Chapter 6: Fronting and Palatalization

1. Introduction

In Gosiute, coronal obstruents are found in distributional patterns which depend upon 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):

(1) Gosiute Fronting

a. dental: [siṯṯu] 'here' (si- 'PROXIMAL' -ttu 'LOCATIVE STEM')
b. alveolar: [sattu] 'here' (sa- 'DISTAL' -ttu 'LOCATIVE STEM')

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

(2) Gosiute Palatalization

a. palato-alveolar: [moɣittši̥] 'bag' (moɣi 'bag' -ṯṯθi̥ 'ABSOLUTIVE')
b. interdental: [poniaṯṯθi̥] 'skunk' (ponia 'skunk' -ṯṯθi̥ 'ABSOLUTIVE')

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

(3) Morpheme-internal Fronting in Gosiute

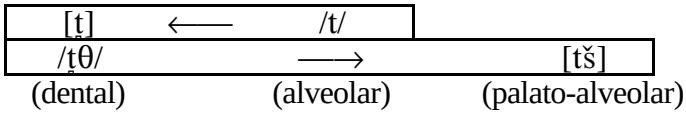
a. dental: [niṯṯoi] 'sing'
b. alveolar: [potto] 'grinding stone'

(4) Morpheme-internal Palatalization in Gosiute

a. palato-alveolar: [huittšu] 'small bird'
b. interdental: [huṯṯθi] '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).

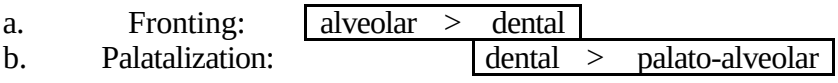
(5) Gosiute coronals following front vowels



In fact, from figure (5) it is plain to see that not only are coronals moving in opposite directions in the same environment, but that they cross paths: an alveolar stop becomes *dental* following a front vowel, but an inter*dental* affricate in the same environment becomes palato-alveolar.

In this chapter I analyze these alternation patterns as two steps of a chain shift. 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 (6).

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



Viewing Fronting and Palatalization as two steps in a chain shift provides unity to these alternations—unity suggested by the identy 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 (see King 1969: 194-200 on early generative accounts of

chain shifts). In the informal analysis of Fronting and Palatalization given in (7), Palatalization is ordered before Fronting.

(7) Rule-based approach to Fronting and Palatalization

a. Palatalization
dental → palato-alveolar / V [-back] __

b. Fronting
alveolar → dental / V [-back] __

While a rule-based approach accounts for the facts, it splits up a unified phenomenon into a set of formally unrelated rules. The following comment from McLaughlin (1987) expresses this failing of rule-based approaches in the analysis of Fronting and Palatalization:

> "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.)

A different problem posed by chain shift phenomena arises in non-derivational theories of phonology 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 OT, however, these intermediate levels are unavailable; an OT 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. In this chapter I provide an account of how

Local Conjunction in the Gosiute constraint set provides a unified and constrained account of both Fronting and Palatalization.

The remainder of this chapter is organized as follows. In section 2 I argue that Fronting in Gosiute is the result of a general phonological requirement on coronals to bear the feature [+distributed] in the environment of a front vowel. In section 3 I argue that Gosiute Palatalization is the result of a requirement on coronals in the environment of a front vowel to bear the feature [+strident]. In section 4 I show how the Local Conjunction of constraints in the Gosiute constraint set limits the distance between input and output forms to produce a chain shift pattern. This chapter concludes in section 5.

2. Fronting and [+distributed]

In this section I analyze Fronting in Gosiute as the result of a general, cross-linguistic requirement on coronals to bear the feature [+distributed] in the environment of a front vowel. In 2.1 I provide the data and generalizations to be accounted for, and in 2.2 I give an analysis which proposes that the correct distributional pattern is between laminal and apical coronal consonants; the change in place of articulation is a by-product of the apical-laminal contrast. A short summary is provided in 2.3.

2.1. Fronting data and generalizations

Fronting in Gosiute involves the complementary distribution of alveolar and dental obstruents; dentals occur following front vowels, and alveolars occur elsewhere. The data in

(8) illustrates this pattern.[1] In (8a), voiced alveolar taps and voiced dental fricatives occur between vowels; dental fricatives follow [i] or [e], and alveolar occur taps elsewhere. In (8b), voiced alveolar and dental stops occur following homorganic nasals; dental nasal-stop clusters follow [i], and alveolar nasal-stop clusters occur elsewhere. In (8c), voiceless alveolar taps and voiceless dental fricatives occur between vowels; dental fricatives follow [i] and [e], and alveolar taps occur elsewhere. Finally, in (8d), 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.

(8) Gosiute Fronting: complementary distribution of dental and alveolar consonants

	{i, e} __		elsewhere	
a.	[piðɨ]	'to arrive'	[pɨɾa]	'arm'
	[peðɨ]	'daughter, niece (SiDa)'	[aɾa]	'uncle (MoBr)'
			[poɾo]	'stick'
			[nuɾaː]	'to run-PL.SUBJ'
b.	[tainn̪d̪ɨ]	'hole'	[kɨndu]	'yesterday'
			[pandɨi]	'killdeer'
			[ondɨ]	'brown'
			[nasundaw̃a]	'to remember'
c.	[piθuː]	'to be stung by a bee'	[towɨr̥ia]	'to pour'
			[aɾ̥aɸ̥ɨ]	'jaw'
d.	[niṯṯoi]	'to sing'	[kʷɨtti]	'to shoot'
			[pattu]	'dead-fall trap'
			[potto]	'grinding stone'
			[uttappɨ̥]	'fine dust'

In (9), I provide examples of the conditioned alternation of dental and alveolar consonants in suffixes following a stem-final front vowel.

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[1]In addition to Fronting, the data in (8) adhere to the generalizations concerning voicing and continuancy and that in (9) show the now familiar effects of the final features; see chapters 2-5 for discussions and analyses of these patterns.

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

	{i, e} __		elsewhere	
a.	*-(n)*tui 'future'			
	[nukki-n̪d̪ui]	'will run'	[naːɾɨa-ɾui]	'will race'
	[hanni-ðui]	'will use'		
b.	-tɨ 'generic aspect'			
	[hiβi-ðɨ]	'drinking'	[kaɾɨ-ɾɨ]	'sitting'
	[pekkai-ðɨ]	'killing'	[tɨkka-ɾɨ]	'eating'
c.	-tɨ 'participle'			
	[wattsɨwi-θɨ̥]	'four'	[sɨːmaː-ɾ̥ɨ]	'ten'
	[maneɣi-θɨ̥]	'five'		
	[naːɸai-θɨ̥]	'six'		
d.	*-ttu* 'locative stem'			
	[sɨ-t̪t̪u]	'here'	[sa-ttu]	'there'
	[se-t̪t̪u]	'here'		

The alveolar obstruents in the first column of both (8) and (9) 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.[2] The alternation of Fronting thus reduces to an alternation between laminals and apicals; laminals follow front vowels and apicals occur elsewhere. Using [t̪] and [t] as cover symbols for the dental and alveolar consonants under discussion here, the figure in (10) summarizes their distribution.

(10) Distribution of dental and alveolar consonants

i, e __	elsewhere
laminal [t̪]	apical [t]

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

2.2. Analysis of Fronting

I turn now to an analysis in terms of distinctive features to account for the distribution of dental and alveolar consonants in Gosiute. 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 Fronting entails the equation of [+distributed] and laminal (= dental), and [–distributed] and apical (= alveolar).[3] Figure (11) shows the feature matrix for the consonants involved in Fronting.

(11) Feature matrix for Gosiute dental and alveolar consonants

	t	t̪
anterior	+	+
strident	-	-
distributed	-	+

In featural terms, Fronting involves a change in the value of [distributed] from "-" to "+":

(12) Fronting

$$t \rightarrow \underset{\cdot\cdot}{t} \qquad \begin{bmatrix} \text{COR} \\ \text{-dist} \end{bmatrix} \rightarrow \begin{bmatrix} \text{COR} \\ \text{+dist} \end{bmatrix}$$

[3]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.

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 (13) captures this generalization:

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

This constraint is an example of sequential grounding (Archangeli and Suzuki 1995; Suzuki 1995, 1997). Sequential grounding was introduced in chapter 4, where the constraint NAS…CONT played a role in the analysis of the behavior of the Nasalizing final feature. Briefly, for any grounded condition X/Y prohibiting the cooccurence of X and Y in a path, there is a *sequential* constraint which prohibits X and Y in adjacent paths. This constraint is abbreviated X…Y, and is universally lower-ranked than the constraint X/Y. Thus for the constraint FR…DIST there is a higher-ranked constraint FR/DIST which prohibits [–back] and [+distributed] from cooccuring in the same path.[4]

Support for constraints with substantive content similar to that of (13) can be found in the Australian languages, where there are intimate connections between dentals and palato-alveolars. For example, in Yukultu, described in Keen (1983), a noun stem-final /t/ alternates with laminal [t̪] or [tʲ] when followed by a suffix which begins with /i/. When the vowel preceding stem-final /t/ is /i/, then the alternant is [tʲ] (14a); otherwise the alternant of /t/ is /t̪/ (14b). In both cases, an apical alternates with a laminal in the environment of a following front vowel.

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[4]The feature [–back] is usually construed as a vocalic feature and [+distributed] as a consonantal feature, so on first sight it may seem unusual to posit a grounding condition which would prohibit these features from cooccuring in a path. However, recent work in Feature Geometry suggests that consonants may also bear vocalic features depending from a V-Place node. See Clements and Hume (1995) for a summary of such proposals.

(14) Yukultu Laminalization

a.	ŋit-a wood-ABS	ŋitʲ-iɭu wood-ALL
b.	ʈaŋkawalat-a man+plenty-ABS	ʈaŋkawalaṯ-iɭu man+plenty-ALL
	jaɭput-a meat-ABS	jaɭpuṯ-iɭu meat-ALL

Figure (15) summarizes this alternation pattern; figure (16) gives a feature matrix for Yukultu coronals:

(15) tʲ / i __ + i
ṯ / a,u __ + i
t / elsewhere

(16) Feature matrix for Yukultu coronals:

	ṯ	tʲ	t	ʈ
distributed	+	+	–	–
anterior	+	–	+	–
high		+		

The Yukultu alternation pattern is very similar to Gosiute Fronting. In both languages the presence of [+distributed] is conditioned by a [–back] vowel. The major difference between the two languages is that in Yukultu, the conditioning front vowel follows the alternating obstruents, rather than preceding them as in Gosiute.

Additional support for the front vowel-laminal coronal connection is provided by South Greenlandic Eskimo (SGE: Swadesh 1946). In this language there are distributional patterns involving apicals and laminals which are conditioned by a front vowel. The inventory of coronal obstruents is given in (17); the descriptions "point" and "blade" are Swadesh's own.

(17) Southern Greenlandic Eskimo coronal inventory (Swadesh 1946: 31)

dental	alveolar	
point	point	blade
t		
	ʂ	s

There is a regular alternation between [t] and [ʂ] between vowels; both alternants are apical, or "point" to use Swadesh's term (p32; no examples are given). In addition, there is an alternation between [t] and [s] (laminal or "blade") following an [i] in a preceding syllable (p33); this [i] is distinguished from a separate vowel [ĭ], which is phonetically identical to [i] but which has no laminalizing effect upon [t] (18) (see Kaplan 1981 and Underhill 1976 for discussion of this vowel in other dialects).

(18) a. akisik /aki-tik/ 'the coat of two of you'
nipitik /nipĭ-tik/ 'the voice of two of you'

b. aɣɣiɣsuq /aɣɣiq-tuq/ 'he who comes'
qanittuq /qanĭt-tuq/ 'he who is close'

Again, the distinction between laminal and apical is conditioned by a high front vowel showing that the Gosiute pattern is not unique.

Satisfaction of FR…DIST comes 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 the *identity* of corresponding elements (McCarthy and Prince 1995). In this case the constraint is IDENT_{IO}[–dist], defined in (19):

(19) IDENT_{IO}[–dist]: An output segment specified [–distributed] has an input correspondent specified [–distributed].

Ranking FR…DIST above IDENT_{IO}[–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 (20).

(20) Ranking: FR…DIST » IDENT_{IO}[–dist]

	/hitto:/ | [-dist]	FR… DIST	IDENT_{IO} [–dist]
a. ☞	hi̪t̪̪o: | [+dist]		*
b.	hitto: | [-dist]	*!	

In the tableau in (20) candidate b. preserves an underlying [-dist] at the cost of violating the higher ranked FR…DIST; candidate a. on the other hand fails to preserve underlying [-dist] but satisfies FR…DIST and is therefore chosen by the constraint hierarchy as optimal.

2.3. Summary of Fronting

In this section I have provided an account of Fronting in Gosiute. This analysis rests on the observation that laminals and apicals are in complementary distribution; 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].

3. Palatalization and [+strident]

In this section I analyze Palatalization in Gosiute as the result of a general, cross-linguistic requirement on coronals to be [+strident] in the environment of a front vowel. In 3.1 I provide the data and generalizations to be accounted for, and in 3.2 I give an analysis which

proposes that the correct distributional pattern is between strident and non-strident coronal consonants. A short summary is provided in 2.3.

3.1. Palatalization data and generalizations

Palatalization in Gosiute is a distributional pattern involving two *laminal* obstruents; palato-alveolar obstruents follow front vowels while interdental obstruents occur elsewhere. In (21a), voiced interdental fricatives and voiced palato-alveolar fricatives occur between vowels; palato-alveolar fricatives follow [i] and [e], and interdental fricatives occur elsewhere. In (21b), 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 (21c), 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.

(21) Gosiute Palatalization

	{i, e} __		elsewhere	
a.	[iža̱ppɨ] [ežikko]	'coyote' 'sling shot'	[ɨðɨ] [paði] [moðo] [huðiðoː]	'to stink' 'older sister' 'beard, whiskers' 'shin'
b.	[mawiñdžoːɣo]	'bracelet'	[tɨn̪d̪ðoː] [wan̪d̪ði] [moːn̪d̪ði] [tuɣun̪d̪ðia]	'hand game bones' 'buck antelope' 'domesticated onion' 'raspberry'
c.	[huittšuː] [pettši]	'small bird' 'holler-DUR'	[hɨẗ̪ẗ̪θippɨ̥] [waẗ̪ẗ̪θɨwiθɨ̥] [poẗ̪ẗ̪θi] [huẗ̪ẗ̪θi]	'saliva' 'four' 'hop, jump' 'grandmother (FaMo)'

In (22), alveolar [s] is in complementary distribution with palato-alveolar [š].

(22)

{i, e} __		elsewhere	
[išaβaippɨ̥]	'Coyote'	[pɨːsi]	'body hair, fur'
[kʷeši]	'tail'	[kasa]	'wing'
		[tosa]	'white'
		[kusippɨ̥]	'ashes'

The data in (23) provides examples of the conditioned alternation of dental and palato-alveolar obstruents in suffixes following a stem-final front vowel.

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

	{i, e} __		elsewhere	
a.	-t̪t̪θɨ̥ 'absolutive'			
	[moɣi-ttšɨ̥]	'bag'	[aɾaŋgu-t̪t̪θɨ̥]	'red ant'
			[ponia-t̪t̪θɨ̥]	'skunk'
b.	-t̪t̪θi 'diminutive'			
	[kahni-ttši]	'little house'	[appɨ-t̪t̪θi]	'dear father'

In addition to the Palatalization data in (23), there are also alternations between [s] and [š] at morpheme boundaries; [š] follows a front vowel, and [s] occurs elsewhere (24).

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

	{i, e} __		elsewhere	
a.	-sɨ 'demonstrative stem'			
	[i-šɨ]	'this'	[u-sɨ]	'that'
	[e-šɨ]	'this'	[a-sɨ]	'that'
b.	-sɨ 'emphatic'			
	[pɨe-šɨ]	'already'	[oyɨ-sɨ]	'always'

Figure (25) summarizes the distributional patterns in (21-22) and the alternations in (23-24).

(25)

	i, e ___ elsewhere	
Palatalization:	laminal [tš]	laminal [t̪θ]
	laminal [š]	apical [s]

In the next section I show that these patterns are the result of pressure placed on coronals to be [+strident] when following a front vowel.

3.2. Analysis of Palatalization

Dentals and palato-alveolars are commonly described in featural terms as [+distributed]. In addition, palato-alveolars share with [s] the feature [+strident]. Thus, all of the segments involved in Gosiute Palatalization are specified as either [+distributed] or [+strident] or both; in (26) I give the feature matrix for these segments.

(26)

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

The analysis of the [s] ~ [š] pattern shown in (21) and (23) is the same as that for Fronting; in both cases an apical coronal alternates with a laminal coronal. In constraint terms, FR…DIST is ranked above IDENT$_{IO}$[–dist] (27):

(27) FR…DIST » IDENT$_{IO}$[–dist]

	/pɨe-sɨ/ [-dist]	FR…DIST	IDENT$_{IO}$ [–dist]
a. ☞	pɨešɨ [+dist]		*
b.	pɨesɨ [-dist]	*!	

In (27), the candidate which satisfies high-ranking FR…DIST is selected over the candidate which preserves an underlying [-distributed], a pattern familiar from Fronting (see (20)).

The distributional pattern involving dentals and palato-alveolars shown in (22) and (24) is not governed by the constraint FR…DIST, since both dentals and palato-alveolars are already specified [+distributed]; In Palatalization it is the value for [strident] which is conditioned by a following front vowel. This generalization is captured in the constraint given in (28).[5]

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

Support for constraints similar to (28) can be found in the alternation in Finnish known as Assibilation (Anttila 1989: 83-4, 219-20; Kiparsky 1993: 282-3, 285-8). In Assibilation [t] and [s] alternate before a following [i] in morphologically conditioned environments (29):

(29) Finnish Assibiliation:

past tense:

halusi	/halut-i/	'want-PAST'
tilasi	/tilat-i/	'order-PAST'
tunsi	/tunte-i/	'know-PAST'

partial nominal paradigms:

	nominative	essive	stem	gloss
	vesi	vete-nä	/vete/	'water'
	käsi	käte-nä	/käte/	'hand'
cf.	koti	koti-na	/koti/	'home'

In verbs, the addition of the past tense suffix *-i* conditions the alternation of *t* and *s*. The partial nominative paradigms show the effects of a more general alternation in which *e* is raised to *i* word-finally; it is this derived *i* which conditions the alternation of *t* and *s*.

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[5]While this constraint is less convincing as a sequential grounding constraint, it is clear that there is an intimate connection between [–back] and [+strident], as shown by the Finnish example below. See Bhat (1978: 57-58) for examples of this relationship from other languages.

In featural terms, the feature [+strident] is added to the feature matrix for [t] when followed by a high, front unrounded vowel (in this case, the past tense suffix *-i*). While an OT analysis of the Finnish data would take me too far afield because of the complexities of the morphological conditioning, it is apparent that a constraint similar to (28) plays a role in Assibilation, lending support to its use in Gosiute Palatalization.

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 IDENT_{IO}[–str], defined in (29):

(29) IDENT_{IO}[–str]: An output segment specified [–strident] has an input correspondent specified [–strident].

For the effects of FR…STR to be seen, it must be ranked above IDENT_{IO}[–str]. These constraints are added to the constraints already existing; their interaction is illustrated in the tableau in (30).

(30) FR…STR » IDENT$_{IO}$[–str]:

	[-str] | /huiṯ̪ṯ̪θuː/ | [+dist]	FR…DIST	FR…STR	IDENT$_{IO}$ [–str]	IDENT$_{IO}$ [–dist]
a. ☞	[+str] | huittšuː | [+dist]			*	
b.	[-str] | huiṯ̪ṯ̪θuː | [+dist]		*!		
c.	[+str] | huittsuː | [-dist]	*!	*!	*	*
d.	[-str] | huittuː | [-dist]	*!			*

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 satifies both of them (huittšuː).

3.3. Summary of Palatalization

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 (30) is still instructive.

4. Chain Shifts and 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 IDENT_{IO}[–str]; this was demonstrated in (30). However, the effects of this same ranking are disasterous for simple Fronting (31).

(31) disaster

	[-str] | /nittoi/ | [-dist]	FR…DIST	FR…STR	IDENT_{IO} [–str]	IDENT_{IO} [–dist]
a. ✘	[+str] | nittšoi | [+dist]			*	*
b.(☞)	[-str] | nit̬t̬oi | [+dist]		*!		*
c.	[+str] | nittsoi | [-dist]	*!	*!		
d.	[-str] | nittoi | [-dist]	*!	*!		

In (31) 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 in coronal obstruents which is characteristic of a chain shift. In Fronting a plain apical alveolar becomes laminal, adding [+dist]; and in Palatalization a laminal dental affricate becomes a laminal palato-alveolar affricate, adding [+strident] (32a). The constraint hierarchy in (30) and (31) cannot capture this stepwise alternation pattern; it requires an "all-or-nothing" change, so that both plain apical [t] and interdental [t̪θ] both become [tš] following front vowels (32b).

(32) a. Attested stepwise pattern:

Fronting (alveolar → dental)	Palatalization (dental → palato-alveolar)
$t \rightarrow \underset{[\text{COR}]}{\text{t̪}}$	$\text{t̪}\theta \rightarrow \underset{\left[\begin{smallmatrix}\text{COR}\\+\text{dist}\end{smallmatrix}\right]}{\text{tš}}$

b. Unattested "all-or-nothing" pattern:

$$\underset{[\text{COR}]}{t}\ ,\ \underset{\left[\begin{smallmatrix}\text{COR}\\+\text{dist}\end{smallmatrix}\right]}{\text{t̪}\theta} \rightarrow \underset{\left[\begin{smallmatrix}\text{COR}\\+\text{str}\\+\text{dist}\end{smallmatrix}\right]}{\text{tš}}$$

The problem is that adding one of [+distributed] or [+strident] is fine, 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 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 by definition ranked above both of its constituent constraints and is violated only in the case where both of the 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 IDENT constraints IDENT_{IO}[–str] and IDENT_{IO}[–dist] are conjoined into a single constraint, IDENT_{IO}[–str] $\&_{\text{loc}}$ IDENT_{IO}[–dist] (=IDENT(S&D)). The conjoined constraint IDENT(S&D) is violated only in the case where both IDENT_{IO}[–str] and IDENT_{IO}[–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 (33).

(33) Gosiute Palatalization: $\left\{\begin{matrix}\text{IDENT(S\&D)}\\ \text{FR…DIST}\\ \text{FR…STR}\end{matrix}\right\}$ » $\left\{\begin{matrix}\text{IDENT}_{\text{IO}}\text{[–str]}\\ \text{IDENT}_{\text{IO}}\text{[–dist]}\end{matrix}\right\}$

	[-str] | /huiṯṯθuː/ | [+dist]	IDENT (S&D)	FR…DIST	FR…STR	IDENT_{IO} [–str]	IDENT_{IO} [–dist]
a. ☞	[+str] | huittšuː | [+dist]				*	
b.	[-str] | huiṯṯθuː | [+dist]			*!		
c.	[+str] | huittsuː | [-dist]	*!	*!		*	*
d.	[-str] | huittuː | [-dist]		*!	*!		*

In (33), any violation of FR…DIST or FR…STR will eliminate a candidate from competition; in this respect it is identical to the tableau in (30). Additionally, since candidate c. violates both IDENT_{IO}[–str] and IDENT_{IO}[–dist] on the same segment it receives a violation mark for the conjoined constraint IDENT(S&D). However, since either ranking of IDENT(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.

In constrast to (33), the constraint competition illustrated in (34) is clear in demonstrating the role played by the conjoined constraint in the selection of the correct output.

(34) Gosiute Fronting: $\left\{\begin{matrix}\text{IDENT(S\&D)} \\ \text{FR…DIST}\end{matrix}\right\}$ » FR…STR

	[-str] | /nittoi/ | [-dist]	IDENT (S&D)	FR…DIST	FR…STR	IDENT_{IO} [–str]	IDENT_{IO} [–dist]
a.	[+str] | nittšoi | [+dist]	*!			*	*
b. ☞	[-str] | nitẗoi | [+dist]			*		*
c.	[+str] | nittsoi | [-dist]		*!		*	
d.	[-str] | nittoi | [-dist]		*!	*		

Candidates c. and d. both violate high-ranking FR…DIST; these violations remove them from competition. Because candidate a. violates both IDENT_{IO}[–str] and IDENT_{IO}[–dist] on the same segment, it also violates high-ranking IDENT(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 (35).

(35) $\left\{\begin{matrix}\text{IDENT(S\&D)}\\ \text{FR…DIST}\end{matrix}\right\}$ » FR…STR » $\left\{\begin{matrix}\text{IDENT}_{\text{IO}}\text{[–str]}\\ \text{IDENT}_{\text{IO}}\text{[–dist]}\end{matrix}\right\}$

5. Conclusion

In this chapter I have shown that the alternations of Fronting and Palatalization in Shoshoni reduce to alternations between laminal and apical coronals. The constraint FR…DIST captures the generalization that laminals occur following front vowels, while apicals occur elsewhere. The change in place of articulation from alveolar to dental on the one hand, and from alveolar to palato-alveolar on the other, is a by-product of the laminal/apical alternation. The constraint FR…DIST was shown to be plausible on cross-linguistic grounds; similar alternations are found in Yukultu and South Greenlandic Eskimo. Extending the analysis to Gosiute necessitated the positing of the constraint FR…STR requiring obstruents to bear the feature [+strident] when following a front vowel. Again, cross-linguistic evidence bears this move out. Alternations which were previously thought to be unrelated (or unrelateable) now admit of a single, simple explanation.

The analysis presented here has several implications. First, I have shown that alternations like Fronting and Palatalization, which seemingly must involve a change of place of articulation can be accounted for purely in terms of the articulatory contrast

between laminals and apicals. Second, Gosiute provides support for the analysis of chain shifts by invoking the formal device of Local Conjunction of constraints. Only by Local Conjoining constraints can the Gosiute alternations be accounted for. Finally, a typological picture of the interaction of front-vowels and coronals is emerging from the data presented here; on the one hand there are languages like Shoshoni, Yukultu, and South Greenlandic Eskimo in which the distinction between laminal and apical is senstive to the presence of front vowels; and on the other hand, languages like Finnish show that sibilants are sensitive to the presence of front vowels. Gosiute is unique in this typology by displaying both types of behavior.