

Fronting and Palatalization in Two Dialects of Shoshoni*

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1. Introduction

In Western Shoshoni, a Uto-Aztecan language spoken in northern Nevada, coronal obstruents are found in distributional patterns which depend on the presence or absence of a preceding front vowel ([i] or [e]). In the pattern I refer to as FRONTING, alveolar stops alternate with dental stops—dental stops occur following front vowels (1a), while alveolar stops occur elsewhere (1b); this pattern is common to all dialects:

(1) Western Shoshoni Fronting

- a. dental: [sittu] ‘here’ (*si-* ‘PROXIMAL’ –*ttu* ‘LOCATIVE STEM’)
- b. alveolar: [sattu] ‘here’ (*sa-* ‘DISTAL’ –*ttu* ‘LOCATIVE STEM’)

In the pattern I refer to as PALATALIZATION, coronal affricates alternate with palato-alveolar affricates—palato-alveolar affricates occur following front vowels (2a), while alveolar affricates occur elsewhere (2b):

(2) Western Shoshoni Palatalization

- a. palato-alveolar: [moyittšj] ‘bag’ (*moyi* ‘bag’ –*ttsj* ‘ABSOLUTE’)
- b. alveolar: [poniattsj] ‘skunk’ (*ponia* ‘skunk’ –*ttsj* ‘ABSOLUTE’)

This distribution of coronals in Western Shoshoni is completely predictable and also occurs morpheme-internally (3-4):

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- (3) Morpheme-internal Fronting in Western Shoshoni
- dental: [hi^{tt}to:] ‘meadowlark’
 - alveolar: [potto] ‘grinding stone’
- (4) Morpheme-internal Palatalization in Western Shoshoni
- palato-alveolar: [huit^{tš}u] ‘small bird’
 - alveolar: [hut^{tš}i] ‘grandmother (FaMo)’

These distributional patterns are not unusual when taken separately. However, finding both of them together is curious, since coronal obstruents move in two different directions in exactly the same environment—towards the front of the mouth in the case of Fronting (5a), and towards the back of the mouth in the case of Palatalization (5b).

- (5) Western Shoshoni coronals following front vowels
- Fronting

[t]	←	/t/
-----	---	-----
 - Palatalization

	/ts/	→	[tš]
--	------	---	------
- (dental) (alveolar) (palato-alveolar)

Palatalization in Gosiute, a dialect of Shoshoni spoken in Western and Central Utah, differs from that in Western Shoshoni in that a palato-alveolar affricate alternates with an interdental affricate; palato-alveolar affricates occur following front vowels (6a), while alveolar affricates occur elsewhere (6b):

- (6) Gosiute Palatalization
- palato-alveolar: [moyittšⁱ] ‘bag’ (*moyi* ‘bag’ -^{tt}θⁱ ‘ABSOLUTE’)
 - interdental: [poniattθⁱ] ‘skunk’ (*ponia* ‘skunk’ -^{tt}θⁱ ‘ABSOLUTE’)

Just as in Western Shoshoni, Fronting and Palatalization in Gosiute are fully regular and occur within morphemes (7-8):

- (7) Morpheme-internal Fronting in Gosiute
- dental: [nit^{tt}oi] ‘sing’
 - alveolar: [potto] ‘grinding stone’

- (8) Morpheme-internal Palatalization in Gosiute
- a. palato-alveolar: [huittʃu] ‘small bird’
 - b. interdental: [huittθi] ‘grandmother (FaMo)’

In Gosiute, not only do coronals move in opposite directions following front vowels, but they actually cross, as is apparent from figure (9):

- (9) Gosiute coronals following front vowels
- a. Fronting

[t]	←	/t/
-----	---	-----
 - b. Palatalization

/tθ/	→	[tʃ]
------	---	------
- (dental) (alveolar) (palato-alveolar)

Previous descriptions of the phonology of Western Shoshoni and Panamint (a closely related language with similar alternation patterns) have treated Fronting and Palatalization separately in spite of the identity of the triggering environments (Crum and Dayley 1993 and Miller 1996 for Western Shoshoni;¹ McLaughlin 1987 and Dayley 1989 for Panamint); no analysis of the Gosiute pattern itself has yet been proposed. McLaughlin (1987) provides the rationale:

“Even though these two sets of rules [i.e. Fronting and Palatalization] are clearly related in having the same environment and the same class of sounds that they operate on [i.e. coronals], there is no way to collapse these two rules in generative phonology without increasing the amount of obfuscation and decreasing the amount of explanation.” (McLaughlin 1987: 73 fn.)

In this paper I provide an analysis of Fronting and Palatalization in western Shoshoni and Gosiute within the framework of Optimality Theory (Prince and Smolensky 1993; McCarthy and Prince 1993, 1995). This analysis accomplishes two things. First, it provides a unified solution to Fronting and Palatalization in both dialects. By providing a unified analysis, I show that the intuition that these two alternations are related is in fact correct. This analysis relies on the feature [distributed], which describes the active articulators in the alternations, the tongue tip ([-distributed]) or tongue blade ([+distributed]).

¹ The data in Miller (1996) is from a speaker of Gosiute, but the transcription has been normalized to conform to a more general Western Shoshoni pattern. For instance, Miller restores all instances of [h] which are absent from his consultant’s speech based on comparative data from other dialects, and the interdental affricate [tθ] and its reflexes are consistently transcribed as alveolar [c], although he does mention their dental articulation the text.

Second, the analysis of the Gosiute patterns provides additional support for the formal device of Local Conjunction within Optimality Theory (Smolensky 1995; see also Kirchner 1996). I show that any Optimality Theoretic analysis of Gosiute Fronting and Palatalization which does not make use of Local Conjunction will not be able to provide a coherent account of these alternation patterns.

The rest of the paper is organized as follows. I begin in section 2 with an analysis of Fronting and Palatalization in Western Shoshoni. In this analysis, I show that both patterns involve the conditioned distribution of apicals and laminals: laminals follow front vowels, and apicals occur elsewhere. In section 3, I provide an analysis of Gosiute Fronting and Palatalization which builds on the results in section 2, showing that the analysis of Western Shoshoni Fronting can be adopted *in toto* for the Gosiute data. The extension of this analysis to Gosiute Palatalization requires the formal device of Local Conjunction of constraints; this formal move does not change the basic insight concerning the distribution of apicals and laminals, however. This paper concludes in section 4.

2. Fronting and Palatalization in Western Shoshoni

In this section I present an analysis of Western Shoshoni Fronting and Palatalization. I show that these alternations in Western Shoshoni are easily explained as the alternation of apical and laminal coronals, with laminals occurring after front vowels and apicals occurring elsewhere. In 2.1, I present the data for Fronting in Western Shoshoni. Based on the articulatory properties of the coronal consonants involved in Fronting, I show that Fronting can be expressed as a requirement on coronals following front vowels to bear the feature [+distributed]. Although this requirement is expressed in Optimality Theoretic terms, the analytical insight behind it is independent of this framework.

In 2.2 I provide data for Palatalization in Western Shoshoni. Again, based on the articulatory properties of the consonants involved in the alternations and distributional patterns, I show that Palatalization is the result of the requirement of coronals following front vowels to bear the feature [+distributed]. Palatalization thus has the same analysis as Fronting, and the unification of these two patterns is achieved. In 2.3 I summarize the results of this section.

2.1. Western Shoshoni Fronting and [+distributed]

I turn first to Fronting in Western Shoshoni. In this distributional pattern, plain alveolar obstruents are in complementary distribution with dental

obstruents; the data in (10) illustrate this pattern.² In (10a), voiced alveolar taps and voiced dental fricatives occur between vowels; dental fricatives follow [i] or [e], and alveolar taps occur elsewhere. In (10b), voiced alveolar and dental stops occur following homorganic nasals; dental nasal-stop clusters follow [i], and alveolar nasal-stop clusters occur elsewhere. In (10c), voiceless alveolar taps and voiceless dental fricatives occur between vowels; dental fricatives follow [i] and [e], and alveolar taps occur elsewhere. Finally, in (10d), voiceless geminate alveolar stops and voiceless geminate dental stops occur between vowels; geminate dental stops follow [i] and [e], and geminate alveolar stops occur elsewhere.

(10) Western Shoshoni Fronting: morpheme-internal complementary distribution of dental and alveolar obstruents

a.	[pira]	‘arm’	[pið̥i]	‘to arrive’
	[ara]	‘uncle(MoBr)	[peð̥i]	‘daughter, niece
	(SiDa)’			
	[poro]	‘cane’		
	[nura:]	‘run-pl.subj.’		
b.	[kindu]	‘yesterday’	[taiŋ̥ði]	‘hole’
	[pandii]	‘killdeer’		
	[ondi]	‘brown’		
	[nasundaŋ̥a]	‘to remember’		
c.	[towiria]	‘to pour’	[piθ̥u:]	‘to be stung by a bee’
	[aɾaθ̥i]	‘jaw’	[pa:nneθ̥i]	‘Northern
	Paiute, Bannock’			
d.	[kʷitti]	‘to shoot’	[hiŋ̥to:]	‘meadowlark’
	[pattu]	‘dead-fall trap’		
	[potto]	‘grinding stone’		
	[uttapp̥i]	‘fine dust’		

In (11), I provide examples of the conditioned alternation of dental and alveolar consonants in suffixes following a stem-final front vowel.

² In addition to Fronting, the data in (6) and (7) show the effects of consonant gradation. The details of Shoshoni consonant gradation are not relevant to the problem at hand, and will not enter into the analysis presented here.

(11) Western Shoshoni Fronting: alternation of dental and alveolar obstruents at morpheme boundaries

- a. *-(n)tuʔi* 'future'
- | | | | |
|---------------|-------------|---------------|------------|
| [na:ria-ruʔi] | 'will race' | [nukki-ŋduʔi] | 'will run' |
| | | [hanni-ðuʔi] | 'will use' |
- b. *-ti* 'generic aspect'
- | | | | |
|------------|-----------|-------------|------------|
| [kari-ri] | 'sitting' | [hiβi-ði] | 'drinking' |
| [tikka-ri] | 'eating' | [pekkai-ði] | 'killing' |
- c. *-ti* 'demonstrative stem'
- | | | | |
|---------|--------|---------|--------|
| [sa-ri] | 'that' | [si-ði] | 'this' |
| [su-ri] | 'that' | [se-ði] | 'this' |
- d. *-ti* 'participle'
- | | | | |
|-------------|-------|---------------|--------|
| [si:ma:-ɾi] | 'ten' | [wattsɪwi-θi] | 'four' |
| | | [maneyi-θi] | 'five' |
| | | [na:ɸai-θi] | 'six' |
- e. *-ttu* 'locative stem'
- | | | | |
|----------|---------|----------|--------|
| [sa-ttu] | 'there' | [si-ttu] | 'here' |
| | | [se-ttu] | 'here' |

The alveolar obstruents in the first column of both (10) and (11) are produced with the tip of the tongue at the alveolar ridge, an *apical* articulation. The dental obstruents in the second column are produced with the blade of the tongue at the alveolar ridge and behind the upper teeth, which is a *laminal* articulation.³ The alternation of Fronting thus reduces to an alternation between laminals and apicals; laminals follow front vowels and apicals occur elsewhere.

³ These articulatory observations were made by speakers of the language reporting and commenting on their own pronunciation of the sounds under investigation.

Using [t̟] and [t] as cover symbols for the dental and alveolar consonants under discussion here, the figure in (12) summarizes their distribution.

(12) Distribution of dental and alveolar consonants:

i,e ____	elsewhere
laminal [t̟]	apical [t]

This kind of alternation is supported on articulatory grounds. In the articulation of a front vowel, the blade of the tongue is close to the roof of the mouth, facilitating a laminal articulation in a neighboring consonant. In Chomsky and Halle (1968), the feature [distributed] is described as controlling the length of constriction along the direction of air flow: “Distributed sounds are produced with a constriction that extends for a considerable distance along the direction of the air flow; nondistributed sounds are produced with a constriction that extends only for a short distance in this direction.” (Chomsky and Halle 1968:312) Since then it has been common to describe dentals and palato-alveolars as [+distributed], and alveolars and retroflexes as [-distributed]. Assigning the feature [distributed] to the coronals involved in Western Shoshoni Fronting entails the equation of [+distributed] and laminal (=dental), and [-distributed] and apical (=alveolar).⁴ Figure (13) shows the feature matrix for the consonants involved in Western Shoshoni Fronting:

(13) Feature matrix for dental and alveolar consonants

	t	t̟
anterior	+	+
strident	-	-
distributed	-	+

In featural terms, Fronting is merely the addition of [+distributed] to an alveolar consonant (14).

(14) Fronting

t	→	t̟
[COR]		[COR +dist]

⁴ Keating (1991) points out that there may actually be less correlation between a long constriction, which is definitional for [+distributed], and laminal articulation than has previously been assumed. I will continue to use the feature [distributed] for convenience, while recognizing that it is actually the apical-laminal distinction which is at work in Gosiute and Shoshoni.

It is important to note that this analysis of Fronting is independent of Optimality Theory; that is, the success or failure of Optimality Theory as a theoretical framework will have no bearing on the validity of the proposal made here that Fronting can be analyzed as the addition of [+distributed] to the feature set of a coronal consonant. That said, the Optimality Theoretic constraint in (15) captures this generalization:

- (15) FR...DIST: A consonant following a [-back] vowel is [+distributed].

The constraint in (15) evaluates a *sequence* of features. In Suzuki (1995, 1997) and Archangeli and Suzuki (1995) the notion of *sequential grounding* is introduced and defended. Briefly, for any grounded condition X/Y prohibiting or requiring the cooccurrence of features X and Y in a path, there is a *sequential* constraint which prohibits or requires X and Y in adjacent paths. This constraint is abbreviated X...Y, and is universally lower-ranked than the constraint X/Y. This means that for the sequential constraint FR...DIST there is also a related, superordinate constraint FR/DIST which requires the features [-back] and [+distributed] to cooccur on a single segment. It is the sequential constraint FR...DIST which is active in the analysis of Fronting in Western Shoshoni.

Satisfaction of FR...DIST comes potentially at the expense of changing the value of the feature [distributed] which is present in underlying representation. The pressure to preserve underlying features and their values is expressed by constraints on faithfulness of corresponding elements (McCarthy & Prince 1995). In this case the constraint is MAX[-dist], defined in (16):

- (16) MAX[-dist]: An input [-distributed] has a corresponding output [-distributed].⁵

Ranking of FR...DIST above MAX[-dist] ensures that its requirements are met at the expense of the preservation of the underlying value of [distributed]; this is illustrated in the tableaux in (17).

⁵ It should be noted that the usage of the constraint family MAX proposed here differs from that introduced in McCarthy and Prince (1995). Their definition of MAX states only that “Every element of S₁ has a correspondent in S₂.” (p122) and makes no requirement on identity or similarity between corresponding elements.

(17) Ranking of FR...DIST >> MAX[-dist]

	/hitto:/ [-dist]	FR...DIST	MAX[-dist]
a. \wp	hitto: [+dist]		*
b.	hitto: [-dist]	*!	

In the tableau in (17) candidate b. preserves an underlying [-distributed] at the cost of violating the higher ranked FR...DIST; candidate a. on the other hand fails to preserve underlying [-distributed] but satisfies FR...DIST and is therefore chosen by the constraint hierarchy as optimal.

Summarizing the results so far, Fronting in Western Shoshoni has been analyzed as the conditioned distribution of laminals and apicals; laminals occur following front vowels, and apicals occur elsewhere. This is expressed in featural terms by equating laminal with [+distributed] and apical with [-distributed] and requiring front vowels to be followed by a [+distributed] consonant. This requirement takes priority over the preservation of the underlying feature value for [distributed]. In the next section, I extend this analysis to Western Shoshoni Palatalization.

2.2. Western Shoshoni Palatalization and [+distributed]

In the distributional pattern of Palatalization in Western Shoshoni, alveolar sibilants are in complementary distribution with palato-alveolar sibilants; the data in (18) illustrates this pattern. In (18a), voiced alveolar fricatives and voiced palato-alveolar fricatives occur between vowels; palato-alveolar fricatives follow [i] and [e], and alveolar fricatives occur elsewhere. In (18b), voiced alveolar affricates and voiced palato-alveolar affricates occur following homorganic nasals; palato-alveolar nasal-affricate clusters follow [i], and alveolar nasal-affricate clusters occur elsewhere. In (18c), geminate alveolar affricates and geminate palato-alveolar affricates occur between vowels; geminate palato-alveolar affricates follow [i] and [e], and geminate alveolar affricates occur elsewhere. Finally, in (18d), voiceless alveolar fricatives and voiceless palato-alveolar fricatives occur between vowels; palato-alveolar fricatives follow [i] and [e], and alveolar fricatives occur elsewhere.

(18) Western Shoshoni Palatalization: morpheme-internal complementary distribution of alveolar and palato-alveolar sibilants

a.	[iz̥i]	‘to stink’	[ižapp̥i]	‘coyote’
	[pazi]	‘older sister’	[ežikko]	‘sling shot’
	[mozo]	‘beard, whiskers’		
	[huziðo:]	‘shin’		
b.	[tindzo:]	‘hand game bones’	[mawiñdža]	‘wrist’
	[wandzi]	‘buck antelope’		
	[warondzipp̥i]	‘wild rye’		
	[k ^w iβundzi]	‘scorpion’		
c.	[hittsipp̥i]	‘saliva’	[huittšu:]	‘small bird’
	[wattsiwiθ̥i]	‘four’	[pettš̥i]	‘holler-DUR’
	[potts̥i]	‘hop, jump’		
	[hutts̥i]	‘grandmother (FaMo)’		
d.	[p̥i:si]	‘body hair, fur’	[išaβaipp̥i]	‘Coyote’
	[kasa]	‘wing’	[k ^w eši]	‘tail’
	[tosa]	‘white’		
	[usi]	‘that’		

In (19), I provide examples of the conditioned alternation of palato-alveolar and alveolar sibilants in suffixes following a stem-final front vowel.

(19) Western Shoshoni Palatalization: alternation between alveolar and palato-alveolar sibilants at morpheme boundaries

a.	-tts̥i	‘absolute’		
	[araŋgu-tts̥i]	‘red ant’	[moɣi-ttš̥i]	‘bag’
	[ponia-tts̥i]	‘skunk’		
b.	-ttsi	‘diminutive’		

	[appi-ttsi]	‘dear father’	[kahni-ttši]	‘little house’
c.	-si	‘demonstrative stem’		
	[u-si]	‘that’	[i-ši]	‘this’
	[a-si]	‘that’	[e-ši]	‘this’
d.	-si	‘emphatic’		
	[oyi-si]	‘always’	[pie-ši]	‘already’

The alveolar obstruents in the first column of (18) and (19) are produced with the tongue tip at the alveolar ridge; they are thus apical. The palato-alveolar obstruents in the second column of (18) and (19) are produced with the tongue blade rounding the corner of the alveolar ridge—a laminal articulation. As with Fronting, the laminal consonants follow front vowels, and the apical consonants occur elsewhere. I use [tš] and [ts] as cover symbols for the dental and alveolar sibilants discussed here; the figure in (20) summarizes their distribution.

(20) Distribution of palato-alveolar and alveolar sibilants:

i, e	_____	elsewhere
laminal	[tš]	apical [ts]

Since both alternants in Palatalization are sibilants, I assign the feature [+strident] to them; this distinguishes the underlying plain coronal /t/ ([-strident]) from the sibilant /ts/ ([+strident]). In 2.2 I discussed the assignment of [+distributed] to laminals and [-distributed] to apicals and demonstrated that Fronting is thus the addition of [+distributed] to the feature matrix of a coronal following a front vowel. Just as dentals are assigned [+distributed], it has been common to assign this feature value to palato-alveolars as well. Making these feature assignments to the coronals involved in Palatalization yields the feature matrix in (21).

(21) Feature matrix for Western Shoshoni sibilants

	ts	tš
anterior	+	-
strident	+	+
distributed	-	+

From the distributional statements summarized in (20) and the feature matrix for Western Shoshoni sibilants in (21), it is clear that Palatalization has the same analysis as Fronting; Fronting is the addition of [+distributed] to a coronal consonant (22). The tableau in (23) provides an example of the interaction of the constraints FR...DIST and MAX[-dist] in Western Shoshoni Palatalization.

(22) Palatalization

ts	→	tš
$\begin{bmatrix} \text{COR} \\ +\text{str} \end{bmatrix}$		$\begin{bmatrix} \text{COR} \\ +\text{str} \\ +\text{dist} \end{bmatrix}$

(23) FR...DIST >> MAX[-dist]

	/huittsu:/ [-dist]	FR...DIST	MAX[-dist]
a. ☞	huittš̥u: [+dist]		*
b.	huittsu: [-dist]	*!	

In the tableau in (23), candidate b. violates high ranking FR...DIST; candidate a. satisfies this constraint at the expense of violating MAX[-dist]. Since FR...DIST is top-ranked, candidate a. is selected as optimal.

2.3. Summary

In this section, I have shown that the alternation patterns of Fronting and Palatalization in Western Shoshoni involve the conditioned distribution of apical and laminal coronals; laminals occur following front vowels, while apicals occur elsewhere. This is represented in an Optimality Theoretic grammar by ranking

the constraint FR...DIST, which requires the feature [+distributed] to follow a segment specified [-back], above a constraint requiring preservation of underlying [-distributed]. In the next section, I use these results as the foundation for the analysis of the Gosiute patterns of Fronting and Palatalization.

3. Gosiute Fronting and Palatalization

Gosiute shows alternation patterns similar to the ones found in Western Shoshoni. As in Western Shoshoni, Fronting is the complementary distribution of laminal and apical coronal consonants before a front vowel (1,7; repeated below for convenience).

(1) Western Shoshoni Fronting

- a. dental: [sittu] ‘here’ (*si-* ‘PROXIMAL’ –*ttu* ‘LOCATIVE STEM’)
- b. alveolar: [sattu] ‘here’ (*sa-* ‘DISTAL’ –*ttu* ‘LOCATIVE STEM’)

(7) Morpheme-internal Fronting in Gosiute

- a. dental: [niittoi] ‘sing’
- b. alveolar: [potto] ‘grinding stone’

Gosiute Palatalization, however, is an alternation between two laminal consonants before a front vowel (6,8; repeated below for convenience).

(6) Gosiute Palatalization

- a. palato-alveolar: [moyittš̥i] ‘bag’ (*moyi* ‘bag’ –*tt̥θ̥i* ‘ABSOLUTE’)
- b. interdental: [poniatt̥θ̥i] ‘skunk’ (*ponia* ‘skunk’ –*tt̥θ̥i* ‘ABSOLUTE’)

(8) Morpheme-internal Palatalization in Gosiute

- a. palato-alveolar: [huittšu] ‘small bird’
- b. interdental: [hutt̥θ̥i] ‘grandmother (FaMo)’

If Fronting is the alternation of alveolars and dentals following front vowels, and Palatalization is the alternation of dentals and palato-alveolars in the same environment, a two-step *chain shift* can be set up which extends from alveolars on one end to palato-alveolars on the other: ALVEOLAR > DENTAL > PALATO-ALVEOLAR. Fronting is the first step in this chain and Palatalization is the second (24).

(24) Fronting and Palatalization as a two-step chain shift

- a. Fronting: alveolar > dental
- b. Palatalization: dental > palato-alveolar

Viewing Fronting and Palatalization as two steps in a chain shift provides unity to these alternations—unity suggested by the identity of their triggering environments. the traditional, rule-based approach to chain shifts is to formulate a rule for each step in the chain and place them in a counter-feeding order. In the informal analysis of Fronting and Palatalization given in (25), Palatalization is ordered before Fronting:

(25) Rule-based approach to Fronting and Palatalization

- a. Palatalization: dental → palato-alveolar / [i]___
- b. Fronting: alveolar → dental / [i]___

While a rule-based approach accounts for the facts, it splits up a unified phenomenon into a set of formally unrelated rules; this type of analysis is therefore not as highly favored as one which views the steps in the chain shift as being part of a single alternation pattern.

A different problem posed by chain shifts arises in non-derivational theories such as Optimality Theory. In a rule-based approach, it is possible for rules to refer to intermediate levels of representation; in fact, reference to intermediate levels is necessary in order to provide a workable analysis of chain shifts. In Optimality Theory, however, these intermediate levels are unavailable; an Optimality Theoretic grammar is usually seen as a mapping of an underlying form directly to a surface representation, mediated only by constraints on well-formedness and faithfulness. In Kirchner (1996), a general solution to the problem posed by chain shifts was provided. His solution involves the *Local Conjunction* (Smolensky 1995) of faithfulness constraints, which effectively limits the “distance” between an underlying form and a surface form along a phonetic or phonological scale, such as that described above for Fronting and Palatalization. It is this kind of solution which proves successful in the analysis of the Gosiute alternation patterns.

In 3.1 I show that the analysis of Fronting in Gosiute is the same as that for Fronting in Western Shoshoni. In 3.2, I show that the Gosiute Palatalization needs a slightly different account than that provided for Western Shoshoni Palatalization, since Gosiute Palatalization is the alternation of two laminal coronals, while in Western Shoshoni, Palatalization, like Fronting, is the alternation of laminals and apicals. I then show that the analyses provided in 3.1 and 3.2 lead to an unattested “all-or-nothing” pattern which apparently requires *all* coronals following front vowels to be realized as palato-alveolar. In 3.3 I show how Local Conjunction in the Gosiute constraint set provides a unified and

restrictive account of both Fronting and Palatalization, sidestepping the “all-or-nothing” problem.

3.1. Gosiute Fronting = Western Shoshoni Fronting

As in Western Shoshoni, Fronting in Gosiute is the complementary distribution of laminal and apical coronal obstruents before a front vowel. In (26a), voiced alveolar taps and voiced dental fricatives occur between vowels; dental fricatives follow [i] or [e], and alveolar taps occur elsewhere. In (26b), voiced alveolar and dental stops occur following homorganic nasals; dental nasal-stop clusters follow [i], and alveolar nasal-stop clusters occur elsewhere. In (26c), voiceless alveolar taps and voiceless dental fricatives occur between vowels; dental fricatives follow [i] and [e], and alveolar taps occur elsewhere. Finally, in (26d), voiceless geminate alveolar stops and voiceless geminate dental stops occur between vowels; geminate dental stops follow [i] and [e], and geminate alveolar stops occur elsewhere.

(26) Gosiute Fronting

a.	[pɪrɑ]	‘arm’	[pɪðɪ]	‘to arrive’
	[ara]	‘uncle (MoBr)’	[peðɪ]	‘daughter, niece’
	(SiDa)			
	[poro]	‘stick’		
	[nura:]	‘to run-PL.SUBJ’		
b.	[kindu]	‘yesterday’	[taiŋɔ]	‘hole’
	[pandii]	‘killdeer’		
	[ondɪ]	‘brown’		
	[nasundaŋa]	‘to remember’		
c.	[towiɕia]	‘to pour’	[piθu:]	‘to be stung by
	a bee’			
	[aɕaɸi]	‘jaw’		

d.	[k ^w itti]	‘to shoot’	[nit̪toi]	‘to sing’
	[pattu]	‘dead-fall trap’		
	[potto]	‘grinding stone’		
	[utapp̪i]	‘fine dust’		

In (27), I provide examples of the conditioned alternation of dental and alveolar consonants in suffixes following a stem-final front vowel.

(27) Gosiute Fronting: alternation of dental and alveolar obstruents at morpheme boundaries

a.	-(n)tui ‘future’			
	[na:ria-ri]	‘will race’	[nukki-ŋ̪ui]	‘will run’
			[hanni-ð̪i]	‘will use’
b.	-ti ‘generic aspect’			
	[kari-ri]	‘sitting’	[hiβ̪i-ð̪i]	‘drinking’
	[tikka-ri]	‘eating’	[pekkai-ð̪i]	‘killing’
c.	-ti ‘demonstrative stem’			
	[sa-ri]	‘that’	[si-ð̪i]	‘this’
	[su-ri]	‘that’	[se-ð̪i]	‘this’
d.	-ti ‘numeral’			
	[si:ma:-ɸ̪i]	‘ten’	[wattsiwi-θ̪i]	‘four’
			[maneyi-θ̪i]	‘five’
			[na:ɸ̪ai-θ̪i]	‘six’
e.	-ttu ‘locative stem’			
	[sa-ttu]	‘there’	[si-t̪tu]	‘here’
			[se-t̪tu]	‘here’

This distribution can be analyzed in the same way as Western Shoshoni; namely by ranking the constraint FR...DIST, which expresses a preference for front vowels to be followed by [+distributed] obstruents, above MAX[-dist], which requires outputs to retain a [-distributed] feature from the input. The tableau in (28) illustrates:

(28) FR...DIST >> MAX[-dist]

	/nittoi/ [-dist]	FR...DIST	MAX[-dist]
a. 	nɪ̥ttoi [+dist]		*
b.	nittoi [-dist]	*!	

In this tableau, candidate b., which fails to specify [+distributed] in its feature set is ruled out by FR...DIST, in spite of pressure exerted by MAX[-dist] to preserve the input [-distributed] intact.

3.2. Gosiute Palatalization ≠ Western Shoshoni Palatalization

Palatalization in Gosiute is a distributional pattern involving two laminal obstruents; palato-alveolar obstruents follow front vowels while interdental obstruents occur elsewhere. In (29a), voiced interdental fricatives and voiced palato-alveolar fricatives occur between vowels; palato-alveolar fricatives follow [i] and [e], and interdental fricatives occur elsewhere. In (29b), voiced interdental affricates and voiced palato-alveolar affricates occur following homorganic nasals; palato-alveolar nasal-affricate clusters follow [i], and interdental nasal-affricate clusters occur elsewhere. In (29c), geminate interdental affricates and geminate palato-alveolar affricates occur between vowels; geminate palato-alveolar affricates follow [i] and [e], and geminate interdental affricates occur elsewhere. Finally, in (29d), alveolar [s] is in complementary distribution with palato-alveolar [ʃ].

(29) Gosiute Palatalization

- | | | | | |
|----|------------------|----------------------|----------------------|--------------|
| a. | [ið̥i] | ‘to stink’ | [iʒappi] | ‘coyote’ |
| | [pað̥i] | ‘older sister’ | [eʒikko] | ‘sling shot’ |
| | [moð̥o] | ‘beard, whiskers’ | | |
| | [huð̥ið̥o:] | ‘shin’ | | |
| b. | [tiŋ̥ð̥o:] | ‘hand game bones’ | [mawiŋ̥ð̥o:yo] | |
| | | ‘bracelet’ | | |
| | [waŋ̥ð̥i] | ‘buck antelope’ | | |
| | [mo:ŋ̥ð̥i] | ‘domesticated onion’ | | |
| | [tuɣuŋ̥ð̥ia] | ‘raspberry’ | | |
| c. | [hiŋ̥t̥θ̥iɪp̥i] | ‘saliva’ | [hiŋ̥t̥ʃu:] | ‘small bird’ |
| | [waŋ̥t̥θ̥iwiθ̥i] | ‘four’ | [pet̥t̥ʃi] | ‘holler-DUR’ |
| | [poŋ̥t̥θ̥i] | ‘hop,jump’ | | |
| | [huŋ̥t̥θ̥i] | ‘grandmother (FaMo)’ | | |
| d. | [pi:si] | ‘body hair, fur’ | [iʃaβaipp̥i] | ‘Coyote’ |
| | [kasa] | ‘wing’ | [k ^w eʃi] | ‘tail’ |
| | [tosa] | ‘white’ | | |
| | [kusipp̥i] | ‘ashes’ | | |

The data in (30) provide examples of the conditioned alternation of dental and palato-alveolar obstruents in suffixes following a stem-final front vowel.

(30) Gosiute Palatalization: alternation between dental and palato-alveolar obstruents at morpheme boundaries

- | | | | | |
|----|-------------------|---------------|---------------|----------------|
| a. | -t̥t̥θ̥i | ‘absolute’ | | |
| | [araŋ̥gu-t̥t̥θ̥i] | ‘red ant’ | [moɣi-t̥t̥ʃi] | ‘bag’ |
| | [ponia-t̥t̥θ̥i] | ‘skunk’ | | |
| b. | -t̥t̥θ̥i | ‘diminutive’ | | |
| | [appi-t̥t̥θ̥i] | ‘dear father’ | [kahnitt̥ʃi] | ‘little house’ |

In addition to the Palatalization data in (30), there are also alternations between [s] and [š]; [š] follows a front vowel, and [s] occurs elsewhere (31):

(31) Gosiute Palatalization: alternation between [s] and [š]

a. -si ‘demonstrative stem’

[u-si]	‘that’	[i-ši]	‘this’
[a-si]	‘that’	[e-ši]	‘this’

b. -si ‘emphatic’

[oyi-si]	‘always’	[pie-ši]	‘already’
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Figure (32) summarizes the distributional patterns in (29) and the alternations in (30-31).

(32)	i,e ____	elsewhere
Palatalization:	laminal [tš]	laminal [tθ]
	laminal [š]	apical [s]

In (33) I give the feature matrix for the segments involved in Gosiute Palatalization:

(33) Feature matrix for Gosiute Palatalization

	tθ	tš, š	s
strident	-	+	+
distributed	+	+	-

The analysis of the [s] ~ [š] alternation shown in (31) is the same as that for Western Shoshoni Palatalization; in both cases an apical alveolar sibilant alternates with a laminal palato-alveolar sibilant. In constraint terms, FR...DIST is ranked above MAX[-dist] (34):

(34) FR...DIST >> MAX[-dist]

	/pie-si/ [-dist]	FR...DIST	MAX[-dist]
a. \wp	pieši [+dist]		*
b.	piesi [-dist]	*!	

In (34), the candidate which satisfies high-ranking fr...dist is selected over the candidate which preserves an underlying [-distributed], a pattern familiar from Western Shoshoni Palatalization.

The distributional pattern involving dentals and palato-alveolars shown in (29) and (30) is not governed by the constraint FR...DIST, since both dentals and palato-alveolars are already specified [+distributed]; in Gosiute Palatalization it is the value for [strident] which is conditioned by a following front vowel. This generalization is captured in the constraint given in (35):

(35) FR...STR: A consonant following a [-back] vowel is [+strident].

Satisfaction of this constraint comes at the expense of changing the value of the feature [strident] which is present in underlying representation. This expense is represented by the constraint MAX[-str], defined in (36):

(36) MAX[-str]: An input [-strident] has a corresponding output [-strident].

For the effects of FR...STR to be seen, it must be ranked above MAX[-str]. These constraints are added to the constraints already existing; their intersection is illustrated in the tableau in (37).

(37) FR...STR >> MAX[-str]:

/hui <u>tt</u> θu:/	FR...DIST	FR...STR	MAX[-str]	MAX[-dist]
a. ☞ hui <u>tt</u> š <u>u</u> :			*	
b. hui <u>tt</u> θu:		*!		
c. hui <u>tt</u> su:	*!	*!	*	*
d. hui <u>tt</u> :	*!			*

In this tableau, any candidate which fails to satisfy either of the constraints on the distribution of [distributed] or [strident] is eliminated in favor of the candidate which satisfies both of them (*huittšu*).

To summarize, I have given an account of Gosiute Palatalization which relies on the constraint FR...STR, requiring front vowels to be followed by a [+strident] consonant. In the next section I show that the ranking as it stands is insufficient to capture Fronting as well as Palatalization in Gosiute; however, the intermediate result in (37) is still instructive.

3.3. Local Conjunction in the Gosiute Constraint Set

In the previous sections I have shown that both FR...DIST and FR...STR are necessary to account for the range of Fronting and Palatalization facts in Gosiute. For the effects of the distributional constraint FR...STR to be seen, it must be ranked above MAX[-str]; this was demonstrated in (37). However, the effects of this same ranking are disastrous for simple Fronting (38) (I use “ ☞ ” to indicate an unattested form which is nevertheless chosen by the constraint hierarchy as optimal):

(38) Disaster:

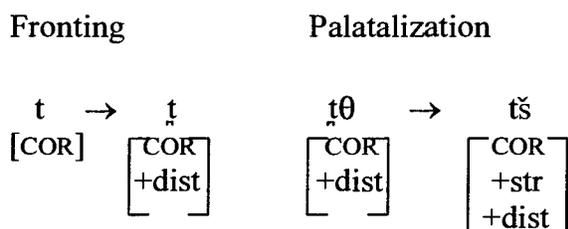
/nit <u>tt</u> oi/	FR...DIST	FR...STR	MAX[-str]	MAX[-dist]
a. ☞ nit <u>tt</u> šoi			*	*
b. (☞) nit <u>tt</u> oi		*!		*
c. nit <u>tt</u> oi	*!	*!		
d. nit <u>tt</u> oi	*!	*!		

In (38) any candidate which violates either FR...DIST or FR...STR is bested by the candidate which violates neither. Attempting to resolve this problem by varying the ranking of the constraints will have no effect, since the palatalized candidate bests any other candidate which violates even one of the distributional constraints.

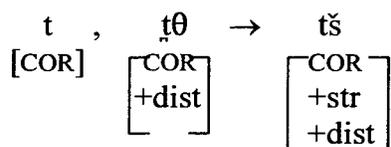
In fact, there is no possible ranking of these four constraints which will yield correct results for both Palatalization and Fronting. This has the effect of palatalizing every coronal obstruent, regardless of its underlying specifications for [strident] and [distributed]. This is an unfortunate result.

The Gosiute alternations display a stepwise change between pairs of coronal obstruents. In Fronting a plain apical alveolar becomes laminal, adding [+distributed]; and in Palatalization a laminal dental affricate becomes a laminal palato-alveolar affricate, adding [+strident] (39a). The constraint hierarchy in (37) and (38) cannot capture this stepwise alternation pattern; it requires an “all-or-nothing” change, so that both plain apical [t] and interdental [tθ] both become [tʃ] following front vowels (39b).

(39) a. Attested stepwise pattern:



b. Unattested “all-or-nothing” pattern:



The problem is that adding one feature of [distributed] or [strident] is allowed, but adding both of them at once is not. This is a familiar pattern and is typical of chain shifts, where segments advance along a phonological dimension (such as height) one step at a time. Following Kirchner (1996), I adopt the use of a formal device, the Local Conjunction of constraints (Smolensky 1995), to escape the all-or-nothing character of the distributional constraints FR...DIST and FR...STR.

Local Conjunction creates a new constraint by conjoining two other constraints. This conjoined constraint is ranked above both of its constituent constraints and is violated only in the case where both of its lower ranked constituent constraints are violated within the same domain (see Smolensky 1995 for the initial statement of and for arguments supporting the local conjunction of

constraints). In Gosiute, the two MAX constraints, MAX[-str] and MAX[-dist], are conjoined into a single constraint MAX[-str] &_{loc} MAX[-dist], which I will abbreviate as MAX(S&D). The conjoined constraint MAX(S&D) is violated only in the case where both MAX[-str] and MAX[-dist] are violated on the same segment. Ranking this conjoined constraint above the markedness constraint FR...STR will give the desired stepwise effect of Fronting and Palatalization (40).

(40) Gosiute Palatalization: MAX(S&D) >> FR...STR

/huittθu:/	MAX(S&D)	FR...DIST	FR...STR	MAX[-str]	MAX[-dist]
a. $\text{huitt}\check{\text{s}}\text{u}$:				*	
b. $\text{huitt}\theta\text{u}$:			*!		
c. huittsu :	*!	*!		*	*
d. huittu :		*!	*		*

In (40), any violation of FR...DIST or FR...STR will eliminate a candidate from competition; in this respect it is identical to the tableau in (37). Additionally, since candidate c. violates both MAX[-str] and MAX[-dist] on the same segment it receives a violation mark for the conjoined constraint MAX(S&D). However, since either ranking of MAX(S&D) and FR...DIST is equally successful in eliminating candidate c., it is not necessarily the conjoined constraint which removes candidate c. from evaluation.

(41) Gosiute Fronting: MAX(S&D) >> FR...STR

/nittoi/	MAX(S&D)	FR...DIST	FR...STR	MAX[-str]	MAX[-dist]
a. $\text{nitt}\check{\text{s}}\text{oi}$	*!			*	*
b. $\text{nitt}\theta\text{oi}$			*		*
c. nittsoi		*!			
d. nittoi		*!	*		

In contrast to (40), the constraint competition illustrated in (41) is clear in demonstrating the role played by the conjoined constraint in the selection of the correct output. Candidates c. and d. both violate high-ranking FR...DIST; these violations remove them from competition. Because candidate a. violates both MAX[-str] and MAX[-dist] on the same segment, it also violates high-ranking MAX(S&D). It is this violation which eliminates candidate a. from competition, leaving candidate b. the winner in spite of its violation of FR...STR.

The final ranking for Gosiute Fronting and Palatalization is given in (42).

(42) Final Ranking

$$\begin{array}{l} \text{MAX(S\&D), } \gg \text{ FR...STR } \gg \text{ MAX[-str],} \\ \text{FR...DIST} \qquad \qquad \qquad \text{MAX[-dist]} \end{array}$$
3.4. Summary of Gosiute Fronting and Palatalization

In this section, I have provided an analysis of Fronting and Palatalization in Gosiute which capitalizes on the similarity between these alternations in Gosiute and their counterparts in Western Shoshoni. Fronting receives the same analysis as in Western Shoshoni—the alternation of apicals and laminals following front vowels. This is expressed in constraint terms by ranking FR...DIST above MAX[-dist]. Palatalization on the other hand, is analyzed as the alternation of sibilants and non-sibilants following front vowels—sibilants follow front vowels, non-sibilants occur elsewhere. In constraint terms, this is expressed by ranking FR...STR above MAX[-dist]. Adding these constraints to the existing ranking for Fronting produces the unwelcome result of requiring all coronals following front vowels to be palato-alveolar. This problem disappears when the two MAX constraints are locally conjoined and the resulting constraint is ranked above FR...STR; this has the effect of making a violation of both constraints on the same segment worse than violations of either constraint by itself. This allows a stepwise alternation among coronals which is characteristic of chain shifts.

4. Conclusion

In this paper I have provided an analysis of Fronting and Palatalization in two dialects of Shoshoni. There are at least two lessons to be learned. First, the intuition that Fronting and Palatalization are related was confirmed. Both alternations in Western Shoshoni involved the alternation of apicals and laminals, and it is not necessary to further specify place of articulation. Second, Fronting and Palatalization in Gosiute are analyzable as two steps in a chain shift. Viewing the alternations in a way confirms their relationship to each other—a relationship suggested by the identity of their triggering environments and provides another argument in favor of the Local Conjunction of constraints as part of the toolbox of UG.

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