	
Form	Gloss
a. šit̚i: - č'it̚	'You will scratch me'
š t̚t̚ (i) č'it̚	
1o-fut-(2s)-'scratch'	
b. šito: - č'it̚	'S/he will scratch me'
š t̚t̚ (o) č'it̚	
1o-fut-(3s)-'scratch'	
c. šit̚it̚ito: - č'it̚	'I will be scratched'
š (?ti) t̚t̚ (o) č'it̚	
1o-(3is)-fut-(3s)-	
'scratch'	
d. šit̚žto: - č'it̚	'S/he will scratch me'
š (ž) t̚t̚ (o) č'it̚	
1o-(4s)-fut-(3s)-'scratch'	

From these data it is concluded that the input form of the first person object marker is the same as the input form of the (default) first person subject marker, it is /š/. Its linear position is different than that of the subject marker, however. The subject marker occurs to the immediate left of the stem, but the object marker occurs on the left edge of the prefixal span.

3.1.3.1.1.3 Summary

The input shape of the first person marker is hypothesized to be /š/ on the basis of the data given here. The first person is marked by /é/ if it is the subject of a the Si-Conjugation perfective verb containing a Ø or † classifier, by /eš/ if it the

subject of a future tense verb, and by /š/ elsewhere (including both subject and object positions). The position of the subject marker is to the immediate left of the stem plus classifier complex (or to the immediate left of the stem if the subject marker is /š/, which blocks the appearance of a classifier). The position of the object marker is leftmost in the prefixal span. These facts are summarized in the chart below.

(40) Generalizations about the First Person Prefixes

Syntax	Input Forms	Linear Position	Alternations
Subject	/é/ or /eš/ or /š/	___(Cl.)Stem	šStem or šV or
Object	/š/	#___	ši

3.1.3.1.2 Second Person

In this section it is shown that the input form of the default second person singular marker is /n/, with subject and object marking differentiated only by the position of the prefix in the string. Subject marking occurs to the immediate left of the stem plus classifier complex, while object marking occurs on the left edge of the prefix span. Other allomorphs of the second person subject marker are shown to be /ʹ/ and /μ/, though all second person objects are marked by /n/. In section 3.1.3.1.2.1 second person subject marking is presented, with second person object marking described in 3.1.3.1.2.2. The conclusions about the second person marker are summarized in 3.1.3.1.2.3.

3.1.3.1.2.1 Second Person Subject

Forms with second person subjects are given in the chart below. Note that the Ø-Imperfective as well as the Si-Conjugation perfective forms contain a marker

[ni] immediately to the left of the stem plus classifier span. It appears, therefore, that [ni] marks second person subjects, except in the future and the optative paradigms⁹.

⁹Note that the [i] preceding the [ni] in the Si-Conjugation perfective forms can be accounted for by syllabification concerns: the Si-Conjugation marker could not be syllabified in that position without the presence of the vowel. Therefore the vowel is hypothesized to be epenthetic. The high tone of the syllable containing the Si-Conjugation marker may result from a general propensity for perfective verbs to have high-toned prefixal clusters. This propensity is not exceptionless, and the distribution of high tones in the perfective conjugations is fairly idiosyncratic. Regardless of the genesis of the high tone in these cases, the syllabification facts are clear. The [i] preceding [ni] is necessary for syllabification of these forms.

(41) Forms with Second Person Subjects		
Tense/Mode/ Conjugation	Form	Gloss
a. Ø- Imperfective	<u>ni</u> .-č ^h a (ni) č ^h a (2s) 'cry'	'You are crying'
b. Si-Perfective Ø-Classifier	<u>śní</u> . - tiz s (ní) tiz conj (2s) 'spin'	'You spun wool'
c. Si-Perfective ‡-Classifier	<u>śní</u> ‡ - ?á s (ní) ‡ ?á conj (2s) cl. 'handle s.r.o'	'You kept it'
d. Si-Perfective l-Classifier	<u>śní</u> l - ?jo:l s (ní) l?jo:l conj (2s) cl. 'lay there'	'You lay there'
e. Future	yíí: - cé:‡ (yi) t̩̩̩ (í) cé:‡ (obj) future (2s) 'scrape'	'You will scrape a hide to soften it it'
f. Optative	wó: - šé:h ó (μ) šé:h optative (2s) 'shave'	'You should shave'

The forms given above might lead to the hypothesis that the input form of the second person subject marker is /ni/ in the perfective and imperfective paradigms.

This is because it is never the case that the [n] of the second person subject marker surfaces as a coda. Nevertheless, it will be seen later in this section that there is reason to believe the input for the second person marker in these cases is /n/ and not /ni/.

In order to determine the input forms of the second person subject marker in the future and the optative, the full paradigms for these forms are given below. In (42), the future tense paradigm suggests that the second person subject is marked by [í]. Since this element has the default vowel quality [high], it is assumed that the second person marker need only be a high tone in this case.

(42) Future Tense Verb: Stem = cé:ɬ 'scrape a hide to soften it'

	Person	Form	Gloss
a.	1	te:š - cé:ɬ	'I will scrape a hide to soften it it'
b.	2	tí:ɬ - cé:ɬ tɪɪ (´) † cé:ɬ fut-(2)-cl-stem	'You will scrape a hide to soften it it'
c.	3	yito:ɬ - cé:ɬ	'S/he will scrape a hide to soften it it'
d.	3-I	ʔato:ɬ - cé:ɬ	'Someone will scrape a hide to soften it it'
e.	4	ǰito:ɬ - cé:ɬ	'S/he will scrate it'

In the optative mode, it appears that a second person subject is marked by a mora, which results in the lengthening of the optative mode marked /ó/.

(43) Optative Mode Verb with /4/ Classifier.

Stem = cé:h 'scrape a hide to soften it'

	Person	Form	Gloss
a.	1	wóš - cé:h	'I should scrape a hide to soften it it'
b.	2	wó: ¹ - cé:h ó (μ) cé:h opt-(2)-stem	'You should scrape a hide to soften it it'
c.	3	yół - cé:h	'S/he should scrape a hide to soften it it'
d.	3-I	?ół - cé:h	'Someone should scrape a hide to soften it it'
e.	4	ǰół - cé:h	'S/he will scrape a hide to soften it it'

In sum, a second person subject may thus be marked in one of three ways. In most cases, it appears to be marked by a [ni], which may be /ni/ or /n/ in the input. In the future tense, a second person subject is marked with a high tone, and in the optative mode it is marked by a mora. Regardless of the allomorph involved, the second person subject is always marked to the immediate left of the stem plus classifier complex. In the next section, second person object marking is explored. Here it is shown that the input form of the default second person marker is /n/ and not /ni/, and that second person object is marked on the left edge of the prefix span, in the same position as that in which first person object marking was observed in the previous section.

3.1.3.1.2.2 Second Person Object

The forms given below contain second person object markers. Note that all forms below begin with an [ni], though the material to the right of the [ni] is variable.

(44) Ø-Conjugation Imperfective: Stem = č'it 'scratch obj'

	Form	Gloss
a.	<u>niš</u> . - č'it	'I scratch you'
	(ni) š č'it	
	(2o)-1s-'scratch'	
b.	<u>ni</u> . - č'it	'S/he scratches you'
	(ni) č'it	
	(2o)-'scratch'	
c.	<u>niʔti</u> . - č'it	'You are being
	(ni) (ʔti) č'it	scratched'
	(2o)-(3is)-'scratch'	
d.	<u>niǰi</u> . - č'it	'S/he (4th) scratches me'
	(ni) (ǰi) č'it	
	(2o)-(4s)-'scratch'	

The Si-Conjugation forms given below similarly show that the second person object marker is always leftmost in the prefixal domain, but provide no evidence about whether the input shape of the marker is /ni/ or /n/.

(45) Si-Conjugation Perfective: Stem = t^haʃ 'kick object'

Form	Gloss
a. <u>n</u> iséʃ. - t ^h aʃ	'I kicked you'
(ni) s é ʃ t ^h aʃ	
(2o)-conj-1s-cl-	
'kick'	
b. <u>n</u> iz. - t ^h aʃ	'S/he kicked you'
(ni) s t ^h aʃ	
(2o)-conj-'kick'	
c. <u>n</u> iʔtiz. - t ^h aʃ	'You were kicked'
(ni) (ʔti) s t ^h aʃ	
(2o)-(3is) conj-	
'kick'	
d. <u>n</u> ǰiz. - t ^h aʃ	'S/he (4th) kicked you'
(ni) (ǰi) s t ^h aʃ	
(2o)-(4s) conj-'kick'	

The future tense paradigm given below shows the same pattern of second person object marking as has all of the other paradigms so far described.

(46) Future: Stem = č'íř 'scratch obj'

Form	Gloss
a. <u>n</u> iteš. - č'íř	'I will scratch you'
(ni) t̩t̩ es č'íř	
(2o)-fut-1s-'scratch'	
b. <u>n</u> ito:. - č'íř	'S/he will scratch you'
(ni) t̩t̩ (o) č'íř	
(2o)-fut-(3s)-'scratch'	
c. <u>n</u> iʔtito:. - č'íř	'You will be scratched'
(ni) (ʔti) t̩t̩ (o) č'íř	
(2o)-(3is)-fut-(3s)-	
'scratch'	
d. <u>n</u> ižto:. - č'íř	'S/he will scratch you'
(ni) (ž) t̩t̩ (o) č'íř	
(2o)-(4s) fut-(3s)-	
'scratch'	

The optative mode gives some evidence that the input form of the second person marker is /n/ and not /ni/. This is because the second person object marker surfaces as [n] before the vowel [ó].

(47)	Optative:	Stem = č'it 'scratch obj'
	Form	Gloss
a.	nóš. - č'it	'I should scratch you'
	n ó š č'it	
	2o-opt-1s-'scratch'	
b.	nó. - č'it	'S/he should scratch you'
	n ó č'it	
	2o-opt-'scratch'	
c.	niʔtó. - č'it	'You should be scratched'
	n (ʔt) ó č'it	
	2o-(3is)-opt-	
	'scratch'	
d.	nǫ́. - č'it	'S/he (4th) should scratch you'
	n (ǫ́) ó č'it	
	2o-(4s)-opt-'scratch'	

There is another reason to believe that the [i] of the second person marker is epenthetic, and that the forms above are not examples of vowel deletion. The epenthesis account captures the generalization that the [i] of the second person marker is like all of the other alternating [i]s in the Navajo prefix span. So far the first person marker and the Si-Conjugation marker have been seen to surface either with the vowel [i] or as a consonant. In both those cases, and in all of the other $i \sim \emptyset$ alternations to be presented in this section, the vowel [i] did not surface before another vowel. It has been argued in those cases that this fact follows from the epenthetic status of the vowel [i] in Navajo. If the same alternation occurring with

the second person prefix is accounted for via deletion, then the analysis is needlessly complicated. All that need be posited is a single fact: prefixal vowels which alternate between V and Ø are epenthetic in Navajo. The second person marker is, under this approach, like all of the other alternating prefixes in this language.

3.1.3.1.2.3 Summary

The evidence in this section suggests that the input form of the second person marker is as follows: /ʔ/ as subject of a future tense verb, /μ/ as subject of an optative verb, and /n/ elsewhere. The failure of the second person marker ever to surface as a coda will be seen in chapter five to result from a general ban on closed syllables in the prefix span in Navajo. These facts are summarized in (48) below.

(48) Generalizations about the Second Person Prefixes

Syntax	Input Forms	Linear Position	Alternations
Subject	/ʔ/ or /μ/ or /n/	___(Cl.)Stem	niC or nV
Object	/n/	#___	

3.1.3.1.3 Third Person

In this section it is argued that third person marking is generally phonologically null. There are two allomorphs of the third person marker, /i/ and /o/, and each of these allomorphs is extremely restricted in its distribution. Section 3.1.3.1.3.1. explores third person subject marking, 3.1.3.1.3.2 presents third person object marking, and 3.1.3.1.3.3. summarizes the conclusions to be drawn from these data.

3.1.3.1.3.1 Third Person Subject

Forms with third person subjects are given in the chart below. While the first three forms in the chart above appear to contain a subject marker [i] to the left of the stem plus classifier complex, such a marker would be either absent or out of position in the last three forms given here. Material not yet accounted for is given in parentheses. This material is accounted for in the description that follows. The conclusion will be that a third person subject is marked by the lack of an overt prefix in the default case.

(49) Forms with Third Person Subjects

Tense/Mode/ Conjugation	Form	Gloss
a. Ø- Imperfective	yí.-č ^h a (yi) č ^h a 3s 'cry'	'S/he is crying'
b. Si-Perfective Ø Classifier	yíz. - tiz (yi) s tiz (?) conj 'spin'	'S/he spun wool'
c. Si-Perfective ‡ Classifier	yís - ?á (yi)s ‡ ?á (?) conj cl. 'handle s.r.o'	'S/he kept it'
d. Si-Perfective l Classifier	yíš - ?jo:l (yi) s ?jo:l (?) conj 'lay there'	'S/he lay there'
e. Future	yíto: - cé:‡ (yi) t̩t̩ (o) cé:‡ (obj) future (3s) 'scrape a hide to soften it'	'S/he will scrape a hide to soften it it'
f. Optative	wó - č ^h a ó č ^h a optative 'cry'	'S/he should cry'

In order to better understand the nature of third person subject marking, each of these paradigms is presented in full in (50) below. The Ø-Conjugation imperfective paradigm is presented first. In this paradigm, the third person subject appears to be marked with [yi]. Comparing the third person form (50c) with the first person form (50a), however, suggests that the [yi] is not a third person subject marker. For both forms, elimination of the [yi] would result in a monosyllabic verb. Monosyllabic verbs are never attested in Navajo, however. All Navajo verbs surface as (at least) disyllabic (Hargus and Tuttle 1997, Kari 1973, McDonough 1990, Young and Morgan 1992, Young 1995)

(50) Ø-Conjugation Imperfective Verb

Stem: -č^ha 'cry'

	Person	Form	Gloss
a.	1	yiš - č ^h a (yi) š č ^h a (?) 1s 'cry'	'I cry'
b.	2	ni - č ^h a n č ^h a 2s-'cry'	'You cry'
c.	3	yi - č ^h a (yi) č ^h a (?)-'cry'	'S/he cries'
d.	3-I	?a - č ^h a (?a)-'cry' (3is)-'cry'	'There is crying'
e.	4	ǰi - č ^h a (ǰi) č ^h a (4s)-'cry'	'S/he cries'

Since the default vowel in Navajo is [i] (as is evident from its overwhelming frequency in the prefix span, as well as the fact that only [i] participates in V ~ Ø alternations), it is reasonable to conclude that the [yi] in the third person form (as well as the one in the first person form) is an epenthetic element inserted to fulfill minimality constraints on the verb (cf. Kari 1973, McDonough 1990, Young and Morgan 1987, 1992, Young 1995).

The optative paradigm given in (51) below confirms the hypothesis that third person subject marking can be phonologically null in Navajo. Note that the third person form of the optative verb contains only a prefixal /ó/, a classifier /ʃ/, and no additional material.

(51) Optative Mode Verb: Stem = cé:h 'scrape a hide to soften it'

	Person	Form	Gloss
a.	1	wóš - cé:h ó š cé:h opt-1s-'scrape'	'I should scrape a hide to soften it it'
b.	2	wóʃ - cé:h ó μ † cé:h opt-2s-cl-'scrape'	'You should scrape a hide to soften it it'
c.	3	yóʃ - cé:h (y) ó † cé:h (3o) opt-cl-'scrape'	'S/he should scrape a hide to soften it it'
d.	3-I	?óʃ - cé:h (?) ó † cé:h (3is)-opt-cl-'scrape'	'Someone should scrape a hide to soften it it'
e.	4	ǰóʃ - cé:h (ǰ) ó † cé:h (4s)-opt-cl-'scrape'	'S/he will scrape a hide to soften it it'

Thus far, the evidence suggests that a third person subject argument is not overtly marked on the Navajo verb. There are cases, however, where there does appear to be phonologically overt marking of a third person subject. These occur in

the Si-Conjugation perfective, and in the Future tense. Each of these cases is examined next.

The Si-Conjugation perfective is inconsistent with respect to third person subject marking. A transitive Si-Conjugation perfective verb is illustrated in (52) below. Transitive Si-Conjugation verbs follow the pattern that would be expected if third person subject marking were phonologically null. The Si-Conjugation marker occurs to the immediate left of the stem, and is preceded by the epenthetic [yi-] to fulfill the disyllabic minimum size requirement for Navajo verbs, as in (52c).

(52) Si-Conjugation Perfective Verb with /l/ Classifier.

Stem = -*ǰo:l* 'lay there'

	Person	Form	Gloss
a.	1	šiš - <i>ǰo:l</i> s š <i>ǰo:l</i> conj-1s-'lay there'	'I lay there'
b.	2	šíníl - <i>ǰo:l</i> s n l <i>ǰo:l</i> conj-2s-cl-'lay there'	'You lay there'
c.	3	<u>yiš</u> - <i>ǰo:l</i> s <i>ǰo:l</i> conj-'lay there'	'S/he lay there'
d.	3-I	ʔaš - <i>ǰo:l</i> (ʔa) s <i>ǰo:l</i> (3is)-conj-'lay there'	'Someone lay there'
e.	4	ǰiš - <i>ǰo:l</i> (ǰi) s <i>ǰo:l</i> (4s)-conj-'lay there'	'S/he lay there'

Third person marking in Si-Conjugation neuter perfective verbs varies, however. Neuter verbs in Navajo have a stative interpretation, and can typically take only an inanimate third person subject. A Si-Conjugation neuter perfective verb is given in (53a) below. Note that the third person subject form (53a) contains the prefixal cluster [si] rather than [yis]. The forms in (53b-c) show that the same stem can be used as a non-neuter Si-Conjugation verb, and that in the non-neuter form the

prefixal cluster surfaces as [yis]. The interpretation of the verb changes as well. In the neuter form, the verb refers to an long, slender flexible inanimate object existing in a place. In the active form, the verb refers (metaphorically) to an long, slender person.

(53) Si-Conjugation Perfective Verb: Neuter versus Non-Neuter

Stem: -lá 'handle a long, flexible object, as a ribbon'

	Person	Form	Gloss
a.	3-Neuter	si - lá	'A long flexible object
		s (?) lá	(as a ribbon) sits there'
		conj-?-'object sits'	
b.	3-Non-Neuter	yiz - lá	'S/he (a tall, thin person)
		(yi) s lá	sits there'
		(?)-conj-'object sits'	
c.	4	ǰiz. - lá	'S/he (4th, a tall, thin
		(ǰ) s lá	person) sits there'
		(4s)-conj-'object	
		sits'	

This asymmetry of third person marking in the Si-Conjugation perfectives poses a problem for positing a single input allomorph for the third person subject marker. This is because the prefixal cluster for third person Si-Conjugation neuter perfectives is [si], but the Si-Conjugation non-neuter perfectives are marked with prefixal [yis] in the third pattern. It is argued here that the pattern in (53) above is the result of an overt third person subject marker in the neuter verb whose input form is /y/, and which vocalizes in subject position.

The need for an input /y/ prefix to indicate a third person argument is motivated three ways. The first source of motivation for input /y/ is the pattern of subject marking in the Si-Conjugation perfectives given in (53) above. The second and third sources of motivation for input /y/ comes from the object marking facts discussed in 3.1.3.1.3.2 below. These include a pattern of third person marking in transitive verbs, and the interaction of input /y/ with plural cliticization. It is shown that the input /y/ third person marker induces diphthongization of the plural clitic /ta/, while epenthetic elements in the prefixal span never induce this diphthongization.

The future paradigm below suggests that there is an additional allomorph of the third person subject marker. The vowel of the prestem syllable in the third person form below is [o], as it is in the third person indefinite and fourth person forms.

(54) Future Tense Verb: Stem = cé:ɫ 'scrape a hide to soften it'

	Person	Form	Gloss
a.	1	te:š - cé:ɫ tμμ eš cé:ɫ fut-1s-'scrape'	'I will scrape a hide to soften it it'
b.	2	tí:ɫ - cé:ɫ tμμ ´ cé:ɫ fut-2s-'scrape'	'You will scrape a hide to soften it it'
c.	3	yito:ɫ - cé:ɫ (yi) tμμ o cé:ɫ (3o)-fut-3s-'scrape'	'S/he will scrape a hide to soften it it'
d.	3-I	?ato:ɫ - cé:ɫ (?a) tμμ o cé:ɫ (3is) fut-3s-'scrape'	'Someone will scrape a hide to soften it it'
e.	4	ǰito:ɫ - cé:ɫ (ǰi) tμμ o cé:ɫ (4s) fut-3s-'scrape'	'S/he will scrape a hide to soften it it'

In this paradigm it appears that a third person subject is marked with a prefixal /o/. Note that the third person indefinite and the fourth person forms also contain this prefixal [o]. This may be interpreted in a number of ways. It may be that the prefixal [o] is actually marking any non-first, non-second person subject. Or it may be that third person indefinite and fourth person verbs are construed as types of third person verbs, and therefore the third person indefinite and fourth person prefixes must attach to verbs already marked for third person subjects.

A review of the Si-Conjugation perfective forms in (52-53) above suggest that this second approach is wrong, however. This is because in the Si-Conjugation perfectives, third and fourth person verbs uniformly surface with no third person subject marking, even though third person subjects are overtly marked (with /y/, [i]) in the Ø-and † classifier paradigms. Therefore it is assumed that the [o] marker in the future tense actually marks a non-first, non-second person subject. In any case, it is clear that future tense verbs do have overt subject marking in the third person. If they did not, the expected prefixal cluster would be [ti:] rather than [to:].

The allomorphs of the third person subject marker are therefore taken to be /y/ for neuter verbs in the Si-Conjugation perfective, and /o/ for verbs in the future tense. Else, third person marking subject marking is taken to be phonologically null. In the next section, these hypotheses are confirmed in the analysis of verbs containing third person objects.

3.1.3.1.3.2 Third Person Object

In this section it is shown that two ways of marking a third person object argument must be allowed in Navajo. Third person objects are marked with a prefix whose input shape is /i/, or else third person object marking is phonologically null. This alternation (between null object marking and /i/ object marking) is controlled by the person of the subject of the verb. In verbs with first or second person subjects, third person objects cannot be overtly marked on the verb. In verbs with third person subjects, third person objects are obligatorily marked. This is illustrated below.

Form (56a) below shows that the prefix cluster for a transitive verb with a first person subject is identical to the prefix cluster for an intransitive verb with a first

person subject. This illustrates the fact that third person objects are not overtly marked on verbs with first person subjects. The form in (56b) shows that verbs with a second person subject have no overt object marking. The forms in (57c-d) shows that overt third person object marking is obligatory in transitive verbs with third person subjects. The third person object marker surfaces as [yi] or [y]¹⁰.

(57) Third Person Object Marking:

Form	Gloss
a. <i>te:š. - č'ił</i>	'I will scratch it'
<i>t eš č'ił</i>	cf. /tʰɛɛ eš č ^h ah/, <i>te:šč^hah</i> 'I
fut-1s-'scratch'	will cry'
b. <i>tí:. - č'ił</i>	'You'll scratch it'
<i>tʰɛɛ ´ č'ił</i>	cf. /tʰɛɛ ´ č ^h ah/ <i>tí:č^hah</i> 'You
fut-2s-'scratch'	will cry'
c. <i>yíto:. - č'ił</i>	'S/he will scratch him/her' cf.
<i>(yi) tʰɛɛ o č'it</i>	/tʰɛɛ o č ^h a/
3o-fut-3s-'scratch'	<i>to:č^hah</i> 'S/he will cry'
d. <i>yół. - cé:h</i>	'S/he should scrape a hide to
<i>(y) ó ł cé:h</i>	soften it' cf. /ó č ^h a/ <i>wóč^ha</i>
3o-opt-cl-'scrape'	'S/he should cry'

In order to account for this pattern of object marking, a phonologically overt object marker must be posited, though its surface distribution must be limited to

¹⁰There is an additional marker that sometimes occurs in verbs with third person objects: [bi]. The [bi] prefix occurs leftmost in the prefixal span, and marks "inverse voice" in the verb. The properties of this prefix, and the syntactic-semantic forces which condition its use are described in detail in Willie (1991). Its phonological properties are exactly parallel with the other object markers of Navajo, and it is not commented upon any further in this dissertation.

forms with third person subjects. Note that the verb in (56b) would be phonologically well-formed without the object marker [yi], so this marker cannot be thought of as an epenthetic element inserted for phonological reasons. It is therefore hypothesized that the input shape of this object marker is /y/, and it is the same prefix that marks third person neuter subjects in the Si-Conjugation perfective verbs discussed in (53) above.

This overt third person marker has three surface shapes. It surfaces as [y] when it occurs prevocally, as in the Optative verb $\underline{y}ó!c\acute{e}:h$ 'S/he should scrape a hide to soften it'. It surfaces as [yi] word-initially before a consonant, as in the future tense verb $\underline{y}i\acute{t}o:\check{c}'i\acute{t}$ 'S/he will scratch him/her'. Finally, it surfaces as [i] in Si-Conjugation perfective neuter verbs such as $sik^{h\acute{a}}$ 'it sits in an open container'. In this last context, the third person marker occurs between two consonants. These facts suggest at least three possible input forms for the third person marker: /y/, /i/ or /yi/.

If it is supposed that the input form of this marker is /y/, a number of facts follow directly. First, the fact that this prefix surfaces as a consonant in prevocalic position results from the observation that it can syllabify as an onset in that position. Second, the fact that this prefix surfaces as [yi] in word-initial but preconsonantal position mirrors exactly the behavior of the other person markers discussed in this chapter. Each is underlyingly consonantal, and each surfaces with vowel epenthesis when necessary for syllabification concerns. Third, the fact that the vowel that sometimes appears in the surface form of this prefix alternates with \emptyset argues for an analysis of that vowel as epenthetic rather than as part of the input.

Forms in which this third person marker surfaces as vocalic, as in the Si-Conjugation perfective neuter form *sik^há* 'it sits in an open container', are problematic for an account based on input /y/, however. If the third person marker is /y/, the expected output for such a form would be the ungrammatical **siyik^há*. The vocalization of this prefix in inter-consonantal position is a property not shared by any of the other prefixes of Navajo. The fact that this third person marker is the only prefix whose input form is that of a glide, however, suggests that it should be more amenable to vocalization than would any other prefix. Therefore, the assumption will be that the input shape of this third person marker is /y/, and its vocalization in interconsonantal position in Navajo will be seen to follow from the interaction of the constraint set motivated in chapters four and five.

Further support for the hypothesis of an input allomorph marking a third person argument is found by examining forms containing the distributive plural proclitic, /ta/ (cf. Willie 1990, Young 1995, Young and Morgan 1992). This element is illustrated by the intransitive forms in (57) below.

(57) The Plural Proclitic /ta/¹¹.

	Singular	Plural	Gloss
a.	to: - č ^h ah	ta+to: - č ^h ah	'S/he, They will cry'
	ṭμ̣ o č ^h ah	ta+ṭμ̣ o č ^h ah	
	fut-3s-'cry'	pl + fut-3s-cry	

Transitive verbs with third person subjects have obligatory object marking. When such forms are pluralized, as illustrated in (58) below, the object marker induces diphthongization of the plural clitic /ta/.

¹¹The requirement that verbs be minimally disyllabic can be fulfilled by the presence of either a proclitic or a prefix, but never by an enclitic.

(58) Forms with Third Person Object Markers and the Plural Clitic.

	Form	Gloss
a.	yito: - č'ił	's/he will scratch it'
	y tμμ o č'ił	
	3o-fut-3s-'scratch'	
b.	te+ito: - č'ił	'they will scratch it'
	ta y tμμ o č'ił	
	pl+3o-fut-3s-'scratch'	

This same pattern can be seen in transitive versus intransitive third person verbs in the Ø-Conjugation imperfective. The relevant contrast is given in (59) below. The form in (59a) is intransitive, and the plural clitic does not surface as a diphthong¹². The form in (59b) is transitive, and the plural clitic does surface as a diphthong. This distinction is explained if it is assumed that overt third person object marking is obligatory in Navajo verbs with third person subjects.

(59) The Plural Proclitic /ta/ and Prestem /i/.

	Singular	Plural	Gloss
a.	yi - č ^h a	ta: - č ^h a	'S/he, They cry'
	č ^h a	ta + č ^h a	
	'cry'	pl + cry	

¹²Note that the vowel of the clitic lengthens in (59a). This is a common property of most (but not all) clitics of this prosodic shape when they occur before a bare stem: the vowel of the clitic lengthens in this environment.

b. yi - č'it	tei - č'it	'S/he scratches them'
y č'it	ta + y č'it	
3o-'cry'	pl + 3o-	
	'scratch'	

It is important to note is that the [yi] object marker cannot be construed as an epenthetic element in the forms above, for two reasons. First, the third person verb on which it appears in (58a) would satisfy minimality without epenthesis, and would be syllabically well-formed. Second, the distinction between the forms in (59) cannot be captured unless the [i] in the prestem syllable of these verbs is seen as part of the input in (59b) but epenthetic in (59a). Therefore an prefix whose input shape is /i/, and which denotes a third person argument, must be posited.

If an input /y/ prefix must be posited for the object marking facts, then it is to be expected that this input /y/ prefix should also be available as a subject marker. The set of object markers in Navajo is generally a subset of the set of subject markers¹³. Therefore the analysis of the Si-Conjugation neuter perfectives exemplified in (53) above as having an input /y/ subject marker not only accounts for the pattern of subject marking in these verbs, but salvages an important generalization about person marking in Navajo. An affix which can mark objects can also mark subjects.

3.1.3.1.3.3 Summary

The evidence given in this subsection leads to the conclusion that there are two overt allomorphs of the third person marker in Navajo. There is an allomorph

¹³With the exception of the fourth person, which is explored next.

/o/ which occurs as a subject marker in future tense verbs, and an allomorph /i/ which occurs as a subject marker in Ø and † classifier Si-Conjugation perfective verbs, and as an object marker for verbs with third person subjects. In all other cases, third person marking is phonologically null. This is reviewed in the chart below.

(60) Generalizations about the Third Person Prefixes

Syntax	Input Forms	Linear Position	Alternations
Subject	/y/ or /o/ (or Ø)	___(Cl.)Stem	yV or yiC or
Object	/y/ (or Ø)	#___	CiC

Note that all of the person markers described so far share the same linear distribution: when they are subject markers, they occur to the immediate left of the stem plus classifier complex (though the first person subject marker /š/ occurs to the immediate left of the stem, blocking the classifier). When they are object markers, they occur as the leftmost prefix in the word. The next two person prefixes to be presented, the third person indefinite and the fourth person, occupy a different subject marking position. Since this constitutes a departure from the pattern seen thus far, a summary of all of the person prefixes discussed to this point is presented below.

(61) Generalizations about the Definite Person Prefixes of Navajo

Marker	Input Forms	Linear Position	Alternations
1st Subject	/é/ or /eš/ or /š/	___(Cl.)Stem	šStem or šV
1st Object	/š/	#___	or šiC
2nd Subject	/˘/ or /μ/ or /n/	___(Cl.)Stem	nV or niC
2nd Object	/n/	#___	
3rd Subject	/y/ or /o/ (or Ø)	___(Cl.)Stem	yV or yiC or
3rd Object	/y/ (or Ø)	#___	CiC

3.1.3.2 The Obviative Person Prefixes

The prefixes in this section mark the obviative categories 'third person indefinite' and 'fourth person'. It is shown that they occupy a different subject position than the definite person markers, but that when they mark objects they occur in the same position as the definite person object prefixes. The third person indefinite marker is taken up in section 3.1.3.2.1, and the fourth person marker in 3.1.3.2.2. The findings are summarized in 3.1.3.2.3.

3.1.3.2.1 Third Person Indefinite

The third person indefinite marker can be translated as "someone" or "something". In this section, the distribution of the third person indefinite subject and object markers is described. It is argued that the input form of the third person indefinite marker is /ʔ/, and it is demonstrated that this marker surfaces as [ʔa] when it occurs before a consonant in the prestem syllable, but as [ʔ] otherwise.

3.1.3.2.1.1 Third Person Indefinite Subject

The table below shows forms with third person indefinite subjects. Note that all forms contain the segment [ʔ]. In the imperfective and perfective forms, the prefix surfaces as [ʔa], but in the future and optative the prefix surfaces as [ʔ]. There are also intervening prefixes, other than the classifiers, between this subject marker and the stem syllable in forms (62b-g). In none of the cases presented in section 3.1.3.1 could a prefix other than a classifier intervene between a subject marker and a stem. The third person indefinite marker surfaces as [ʔa] when it occurs before a consonant in the prestem syllable (as in the forms 62b-d) or when it occurs as the leftmost prefix (as in 62e). It surfaces as [ʔ] when it occurs before a vowel (as in 62f), or when it can close a pre-prefixal syllable (as in the future tense). This last environment occurs only in transitive verbs with overt object marking, because the object prefix is the only prefix which can occur to the left of the third person indefinite subject marker. In any form without overt object marking, the third person indefinite prefix will occur in word-initial position, and will therefore not surface as a coda.

(62) Forms with Third Person Indefinite Subjects

	Tense/Mode/ Conjugation	Form	Gloss
a.	Ø- Imperfective	<u>ʔa</u> .-č ^h a (ʔa) č ^h a (3is) 'cry'	'There is crying'
b.	Si-Perfective Ø-Classifier	<u>ʔaz</u> . - tiz (ʔa) s tiz (3is) conj 'spin'	'Someone spun wool'
c.	Si-Perfective ʔ-Classifier	<u>ʔas</u> - ʔá (ʔa) s ʔá (3is) conj 'handle s.r.o'	'Someone kept it'
d.	Si-Perfective l-Classifier	<u>ʔaš</u> - ʔo:l (ʔa) s ʔo:l (3is) conj 'lay there'	'Someone or something lay there'
e.	Optative	<u>ʔó</u> - č ^h a (ʔ) ó č ^h a (3is) optative 'shave'	'There should be crying'
f.	Future	<u>ʔato:l</u> . - žiš (ʔa) tʉm o l žiš (3is) fut. 3s cl 'dance'	'There will be dancing'

The third person indefinite marker is therefore hypothesized to be [ʔa] or [ʔ].

In keeping with the analysis given in section 3.1.2.1 of the definite person markers,

it is argued in the next section that the input shape of the third person indefinite prefix is /ʔ/, and the vowel that sometimes occurs to the right of this prefix is epenthetic.

3.1.3.2.1.2 Third Person Indefinite Object

Forms containing third person indefinite object prefixes are given below. Note that this prefix surfaces as [ʔa] unless it precedes a vowel, in which case it surfaces as [ʔ]. Note also that this prefix is always leftmost in the word.

(63) Forms with Third Person Indefinite Objects

Tense/Mode/ Conjugation	Form	Gloss
a. Ø- Imperfective	<u>ʔa</u> š.-č'it (ʔa) š č'it (3-I) 1s 'scratch'	'I am scratching'
b. Si-Perfective	<u>ʔa</u> sé. - tiz (ʔa) s é tiz (3-I) conj 1s 'spin'	'I wool- spun' (Ø classifier)
c. Si-Perfective	<u>ʔa</u> sé† - ʔá (ʔa) s é † ʔá (3-I) conj 1s cl 'handle it'	'I safe-kept' († classifier)
d. Future (Transitive)	<u>ʔa</u> te:š - č'i† (ʔa) tɯɯ eš č'i† (3-I) future 1s 'scratch'	'I will scratch'
e. Optative	<u>ʔo</u> š - č'it (ʔ) ó š č'it (3-I) optative 1s 'scratch'	'I should scratch'

The distribution of the third person indefinite object marker suggests that its input form is /ʔ/ and not /ʔa/. The vowel [a] appears if the syllable containing the third person indefinite prefix would otherwise be ill-formed. Although the epenthetic vowel of Navajo is typically [i], it is plausible that the [a] in this environment is also

epenthetic. This is because the laryngeal features of the glottal element could easily induce lowering of the epenthetic vowel that follows it (cf. McCarthy 1991). The distribution of this vowel suggests that it is epenthetic, and not part of the input shape of the third person indefinite prefix.

This accounts also for the surface form of the future tense transitive verbs such as *šitito:č'it* 'I will be scratched'. In transitive verbs with overt object marking, indefinite subjects only occur in the passive voice. That is, indefinite subject marking must cooccur with the passive prefix [ti] in any verb with an overt object marker. A complete analysis of passivization in Navajo would take us far afield, and is therefore avoided here. What is important to note is that in forms like *šitito:č'it* 'I will be scratched', the indefinite marker surfaces as [ʔ] and it immediately precedes a prefix. In doing so, it forms the coda of a pre-prefixal syllable. The third person indefinite marker never surfaces as a coda of the prestem syllable, however (e.g. *ʔač^ha* 'there is crying', never **yiʔč^ha*). Note that if the third indefinite prefix were underlyingly /ʔa/, there would be no reason to delete the vowel, since **šiatito:č'it* is perfectly well-formed from a phonological point of view. This ungrammatical form contains fewer closed syllables than does the grammatical one, moreover, and therefore ought to be preferred on phonological grounds. Therefore, a deletion account of the behavior of the third person indefinite form would have to stipulate deletion of the vowel in non-word-initial position, before a prefix. An epenthesis account positing pressure for the third person indefinite prefix to occur left-adjacent to another prefix, on the other hand, handles these facts without additional stipulation, as is seen in chapter five of this dissertation.

3.1.3.2.1.3 Summary

The findings concerning the third person indefinite marker are summarized below. This prefix surfaces as [ʔa] or [ʔ]. It surfaces as [ʔ] when it occurs before a vocalic prefix, or when it can form the coda of a non-prestem syllable. Otherwise, (when it is word-initial, or before a consonantal prefix in the prestem syllable) it surfaces as [ʔa].

(64) Generalizations about the Third Person Indefinite Prefix

Marker	Input Forms	Linear Position	Alternations
3-I Subject	/ʔ/	(Object)___	ʔ.Prefix or
3-I Object	/ʔ/	#___	#ʔa

The final person prefix to be discussed is the fourth person marker. This is taken up in the next section.

3.1.3.2.2 Fourth Person

The fourth person is used to mark an obligatorily animate, usually human, argument of the verb. Its use as a subject marker is taken up in section 3.1.3.2.2.1, and as an object marker in 3.1.3.2.2.2. The findings of this section are summarized in 3.1.3.2.2.3.

3.1.3.2.2.1 Fourth Person Subject

Forms containing a fourth person subject marker are given in the chart below. Note that the fourth person is marked by a prefix of shape [ʃi], [ʃ] or [ʒ] in all cases.

(65) Forms with Fourth Person Subjects

	Tense/Mode/ Conjugation	Form	Gloss
a.	Ø- Imperfective	ǰ̃.-č ^h a (ǰi) č ^h a (4s) 'cry'	'S/he is crying'
b.	Si-Perfective Ø-Classifier	ǰ̃z. - tiz (ǰi) s tiz (4s) conj 'spin'	'S/he spun wool'
c.	Si-Perfective ǰ-Classifier	ǰ̃s - ʔá (ǰi) s ʔá (4s) conj 'handle s.r.o.'	'S/he kept it'
d.	Si-Perfective l-Classifier	ǰ̃š - ʔo:l (ǰi) s ʔo:l (4s) conj 'lay there'	'S/he lay there'
e.	Future (Intransitive)	ǰ̃to:. - č ^h ah (ǰi) t̃m̃ o č ^h ah (4s) future 3s 'cry'	'S/he will be crying'
f.	Future (Transitive)	š̃žto: - č'it̃ š̃ (ǰ) t̃m̃ o č'it̃ 1o(4s) future 3s 'scratch'	'S/he will scratch me'

g. Optative	ǰó - žé:h	'S/he should
	(ǰ) ó žé:h	shave'
	(4s) optative 'shave'	

The fourth person marker surfaces as [ǰi] when it is leftmost in the verb and occurs before a consonant (as in the Ø Imperfective, and the Ø- and l-classifier forms of the Si-Perfective). It surfaces as [ǰ] when it occurs before a vocalic prefix (as in the optative). When it occurs after an overt object marker, and can therefore form the coda of a pre-prefixal syllable, it surfaces as a coda. When it surfaces as a coda, the fourth person marker surfaces as [ž].

Affricates never occur in coda position in Navajo, while fricatives such as [ž] occur in either onset or coda position. This suggests that the input form of this prefix is /ǰ/ and that it deaffricates when it occurs in coda position (since there would be no natural account of the alternation of /ž/ - [ǰ] in onset position). The linear position of the fourth person subject marker appears to be leftmost in the verb, unless there is an overt object marker. If there is an overt object marker, it occurs to the left of the fourth person subject marker (as in the transitive future tense and Si-Perfective forms above).

Note that the distribution of the fourth person subject marker is identical to that of the third person indefinite subject marker. Both occur on the left edge of the word, and can only be preceded by an object marker. Both occur as C before a vocalic prefix, or when they can form the coda of a pre-prefixal syllable. Both occur as CV when they occur before a consonant in the prestem syllable. With these facts in mind, the next section presents forms with fourth person object prefixes.

3.1.3.2.2.2 Fourth Person Object

Forms with fourth person objects are given in the chart below. The object marker is always leftmost in the verb. It surfaces as [ho] or [ha] if it occurs before a consonant, or as [h] before a vocalic prefix. It never surfaces as a coda, because no prefix can occur to its left.

(66) Forms with Fourth Person Objects

Tense/Mode/ Conjugation	Form	Gloss
a. Ø- Imperfective	<u>háš</u> .-č'it (ha) š č'it (4o) 1s 'scratch'	'I am scratching him/her'
b. Si-Perfective	<u>hosé</u> . - k'á:z (ho) s é k'á:z (4o) conj 1s 'massage'	'I straightened/ massaged him/her'
c. Future	<u>hote:š</u> - č'ił (ho) ṭ̣̣ eš č'ił (4o) future 1s 'scratch'	'I will scratch him/her'

These facts are taken as evidence that the input form of the fourth person marker is /ho/ or /ha/¹⁴. The vowel quality with which this prefix will surface is difficult to predict, and is left as a project for future research.

3.1.3.2.2.3 Summary

¹⁴There are a number of prefixes that vary between [ho] and [ha] in Navajo, including the fourth person object, the spatial subject marker and at least one adverbial element. The vowel quality alternations in each of these prefixes are complex, and the environments in which these alternations occur may differ for each of the different markers (cf. Young and Morgan 1987, Willie p.c.)

The facts presented here are summarized in the chart below. The fourth person subject marker has the input form /ǰ/. It surfaces as [ǰi] when it is initial in the word, or when it precedes a consonant in the prestem syllable. It surfaces as a coda, [ǰ], when it can close a pre-prefixal syllable. It surfaces as [j] when it precedes a vowel. The fourth person object marker has input form /ho/ or /ha/, and never surfaces as a syllable coda.

(67) Generalizations about the Third Person Indefinite Prefix

Marker	Input Forms	Linear Position	Alternations
4th Subject	/ǰ/	(Object)___	ǰ.Prefix or #ǰi
4th Object	/ho/ or /ha/	#___	haC, or hoC

3.1.3.3 Summary of the Person Prefixes

The person prefixes motivated here share a number of common properties. All of the prefixes which alternate between C and CV surface as C before a vowel, and as CV in at least some preconsonantal positions. The first person prefix surfaces as C before a vowel, or before the stem syllable. The third indefinite and fourth person prefixes surface as C before a vowel, or when they can close a pre-prefixal syllable. All vowel-Ø alternations presented here are analyzed in terms of epenthesis rather than deletion, and all instances of closed syllables in the prefix span occur in specific morphological environments. Closed syllables may occur to create perfect alignment between a prefix and the verb stem, or to create perfect alignment between a prefix and another prefix. These facts are illustrated below.

(68) Generalizations about the Person Prefixes of Navajo

Marker	Input Forms	Linear Position	Alternations
1st Subject	/é/ or /eš/ or /š/	___(Cl.)Stem	šStem or šV
1st Object	/š/	#___	or šiC
2nd Subject	/´/ or /µ/ or /n/	___(Cl.)Stem	nV
2nd Object	/n/	#___	or niC
3rd Subject	/y/ or /o/ (or Ø)	___(Cl.)Stem	yV or yiC or
3rd Object	/y/ (or Ø)	#___	CiC
3-I Subject	/ʀ/	(Object)___	ʀ.Prefix or
3-I Object	/ʀ/	#___	#ʀa
4th Subject	/ǰ/	(Object)___	ǰ.Prefix or #ǰi
4th Object	/ha/ or /ho/	#___	

All of the person prefixes occur in word-initial position when they mark an object. The definite person prefixes (first, second and third person) occur to the immediate left of the stem plus classifier complex when they mark the subject. The obviative person prefixes (third indefinite and fourth person) occur on the left edge of the word when they mark the subject of an intransitive verb. In transitive verbs, object markers occur to the left of the obviative subject markers.

In the next section, the linear order of all of the prefixes discussed in this chapter is established. The tense, mode and conjugation markers are revisited, and the variability in the position of the Si-conjugation marker is accounted for.

3.2 A COMPLETE VIEW OF THE LINEAR ORDERING OF THE PREFIXES

The linear ordering of prefixes which has been established so far is given below. Object prefixes are leftmost in the word. Obviative subject prefixes occur to the right of the object prefixes, otherwise leftmost in the word. Classifiers always occur to the immediate left of the stem, which is always word-final. Definite subject markers always occur to the immediate left of the classifier, if one surfaces, else to the immediate left of the stem.

(69) Linear Order of Prefixes Established so far.

Obj. + Obv. Subj. + ? + Def. Subj. + Class. + Stem

The position of the tense, mode and conjugation markers in this complex has not yet been fully established. In order to determine the position of these prefixes, the forms containing them are reviewed below. It will be demonstrated that all of them occur in the position marked by the ? in the schema above.

The future prefix is templatic, and always occurs in the prestem syllable. The forms below show that the definite subject markers occur within the prestem syllable, but that the obviative subject markers occur outside of it. This suggests that the future tense marker occurs between the obviative subject and the definite subject.

(70) Future Tense Verb with /ʎ/ Classifier.

Stem = cé:ʎ 'scrape a hide to soften it'

	Person	Form	Gloss
a.	1	te:š - cé:ʎ ʎʎ eš cé:ʎ Fut-1-'scrape'	'I will scrape a hide to soften it'
b.	2	tí:ʎ - cé:ʎ ʎʎ ´ ʎ cé:ʎ Fut-2-cl-'scrape'	'You will scrape a hide to soften it'
c.	3	yito:ʎ - cé:ʎ i ʎʎ o ʎ cé:ʎ obj-Fut-3-cl-'scrape'	'S/he will scrape a hide to soften it'
d.	3-I	?ato:ʎ - cé:ʎ ? ʎʎ o ʎ cé:ʎ 3-I-Fut-3-cl-'scrape'	'Someone will scrape a hide to soften it'
e.	4	ǰito:ʎ - cé:ʎ ǰ ʎʎ o ʎ cé:ʎ 4-Fut-3-cl-'scrape'	'S/he will scrape a hide to soften it it'

The forms given below are in the optative mode. They illustrate the fact that the optative mode marker also occurs in the linear position marked by the "?" in the schema above. The optative prefix /ó/ occurs to the left of the definite subject markers, but to the right of the obviative subject markers.

(71) Optative Mode Verb (Transitive, /ʃ/ Classifier).

Stem = cé:h 'scrape a hide to soften it'

	Person	Form	Gloss
a.	1	wóš - cé:h ú š cé:h Opt-1-'scrape'	'I should scrape a hide to soften it'
b.	2	wóʃ - cé:h ú μ † cé:h Opt-2-cl-'scrape'	'You should scrape a hide to soften it'
c.	3	yóʃ - cé:h y ú † cé:h 3o-Opt-cl-'scrape'	'S/he should scrape a hide to soften it'
d.	3-I	?óʃ - cé:h ? ú † cé:h 3-I-Opt-cl-'scrape'	'Someone should scrape a hide to soften it'
e.	4	ǰóʃ - cé:h ǰ ú † cé:h 4-Opt-cl-'scrape'	'S/he should scrape a hide to soften it it'

The forms below show that the Si-Conjugation marker also occurs to the left of the definite subject markers, and to the right of the obviative subject markers. The variability in the position of the Si-Conjugation marker is a result of the variability in the subject marking that occurs in this class of the vocabulary. The imperfective forms are taken up first. Since the Si-Conjugation marker only occurs in the first and second person forms of imperfective verbs, only these forms are given here. They

show that the Si-Conjugation marker occurs to the left of the first and second person subject markers.

(72) Si-Conjugation Imperfective Verb (Transitive, /4/ Classifier).

Stem = (tah 'up') -t^he:h 'set object up at rest'

	Person	Form	Gloss
a.	1	tah šiš.-t ^h e:h	'I am setting
		tah ʒ š t ^h e:h	it up at rest'
		'up' Conj-1-'set'	
b.	2	tah síł - t ^h e:h	'You are
		tah ʒ ´ ł t ^h e:h	setting it up
		'up' Conj-2-cl-'set'	at rest'

The forms in (73) below show that the conjugation marker occurs to the left of the definite subject markers (73a-c), but to the right of the obviative subject markers (73d-e), in Si-Conjugation perfective verbs as well.

(73) Si-Conjugation Perfective Verb (Transitive, Ø-Classifier).

Stem: -tiz 'spin wool'

	Person	Form	Gloss
a.	1	sé - tiz	'I spun
		ɣ é tiz	wool'
		Conj-1s - 'spin'	
b.	2	síní - tiz	'You spun
		ɣ n tiz	wool'
		Conj- 2s -'spin'	
c.	3	yiz - tiz	'S/he spun
		y ɣ tiz	wool'
		3o Conj- 3s -'spin'	
d.	3-I	?az.-tiz	'Someone
		? ɣ tiz	spun wool'
		3is -Conj- 'spin'	
e.	4	ǰiz.-tiz	'S/he spun
		ǰ ɣ tiz	wool'
		4s -Conj- 'spin'	

The next paradigm shows the same pattern for Si-Conjugation perfectives with I-classifiers. Note here that the Si-Conjugation marker always surfaces as the coda of the prestem syllable in the absence of a definite subject marker. If a definite subject marker intervenes between the conjugation marker and the stem, the conjugation marker always surfaces as an onset. If no definite subject marker

intervenes, the conjugation marker always surfaces as a coda. In doing so, it blocks the appearance of the classifier prefix.

(74) Si-Conjugation Perfective Verb (Intransitive, /l/ Classifier).

Stem = *ǰo:l* 'lay there'

	Person	Form	Gloss
a.	1	šiš - <i>ǰo:l</i> <u>š</u> š <i>ǰo:l</i> Conj-1-'lay there'	'I lay there'
b.	2	šiníl - <i>ǰo:l</i> <u>n</u> l <i>ǰo:l</i> Conj-2-cl-'lay there'	'You lay there'
c.	3	yiš - <i>ǰo:l</i> <u>ǰ</u> <i>ǰo:l</i> Conj-'lay there'	'S/he lays there'
d.	3-I	ʔaš - <i>ǰo:l</i> ʔ <u>ǰ</u> <i>ǰo:l</i> 3-I- Conj- 'lay there'	'Someone or something lays there'
e.	4	ǰiš - <i>ǰo:l</i> ǰ <u>ǰ</u> <i>ǰo:l</i> 4-Conj-'lay there'	'S/he lays there'

These facts lead to the complete linear ordering of the prefixes described in this chapter as follows.

(75) Linear Order of Prefixes

Obj. + Obv. Subj. + Tense/Mode/Conj + Def. Subj. + Class. + Stem

Note that the tense, mode and conjugation prefixes share a linear position in the prefix span of Navajo. This fact coincides with a semantic restriction such that no two of these categories can typically be marked in the same verb. The ordering of these prefixes is accounted for in the next chapter, as are the alternations in the prefixal span which result in closed prefixal syllables in Navajo.

The results of this section have been the identification of a set of input shapes for the prefixes which are accounted for in this dissertation. Many of the prefixes have been described as having more than one input allomorph. In the next section, this fact is articulated in detail, and it is shown that the phenomenon I am characterizing as "input allomorphy" is empirically distinguishable from the phonologically-driven allomorphy which is the subject of the next two chapters.

3.3 A NOTE ABOUT ALLOMORPHY

The prefix sets derived in the previous section are repeated here for convenience. Note that many of the prefixes have been assigned more than one input shape. The classifiers are reviewed first. Two different input shapes for the classifiers are posited: the voiced lateral and the voiceless lateral.

(76) Generalizations about the Classifier Prefixes

Semantics	Input Forms	Linear Position	Alternations
Transitivity	/l/ or /ʎ/	___Stem	*š/s ____

Comparison of forms such as *níł.tí* 'I brought it' and *yíl.tí* 'it was brought' show that the voicing characteristics of the lateral classifiers are not phonologically predictable (the voiced and voiceless classifiers can each occur in identical phonological environments), and that the voicing of the classifier may have semantic content (in this case "active" or "passive" voice). This is not, therefore, a case of

phonologically-driven allomorphy: it is simply the case that /l/ and /ʎ/ are different prefixes, each of which occurs in a single position in the verb.

The allomorphy that occurs in the subject prefixes is more difficult to characterize. The person markers include elements which have been argued to have more than one input representation, but not more than one meaning. The person markers which have more than one input allomorph are reviewed in (77) below. Note that it is only the definite subject marking patterns which are at issue here.

(77) Input Allomorphy in the Person Prefixes of Navajo

Marker	Input Forms	Linear Position	Alternations
1st Subject	/é/ if Si-Conjugation Perfective, Ø- or -ʎ-Classifier; or /eš/ if Future Tense; or /š/ elsewhere.	___(Cl.)Stem	šStem or šV
2nd Subject	/˘/ if Future tense; or /μ/ if Optative mode, or /n/ elsewhere.	___(Cl.)Stem	nV
3rd Subject	/y/ if Si-Conjugation Perfective Neuter, or /o/ if Future tense, or Ø elsewhere.	___(Cl.)Stem	yV or yiC or CiC

There are two reasons for positing that the different shapes of these person prefixes listed above are not phonologically - driven. The first reason is that there is no clear phonological similarity, a priori, between the forms. This is particularly obvious for the second person marker. There is no obvious rationale for an /n/ to alternate with either a high tone or a mora on the basis of traditionally recognized phonological processes like assimilation, dissimilation, insertion or deletion.

The second reason for positing that these are different input allomorphs is that there is no sense in which a phonological environment can be identified in which one or the other of the allomorphs predictably surfaces. The only way in which to predict which allomorph surfaces is by knowing the tense, aspectual and conjugational properties of the verb as a whole. Within a particular paradigm, there is no allomorphy of this sort: the subject marker to be utilized is absolutely predictable on the basis of the tense, mode, conjugation and transitivity properties of the verb, but not on the basis of anything else. An example of this is given below.

The Si-Conjugation paradigms discussed here show two different first person subject markers. In Si-Conjugation imperfective verbs, such as *tah šiš^he:h* 'I am setting it up at rest', a first person subject is always marked by /š/. The phonological environment in which the first person marker /š/ occurs is as follows: /s __ t^h/. In Si-Conjugation perfective verbs such as *tah sé^ht^hi* 'I set it up', a first person subject is marked by /é/, but the phonological environment is exactly the same: /s __ t^h/. There are no phonological properties of stems or of other prefixes that result in different patterns of subject marking. Si-Conjugation Perfective verbs taking Ø or † classifiers always take a first person prefix /é/, and Si-Conjugation Imperfective verbs always take a first person prefix /š/, regardless of the shape of the stem, or of

the other prefixes in the representation. The shape of the subject marker is controlled by the conjugation pattern demanded by Si-Conjugation verbs.

The same argument can be made for all of the input allomorphs proposed above. The selection of input forms is controlled by the tense, mode and aspectual properties of the verb, and is unpredictable on phonological grounds. I therefore assume that the selection of input form of these affixes is controlled by the syntax-semantic component of the grammar, and not by the phonological component. It can be accounted for by allowing the selection of inputs to be driven by the lexical-semantic features of a particular verb, but it cannot be accounted for in the phonology.

The type of allomorphy discussed in this section stands in stark contrast with that described in previous sections of this chapter, and accounted for in chapters four and five. Allomorphy involving V/Ø and C/Ø alternations is driven by the competing requirements governing morphological alignment and phonological well-formedness of verbs. This phonologically-driven allomorphy is the subject of the next two chapters. With this distinction in mind, section 3.4. summarizes the findings of this chapter.

3.4 CONCLUSION

The prefixes described in this chapter are reviewed below. There are two classifier prefixes accounted for here, the voiced and the voiceless lateral classifier. Each occurs to the immediate left of the stem, as the coda of the prestem syllable, and each is blocked by any [s] or [š] in the coda of the prestem syllable.

(78) Generalizations about the Classifier Prefixes

Semantics	Input Forms	Linear Position	Alternations
Transitivity	/l/ or /ʌ/	___Stem	*š/s ___

Three tense, mode and conjugational prefixes have been described. Each occurs to the left of the definite subject marker, and to the right of the obviative subject marker. The optative mode marker is vocalic, and surfaces with an epenthetic onset when it is word-initial. The Si-Conjugation marker surfaces as an onset unless it can close the prestem syllable. If no definite subject prefix occurs in a Si-Conjugation form, the /s/ marker closes the prestem syllable, and blocks the occurrence of any classifier prefix.

(79) Generalizations about the Future Tense, Optative Mode and Si-Conjugation Prefixes:

Semantics	Input Form	Linear Position	Alternations
Future Tense		___Def.Subj	None
Optative Mode	ó	___Def.Subj	#wó or ó
Conjugation	s	___Def.Subj	s-Stem or sV

Finally, the person prefixes of Navajo occur as subjects or as objects. Object prefixes occur on the left edge of the verb and definite subject prefixes (those above the double line in the chart below) occur to the immediate left of the stem plus classifier complex. When the first person is marked by an [š], it closes the prestem syllable and blocks the appearance of the classifier. The obviative subject markers occur on the left edge of the verb, unless the verb contains an overt object marker. In verbs with obviative subjects and overt object marking, the object marker occurs to

the immediate left of the obviative subject marker. The obviative prefixes surface as syllable onsets unless they can close a syllable outside of the prestem syllable. This only occurs in forms with overt object marking. In all other cases, the obviative subject markers surface as syllable onsets. These facts are summarized in the table below.

(80) Generalizations about the Person Prefixes of Navajo

Marker	Input Forms	Linear Position	Alternations
1st Subject	/é/ or /eš/ or /š/	___(Cl.)Stem	šStem or šV
1st Object	/š/	#___	or šiC
2nd Subject	/´/ or /μ/ or /n/	___(Cl.)Stem	nV
2nd Object	/n/	#___	or niC
3rd Subject	/y/ or /o/ (or Ø)	___(Cl.)Stem	yV or yiC or
3rd Object	/y/ (or Ø)	#___	CiC
3-I Subject	/ʔ/	(Object)___	ʔ.Prefix or
3-I Object	/ʔ/	#___	#ʔa or ʔV
4th Subject	/ǰ/	(Object)___	ǰ.Prefix or #ǰi
4th Object	/ha/ or /ho/	#___	or ǰV

The syllable structure alternations in which the prefixes given above participate are accounted for in the next two chapters. Chapter four accounts for the alternations involving the first person marker /š/, the Si-Conjugation marker, and the classifiers. Each of these prefixes may surface as the coda of the prestem syllable. The classifiers fail to surface out of this position, but the first person marker and the Si-Conjugation marker each surface as a syllable onset if they can not surface as the coda of the prestem syllable. Chapter five accounts for the alternations involving the

obviative prefixes. Each of these prefixes surfaces either as an onset or as the coda of a pre-prefixal syllable. In chapter six, the results found in this chapter are compared with the input forms of the Navajo prefixes posited in the traditional Athapaskanist literature.

CHAPTER 4: PRESTEM CLOSED SYLLABLES IN THE NAVAJO PREFIXES

4.0 INTRODUCTION

In this chapter, alternations involving the appearance of closed prestem syllables in the Navajo verb are documented and accounted for. In order to lay the empirical ground for this part of the analysis, several sets of alternations are outlined. The first involves underlyingly vocalic prefixes which sometimes surface as CV, and sometimes as V. These are seen to require an analysis in which constraints banning onsetless syllables and segmental deletion outrank constraints banning epenthesis. The second set of alternations involves underlyingly consonantal prefixes which sometimes surface as codas of a prestem syllable. Some of these prefixes, the prefixes marking the first person /š/ and the S-Conjugation marker /s/, surface either as codas of the prestem syllable, or else as onsets to a non-prestem syllable. Others of these prefixes, the classifiers /l/ and /ʎ/, surface either as the coda of the prestem syllable or not at all. The obviative third person prefixes, which surface either as the coda of a pre-prefixal syllable or as an onset, are treated in chapter 5.

Section 4.1. of this chapter outlines the alternations to be accounted for here. Section 4.2 contains the account of these alternations. Section 4.3 summarizes and concludes the chapter.

4.1 THE ALTERNATIONS

The non-alternating prefixes will be reviewed first, in section 4.1.1. These prefixes always surface in the form which was shown in the previous chapter to be their input shape. Second, the vocalic prefixes which surface as CV in word-initial

position are presented in section 4.1.2. Section 4.1.3. reviews the alternations in which the classifier prefixes participate. These prefixes surface either as C or Ø, but never as CV. The prefixes which alternate between C and CV, the /s/ first person marker and the S-Conjugation marker, are presented in section 4.1.4. The analysis that follows provides a unified account of all of these alternations.

4.1.1 Non-Alternating Prefixes

Of the prefixes presented in chapter three, the following do not alternate, but always surface in the same shape. For this reason, it is assumed that the surface shape of these prefixes is the same as their input shape. Each consistently appears with a particular affix on its left. Each is vocalic, but never appears in word-initial position because each is always preceded by a consonantal element, furnished by the conjugation or tense marking with which it cooccurs.

(1) Non-Alternating Prefixes: Single Environment

Semantics	Marker	Linear Position
S-Conjugation, Perfective, † or Ø Classifier, First Person Subject	é	s____(Classifier)Stem
Future, First Person Subject	eš	ṭμ____(Classifier)Stem
Future, Third Person Subject	o	ṭμ____ Stem

The S-Conjugation Perfective First Person prefix, though underlyingly vocalic, is always preceded by the Si-Conjugation marker as in the form *sétiz* 'I

spin it' . Therefore it never surfaces word-initially, and never creates an onsetless syllable¹. The future tense subject markers, similarly, supply the vowel quality for the templatic future tense prefix, which is consonant-initial. The templatic prefix denoting the future tense is described next.

(2) The Future Marker

Semantics	Input Form	Linear Position	Alternations
Future Tense		___Def.Subj	None

The future marker always surfaces as a heavy syllable with a [t] onset, e.g. *to:le:t* 'it will be'.

4.1.2 Vocalic Prefix: V ~ CV

The prefix which alternates in surface shape between V and CV, the optative marker /ó/, is given in the chart below.

(3) Vocalic Prefix: V ~ CV

Meaning	Marker	Form	Gloss
Optative	ó	ó - č ^h a	's/he should be
		ó č ^h a	crying'
		opt-'scratch'	
	š ó	š ó - č'it	's/he should be
		š ó č'it	scratching me'
		1o-opt-'scratch'	

¹Whether it's an accident that this prefix never occurs in an environment where an epenthetic onset would be called for cannot be determined. This may be evidence of a conspiracy of morphological and phonological properties in Navajo.

In sum, this prefix surfaces as a vowel if it is preceded by a consonantal prefix. Otherwise, it surfaces as a CV syllable in which the C is a homorganic glide. This is summarized in the chart below.

(4) Vocalic Prefix: V ~ CV

Context	Surfaces as:
Word-Initial	CV
Else	V

The next sets of prefixes are underlyingly consonantal, but surface either as C or Ø. These are the classifier prefixes.

4.1.3 Classifiers: C ~ Ø

The classifier prefixes participate in C ~ Ø alternations. In review, these prefixes surface as codas of the prestem syllable unless the first person singular subject marker /š/ or the conjugation marker /s/ surfaces in this position. The classifiers fail to surface in first person singular verbs containing /š/ or /s/, as illustrated below.

(5) Classifiers. /l/ and /ʎ/, in Verbs with /š/ or /s/

Conjugation	Form	Gloss
S-Conjugation, Perfective; l-Classifier.	šiš.-ʎo:l	'I lay there'
	s š ʎo:l conj-1s-'lay there'	
	šiníʎo:l	'You lay there'
	s ní l ʎo:l conj-2s-cl-'lay there'	
S-Conjugation Perfective; †-Classifier.	ʎas - ʎá	'There is safe-keeping'
	ʎ s ʎá 3is-conj-'handle s.r.o.'	
	sé† - ʎá	'I kept it'
	s é † ʎá conj-1s-cl-'handle s.r.o.'	

The data above show also that the classifiers always surface as codas, if they surface at all. The facts regarding the classifier prefixes are summarized below.

(6) Classifier Prefixes: C ~ Ø

Context:	Surfaces as:
š/s___	Ø
Else	C

The classifiers surface as codas of the prestem syllable, but never as its onset². It will be seen that another set of prefixes surfaces either as a coda or as an onset. These are presented next.

4.1.4 Person and Conjugation Prefixes: C ~ CV

The person and conjugation prefixes which alternate between C and CV create a challenge to any account of the Navajo prefix span based solely upon syllable structure concerns. This is because these prefixes may form either open or closed syllables, depending upon their linear position in the word. These prefixes surface as C before a vowel, as C in some preconsonantal positions, but as CV in other preconsonantal positions. The first person marker /š/ and the Si-Conjugation marker /s/ surface as codas of the prestem syllable, else as syllable onsets. This is illustrated below.

These prefixes surface either as C or CV. They surface as C when they precede a vocalic prefix, as illustrated below.

²It is worth considering an analysis in which classifiers are marked as codas in the input. Such a stipulation would work, but is unnecessary. It is shown in subsequent sections that the behavior of classifiers is a result of their alignment properties. These properties have to be stated anyway, in order to ensure that the classifier surfaces as a prefix. No stipulation about input need be made.

(7) C Before V

Prefix	Form	Gloss
1st Person /š/	<u>š</u> ó.-č'it š ó č'it 1o-opt-'scratch'	'S/he should scratch me'
S-Conjugation /s/	<u>s</u> é.-tiz š é tiz conj-1s-'spin'	'I spun wool'

These same prefixes surface as C when they can form the coda to the prestem syllable in the word, as illustrated below.

(8) C if Coda of the Penult.

Prefix	Form	Gloss
1st Person /š/	<u>n</u> óš.-č'it n ó š č'it 2o-opt-1s-'scratch'	'I should scratch you'
S-Conjugation /s/	<u>š</u> jiz.-tá š s tá 4s-conj.-'sit'	'S/he sits'

The default first person marker and the S-conjugation marker surface as codas of the prestem syllable, but never as pre-prefixal codas. In pre-prefixal preconsonantal environments, they surface as onsets to a syllable with an epenthetic vowel as its peak. This is illustrated in the forms below.

(9) Ci if not Coda of the Penult.

Prefix	Form	Gloss
1st Person /s/	šito:.-č'ił š tɯμ o č'ił 1o-fut-3s.-'scratch'	'S/he will scratch me'
S-Conjugation /s/	š.ńl.-joił š n l joił conj-2s-cl-'lay there'	'You lay there'

The distribution of the S-Conjugation marker and the first person prefix cannot be explained, therefore, without reference both to the particular segmental quality of the prefixes involved (both are coronal voiceless fricatives) and the position in which they occur in the word (the prestem syllable).

4.1.5 Third Person Prefix: C ~ CV ~ V

The third person marker /y/ participates in an additional type of alternation compared to the other prefixes whose input shape is consonantal. This marker surfaces as [y] before a vowel (10a), as [yi] word-initially before a consonant (10b), or as [i] interconsonantly (10c).

(10) Third Person Marker /y/:

Position	Form	Gloss
Prevocalic	yóʔ. - cé:h	S/he should scrape a hide to
	y ó ʔ cé:h	soften it'
	3o-opt-cl-'scrape'	
Word-Initial and Preconsonantal	yítoʔ. - cé:ʔ	'S/he will scrape a hide to
	y ṭṃ o ʔ cé:ʔ	soften it'
	3o-fut-3s-cl-'scrape'	
Interconsonantal	ṣi. - lá	'A long, slender, flexible object
	s y lá	(as a ribbon) sits'
	conj-3s-'handle object'	

The alternations in (10a-b) above are exactly the same as those in which the other consonantal prefixes of Navajo participate. The alternate in (10c) is distinct, however. The fact that the third person prefix is a glide allows it to vocalize in interconsonantal position, whereas the obstruent consonantal prefixes never vocalize.

4.1.6 Summary

A summary chart of the facts described in this subsection is given below. The classifiers /l/ and /ʔ/ surface as codas of the prestem syllable, or not at all. The classifiers do not surface when the /š/ first person marker or the S-Conjugation marker occurs as a coda of the prestem syllable. The /š/ first person marker surfaces as [š] in prevocalic position, or when it can close the prestem syllable of the word. Otherwise, it surfaces as [ši]. The S-conjugation marker, /s/ surfaces as [s] in prevocalic position, or when it can close the prestem syllable of the word. Otherwise

it surfaces as [si]. Neither the second person prefix /n/ nor the third person prefix /y/ surface as syllable codas, but each surfaces as C before a vowel.

(11) Generalizations About Consonantal Prefixes

	Before A Vowel	Coda?	Elsewhere
/ʌ/	∅	Prestem	∅
/ʌ/	∅	Prestem	∅
/š/	[š]	Prestem	[ši]
/s/	[s]	Prestem	[si]
/n/	[n]	Never	[ni]
/y/	[y]	Never	[yi] or [i]

The analysis that follows shows that these patterns are a direct result of the interaction of universal syllable structure constraints with constraints requiring fidelity of inputs and outputs, and alignment constraints which require particular prefixes to occur in particular positions.

In the next section a unified account of these alternations is presented. It is proposed that the interaction of syllable structure markedness constraints with faithfulness constraints and morpheme-specific alignment constraints results in the surface distribution of all of these prefixes.

4.2 THE ANALYSIS

The alternations described above are accounted for here. All can be seen to follow from interactions between faithfulness and syllable structure markedness constraints with a set of ranked alignment constraints. In particular, the correspondence constraint DEP_{IO} is violated in favor of constraints on syllable

structure ONSET, *COMPLEX and NOCODA. The distribution of closed syllables results from an constraints forcing particular affixes to appear in particular alignment configurations, sometimes in violation of NOCODA.

The linear order of prefixation derived in chapter three is not accounted for in this analysis, which focuses only on the syllable structure alternations themselves. The order of prefixation in Navajo is strict (Saville 1996, Courtney and Saville-Troiike 1997), and has been argued to be the result of a slot-and-filler type of templatic morphological system (Kari 1973, 1978, 1979, Young 1995, Young and Morgan 1951, 1987, 1992). Such a system would be typologically unusual, and it may be the case that there is no empirical need to posit one, given the ALIGNMENT constraint schema made available under Optimality Theory (McCarthy and Prince 1993b). ALIGNMENT constraints have been utilized by others in determining order of affixation in closely related Athapaskan languages (Hargus and Tuttle 1997, Potter 1996), and I have no reason to believe that such constraints are not responsible for order of affixation effects in Navajo. There are, however, several reasons not to include a full analysis of linear ordering of affixes here.

First, if claims such as those made by Saville-Troiike (1996) are correct, order of affixation in Navajo never varies, not even in child language. This means that an Optimality Theoretical account of order of affixation in Navajo would be uninteresting in the following way: if all generalizations about order of affixes are surface-true, then the constraint interactions that result in order of affixation would not be especially interesting. The exercise of applying Optimality Theoretic machinery to these phenomena would likely not result in new insights into the theory.

Second, an analysis of order of affixation in Navajo would take us far afield of the syllable structure data in the following way. The prefixes which participate in syllable structure alternations in Navajo are a subset of the prefixes that can occur in a Navajo verb. There are a number of lexical and adverbial prefixes which do not participate in these alternations, but which can occur in at least two different positions in the prefixal string. A complete account of order of affixation would have to include these prefixes, and this would involve presenting a substantially larger body of data than has been included in this dissertation. These additional data provide no insights into the syllable structure alternations which are the subject of this analysis, however.

Therefore, in the analysis presented in this chapter and in chapter five, it is assumed that prefixes are ordered correctly, but no analysis of the constraints which order them is given. This is functionally equivalent to the assumption that Navajo affixes are ordered in the input, but no such claim is being made here. Instead, it is assumed that there is a set of ranked alignment constraints which produce the correct order of affixation for all of the prefixes (and the clitics, for that matter) of this language, and that this set of alignment constraints is so interleaved with those of interest here as to produce the right result regardless of whether the input is ordered or not. Of course, any full analysis of the morphophonology of Navajo would require the articulation of these constraints, and this hierarchy, and that project is left for future research. It should further be noted that the constraints which are posited here, and which are necessary to account for the syllable structure alternations in the Navajo prefixes, do partially determine the order of affixes in the output. This is taken as a convenient outcome, but it is not the case that the order of affixation can be

fully determined simply by positing the constraints and rankings that are required for an analysis of these syllable structure alternations.

The analysis is introduced in 4.2.1. In 4.2.2, the underlyingly vocalic prefixes (V ~ CV) are accounted for. In 4.2.3, the prefixes which may surface as prestem codas are accounted for. Section 4.3.4 concludes the analysis.

4.2.1 Introduction

It has been shown above that the prefixes of Navajo undergo a number of syllable structure alternations. The result of these alternations follows from the notion that segments must be incorporated into the syllable structure of a word in order to be pronounced. The assumptions under which the following analysis is proposed crucially involve the interaction of pressures for exhaustivity of syllabification with those requiring fidelity between input and output strings.

Under Correspondence Theory the constraints PARSE-SEGMENT and MAX_{IO} are required in order to force exhaustive syllabification of input segments. The latter constraint, bars phonological deletion, while the former forces exhaustive syllabification of surface forms.

(12) MAX_{IO}:

Every element in the Input has a correspondent in the Output.

(13) PARSE-SEGMENT:

Avoid unsyllabified segments.

The interaction of these two constraints is illustrated schematically below. The tableau below shows that all else being equal, a candidate such as (a) will always be preferred over the candidates in (b-c). This is because the candidate in (a) is exhaustively syllabified and it has perfect fidelity to the input string. The candidate in

(b) is faithful to the input, but not exhaustively syllabified. The candidate in (a) is exhaustively syllabified, but is not faithful to the input.

(14) input: CVC

Candidates	PARSE-SEGMENT	MAX _{IO}
a 		
b 	*!	
c 		*!

The relative ranking of PARSE-SEGMENT and MAX_{IO} only becomes relevant when a constraint on syllable structure intervenes to exclude the candidate in (a).

One possibility for such a constraint is NOCODA, reviewed below.

(15) Constraint Banning Closed Syllables

NOCODA: Syllables do not have codas.

If this constraint is ranked above either PARSE-SEGMENT or MAX_{IO}, the relative ranking of PARSE-SEGMENT and MAX_{IO} will determine the optimal candidate. This is illustrated below. In a language in which PARSE-SEGMENT outranks MAX_{IO}, candidate (b) will be selected as optimal. This candidate contains a pronounced but unsyllabified segment. In a language in which MAX_{IO} outranks PARSE-SEGMENT, candidate (c) would be pronounced. In such a language the rightmost input C would simply not be included in the surface representation of the word, and so it would not be pronounced.

(16) input: CVC

	Candidates	NOCODA	PARSE-SEGMENT	MAX _{IO}
a		*!		
b			*	
c				*

Under Correspondence Theory, then, it is impossible for an output candidate to contain a segment that is both unsyllabified and unpronounced. Any unpronounced segment would be absent from the output representation, while any unsyllabified segment in an output form would presumably be pronounced.

In the analysis that follows, it is assumed that PARSE-SEGMENT outranks MAX_{IO} in Navajo. Therefore representations such as the one in (b) will not be included in the set of output candidates for any of the tableaux. Any candidate like (b) would be eliminated by the highly ranked PARSE-SEGMENT. This assumption is based on the fact that the distribution of segments in surface forms of words reflects exhaustive syllabification. There is no evidence that any segment which surfaces in a Navajo word is unsyllabified. Therefore, the ranking below is assumed without further argument. In this regard, Navajo is assumed to be similar to the vast majority of the languages of the world in that it affirms both claims underlying the notion of syllabic licensing.

4.2.2 Vocalic Prefixes: V ~ CV

The prefixes which are underlyingly vocalic undergo the following alternations: when they are preceded by a consonantal prefix, they occur as V; when they are word-initial, they occur as CV. The linear ordering of elements ensures that these prefixes are never preceded by a vowel within a word³

(17) Vocalic Prefixes: V ~ CV

Context	Surfaces as:	Form	Gloss
Word-Initial	CV	wóč ^h a	's/he is
		ó č ^h a	crying'
		opt-'cry'	
Else	V	ǰóč ^h a	's/he (4th) is
		ǰ ó č ^h a	crying'
		4th-opt-'cry'	

As was shown in chapter one, Navajo syllables are always consonant-initial. This suggests the high ranking of the constraint requiring syllables to have onsets in Navajo phonology.

(18) ONSET: (ONS)

Syllables are consonant-initial.

When the vocalic prefix is word-initial, and epenthetic onset is inserted. This shows that both Onset and MAX_{IO} are ranked above the faithfulness constraint DEP_{IO}. The two faithfulness constraints at issue are formalized below.

³This is the type of morphophonological conspiracy that is expected under Optimality Theory, where both morphological and phonological constraints simultaneously at determine the best possible output. This particular effect, however, is not captured under the current analysis.

(19) DEP_{IO}:

Every element in the output has a correspondent in the input.

(20) MAX_{IO}:

Every element in the input has a correspondent in the output.

This is illustrated in the tableaux below. This tableau motivates the ranking of ONSET and MAX_{IO} over DEP_{IO}. In the tableaux that follow, underlined segments are epenthetic, and periods denote syllable boundaries. The form in (a) violates only the lowest ranked constraint, so it surfaces as optimal. The form in (b) is completely faithful to the input, but contains an onsetless syllable. The fact that (b) does not surface proves that ONSET dominates DEP_{IO} in Navajo. The form in (c) satisfies the syllable structure constraint by deleting a segment, rather than by inserting one. The fact that this form does not surface proves that MAX_{IO} dominates DEP_{IO} in Navajo.

(21) input: /ó 'optative', č^ha 'cry'/ wóč^ha 'S/he should cry'⁴

Candidates	ONS	MAX _{IO}	DEP _{IO}
a <u>w</u> ó.č ^h a			*
b ó.č ^h a	*!		
c č ^h a		*!	

(22) Ranking:

ONSET, MAX_{IO} >> DEP_{IO}

The next tableau shows that this hierarchy also gets the right results for forms in which a vowel-initial prefix is preceded by a consonantal prefix. In this case,

⁴Note that a candidate such as *tóč^ha would tie with the optimal form in (a) under the constraints given here. The fact that the epenthetic onset is always a glide homorganic with the following vowel is presumably the result of a set of superordinate constraints on the featural properties of epenthetic segments in this language.

epenthesis is unnecessary, since the consonantal prefix can serve as an onset to the word-initial syllable. The form in (a) is optimal because it violates none of these constraints. Faithful reflection of the input results in perfectly well formed syllables in the output. The form in (b) loses because it contains an unnecessary violation of MAX_{IO} . The form in (c) loses because it contains an unnecessary violation of DEP_{IO} .

(23) input: \check{y} '4th person', \acute{o} 'optative', $\check{c}^h a$ 'cry' / $\check{y}\acute{o}\check{c}^h a$ 'S/he is crying'

	Candidates	ONS	MAX_{IO}	DEP_{IO}
☞ a	$\check{y}\acute{o}.\check{c}^h a$			
b	$w\acute{o}.\check{c}^h a$		*!	
c	$\check{y}i\acute{o}.\check{c}^h a$			*!

The ranking motivated in this section is schematized below.

(24) Ranking:

$ONS, MAX_{IO} \gg DEP_{IO}$

This accounts for the alternations of the vocalic prefixes of Navajo. Before taking up the next two sets of alternations, two additional constraints are motivated. Each is true on the surface of all Navajo verbs, and therefore each will be considered to be top ranked. The first of these accounts for the lack of complex onsets and codas in Navajo verbs. The second accounts for the disyllabic minimum size of the verb in Navajo.

4.2.2.1 Syllable Edges and Epenthesis

All Navajo syllables have a single consonantal onset, and some have a single consonant in coda position. No tautosyllabic CC sequences occur in Navajo,

however. Such sequences are ruled out by the syllable structure constraint

*COMPLEX, (Prince and Smolensky 1993:99), which is defined below.

(25) Constraint Barring Complex Syllable Margins

*COMPLEX Syllable positions (onset, coda) are limited to at most one segment.

In sequences in which tautosyllabic CC sequences might be expected due to morpheme concatenation, epenthesis occurs between the two consonantal segments. This is illustrated in the tableau below. The candidate in (a) is optimal, and it satisfies *COMPLEX but violates DEP_{IO}. This shows that *COMPLEX dominates DEP_{IO}. The candidate in (b) violates *COMPLEX, so it is eliminated. The candidate in (c) fails to include correspondents for all underlying material, so it is eliminated.

(26) input: /j '4th person', č^ha 'cry'/ jič^ha 'S/he is crying'

	Candidates	*COMPLEX	MAX _{IO}	DEP _{IO}
☞ a	ji.č ^h a			*
b	jč ^h a	*!		
c	č ^h a		*!	

The ranking argument provided by this tableau is summarized below.

(27) Ranking:

*COMPLEX >> DEP_{IO}

Therefore, *COMPLEX is included in the set of syllable structure constraints which dominate DEP_{IO}. The complete hierarchy motivated to this point is given below.

(28) Ranking Summary:

*COMPLEX, ONSET, MAX_{IO} >> DEP_{IO}

The patterns illustrated here suggest that epenthesis is uniformly recruited to salvage otherwise ill-formed syllables in Navajo. This effect is a direct result of the high ranking of PARSE-SEGMENT in this language, and the low ranking of DEP_{IO}. If segments needn't be syllabified on the surface, then DEP_{IO} needn't be violated to create acceptable forms. If DEP_{IO} were ranked higher, particularly if it were ranked above MAX_{IO}, then deletion of segments would be preferable to epenthesis. The fact that epenthesis occurs to create better syllables entails that syllabification of segments is a prerequisite in Navajo. In fact, epenthesis occurs in another environment, to salvage otherwise subminimal verbs. This is illustrated in the next section.

4.2.2.2 Verb Binariness and Epenthesis

All verbs in Navajo surface as minimally disyllabic⁵. Although this disyllabic minimum may be derived by constraints requiring that Navajo verbs be footed, for now it is merely stipulated in the form of the constraint VERB-BINARITY,⁶ formalized below.

(29) Constraint Requiring Disyllabicity of Verbs

VERB-BINARITY: (V-BIN) Verbs are minimally binary at the syllabic level of analysis.

The existence of this constraint is motivated by forms with no overt prefixes, such as the third person of the Ø-Conjugation imperfective. This is illustrated in the tableau below. The form in (a) is optimal even though it violates DEP_{IO} twice. This is because it satisfies the higher ranked VERB-BINARITY and ONSET constraints. The

⁵See Meek 1997, and Hargus and Tuttle 1997 for different approaches to the binarity problem.

⁶The reader should note the resemblance of this constraint to the familiar FOOT-BINARITY of McCarthy and Prince 1993a and Prince and Smolensky 1993.

candidate in (b) fails because it creates an onsetless syllable. The candidate in (c) fails in spite of its perfect fidelity to the input. This is because it is not disyllabic.

(30) input: /č^ha 'cry'/ yič^ha 'S/he is crying'

	Candidates	ONS	V-BIN	DEP _{IO}
☞ a	<u>y</u> i.č ^h a			*
b	i.č ^h a	*!		*
c	č ^h a		*!	

This tableau provides the ranking argument that VERB-BINARITY dominates DEP_{IO}, as summarized below.

(31) Ranking

VERB-BINARITY >> DEP_{IO}

The tableau above omits reference to candidates in epenthesis occurs on the right edge, instead of on the left edge of the verb. Nothing about the hierarchy so far excludes such candidates. In fact, a candidate with epenthesis on the right would tie along the constraints motivated so far with a candidate with epenthesis on the left. This is illustrated below, where the "gun" icon points to a candidate which is selected by the hierarchy, but which is not attested. The candidate in (a), with epenthesis on the left, is preferred over the candidate in (b) with epenthesis on the right.

(32) input: /č^ha 'cry'/ yič^ha 'S/he is crying'

	Candidates	*COMP	ONS	MAX _{IO}	DEP _{IO}
☞ a	<u>y</u> i.č ^h a				**
☛ b	č ^h a. <u>y</u> i				**

This motivates an Alignment constraint requiring that the right edges of a stem align with the right edge of the word⁷. This constraint is formalized below.

(33) Constraint Requiring Right-Alignment of Stem and Word.

ALIGN-STEM, RIGHT, WORD, RIGHT (ALIGN-STEM): Align the right edge of every stem with the right edge of the prosodic word.

As long as this constraint is included in the hierarchy, the right form is obtained. This is illustrated below, where ALIGN-STEM is included in the top block of constraints. It appears that this constraint is in fact never violated on the surface in Navajo, and so it is assumed to be top-ranked throughout this analysis. The necessity for a constraint such as this one is returned to in chapter five.

The candidates in (a) and (b) in (34) below differ only with respect to ALIGN-STEM. Since candidate (a) satisfies ALIGN-STEM, it is selected as optimal. Candidate (b) violates ALIGN-STEM, and is eliminated.

(34) input: /č^ha 'cry'/ yič^ha 'S/he is crying'

	Candidates	ALIGN-STEM	*COMP	ONS	MAX _{IO}	DEP _{IO}
☞ a	<u>yi</u> .č ^h a					**
☛ b	č ^h a. <u>yi</u>	*!				**

The ranking motivated in this subsection is reiterated below.

(35) Ranking:

VERB-BINARITY >> DEP_{IO}

⁷A constraint of the ANCHORING type, as suggested by McCarthy and Prince 1995 would do the same empirical work as does this alignment constraint. See Hendricks and Meek 1996 for reasons to prefer an Alignment-based approach to this problem.

All of the rankings derived so far are summarized below.

(36) Ranking Summary:

ONSET, MAX_{IO} *COMPLEX, VERB-BINARITY >> DEP_{IO}

The ranking of ALIGN-STEM is not yet established. Note the general pattern here: the constraint DEP_{IO}, which bans epenthesis is apparently low-ranked in Navajo. Therefore, underlying unsyllabifiable sequences are salvaged by epenthesis, and not generally by deletion. The next section takes up the alternations in the prefixes which produce closed prestem syllables. These include the classifiers, the first person singular marker and the S-conjugation marker. Here it is shown that the pressure to avoid deletion of segments is relativized to the particular morphemes at hand. In particular, classifier prefixes may be deleted, in spite of a language-wide prohibition against the deletion of other elements.

4.2.3 Consonantal Prefixes: Alignment and Faithfulness

The underlyingly consonantal prefixes of Navajo have the following patterns of distribution. There are three types. One type, the laterals, occur as the coda of the prestem syllable of the word, or not at all. The second type, the voiceless coronal fricatives, occur as the coda of the prestem syllable, or else as a syllable onset. The third type, the obviative subject markers, occur as a coda of the word-initial syllable, if that word-initial syllable is pre-prefixal. Otherwise, they occur as a syllable onset. This is summarized in the chart below, where the underlined cells are those which are dealt with in this section. The remaining two types are accounted for in chapter five.

(37) Generalizations About C ~ CV Prefixes

	<u>__V</u>	<u>__Stem</u>	Elsewhere	Coda?	Meaning
/ʌ/	<u>∅</u>	<u>[ʌ]</u>	<u>∅</u>	<u>Prestem</u>	<u>Valence Marker</u>
/ʌ/	<u>∅</u>	<u>[l]</u>	<u>∅</u>	<u>Prestem</u>	<u>Valence Marker</u>
/š/	<u>[š]</u>	<u>[š]</u>	<u>[ši]</u>	<u>Prestem</u>	<u>1st Person</u>
/s/	<u>[s]</u>	<u>[s]</u>	<u>[si]</u>	<u>Prestem</u>	<u>S-Conjugation</u>
/y/	<u>[y]</u>	<u>[yi]</u>	<u>[yi] or [i]</u>	<u>Never</u>	<u>3rd Person</u>
/j/	<u>[j]</u>	<u>[ji]</u>	<u>[ji] or [ž]</u>	Prefix-Span-Initial	4th Person
/ʔ/	<u>[ʔ]</u>	<u>[ʔa]</u>	<u>[ʔa] or [ʔ]</u>	Prefix-Span-Initial	3rd Indefinite

4.2.3.1 The Classifiers

The classifiers are described first. The invariance of their position in the word suggests a highly ranked constraint requiring alignment between the classifier and the stem. This constraint is given below.

(38) ALIGN-CLASSIFIER, RIGHT, STEM, LEFT: (ALIGN-CL)

Align the right edge of every classifier with the left edge of some verb stem.

The evaluation of candidates by this constraint is exemplified below. A violation of alignment is incurred for classifier prefix which is not properly aligned with the left edge of the stem. This is a departure from the traditional manner of evaluation of alignment constraints in which violations are accumulated gradually according to how far away (in segments or syllables) the two edges mentioned in the alignment constraint occur from each other. For now, it is simply assumed that this constraint is evaluated categorically, though a set of alternative approaches in which gradient evaluation would be allowed is given in chapter five, section 5.2.4. Full

discussion of this issue would take us far afield from the analysis presented here, however, so it is delayed until that section.

The candidate in (a) is selected as optimal because it satisfies the highly ranked ALIGN-CL constraint. The candidate in (b) has a misalignment of the classifier prefix, so is discarded. The candidate in (c) fails to include the classifier at all. This results in (vacuous) satisfaction of the ALIGN-CL constraint, but in violation of MAX_{IO}.

(39) input: /j '4th person', † 'classifier' , cé:h 'scrape'/

ǰiɰcé:h 's/he is scraping a hide to soften it'

	Candidates	ALIGN-CL	MAX _{IO}	DEP _{IO}
☞ a	ǰiɰ.cé:h			*
b	†ǰ.cé:h	*!*		*
c	ǰi.cé:h		*!	*

Note that a single ALIGN-CL violation is sufficient to rule out the form in (b).

The second violation of this constraint is superfluous. This tableau contains no ranking arguments with regard to the position of ALIGN-CL in the hierarchy.

Regardless of its ranking, the correct result would be obtained.

Evidence that ALIGN-CL outranks DEP_{IO} is provided in the tableau below. In forms containing no overt prefixes other than the classifier, epenthesis occurs to create a well-formed syllable. The position of epenthesis preserves alignment between the classifier and the stem. This is illustrated below.

The interaction of these constraints is illustrated in the tableau below. The form in (a) is optimal, even though it contains two violations of DEP_{IO}. The candidate in (b) violates the ALIGN-CL, so it is eliminated. The candidate in (c)

violates ONSET, so it is eliminated. The candidate in (d) violates *COMPLEX, so it is eliminated. The candidate in (e) violates the constraint requiring that all underlying material have a surface counterpart, so it is eliminated. Comparison between forms (a) and (b) above provide the argument for ranking ALIGN-CL above DEP_{IO}.

- (40) input: /ʃ 'classifier' , cé:h 'scrape'/ yɪʃcé:h 'he is scraping a hide to soften it'

Candidates	ALIGN-CL	ONS	*COMP	MAX _{IO}	DEP _{IO}
a <u>y</u> ɪʃ.cé:h					**
b ʃ _i .cé:h	*!				*
c ɪʃ.cé:h		*!			
d ʃcé:h			*!		*
e cé:h				*!	

Again, note that a single violation of ALIGN-CL is sufficient to rule out the ungrammatical forms. No form is selected as optimal with even a single violation of this constraint. The ranking argument available from the above tableau is schematized below.

- (41) Ranking:

ALIGN-CL >> DEP_{IO}

This accounts for the positioning of the classifiers, and for the pattern of epenthesis in forms containing only a classifier prefix and a stem. The classifiers fail to surface in verbs which contain a /ʃ/ right-aligned with the stem. This fact is taken up next.

4.2.3.2 Classifiers and the S-Prefixes

From a morphological point of view, there are two environments in which the classifiers fail to surface. One is when the first person subject marker /š/ occurs, e.g. *yītcé:h* 'you are scraping it' versus *yīšcé:h* 'I am scraping it'. The first person subject marker /š/ is always aligned with the left edge of the stem. The other is when the S-Conjugation marker /s/ surfaces in a position aligned with the left edge of the stem, i.e. *yīšjo:l* 's/he cowers, huddles' versus *ší:ljo:l* 'we 2 cower, huddle'.

From a phonological point of view, these two environments may be formulated as one. The classifiers fail to surface when a voiceless coronal fricative (a set of elements which will henceforth be referred to as the "/s/-prefixes") surfaces to the immediate left of the stem.

These facts suggest that the prefixes [s] and [š] are subject to an alignment constraint similar to the one given above for the classifiers. This constraint is given below:

(42) ALIGN-/s/, RIGHT, STEM, LEFT: (ALIGN-S)

Align the right edge of every /s/ prefix with the left edge of some verb stem.

This constraint will be shown to hold true for all prefixes which are underlyingly /s/ or /š/ (this includes the first person subject and object markers as well as the S-Conjugation marker), though some of these prefixes are governed by additional alignment requirements as well, and these requirements are presented in subsequent sections of this chapter. The fact that not all /s/ or /š/ prefixes are aligned with the left edge of the stem on the surface shows that this constraint is violable. This constraint is also evaluated categorically, as was ALIGN-CLASSIFIER above.

If this alignment constraint is ranked above DEP_{IO}, we get the result that the first person subject marker will always occur as coda of the prestem syllable in Ø classifier verbs, even when no other prefix is present. This is shown below. The form in (a) satisfies all three top ranked constraints, violating only DEP_{IO}. The candidate in (b) violates ALIGN-S and so is eliminated. The candidate in (c) violates *COMP and so is eliminated. The candidate in (d) violates ONS and so is eliminated.

(43) input: / š '1st Person', č^ha 'cry'/ yišč^ha 'I am crying'

	Candidates	ALIGN-S	*COMP	ONS	DEP _{IO}
☞ a	<u>yi</u> šč ^h a				**
b	šič ^h a	*!			*
c	šč ^h a		*!		
d	š.č ^h a			*!	*

The argument for ranking ALIGN-S above DEP_{IO} is found by comparing forms (a) and (b).

(44) Ranking:

ALIGN-S >> DEP_{IO}

This account so far predicts that the S-Conjugation marker should have an identical distribution to the first person subject marker. That is, the S-conjugation marker should always surface with perfect alignment to the left edge of the stem. The forms given below show that this is not the case, however.

The chart below reviews the following properties of the S-Conjugation marker. First, the S-Conjugation marker blocks the occurrence of the overt classifier only when no overt subject marker intervenes between the two. Second, the S-conjugation marker always occurs to the left of any overt subject marker. The

subject marker intervenes between the S-conjugation marker and the stem. In this paradigm, the S-conjugation marker is underlined, while the classifier prefix is double-underlined.

There are two issues to be dealt with here. First, the S-conjugation marker, and the /š/ first person marker block the appearance of the classifier in forms with no intervening overt subject marker (as in (a), (e-f) above). Second, the S-conjugation marker can be displaced leftward by an overt subject marker. Since the first person marker /š/ is a subject marker, it is never displaced in this manner. In the data that follow, the /s/ prefixes are underlined, and the classifier prefixes are double-underlined.

(45) S-Conjugation Perfectives, I-Classifier

Person	Singular	Gloss
(a) 1st Singular	š <i>š</i> .- <u>žo:l</u> s š žo:ł conj-subject-stem	'I lay there'
(b) 2nd Singular	š <i>š</i> .níł.- <u>žo:l</u> s n l žo:ł conj-subject-class-stem	'You lay there'
(c) 3rd Person	y <i>š</i> .- <u>žo:l</u> s žo:ł conj-stem	'S/he lays there'
(d) 4th Person	ž <i>š</i> .- <u>žo:l</u> ž s žo:ł subject-conj-stem	'S/he lays there'

These facts create an apparent paradox. The S-Conjugation marker can occur with improper alignment, while the classifier prefix cannot surface unless it is left-aligned with the stem. Nevertheless, the S-Conjugation marker is not displaced by the conjugation marker. That is, the form *šilʃo:l 's/he cowers, huddles' does not occur, even though it is perfectly well formed phonologically. The fact that yišʃo:l, 's/he cowers, huddles' occurs instead makes it appear as if the classifier is being unnecessarily deleted. In the paragraphs that follow, however, it is shown that the deletion of the classifier is motivated by the alignment concerns of the S-Conjugation marker in concert with the relatively low priority given to including classifier prefixes in the surface representations of words.

The blocking effect of the classifier by the /s/ prefixes is summarized as follows. In any form with perfect alignment of an /s/ prefix, no classifier occurs on the surface. In any form with a surfacing classifier, a prefixal /s/ is misaligned. Furthermore, any string with a misaligned /s/ contains an overt subject prefix. The alignment constraint governing classifiers and the alignment constraint governing /s/ prefixes are restated below.

(46) ALIGN-CLASSIFIER, RIGHT, STEM, LEFT: (ALIGN-CL)

Align the right edge of every classifier with the left edge of some verb stem.

(47) ALIGN-/s/, RIGHT, STEM, LEFT: (ALIGN-S)

Align the right edge of every element /s/ with the left edge of some verb stem.

The constraint ALIGN-CL will not be violated in any form which contains no output classifier prefix. Any output string that does not contain a classifier will

vacuously satisfy ALIGN-CL. Similarly, any output string that does not contain a S-prefix will vacuously satisfy ALIGN-/s/. Pressure for these elements to be included in output strings is a result of the faithfulness constraint MAX_{IO}. Failure to include an input classifier in the output string, or an input /s/ in the output string, will result in a violation of MAX_{IO}, not a violation of alignment. This is illustrated in the tableau below.

Assuming no ranking of the constraints given so far, candidates (a) through (d) below tie. These candidates in each violate MAX_{IO} once. They both satisfy the alignment constraints. The candidates (c) and (d) each incur multiple violations of one of the alignment constraints, but no violations of MAX_{IO}. The fact that the optimal candidate (a) violates MAX_{IO} and none of the alignment constraints suggests that both alignment constraints must be ranked above MAX_{IO}.

(48) input: /š 'S-conjugation', l, 'classifier' jo:l 'cower'/ yišjo:l 'S/he lays there'

	Candidates	ALIGN-S	ALIGN-CL	MAX _{IO}
☞ a	yišjo:l			*
☞ b	yišjo:l			*
☞ c	šišjo:l	*		
☞ d	šišjo:l		*	

This tie can be broken by looking more closely at the constraint MAX_{IO}. Rather than being viewed as monolithic, MAX_{IO} can be broken down into a number of component constraints, each of which refers to a particular element or set of elements. The fact that classifier prefixes can be deleted suggests that the MAX_{IO} constraint referring particularly to classifiers is lower ranked than are the MAX_{IO}

constraints referring specifically to the other elements of the Navajo verb. The MAX_{IO} constraint referring to the classifier element is formalized below.

(49) $\text{MAX}_{\text{IO}}\{\text{CL}\}$:

Every Classifier element in the input has a correspondent in the output.⁸

Rather than enumerating all possible MAX_{IO} constraints, the following notation (taken from Fulmer 1997; Hammond 1997) will be used here to refer to the cluster of remaining MAX_{IO} constraints.

(50) $\text{MAX}_{\text{IO}}\{*\text{CL}\}$:

Every (non-classifier) element in the input has a correspondent in the output.

As long as the $\text{MAX}_{\text{IO}}\{\text{CL}\}$ constraint is dominated by the remaining MAX_{IO} constraints (summarily referred to as $\text{MAX}_{\text{IO}}\{*\text{CL}\}$), the right result will be obtained with respect to the blocking of the classifier by the /s/ prefixes. This is illustrated in the tableau below, where the generalized non-classifier $\text{MAX}_{\text{IO}}\{*\text{CL}\}$ constraints are ranked in the top block, but the classifier $\text{MAX}_{\text{IO}}\{\text{CL}\}$ constraint is demoted to a lower ranking.

The candidate in (a) is optimal because it only violates $\text{MAX}_{\text{IO}}\{\text{CL}\}$. The candidate in (b) deletes the Si-Conjugation marker, so it is eliminated. The candidate in (c) misaligns the classifier, so it is eliminated. The candidate in (d) misaligns the

⁸The existence of a demoted MAX_{IO} constraint referring to classifier prefixes is functionally motivated as well. The classifier prefixes appear to contain little information as to the surface form of the verb, and what information they do signal (i.e. transitivity) can typically be deduced from the nature of the stem and the other occurring prefixes (i.e. whether the verb occurs with an object prefix or not). This is not to say that the classifiers are semantically vacuous, only that the information they denote seems to be less salient than is the information provided by other prefixes.

Si-Conjugation marker, so it is eliminated. Comparison of the forms in (a) and (b) provides the argument for ranking $\text{MAX}_{\text{IO}}\{*\text{CL}\}$ above $\text{MAX}_{\text{IO}}\{\text{CL}\}$. Comparison of the forms in (a) and (d) provides the argument for ranking ALIGN-S above $\text{MAX}_{\text{IO}}\{\text{CL}\}$.

(51) input: / s 'S-conjugation' , l, 'classifier' jo:l 'cower'/ yišjo:l 'S/he lays there'

	Candidates	$\text{MAX}_{\text{IO}}\{*\text{CL}\}$	ALIGN-CL	ALIGN-S	$\text{MAX}_{\text{IO}}\{\text{CL}\}$
☞ a	<u>yi</u> šjo:l				*
b	y <u>i</u> ljo:l	*!			
c	liš <u>jo</u> :l		*!		
d	š <u>i</u> ljo:l			*!	

The ranking derived here is schematized below.

(52) Ranking

$\text{MAX}_{\text{IO}}\{*\text{CL}\}, \text{ALIGN-S}, \text{ALIGN-CL} \gg \text{MAX}_{\text{IO}}\{\text{CL}\}$

This hierarchy appears to contain some redundancy. Specifically, there are two different alignment constraints referring to the same position in the word, and also two different MAX_{IO} constraints (actually many more, but two rankable sets). Simplification of the hierarchy is desirable. There is no evidence for the ranking of the two alignment constraints, ALIGN-S and ALIGN-CL , with respect to each other. Therefore, they are collapsed into a single alignment constraint⁹, formalized below:

⁹This move is solely notational, and saves space in the analysis to come. What is clear is that both alignment constraints mentioned here, ALIGN-S and ALIGN-CL are positioned in the hierarchy in approximately the same place, and there is no evidence for their ranking with respect to each other.

(53) ALIGN-{/s/-PREFIX,CLASSIFIER}, RIGHT, STEM, LEFT: (ALIGN-S/CL)

Align the right edge of every element /s/ or classifier prefix with the left edge of some verb stem.

The blocking phenomenon described above is accounted for by the interaction of the MAX_{IO} constraints, rather than by ranked alignment constraints. That this move has no ill-effects on the outcome of the evaluation is illustrated in the tableau below.

(54) input: /s 'S-conjugation' , l, 'classifier' jo:l 'cower'/ yišjo:l 'S/he lays there'

	Candidates	MAX _{IO} {*CL}	ALIGN-S/CL	MAX _{IO} {CL}
a	<u>yi</u> šjo:l			*
b	y <u>i</u> ljo:l	*!		
c	š <u>i</u> ljo:l		*!	
d	l <u>i</u> šjo:l		*!	

The outcome is exactly the same as that above. Alignment violations eliminate the ungrammatical forms in (c) and (d), and the form that is selected as optimal has perfect alignment of all surfacing prefixes. The blocking of the classifier by the /s/ prefixes may be seen as a result of the identical alignment requirements on each prefix combined with the fact that the classifier prefixes are more readily deleted than the /s/ prefixes. In fact, collapsing both alignment constraints into one captures the right generalization: the blocking effect occurs because both the /s/-prefixes and the classifiers are subject to exactly the same positional pressure. The revised ranking derived here is given below. Note that the top ranked constraints

$\text{MAX}_{\text{IO}}\{\ast\text{CL}\}$ and ALIGN-S/CL are not yet ranked with respect to each other, their ranking is determined next.

(55) Ranking

$$\text{MAX}_{\text{IO}}\{\ast\text{CL}\}, \text{ALIGN-S/CL} \gg \text{MAX}_{\text{IO}}\{\text{CL}\}$$

This accounts for the blocking phenomenon that prevents the classifier from surfacing in the environment of /s/. The second problem which was identified in this section was the fact that intervening subject prefixes cause /s/ to surface in a misaligned position. When they do, the classifier is free to surface in its properly aligned position, just to the left of the stem. This is accounted for next.

Imperfect alignment of /s/ prefixes is tolerated just in case an overt subject prefix intervenes between /s/ and the stem. This happens in two environments. When the first person /s/ marks an object, and when the S-Conjugation marker occurs in a form with an overt subject marker of any kind. Cases with the S-Conjugation marker in which this occurs are reviewed below. In (a) the intervening prefix is the first person subject marker, which is also subject to the ALIGN-S/CL constraint. It blocks the occurrence of the classifier, and produces the misalignment of the conjugation marker. In (b) the intervening subject prefix is not subject to the alignment constraint, and so the classifier is allowed to surface with perfect alignment. The S-conjugation marker, on the other hand, surfaces out of alignment with the stem.

(56) S-Conjugation Perfectives, I-Classifier Type with Misaligned /s/

Person	Singular	Gloss
(a) 1st Singular	šiš.-ǰo:l s š ǰo:l conj-subject-stem	'I lay there'
(b) 2nd Singular	ší.níl.ǰo:l s n l ǰo:l conj-subject-class-stem	'You lay there'

In forms like (a) the current hierarchy selects the optimal form so long as one additional ranking is considered. If the constraint $\text{MAX}_{\text{IO}}\{\ast\text{CL}\}$ dominates ALIGN-S , the right result is obtained, as demonstrated below. The candidate in (a) is optimal in spite of its single violation of ALIGN-S/CL . In any form with two surfacing /s/ prefixes, ALIGN-S/CL must be violated at least once¹⁰. The candidates in (c-e) are eliminated due to violations of $\text{MAX}_{\text{IO}}\{\ast\text{CL}\}$. The candidate in (b) contains more violations of ALIGN-S/CL than does the optimal candidate. Here, gradient evaluation of the constraint ALIGN-S/CL is unnecessary to rule out the candidate in (b), because this candidate contains two different misaligned prefixes. Even under an absolute interpretation of the alignment constraint, candidate (b) would be eliminated because it would contain two violations, while the optimal candidate in (a) contains only one. Evidence for ranking $\text{MAX}_{\text{IO}}\{\ast\text{CL}\}$ above ALIGN-S/CL is found by comparing forms (a) and (b).

¹⁰This is true unless forms with coalescence are considered, in which case a single, properly aligned /s/ could correspond to both underlying /s/ prefixes. Such candidates are not considered here, nor is the constraint that would eliminate them from the hierarchy. Coalescence is dealt with in detail in the alternative analyses below, however.

- (57) input: /s 'Si-conjugation' ,š '1st person', l, 'classifier' ʃo:l 'cower'/
 šišʃo:l 'I lay there'

	Candidates	MAX _{IO} {*CL}	ALIGN-S/CL	MAX _{IO} -CL
☞ a	š <i>š</i> ʃo:l		*	*
b	š <i>š</i> iʃo:l		**!	
c	š <i>i</i> ʃo:l	*!	*	
d	<u>y</u> iš.ʃo:l	*!		
e	l <i>i</i> s. ʃo:l	*!	**	

Note that there is no way to tell on the basis of the surface form in (a) whether the Si-Conjugation marker or the first person marker has been misaligned. Both of these prefixes always surface with identical features on the surface in any first person Si-Conjugation form, due to strident harmony. Both the alignment constraint given here, and the general phonology of the language render the order of /s/-prefixes indeterminate on the surface in Navajo. This is taken to be a good result of this analysis, because there is evidence from strident harmony that the order of these prefixes is, in fact, indeterminate (cf. Platero n.d., Meek 1997a). There is no further evidence for the ranking of any of the other constraints in this tableau.

- (58) Ranking

$$\text{MAX}_{\text{IO}}\{*\text{CL}\} \gg \text{ALIGN-S/CL}$$

4.2.3.2 Apparent Exceptions

There exist two patterns of exceptions to the generalizations described above. First, there is a S-conjugation perfective form, the neuter, which appears to be exceptional in that the S-conjugation marker surfaces in a prefixal cluster of shape

[si] rather than [yis]. Second, when the /s/ first person marker marks the object of a verb rather than its subject, it never satisfies the alignment constraint above. In these cases, it always occurs as the onset the word-initial syllable, and never as a coda. The first exception is described below, and was argued in chapter three to result from the presence of an input /y/ marking a third person, Si-Conjugation neuter perfective subject in the form in (59a). No subject marking is hypothesized in the input to (59b).

(59) S-Conjugation Perfectives: Neuter and Non-Neuter

Verb Type	Singular	Gloss
(a) 3rd Person Neuter	si.-lá s y lá conj-3s-'object sits'	'A long, slender, flexible object (as a ribbon) exists'
(b) 3rd Person Non-Neuter	yiz.-lá s lá conj.-'object sits'	'S/he (a tall, slender person) exists'

Forms such as that in (a) above present a puzzle for this analysis. Forms such as (59b) demonstrate perfect alignment between the S-conjugation marker and the stem. In form (a) there is an vowel which might be analyzed as epenthetic interceding between the S-conjugation marker and the stem.

There are two possible solutions to this problem. The first is to assume that the forms in (59a-b) have identical input, and the difference between them is a result of a different constraint ranking for forms like those in (59a) than the ranking that is proposed for forms like (59b). This type of approach has been taken in order to account for differences in prosodic patterns between lexical classes in by Tranel 1994

and Blevins and Inkelas 1997, for example. These scholars suggest that different hierarchies may be used for different classes of vocabulary within a language.

The second approach to this problem is to assume that the underlying form of the affixes in (a) differ from those in (b). In particular, the underlying form in (a) is taken to be /s 'conjugation'- y 'third person' - lá 'handle a slender, flexible object'/, while that of (c) could be /s 'conjugation' - lá 'handle a slender, flexible object'/. The presence of a non-default allomorph of a subject marker is not remarkable in Navajo, it has been shown in the motivation of the underlying forms that non-default allomorphs are common, and that these non-default allomorphs are restricted in the morpho-syntactic environment in which they occur. For these reasons, the second of these two approaches is favored here, and the underlying form of *silá* 'a slender, flexible object sits' is taken to be /s 'conjugation'- y 'third person' - lá 'handle a slender, flexible object'/.¹¹

This approach raises the question, however, of why this verb does not surface as *siylá or *siyilá. That is, why does the /y/ vocalize, rather than surfacing as a consonant. There must be a constraint ranking which results in a preference for vocalization of /y/ in interconsonantal position, rather than epenthesis. In fact, the constraint hierarchy given so far predicts exactly this outcome, as is demonstrated in the tableau below.

¹¹Note that the motivation for proposing underlying /s/ rather than /si/ came not only from the cases under discussion here, but also from cases such as *šohč'it* 'you 2 are scratching me', in which the /s/ prefix (in this case the object marker: cf. forms like *šoŋjo:l* 'you 2 cower, huddle' for the S-Conjugation marker in the same environment) precedes a vowel (the second person dual /o/). When this occurs the prefix contributes neither vowel quality nor moraic weight, hence it is underlyingly consonantal.

In the tableau below, the form in (b) is eliminated because it fails to include the subject marker /y/. The forms in (c-d) are eliminated because each of them contains epenthetic segments, whereas the optimal form in (a) requires no epenthesis.

- (60) input: / s 'conjugation' , y '3s' lá 'handle a slender flexible object'/
silá 'a slender, flexible object sits'

	Candidates	MAX _{IO} {*CL}	ONS	*COMP	ALIGN-S	DEP _{IO}
☞ a	<u>si.lá</u>				*	
b	yis.lá	*!			*	**
c	si.yi.lá				*	*!*
d	siy.lá				*	*!

The candidate in (a) must, however, violate some constraint on syllabification. This candidate syllabifies a consonant as a peak, rather than as a margin, of the syllable. Prince and Smolensky (1993) posit an harmonic hierarchy of constraints by which the relative affinity of particular segments to particular syllabic positions is determined. For each segment in an inventory, two constraints are considered: one which requires that the segment not be mapped to a syllable peak, and one that requires that the segment not be mapped to a syllable margin. The constraints required to account for the syllabification of the segment /y/ are given below.

- (61) Constraints on the Syllabification of /y/:
- *PEAK/Y (*P/Y): Do not map /y/ to a syllable peak.
 - *MARGIN/Y (*M/Y): Do not map /y/ to a syllable margin.

The ranking of these two constraints with respect to each other distinguishes vowels (or segments which typically affiliate to syllable peaks) from consonants (or segment which typically affiliate to syllable margins) as follows. For vowels, the constraint barring a mapping of the vowel to a syllable peak is outranked by the constraint barring a mapping of the vowel to a syllable margin. The opposite ranking holds for consonants. Since the glide /y/ is a consonant, and typically affiliates to syllable margins, the following ranking is required.

(62) Ranking of Constraints Governing Syllabic Affiliation of /y/:

*PEAK/Y >> *MARGIN/Y

The optimal form in the tableau in (60) above, however, violates *PEAK/Y. Therefore, there must be some constraint which outranks *PEAK/Y, and forces this non-optimal syllabification. That constraint is Depio. A tableau illustrating the ranking of DEP_{IO} over *PEAK/Y (and also, by transitivity, over *MARGIN/Y), is given in (63) below. For ease of reference in (63), the constraints ONSET and *COMPLEX are not included, nor are candidates which would violate them. The evaluation of these constraints results in the same pattern of violation as in (60), with the candidate in (a) selected because it violates fewer of the higher-ranked constraints.

- (63) input: / s 'conjugation' , y '3s' lá 'handle a slender flexible object'/
silá 'a slender, flexible object sits'

	Candidates	MAX _{IO} {*CL}	ALIGN-S	DEP _{IO}	*P/Y	*M/Y
a	<u>si.lá</u>		*		*	
b	yis.lá	*!	*	**		*
c	si.yi.lá		*	*!*		*
d	siy.lá		*	*!		*

The rankings that are required for this result are summarized in (64) below.

(64) Ranking Summary:

DEP_{IO} >> *PEAK/Y >> *MARGIN/Y

The fact that /y/ is the only consonant which can vocalize is a result of the ranking of the remaining *PEAK/CONSONANT constraints for each of the consonants of Navajo. Each of these constraints must be ranked above DEP_{IO} for the right result to be obtained. This ranking falls out naturally from the sonority hierarchy, which is posited by Prince and Smolensky (1993) to undergird the universal harmonic ranking of *PEAK/CONSONANT and *MARGIN/CONSONANT constraints. The glide /y/ is the most sonorous consonant of Navajo, therefore the *PEAK/Y constraint should be subordinate to all other *PEAK/CONSONANT constraints referring to less sonorous segments.

The second set of exceptions to the pattern described above involve the /š/ first person marker when it marks the object, rather than the subject, of the verb¹². The forms below illustrate this pattern.

¹²Again, the motivation for proposing that the first person object marker is

(65) Ø Imperfectives

Verb Type	Singular	Gloss
(a) 3rd Person Subject	ši.-č'it	'S/he, They scratch me'
1st Person Object	š č'it	
	object-stem * yiš.č'it	
(b) 1st Person Subject	yiš.-č'it	'I scratch him/her/them'
3rd Person Object	š č'it	
	subject-stem	

The form in (a) violates ALIGN-S/CL, but the form in (b) does not. In (a) the /š/ prefix marks the person features of the object of the transitive verb, but in (b) this prefix marks the person features of the subject of the transitive verb.

As was demonstrated in chapter three, object markers are always leftmost in the prefix span. Therefore an alignment constraint requiring left alignment of object prefixes in the verb is proposed. While this constraint certainly bears on the order of affixation in the prefixal span, it is posited here to account for the fact that the /š/ first person marker always surfaces as a syllable onset when it marks an object, but may occur as a coda when it does not mark an object. Its presence in the hierarchy accounts for this syllable structure alternation in the prefixes of Navajo.

(66) Constraint Requiring Left Alignment of Object Prefixes

ALIGN OBJECT, LEFT, PREFIX-SPAN, LEFT: (ALIGN-OBJ):Align the left edge of any object prefix with the left edge of the verb.

underlyingly /š/ and not /ši/ comes from two sources. First, this prefix occurs as [š] before a vowel, as illustrated in the previous footnote. Second, positing underlying /ši/ would miss the generalization that object markers are always homophonous with the default subject marker of the same person/number features.

This constraint must dominate ALIGN-S/CL in order for its effects to be seen on the surface. If it does, the right result is obtained for all forms with a first person object (indeed, for all forms with any object marker at all). The tableau below illustrates the interaction of these two constraints for a form with a first person object marker.

(67) input: / š '1st person object', č'it 'scratch'/ šič'it 's/he scratches me'

	Candidates	ALIGN OBJ	ALIGN-S/CL
☞ a	šič'it		*
b	yiš.č'it	*!	

The form in (b) is eliminated by ALIGN OBJECT because it contains an object prefix which is not aligned with the left edge of the prefixal span. The form in (a) is therefore selected as optimal. The interaction of these constraints for a form with a first person subject marker is illustrated below.

(68) input: / š '1st person subject', č'it 'scratch'/ yišč'it 'I am scratching him/her'

	Candidates	ALIGN OBJ	ALIGN-S
a	šič'it		*!
☞ b	yiš.č'it		

This time the form in (b) vacuously satisfies the constraint ALIGN OBJECT because it contains no object marker. In view of candidate (a)'s violation of the lower ranked ALIGN-S/CL, candidate (b) is selected as optimal. The derived ranking of these two constraints is given below.

(69) Constraint Ranking:

ALIGN OBJ >> ALIGN-S/CL

The constraint ALIGN OBJ is added to the hierarchy derived so far in the tableau below, which shows the evaluation of a form containing a first person object marker. The stem -č'it takes no classifier prefix, so the MAX_{IO}{CL} constraint is not included in the tableau (this is for the sake of clarity: it is vacuously satisfied in the actual evaluation, since there is no input classifier). The candidate in (a) is selected as optimal because it satisfies all of the top-ranked constraints. The candidate in (b) is eliminated because it has an improperly aligned object marker. The candidate in (c) is eliminated because it is not a well-formed syllable. The candidate in (d) is eliminated because it contains an onsetless syllable. The candidate in (e) is eliminated because it fails to include the first person marker at all.

(70) input: /š '1st person object', č'it 'scratch'/ šič'it 's/he scratches me'

Candidates	MAX _{IO} {*CL}	ONS	*COMP	ALIGN- OBJ	ALIGN- S/CL	DEP _{IO}
a š _i .č'it					*	*
b <u>y</u> iš.č'it				*!		**
c šč'it			*!			
d <u>i</u> š.č'it		*!				
e č'it ¹³	*!					

4.3 SUMMARY

¹³This form would also be excluded by VERB-BINARITY.

The analysis so far is summarized below. The interaction of constraints that result in the surface distribution of the classifier prefixes, and of the /s/ first person marker and the S-conjugation marker has been established. The rankings derived to this point are reviewed below.

(67) Rankings Derived in this Section:

ONSET, *COMPLEX, VERB-BINARITY, ALIGN OBJECT,
 MAX_{IO}{*CL}, *PEAK/CONSONANT{*Y},
 >> ALIGN-S/CL
 >> DEP_{IO}, MAX_{IO}{CL}
 >> PEAK/Y
 >> MARGIN/Y

The surface shape of vocalic prefixes results from the domination of a correspondence constraint barring epenthesis by a syllable structure constraint requiring syllables to have consonantal onsets. The distribution of the classifier, first person and S-conjugation prefixes results from the interaction of constraints governing syllable structure with those governing correspondence and alignment. In all cases so far, the syllable structure constraints discussed have been top-ranked, and unviolated on the surface. However, the constraints and rankings motivated thus far do not correctly predict the surface forms of all prefixes in all verbs. There are two remaining patterns to be reckoned with. The first is the pattern by which the third person indefinite and fourth person subject markers sometimes surface as codas and sometimes surface as onsets of a syllable containing an epenthetic vowel. The second is a pattern of epenthesis that eschews closed syllables except in cases where

epenthesis would interfere with perfect alignment of prefixes. These are described in the next chapter.

CHAPTER 5: CLOSED SYLLABLES IN THE NAVAJO PREFIX SPAN

5.0 INTRODUCTION

The goal of this chapter is to extend the analysis developed in chapter four to account for two additional syllable structure alternations in the Navajo prefix span. The first of these involves the use of epenthesis generally to avoid closed syllables in the prefixes of Navajo. The second involves the appearance of closed syllables outside of the prestem syllable in forms with obviative subjects. Obviative subject markers /ʔ/ 'third person indefinite' and /j/ 'fourth person' surface as syllable onsets in the prestem syllable, or when they are verb-initial. Otherwise, they surface as syllable codas.

Closed syllables occur in a very limited number of cases in the Navajo prefix span. Closed prestem syllables occur when a classifier or /s/ prefix aligns properly with the stem, e.g. *yíš.č^ha* 'I am crying'. Otherwise, prestem syllables are open. Non-prestem syllables may be closed by the obviative person markers, e.g. *šíž.to:č'íł* 'S/he (4th) will scratch me', but not otherwise. The analysis presented so far cannot limit the appearance of closed syllables to these and only these prefixes, in these and only these positions. This chapter begins by articulating the problem, and solves it by introducing the constraint NOCODA into the appropriate position in hierarchy developed in chapter four.

The second type of alternation, the appearance of closed syllables outside of the prestem position, is seen in this chapter to arise from the ranking of alignment constraints mentioning the obviative third person markers (/j/ 'fourth person'; and /ʔ/ third person indefinite) above NOCODA. It is shown that these two prefixes surface

as codas only if doing so allows them to be perfectly aligned with another prefix. Else, epenthesis is invoked so that the obviative prefix surfaces as an onset. This accounts for the limitation of syllables closed by obviative prefixes to non-prestem syllables, e.g. *šič.to:č'it* 'S/he (4th) will scratch me', but *šič'it* 's/he (4th) is scratching me', **šič'it*. Different alignment requirements (alignment to stems versus alignment to prefixes) account for the complementary distribution of prefixes which can occur as codas in Navajo.

Furthermore, the requirement that the obviative prefixes align with prefixes fills out the alignment typology for this language. Alignment may refer to words (as does the alignment constraint requiring object markers to be leftmost in the word), or to stems (as does the alignment constraint requiring classifiers and /s/ prefixes to be left-adjacent with the stem), or to prefixes (as does the alignment constraint presented in this chapter, which requires obviative prefixes to be left-adjacent with a prefix). All possibilities are attested.

The chapter proceeds as follows. Section 5.1. extends the analysis already given to include the constraint NOCODA. This accounts for the distribution of closed syllables in words with classifiers or /s/ prefixes, as well as those containing none of those prefixes. Section 5.2 reviews the distribution of the obviative third person markers in Navajo, /ʔ/ third person indefinite and /j/, fourth person; and shows how their appearance as codas only in pre-prefixal syllables also arises from the interaction of alignment, faithfulness and syllable structure constraints, crucially including NOCODA. Section 5.3. concludes the analysis.

5.1 CLOSED SYLLABLES IN THE NAVAJO PREFIX SPAN

In section 5.1.1. the activity of the constraint NOCODA in the hierarchy of Navajo is motivated. In section 5.1.2, this constraint is added to the hierarchy developed in chapter four. Section 5.1.3. summarizes the results of this section.

5.1.1 Motivating NOCODA in Navajo

It is not the case that closed syllables are freely allowed in the prefix span of the Navajo verb. In fact, the only cases of closed syllables in this domain involve the classifiers, the /š/ first person marker, the S-conjugation marker and the obviative person markers. To illustrate this fact, four Navajo verbs are listed below. Each contains only consonantal prefixes in the input.

In the forms below, it is evident that epenthesis is generally used to avoid closed syllables in Navajo. The form in (a) contains one consonantal prefix, /n/ 'second person'. Here epenthesis occurs in order to form a prestem syllable with [n] as its onset. The form in (b) contains two consonantal prefixes; /š/ 'first person' marks the object and /n/ 'second person' marks the subject. Here epenthesis occurs twice. Note that there would be nothing syllabically ill-formed if there were a single instance of epenthesis in this word: *šín.č'ít. This form is ruled out, even though the nasal /n/ is an acceptable coda in Navajo (i.e. *šin.ta* 'then, only then, ever'). The form in (c) confirms that epenthesis is utilized even when it is not needed to create a well-formed syllable. The ungrammatical forms in (d-e) further illustrate this fact. Each has fewer epenthetic segments than does the attested form in (c). Each creates a closed prefixal syllable of a type which does occur in Navajo words. The ungrammaticality of these forms is not accounted for in the analysis presented so far.

(1) Forms Containing Consonantal Prefixes.

	Prefixes	Form	Gloss
a.	One	n _i . - č ^h a n - č ^h a 2s - 'cry'	'You are crying'
b.	Two	yíní - šé:ʔ y - n - č'it 3obj - 2subj - 'mow'	'You mowed it'
c.	Three	š _i .š _i .n _i - č'it š - s - n - č'it 1obj - conj. - 2subj - 'scratch'	'You scratched me'
d.	Three	*s _i s.n _i - č'it cf. š _i š. - jo:l 'I lay there'	Ungrammatical!
e.	Three	*s _i .s _i n. - č'it cf. - <u>sin</u> 'song'	Ungrammatical!

The hierarchy developed in chapter four is repeated below, for ease of reference. This hierarchy will be extended in this section to account for the facts described above.

(2) Rankings Derived Chapter Four:

ONSET, *COMPLEX, VERB-BINARITY, ALIGN OBJECT, LINEARITY,

MAX_{IO}{*CL}

>> ALIGN-S/CL

>> DEP_{IO}, MAX_{IO}{CL}

As is demonstrated below, this hierarchy produces the wrong result for forms like those in (b-c) above. This is because this hierarchy allows minimal epenthesis in order to create well-formed syllables on the surface, and to observe relevant alignment constraints. In forms with one consonantal prefix, a single epenthetic vowel will generally be inserted to create a syllabifiable string: Ci - Stem. If the consonantal prefix is a classifier or /s/ prefix, the string will contain an epenthetic vowel and an epenthetic onset: yiC - Stem. This shows that extra epenthesis is allowed in order to satisfy the requirement that the /s/ prefix (or classifier) be perfectly aligned with the stem.

In forms with two consonantal prefixes, the analysis given so far predicts the insertion of a single epenthetic vowel, because that is all that is needed to create a syllabifiable string: CiC - Stem. However, this pattern only occurs when the prestem prefix is a classifier or an /s/ prefix, as it does in forms like *ǰiǰo:l* 'S/he (4th) cowers'. Otherwise, as in form (b) above, the string will surface with two epenthetic vowels: CiCi.-Stem. Similarly, for forms such as (c) above, the analysis so far predicts that only two epenthetic vowels should be inserted, though it does not differentiate between forms of the shape Ci.CiC. - Stem and CiC.Ci - Stem. Unfortunately, in forms like (c), three epenthetic vowels may be inserted, and they surface shape is Ci.Ci.Ci - Stem. This is unaccounted for under the analysis given in chapter four, because there is no apparent motivation for the extra epenthetic segments.

This problem with the current account is illustrated schematically below. Note that closed syllables are always preferred over open ones, because creation of open syllables requires extra epenthetic segments. Due to space limitations, only the

relevant constraints are included in the tableau: alignment constraints are omitted, and it is assumed that the input contains no prefixes which are subject to any of the alignment constraints presented so far. The optimal output is Ci.Ci.Ci.Stem, but the outputs CiC.Ci.Stem or Ci.CiC.Stem are attested in Navajo (these candidates, (b-c) below, tie according to the current analysis).

(3) input: / C, C, C Stem/ Ci.CiC.Stem or CiC.Ci.Stem

	Candidates	MAX _{IO} {*CL}	ONS	*COMP	V-BIN	MAX _{IO} {CL}	DEP _{IO}
☞ a	C _i .C _i .C _i .Stem						***!
☞ b	C _i C.C _i .Stem						**
☞ c	C _i .CiC.Stem						**
d	C _i CC.Stem			*!			

The problem with the analysis developed so far is that it presumes that closed syllables are well-formed. Optimality Theory allows for the possibility, however, that closed syllables are ill-formed in Navajo, even though they occasionally occur on the surface. This is because the markedness constraint barring closed syllables, NOCODA, can be ranked sufficiently low in the hierarchy to ensure that its effect emerges only under pressure from higher ranked constraints. This observation cannot be readily stated under a rule-based analysis.

5.1.2 NOCODA in the Hierarchy

The definition of the constraint NOCODA is repeated below, for ease of reference.

(4) NOCODA: Syllables do not have codas.

This constraint is violated only under certain circumstances in the Navajo verb. It is violated in the stem, it is violated in the prestem syllable in a verb with an overt classifier or an appropriately positioned first person subject marker /ʃ/ or a S-conjugation marker. It is also violated in the prefix-initial syllable in a verb with a third person indefinite or fourth person subject marker, as will be illustrated in section 5.2 below.

In order to allow for closed syllables anywhere in the verb, NOCODA must be dominated by other constraints. In particular, it must be dominated by any constraints that force the creation of closed syllables. ALIGN-S/CL is one such constraint. The correct ranking of NOCODA with respect to ALIGN-S/CL, as well as the other constraints motivated in chapter four, is given in the tableau below. For clarity, the MAX_{IO} constraints discussed in the previous section are omitted here, as are any candidates which violate them.

This tableau shows the interaction of this revised hierarchy for a form with a closed prestem syllable. In this case, it is a classifier prefix which closes prestem syllable, and the other prefixes occur in open syllables. The candidates in (b-c) twice violate the alignment constraint requiring that classifiers and /s/ prefixes close the prestem syllable, so they are eliminated. The candidate in (d) surfaces with a complex onset, and so is eliminated. Candidate (a) is correctly selected as optimal.

- (5) Input /s 'conj', n '2', l 'classifier' ʃo:l 'lay there/' 'You are laying there' ʃi.ni.l.ʃo:l

	Candidates	ONS	*COMP	ALIGN- OBJ	ALIGN- S/CL	NO- CODA	DEP _{IO}
a	ʃi.ni.l.ʃo:l				*	**	**
b	ʃi.ni.li.ʃo:l				**!	*	***
c	ʃin.li.ʃo:l				**!	**	**
d	ʃni.l.ʃo:l		*!		*	**	*

Comparison of candidates (a) and (b-c) show that NOCODA must be subordinate to the constraint ALIGN-S/CL.

- (6) Ranking

ALIGN-S/CL >> NOCODA

Note furthermore that the presence of classifier prefixes as codas of the prestem syllable necessitates the ranking of the constraint banning omission of the classifiers, MAX_{IO}{CL}, over the constraint NOCODA. If the ranking were reversed, it would always be better to omit classifiers than it is to include them as codas of the prestem syllable. This is illustrated in the tableau below, in which a form containing only a stem and a classifier prefix is evaluated. The forms in (b-c) are excluded due to fatal violations of the syllable structure constraints ONSET and *COMPLEX. The form in (d) is discarded because the classifier is misaligned. The form in (e) is eliminated because it omits the classifier. Comparison of the forms (a) and (e) gives evidence for the ranking of MAX_{IO}{CL} above NOCODA.

- (7) Input /ʃ 'classifier' cé:h 'scrape'/ 'S/he is scraping a hide to soften it' yiʃcé:h

	Candidates	ONS	*COMP	ALIGN-S/CL	MAX _{IO} {CL}	NO-CODA	DEP _{IO}
a	yiʃ.cé:h					**	**
b	iʃ.cé:h	*!				**	*
c	ʃcé:h		*!			*	
d	ʃi.cé:h			*!		*	*
e	yi.cé:h				*!	*	**

The ranking argument available from the tableau above is summarized below.

- (8) MAX_{IO}{CL} >> NOCODA.

The tableau below shows that the categorical, rather than gradient, evaluation of the constraint ALIGN-S/CL is crucial to the analysis given so far. In tableau (9), the constraint ALIGN-S/CL is interpreted categorically, as it has been throughout the analysis: it is violated once for every misaligned /s/-prefix (or classifier) that surfaces in an output candidate. The degree of misalignment is irrelevant to the constraint, however. In tableau (9), the right result is obtained. Candidate (a) best satisfies the alignment constraint under this interpretation, and candidate (b) is rejected because it violates NOCODA but does not contain a perfectly aligned /s/-prefix. Since all candidates violate ALIGN-S/CL an equal number of times, NOCODA selects candidate (a) as optimal.

(9) Input /š '1', s 'conj' n '2', č'it 'scratch'/ 'You scratched me'

ṣ̌i.ṣ̌i.ṇi - č'it

	Candidates	ONS	*COMP	ALIGN- OBJ	ALIGN-S/CL	NO- CODA	DEP _{IO}
a	ṣ̌i.ṣ̌i.ṇi - č'it				**	*	***
b	ṣ̌iš.ṇi - č'it				**	**!	**
c	ṣ̌i.ṣ̌in - č'it				**	**!	**
d	ṣ̌išn. - č'it		*!		**	**	*

Under this interpretation of the constraint ALIGN-S/CL, an additional ranking can be established. Comparison of forms (a) with (b-c) above motivates the ranking of NOCODA above DEP_{IO}. This ranking is given below.

(10) Ranking

NO-CODA >> DEP_{IO}

By transitivity, the ranking below is derived.

(11) Ranking

ALIGN-S/CL, MAX_{IO}{CL} >> NOCODA >> DEP_{IO}

Tableau (12) shows that a gradient interpretation of the constraint ALIGN-S/CL results in the wrong output. In the tableau in (12), one violation of ALIGN-S/CL is calculated for every segment that intervenes between an /s/-prefix and the stem. This has the unfortunate result that candidates with prefixal closed syllables better satisfy ALIGN-S/CL, even if these closed syllables do not result in perfect alignment between the /s/-prefix and the stem. Since ALIGN-S/CL dominates NOCODA, closed prefixal syllables are tolerated in order to better satisfy ALIGN-

S/CL. This is illustrated in the candidate in (b). The candidate in (a) is optimal, but is incorrectly ruled out because it contains too many violations of ALIGN-S/CL.

(12) Input /š '1', s 'conj' n '2', č'it 'scratch'/ 'You scratched me'

ṣ̌i.ṣ̌i.ṇi - č'it

	Candidates	ONS	*COMP	ALIGN- OBJ	ALIGN-S/CL	NO- CODA	DEP _{IO}
☞ a	ṣ̌i.ṣ̌i.ṇi - č'it				*****!****	*	****
☞ b	ṣ̌i.ṣ.ṇi - č'it				****	**	**
c	ṣ̌i.ṣ̌iṇ - č'it				*****!*	**	**
d	ṣ̌i.ṣṇ. - č'it		*!		****	**	*

The reason that candidate (a) above is actually preferred in Navajo over candidate (b) is intuitively clear, but formally difficult to capture. NOCODA violations are only justified if they result in perfect alignment between an /s/ prefix and a stem. If NOCODA violations are incurred, but the result is still imperfect alignment of the /s/ prefix and the stem, these NOCODA violations are fatal. The categorical, rather than gradient, interpretation of the alignment constraint ALIGN-S/CL, which is illustrated in tableau (7) above, is unconventional. A discussion of other formal possibilities for accounting for this type of all-or-nothing alignment phenomenon is delayed until section 5.2.4. For now, comparison of the tableau in (7) and (10) shows that an absolute interpretation of the constraint ALIGN-S/CL is necessary for the data presented so far.

Note that verb-final epenthesis can be ruled out by the constraint ALIGN-STEM which was posited in chapter four. This constraint is never violated on the

surface in Navajo, and so is assumed to be top-ranked. This constraint is repeated below for convenience.

(13) Constraint Barring Epenthesis at the Right Word Edge:

ALIGN STEM, RIGHT, PROSODIC WORD, RIGHT (ALIGN-STEM):

Align the right edge of the stem with the right edge of the prosodic word.

This constraint not only eliminates forms with verb-final epenthesis to avoid closed syllables, but it also, if sufficiently highly ranked, account for the existence of prefixes but no suffixes in this language¹. The interaction of this constraint in the hierarchy is demonstrated in the tableau below. For reasons of space, the undominated syllable structure constraints *COMPLEX and ONSET have been omitted from this tableau, as have candidates which would violate them.

(14) /Input š '1', s 'conj' n '2', č'it 'scratch'/ 'You scratched me'

ṣ̌i.ṣ̌i.ṇi - č'it

Candidates	ALIGN-STEM	ALIGN-OBJ	ALIGN-S/CL	NO-CODA	DEP _{IO}
a ṣ̌i.ṣ̌i.ṇi - č'it			**	**	***
b ṣ̌i.ṣ̌i.ṇi - č̣i.ṭi	*!		**	*	

¹There are purported suffixes in Navajo which are posited to account for the stem variation that signals tense, mode and aspect. The arguments for Navajo suffixes come from diachronic and comparative analysis (cf. Leer 1979). If this account is right, the importance of this constraint is confirmed: suffixes coalesce with the final segment of the stem, thus preserving right-edge alignment of the prosodic word and the stem. Of course, enclitics must therefore be viewed as attaching outside of the prosodic word.

Comparison of these two candidates motivates the ranking of ALIGN-STEM over NOCODA . Candidate (b) is eliminated by ALIGN-STEM , even though it fares better on NOCODA than does the optimal form, candidate (a).

(15) Ranking:

ALIGN-STEM >> NOCODA

5.1.3 Summary

This section accounted for the general distribution of closed syllables in the Navajo verb prefixes. Closed syllables are avoided, unless one of the constraints ALIGN-STEM or ALIGN-S/CL overrides the ban on them. The rankings derived in this section are reviewed here, and the total ranking scheme is given as well.

(16) Rankings Derived in this Section

ALIGN-STEM, ALIGN-S/CL, MAX_{IO}{CL} >> NOCODA >> DEP_{IO}

(17) Rankings Derived So Far:

ONSET, *COMPLEX, VERB-BINARITY, ALIGN OBJECT, LINEARITY,
MAX_{IO}{*CL} ALIGN STEM, *PEAK/CONSONANT{*Y}

>> ALIGN S/CL , MAX_{IO}{CL}

>> NOCODA

>> DEP_{IO}

>> *PEAK/Y

>> *MARGIN/Y

This ranking results in the creation of open syllables in the prefixal domain of Navajo, unless doing so would result in violation of ALIGN-S/CL. There is however, one additional case in which closed syllables are tolerated in the Navajo

prefix span. This occurs when the obviative prefixes /ʔ/ and /j/ can form codas of a non-prestem syllable. The next section addresses these prefixes.

5.2 THE OBVIATIVE PERSON PREFIXES: CODAS OUTSIDE OF THE PRESTEM SYLLABLE

This section reviews the distribution of the obviative person markers in Navajo. The data are reviewed in 5.2.1, and the generalizations gleaned in chapter three are repeated. The analysis presented thus far is extended to account for the distribution of the obviative person prefixes in section 5.2.2.

5.2.1 NOCODA and the Obviative Third Person Prefixes

The third person obviative markers include the third person indefinite prefix /ʔ/ 'someone, something', and the fourth person /j/ 's/he (4th)'. The distribution of these prefixes is reviewed here. Note that each surfaces as the onset of a prestem syllable, as in (a, d) below, or as the onset of a word-initial syllable, as in (b, e). Otherwise, each of these prefixes surfaces as a coda, as in (c,f).

(18) Third Person Obviative Markers: C ~ CV

	Meaning	Marker	Form	Gloss
a.	4th Person Penult	ǰ	ši.ǰi.- č'it š ǰ č'it obj-subj-stem	's/he (4th) is scratching me'
b.	Initial	ǰ	ǰi.to: -č'ił ǰ tμμ o č'ił subj-fut-subj-stem	's/he (4th) will be scratching it'
c.	Pre-Penult	ǰ	ši.ǰ.to: -č'ił š ǰ tμμ o č'ił obj-subj-fut-subj-stem	's/he (4th) will be scratching me'
d.	3rd Person-ind. Penult	ʔ + Passiv e	ši.ǰ.ti.- č'it š ʔ t č'it obj-subj-passive-stem	'I'm being scratched'
e.	Initial	ʔ	ʔa.to: -č'ił ʔ tμμ o č'ił subj-fut-subj-stem	'someone will be scratching it'
f.	Pre-Penult	ʔ + Passiv e	ši.ti.ʔ.to:.- č'it š t ʔ tμμ o č'ił obj-pass-fut-sub-stem	'I'll be scratched'

Note the vowel associated with the fourth person prefix in forms (a-b) is [i], while that associated with the third person indefinite prefix in forms (d-e) is [a]. This is consistent with the claim that these vowels are epenthetic. Recall from chapter

three, section 3.1.3.2, that the epenthetic vowel surface as low when it occurs to the immediate right of the glottal stop.

The linear order of the third person indefinite and fourth person prefixes is crucial to the analysis that comes. When these prefixes occur they are either the first prefix or the second prefix in the word. The only prefixes which can occur to the left of the obviative subject markers are the object prefixes. This is shown in forms (c, f) above.

It was shown in chapter four that the default first person marker and the S-conjugation marker surface as codas of the prestem syllable or else as syllable onsets, e.g. *yǐš.č^ha* 'I am crying', vs. *šito:č'it* 'S/he will be scratching me'. The third indefinite and fourth person markers have the opposite distribution. They surface as codas of pre-prefixal syllables, but never as codas of prestem syllables. The generalizations about the obviative person prefixes are summarized below.

(19) Generalizations About Obviative Person Prefixes

	__V	__Stem	Elsewhere	Coda?	Meaning
ʃ/	[ʃ]	[ʃi]	[ʃi] or [ž]	Pre-Prefixal	4th Person
/ʔ/	[ʔ]	[ʔa]	[ʔa] or [ʔ]	Pre-Prefixal	3rd Indefinite

The next section accounts for this distribution by extending the analysis developed thus far, and incorporating a constraint requiring that obviative prefixes be aligned to the left of a prefix.

5.2.2 An Analysis of the Obviative Person Markers

The third indefinite and fourth person markers /ʔ/ and ʃ/ have in common the following properties. First, each surfaces as a consonant before a vowel (e.g..

ǰóč^hah 'S/he (4th) should be crying', *ʔóč^hah* 'There should be crying'). Second, each surfaces as CV in some preconsonantal environments, as follows.

These prefixes never surface as codas of the prestem syllable (e.g. *šǰič'it* 's/he (4th) is scratching me' **šǰč'it*). They do, however, surface as codas of a pre-prefixal syllable (e.g. *šǰto:č'it* 's/he (4th) will be scratching me', **šǰito:č'it*). The current hierarchy selects the correct forms for verbs in which the obviative prefixes surface in open syllables. This is because of the introduction of the constraint NOCODA into the hierarchy, as is illustrated below.

The tableau below shows that the correct form is selected by the current hierarchy for verbs containing a fourth person marker which surfaces as an onset. The candidates (a-b) below differ only in the number of epenthetic segments (and therefore the number of closed syllables) in the word. This hierarchy selects (a) because it contains fewer closed syllables than does (b).

(20) input: / š 1st person subject, ǰ '4th person object', č'it 'scratch/'

šǰič'it 's/he is scratching me'

Candidates	MAX _{IO}	*COMP	ALIGN- OBJ	ALIGN- S/CL	NO CODA	DEP _{IO}
	{*CL}					
a				*	*	**
b				*	**!	*

This hierarchy selects the wrong candidate for forms in which the fourth person marker surfaces as a coda, however. Such a case is illustrated below. In the tableau below, the form in (a) is incorrectly eliminated by NOCODA, and the candidate in (b) is wrongly selected as optimal.

(21) input: / š 1st person subject, ʝ '4th person object', to: 'future' č'ı̄

'scratch'/ šı̄ʝto:č'ı̄ 's/he will scratch me'

	Candidates	MAX _{IO} {*CL}	*COMP	ALIGN- OBJ	ALIGN- S/CL	NO- CODA	DEP _{IO}
☞ a	šı̄ʝ.to:č'ı̄				*	**!	*
☞ b	šı̄.ʝı̄.to:č'ı̄				*	*	**

There must, therefore, be another constraint in the hierarchy that excludes (b) on independent grounds. This constraint must outrank NOCODA in order for its effect to be seen on the surface. Furthermore, this constraint must name both of the obviative person prefixes of Navajo. This is because both the third person indefinite and the fourth person prefixes have exactly the same distribution.

The distribution of the obviative prefixes requires that two new alignment constraints be introduced into the hierarchy in order to account for their syllabic properties. The first, given in 5.2.2.1 below, accounts for the fact that the obviative markers surface as onsets when they are word-initial. The second, given in 5.2.2.2, accounts for the fact that the obviative markers surface as codas in pre-prefixal syllables, just in case the obviative marker is not leftmost in the word.

5.2.2.1 Obviatives as Onsets

The distribution of the obviative prefixes makes it clear that these prefixes, like the object prefixes of Navajo, are constrained to surface close to the left edge of the verb. As with the object marker /š/ as discussed in chapter four, it is pressure for leftmostness of the obviative markers that ensures they surface as syllable onsets in word-initial position. In fact, the object prefixes are the only prefixes which can

occur to the left of the obviative subjects. Therefore, the following alignment constraint is proposed, calling for the left-edge alignment of the obviative prefixes.

(22) Constraint:

ALIGN-OBVIATIVE, LEFT, VERB, LEFT (ALIGN-OBV): Align the Left edge of any obviative prefix with the left edge of the verb.

The need for this constraint in the hierarchy is shown in the tableau below. This tableau shows the evaluation of a form containing no object prefix. (The top ranked syllable structure constraint *COMPLEX is not included in the tableau to save space; no candidates which violate it are considered either.) The candidate in (a) is selected as optimal because it contains a properly aligned obviative subject marker. The candidate in (b) is eliminated because it does not. No ranking arguments are available on the basis of this tableau, however, and the constraint ALIGN-OBVIATIVE has been placed in the top block for convenience. The constraint NOCODA is sufficient to get this result at this point in the analysis.

(23) input: /ǰ '4th person subject', tʰɯ 'future' o 'third person' č'it 'scratch'/ ǰito:č'it 's/he is scratching me'

Candidates	ONS	ALIGN- OBJ	ALIGN- OBV	ALIGN- S/CL	NO- CODA	DEP _{IO}
a ǰi.to:č'it					*	*
b yiž.to:č'it			*!*		**	*

The constraint ALIGN-OBVIATIVE is violated only when an object prefix surfaces. Such cases motivate the ranking of ALIGN-OBJECT over ALIGN-OBVIATIVE. This is illustrated in the tableau below. The forms in (b-c) are eliminated because they do not properly align the object prefix with the left edge of

the verb. The form in (d) is eliminated because it contains an unnecessary violation of NOCODA. The form in (a) is selected in spite of its violation of ALIGN-OBVIATIVE, because its closest competitor, (d), also violates ALIGN-OBVIATIVE.

(24) input: / š 1st person object, ĵ '4th person subject', č'it 'scratch'/
šičto:č'it 's/he is scratching me'

Candidates	ONS	ALIGN- OBJ	ALIGN- OBV	ALIGN- S/CL	NO- CODA	DEP _{IO}
a šič'it			**	*	*	**
b ĵič'it		*!*		*	*	**
c ĵšič'it		*!*			**	*
d šič'it			**	*	**!	*

It is still the case that the presence of ALIGN-OBJECT and NOCODA in the hierarchy are sufficient to determine the right result. However, it is shown in the next section that Align-Obviative is crucial to the analysis. Comparison of (a) and (b) above motivates the ranking of ALIGN-OBJECT over ALIGN-OBVIATIVE.

(25) Ranking:

ALIGN-OBJECT >> ALIGN-OBVIATIVE

The relative ranking of ALIGN-OBVIATIVE with respect to the other constraints in the hierarchy is still indeterminate. As long as it is ranked lower than ALIGN-OBJECT, the right result is obtained. The precise ranking of these constraints is confirmed in section 5.2.2.2 below.

5.2.2.2 Obviatives as Codas

The forms in which an obviative prefix creates a closed syllable remain unaccounted for. The constraint ALIGN-OBVIATIVE posited above cannot account for

these cases, because the obviative marker always violates this constraint when it occurs as a syllable coda. Note that the alignment between the obviative prefix and the left edge of the word is the same regardless of whether the prefix is syllabified as a coda to an initial syllable, or as an onset to a peninitial syllable². This is illustrated below:

(26) Left-Alignment of Obviative Prefixes

Alignment	Form	Gloss
a. #CV.ɿ	šič'iit š ɿ č'iit object-subject-stem	's/he is scratching me'
b. #CVɿ.	šič.to:.-č'iit š ɿ tɿμ o č'iit obj-subj-tense-subj-stem	's/he will be scratching me'

Furthermore, although the obviative markers can surface as codas, their ability to do so depends on their manifesting perfect left-alignment with another prefix. That is, it is impossible for a Navajo verb to surface with an obviative subject marker as the coda of a prestem syllable. Instead, obviative markers occur as syllable codas only if doing so results in perfect alignment between the right edge of the obviative marker, and the left edge of another prefix. The constraint responsible for this is formalized below.

²This follows if alignment violations are gradiently evaluated, and are counted in terms of segments or root nodes. If they are counted in terms of syllables, the form in (b) would have better left-alignment of the obviative than would that in (a). This is the desired result, but as the other alignment constraints posited here crucially require that violations of alignment constraints not be counted in terms of syllables, it is assumed that violations of the constraint ALIGN-OBVIATIVE are not counted according to syllables either.

- (27) Constraint Requiring Obviative Prefixes to Align with a Prefix
 ALIGN OBVIATIVE, RIGHT, PREFIX, LEFT (ALIGN-OBV-R): Align the Right edge of every obviative person marker with the Left edge of some prefix.

In order to maintain clarity in the analysis, the constraint requiring obviatives to be leftmost in the word will hereafter be referred to as ALIGN-OBVIATIVE-L, in contradistinction to this constraint, which refers to alignment of the right edge of the obviative and which is termed ALIGN-OBVIATIVE-R. Note that the inclusion of this constraint fills out the typology of alignment constraints used in Navajo. Alignment may refer to edges of words (as does ALIGN-OBJECT), or of stems (as does ALIGN S/CL) or of prefixes. This is illustrated in the chart below.

(28) ALIGNMENT in Navajo

Align-to-Word	Align-to-Stem	Align-to-Prefix
ALIGN-OBJECT, ALIGN-OBVIATIVE-L	ALIGN-S/CL ALIGN-STEM	ALIGN-OBVIATIVE-R

In every case, affixes are aligned with a morphological unit which is perfectly well defined as part of the universal inventory of morphological categories. This is exactly the kind of inventory allowed by the universal Alignment schema, and no language-specific categories need to be referred to.

The constraint ALIGN-OBVIATIVE-R must dominate NOCODA for its effect to be seen on the surface. In the tableau below, the highly ranked ONSET constraint is not given, nor are candidates which would violate it. The candidate in (b) is eliminated because it fails to properly align the right edge of the obviative marker with a prefix. This shows that the constraint ALIGN-OBVIATIVE-R is active in

Navajo. The candidate in (c) is eliminated because it contains too many ALIGN-OBVIATIVE-L violations. The candidate in (d) is eliminated because it misaligns an object marker, in violations of the high-ranked ALIGN-OBJECT. Therefore, the candidate in (a) is selected as optimal³.

(29) input: / š 1st person object, ʃ '4th person subject', tɯɯ 'future' o
'third person' č'it 'scratch'/ šižto:č'it 's/he is scratching me'

Candidates	ALIGN- OBJ	ALIGN- OBV-L	ALIGN- OBV-R	ALIGN- S/CL	NO- CODA	DEP _{IO}
a ʃiž.to:č'it		**		*	**	*
b ši.ʃi.to:č'it		**	*!	*	*	**
c ši.to:ž.č'it		***!*	*	*	**	*
d ʃi.ši.to:č'it	*!*		*	*	*	**

Comparison of forms (a) and (b) show that ALIGN-OBVIATIVE-R must dominate NOCODA. If the ranking were reversed, the form in (b) would be selected as optimal.

(30) Ranking

ALIGN-OBVIATIVE-R >> NOCODA

In order to derive the ranking of ALIGN-OBVIATIVE-L with respect to ALIGN-OBVIATIVE-R, forms with word-initial obviative prefixes must be reconsidered. This is accomplished with the tableau below. The candidate in (a) is selected because it best satisfies ALIGN-OBVIATIVE-L. It does so at the expense of ALIGN-OBVIATIVE-

³In fact, the alignment constraints given here account for the positional requirements of the obviative markers in a somewhat inelegant way: the fact is that alignment of the obviatives must be (a) leftmost, and (b) to the left of a prefix. These are both requirements on the leftmostness of the obviatives, and therefore ought to be characterizable as one alignment constraint. This task is left to future analysis.

R , however. This motivates the ranking of ALIGN-OBVIATIVE-L above ALIGN-OBVIATIVE-R . The candidate in (b) satisfies ALIGN-OBVIATIVE-R at the expense of the higher ranked ALIGN-OBVIATIVE-L , so is eliminated.

- (31) input: /ǰ '4th person subject', tɯɯ 'future' o 'third person' č'it
'scratch'/ ǰito:č'it 's/he is scratching me'

Candidates	ALIGN OBJ	ALIGN- OBV-L	ALIGN- OBV-R	ALIGN- S/CL	NO- CODA	DEP _{IO}
a ǰi.to:č'it			*		*	*
b ǰiž.to:č'it		*!*			**	*

Comparison of form (a) with those in (b-c) show that ALIGN-OBVIATIVE-L must outrank ALIGN-OBVIATIVE-R. This comparison shows that the inclusion of the constraint ALIGN-OBVIATIVE-L is crucial to the syllable structure alternations in which the obviative prefixes participate. This ranking is summarized below.

- (32) Ranking:

ALIGN-OBVIATIVE-L >> ALIGN-OBVIATIVE-R

The analysis so far predicts the following. An object prefix will always surface with perfect left alignment with the word, and will consequently always surface as an onset. The obviative subject markers will occur on the left edge of the word, so long as there is no object prefix. In forms with an object prefix, however, the presence of the object prefix makes it impossible to perfectly satisfy ALIGN-OBVIATIVE-L without violating the higher-ranked ALIGN-OBJECT. Since all forms which satisfy ALIGN-OBJECT will necessarily violate ALIGN-OBVIATIVE-L, ALIGN-OBVIATIVE-L will not be able to differentiate between the remaining candidates⁴. The

⁴This is not exactly true, as the gradient nature of alignment violations ensure that forms which multiply violate Align-Obviative-Left will still be weeded out by that

lower ranked ALIGN-OBVIATIVE-R can therefore select a form in which the obviative subject marker surfaces with perfect right alignment to a prefix, and thus as a syllable coda. In short, the influence of ALIGN-OBVIATIVE-R will only be seen in forms which, for independent reasons, must violate ALIGN-OBVIATIVE-L.

There are two additional types of forms to consider. First, in forms in which no prefix occurs to the right of the obviative (e.g. *š̃jič'it* 's/he (4th) is scratching me'), the obviative marker must surface as an onset. Second, in forms in which only a classifier or /s/ prefix occurs to the right of the obviative (e.g. *š̃jihoz* 's/he (4th) is tickling me'), the classifier must surface as a coda of the prestem syllable, and the obviative marker must surface as an onset. These are taken in order.

In forms with no prefix on the right of the obviative marker, ALIGN-OBVIATIVE-R cannot be satisfied. Therefore, NOCODA selects the optimal candidate, as in (a) below. The form in (b) has an obviative marker which surfaces as a coda, and which is right-aligned with the stem. This does not satisfy ALIGN-OBVIATIVE-R, and so is discarded by NOCODA. The form in (c) misaligns the object marker, and so is dismissed by the top-ranked constraint ALIGN OBJECT.

constraint, in favor of those which minimally violate it. This is another case in which the formalism of Optimality Theory allows the analysis to capture the effect of constraints which do not characterize surface-true generalizations, but which nevertheless influence the phonology of a language.

(33) input: /š 'first person object', ĵ '4th person subject', č'it 'scratch'/

šĵič'it 's/he is scratching me'

	Candidates	ALIGN OBJ	ALIGN- OBV-L	ALIGN- OBV-R	ALIGN- S/CL	NO- CODA	DEP _{IO}
a	šĵič'it		**	*	*	*	**
b	šĵč'it		**	*	*	**!	*
c	ĵšč'it	*!*		*		**	*

In a verb in which a classifier or /s/ prefix occurs to the right of the obviative marker, it would be possible for the obviative marker to surface with right alignment to the classifier or /s/ prefix, thus (double) closing the prestem syllable. However, doing so would result in a violation of the undominated syllable structure constraint *COMPLEX, because a complex coda would be created. The creation of a complex coda could be avoided in two ways. One is deletion of the obviative marker. This would violate the top-ranked MAX_{IO}{*CL}, which marks any representation in which a non-classifier element has been deleted, however. Another is deletion of the /s/ prefix or classifier. In the case of an /s/ prefix, deletion of the /s/ would violate the top-ranked MAX_{IO}{*CL}, and so is avoided. In the case of a classifier prefix, however, the low ranking of the constraint MAX_{IO}{CL}, however, makes the deletion of the classifier less costly.

This case is illustrated below, and the right result is obtained. *COMPLEX eliminates the candidate in (b), which satisfies ALIGN-OBVIATIVE-R. Candidate (c) omits the classifier in order to satisfy *COMPLEX. Doing so renders the form incapable of satisfying ALIGN-OBV-R, since there is no prefix to the right of the obviative marker on the surface. The candidate is eliminated because it violates

$MAX_{IO}\{CL\}$. The candidate in (d) misaligns the object marker, and is therefore eliminated. Note that if the ranking between $MAX_{IO}\{CL\}$ and DEP_{IO} were reversed, candidate (c) would be incorrectly selected as optimal. The candidate in (a) in which the obviative marker surfaces as a syllable onset, is preferred to all other candidates.

- (34) input: /š 'first person object', j '4th person subject', † 'classifier'
hož 'tickle'/ šj†hož 's/he is tickling me'

	Cands.	*CMP	ALIGN OBJ	ALIGN- OBV-L	ALIGN- OBV-R	MAX_{IO} {CL}	NO- CODA	DEP_{IO}
a	šj†.hož			**	*		**	**
b	šjž†.hoz	*!		**			**	*
c	šjž.hoz			**	*	*!	**	*
d	jš.hoz		*!		*	*		*

This concludes the analysis. The rankings motivated in this section are reviewed below.

- (35) Rankings Derived in this Chapter

*OBVIATIVE-STEM, ALIGN-OBVIATIVE-L

>> ALIGN-OBVIATIVE-R, $MAX_{IO}\{CL\}$

>> NOCODA

>> DEP_{IO}

5.2.3 Summary of the Hierarchy

The entire ranking scheme proposed in this dissertation is depicted below. This hierarchy accounts for all of the syllable structure alternations in the Navajo verbal prefixes. The problem of gradient versus categorical evaluation of alignment constraints is returned to in section 5.2.4 below.

- (36) Entire Ranking Scheme
- ONSET, *COMPLEX, VERB-BINARITY, MAX_{IO}{*CL} ALIGN-STEM,
ALIGN-OBJECT, *PEAK/CONSONANT {*Y}
- >> ALIGN-OBVIATIVE-L
- >> ALIGN-S/CL , ALIGN-OBVIATIVE-R, MAX_{IO}{CL}
- >> NOCODA
- >> DEP_{IO}
- >> *PEAK/Y
- >> *MARGIN/Y

5.2.4 Categorical and Gradient Alignment

In this chapter it has been argued that the constraint ALIGN-S/CL must be evaluated categorically, and not gradiently, in order to account for the facts of Navajo. This is a departure from the conventional interpretation of alignment (but see Eisner 1997 for a similar proposal). It is the case that all of the alignment constraints proposed in chapters four and five of this dissertation, if interpreted categorically rather than gradiently, would produce the right result with respect to the syllable structure alternations accounted for here. That is, for these alternations, there is never a reason to posit gradient violations of alignment constraints. Perfect alignment is called for across the board, and where it cannot be attained (due to the intervention of superordinate constraints), the degree of misalignment is irrelevant.

It is not the case, however, that gradient constraint violation can be supplanted by categorical interpretation of alignment constraints generally. In the domain of stress theory, for example, the distance between the edge of a foot and the edge of a word may be crucial, not just the absolute misalignment of foot and word.

Similarly, ordering of affixation via alignment constraints crucially relies on gradient evaluation of them. If this were not the case, and all alignment constraints were interpreted absolutely, then the expected result would be that prefixes forced into misalignment should be able to surface anywhere in the prefixal span. This doesn't happen, however. Misaligned prefixes tend to surface in a spot that is minimally distant from the one that is called for by the alignment constraints that mention them.

The distribution of the obviative subject markers in the analysis above has exactly this quality. These markers surface either in the initial syllable (that is, with perfect left-edge alignment with the word), or in the peninitial syllable (that is, with minimally imperfect left-edge alignment). They never surface in the third syllable from the left. This fact falls out of a gradient interpretation of the constraint ALIGN-OBVIATIVE-LEFT, but would have to be stipulated in an account in which all alignment constraints were construed as absolute.

In fact, the data presented in this dissertation can be accounted for via strictly gradient alignment constraints, though the required alignment constraints miss an important generalization: the generalization that both of the /s/-prefixes, the first person marker /s/ and the Si-Conjugation marker /s/ violate NOCODA only if such a violation results in perfect alignment between the prefix and the stem. If other prefixes intervene between either of these two prefixes and the stem, such that no amount of NoCoda violation could result in perfect alignment, NOCODA is not violated. The alignment constraints that are required are given in (35) and (36) below.

- (37) ALIGN \check{s} , RIGHT, STEM, LEFT (ALIGN- \check{s}):

Align the Right edge of every / \check{s} / first person subject prefix with the Left edge of some verb stem.

- (38) ALIGN SI-STEM, LEFT, S-PREFIX, RIGHT (ALIGN-S):

Align the Left edge of every third person Si-Conjugation stem with the Right edge of some /s/ conjugation prefix.

The alignment constraint in (35) above refers only to the first person marker / \check{s} /, when it is a subject marker. Recall that this marker always surfaces as the coda of the prestem syllable, e.g. *yiš.č^ha* 'I am crying'. The second alignment constraint above reverses the order of arguments such that for any third person, Si-Conjugation verb, perfect alignment is required between the Si-Conjugation marker and the stem, e.g. *yiš.žo:ʔ* 's/he cowers'. In verbs that are not third person, there is no pressure for such an alignment configuration, so there would be no pressure to create prefixal closed syllables in these forms. This would result, empirically, in exactly the pattern described here.

The analytical shortcomings of such a move are all theory-internal, but they are considerable. First, the approach misses the generalization that Si-Conjugation markers and \check{s} first person markers behave in exactly the same way as each other. When they can, they both occur as codas of the prestem syllable. When they can't, they do not induce extra NOCODA violations. Second, the reference to "third-person, Si-Conjugation" verbs in the constraint in (36) above is less appealing than are constraints that simply refer to stems and prefixes more generally. Third, the analysis suggested in this section utilizes a number of alignment strategies, when in fact a single alignment strategy would work: categorical alignment accounts for all of

the syllable structure alternations presented here without the necessity of positing additional constraints to account for similar patterns of distribution.

If both gradient and absolute interpretations of alignment constraints appear to be required by the data, the manner in which this distinction can best be formally captured is unclear. There are at least three possibilities. One is that the gradient vs. categorical evaluation of alignment constraints could be considered to be parametric. That is, languages choose whether alignment is calculated gradiently or not.

A second possibility is that all apparently gradient constraints are in fact sets of categorical constraints. On this view, any putatively gradient alignment constraint is actually a (presumably infinite) set of categorical alignment constraints that includes (at least) the following:

(39) Set of Categorical Alignment Constraints for ALIGN-X, L, Y, R:

ALIGN-X,Y-0: The left edge of any X is exactly zero segments away
from the right edge of Y.

ALIGN-X,Y-1: The left edge of any X is exactly one segment away
from the right edge of Y.

ALIGN-X,Y-2: The left edge of any X is exactly two segments away
from the right edge of Y.

.....

ALIGN-X,Y-n: The left edge of any X is exactly n segments away
from the right edge of Y..

Under such an approach, apparently gradient constraint evaluation would simply follow from the ranking of each of these categorical constraints at the same place in the hierarchy. Categorical evaluation would follow from the ranking of any

one of these constraints above all the others, with another type of constraint (i.e. a markedness constraint such as NOCODA) intervening between them.

This approach is formally appealing in that it reduces the types of constraint evaluation allowed in Optimality Theory to one, but it is problematic in at least two ways. First, it assumes an infinite set of constraints for every apparently gradient phenomenon. This is computationally implausible. Second, it massively overgenerates possibilities that languages do not ever seem to exploit. For example, it predicts that there should be a language in which misalignment of two elements by exactly four segments should be preferred over misalignment by three or fewer segments, as well as misalignment by five or more segments. This type of pattern never occurs.

Note that the phenomenon which has been captured by positing non-gradient evaluation of the alignment constraint ALIGN-S/CL suggests non-strict ranking of constraints in the following sense. The constraint NOCODA is violated only in case such violation creates perfect alignment of an /s/-prefix with the stem. When violation of NOCODA would result in imperfect (albeit minimally imperfect) alignment of an /s/-prefix with the stem, then it is never violated. Thus, NOCODA appears to occur in the constraint hierarchy in two different places: both above and below ALIGN-S/CL.

In the Optimality Theoretic literature, local conjunction (Elzinga 1995, Fountain 1996, Hammond 1997b, Smolensky 1995) has been proposed as a way to circumvent strict constraint ranking. Local conjunction is posited to account for phenomena in which two constraint violations in a single domain can render a form ungrammatical, even though one violation of the same constraint in the same domain

is readily tolerated on the surface in a particular language. In this regard, local conjunction is a strategy for eliminating "the worst of the worst" from consideration by the remainder of the constraint hierarchy.

The current phenomenon, however, is the mirror image of the kind of pattern for which local conjunction has been proposed. In order to capture a categorical alignment effect, it must be the case that two (or more) violations of the alignment constraint fail to render ungrammaticality, although a single violation is enough to discard any candidate. In this sense, categorical evaluation of alignment constraints is a way of eliminating the "best of the worst" from contention, so that the remaining hierarchy can decide from among the rest of the candidates.

The third possibility for accounting for the facts presented in this chapter is the one that has been taken here. It is that some alignment constraints simply require gradient evaluation, while others call for categorical evaluation. This approach is formally unsatisfying, but it is motivated by the data given in this chapter, and it does not suffer from the empirical and theoretical inadequacies of the other alternatives suggested here. A better solution to this problem is left as a topic for further research.

5.3 SUMMARY AND CONCLUSIONS

This chapter has extended the analysis developed in chapter four to account for the full range of syllable structure alternations in the prefixal span of the Navajo verb. All instances of closed prefixal syllables are the result of alignment constraints which outrank NOCODA. This explains why it is the case that only certain prefixes can surface as codas, while others (such as the /n/ prefixes marking the second person) never do. It furthermore accounts for the fact that both the input shape of

particular prefix and its linear order in the prefixal string determine its surface shape. Alignment constraints specify both particular prefixes and particular linear positions.

Both alignment constraints which produce closed prefixal syllables, ALIGN-S/CL and ALIGN-OBVIATIVE-R are surface violable, and therefore dominated by higher ranked constraints. This explains why the prefixes which can form closed syllables in some cases do not do so in every case. Finally, this analysis points to one of the foremost advantages of an Optimality Theoretic approach to these data. The fact that requirements such as the alignment constraints mentioned above, as well as the markedness constraint NOCODA, play a significant role in the phonology of Navajo, even though they do not describe surface-true generalizations, is expected according to the constraint-ranking proposal of Optimality Theory. It is not readily captured in terms of rule-based phonological theory⁵.

Finally, the alignment constraints of Navajo are seen to refer to all well-defined morphological units described in this dissertation: word, stem and prefix. This is exactly what is predicted under Generalized Alignment, and it is attested in this language. These morphological categories are certainly of universal applicability, as are the prefixal categories that are referred to by the alignment constraints. These include the phonological category '/s/ prefixes', and the morphological categories 'classifiers prefixes' and 'obviative prefixes'. The universal applicability of all of these categories is obvious: while not all languages may exploit each of these particular categories, all of them are drawn from universal sets of phonological (voiceless coronal fricatives) and morphological (transitivity

⁵In rule-based approaches, rule ordering accounts for the non-surface-trueness of phonological generalizations. These approaches miss the fact that the generalizations to be captured are the result of universal principles, however.

markers, obviative person markers) objects. Therefore it can be argued that the alignment constraints posited here are in no way parochial, but instead draw from the universally possible set of phonological and grammatical categories.

The final chapter of this dissertation reviews a number of alternative approaches to these data, both within and outside of Optimality Theory. It also draws comparisons between the input forms generated in this dissertation, and those proposed in the Athapaskanist literature. It concludes with a number of final observations and directions for further work.