PALATALIZATION IN ALBANIAN: AN ACOUSTIC INVESTIGATION OF STOPS AND AFFRICATES

by

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In honor of and in memory of Grandpa Herman May, Grandpa Edward Trieglaff, and Tahir Kolgjini.

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ABSTRACT

PALATALIZATION IN ALBANIAN: AN ACOUSTIC INVESTIGATION OF STOPS AND AFFRICATES

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Palatalization is a very common process cross-linguistically; it has been widely attested in both Indo-European (e.g. Slavic) and non-Indo-European languages (e.g. Bantu and Chinese). Palatalization can be broken down into velar palatalization (e.g. k, g > tʃ, dʒ/_ i, j) and coronal palatalization (e.g. t, d > tʃ, dʒ/__ j), whereby the targets tend to be velar and alveolar stops and the triggers are frequently non-back vowels and glides. The outputs of palatalization are often sounds formed in a different place of articulation than the original target segment and with a different manner of articulation

than the target, which frequently results in a palato-alveolar affricate. Palatalization in Albanian, however, was ignited not only by velar and alveolar stops before non-back vocoids, but also by spirant and glide strengthening in the word-initial position. In Albanian, the output of palatalization was the voiceless and voiced palatal stop (e.g. k, g > c, ɟ /_ i, j; t, d > c, ɟ /__ j; s, j > c, ɟ /#_, respectively). More recently, for many native speakers (NSs) of Albanian, the palatal stops have changed into palato-alveolar affricates, e.g. c, ɟ > ʧ, ʤ. That is, the complex palatal stops have gone from being coronal-dorsal to coronal; this de-dorsalization of palatal stops is especially the case in the Gheg variety of Albanian, and is beginning to be the case in the Tosk variety, as well. In the case that the Albanian palatal stops are becoming palato-alveolar affricates, this change could constitute the final stages in the palatalization process of velar, coronal, and palatal sounds. Further, this final stage of palatalization represents a merger of phonemic Albanian palatal stops with phonemic Albanian palato-alveolar affricates, whereby the contrast between the two distinct phonemes is lost; as a result of the merger, the marked former is lost in favor of the less marked latter. These claims are verified using the speech of 100 NSs of Albanian (50 Gheg and 50 Tosk), whereby both temporal and spectral characteristics of the target phonemic voiceless and voiced palatal stops and palato-alveolar affricates of the Albanian language have been measured.

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CHAPTER 1

INTRODUCTION

Palatalization is a very common process cross-linguistically; it has been widely attested in both Indo-European (e.g. Slavic) and non-Indo-European languages (e.g. Bantu and Chinese). Palatalization can be broken down into velar palatalization (e.g. k, g > ʧ, ʤ/_ i, j) and coronal palatalization (e.g. t, d > ʧ, ʤ/__ j), whereby the targets tend to be velar and alveolar stops and the triggers are frequently non-back vowels and glides. The outputs of palatalization are often sounds formed in a different place of articulation than the original target segment and with a different manner of articulation than the target, which frequently results in a palato-alveolar affricate.

In Albanian, however, palatalization was ignited not only by velar and alveolar stops before non-back vocoids, but also by spirant and glide strengthening in the word-initial position; the output of palatalization was the voiceless and voiced palatal stop (e.g. k, g > c, ɟ/_ i, j; t, d > c, ɟ/__ j; s, j > c, ɟ/#_, respectively). More recently, for many native speakers (NSs) of Albanian, the palatal stops have changed into palato-alveolar affricates, e.g. c, ɟ > ʧ, ʤ. That is, the complex palatal stops have gone from being coronal-dorsal to coronal; this de-dorsalization of palatal stops is clearly heard in the Gheg (northern) variety of Albanian, and is beginning to be the case in the Tosk (southern) variety, as well. In the case that the Albanian palatal stops are becoming palato-alveolar affricates, this change could constitute the final stages in the palatalization process of velar, coronal, and palatal sounds. Further, this final stage of palatalization represents a merger of phonemic Albanian palatal stops with phonemic Albanian palato-alveolar affricates, whereby the contrast between the two distinct phonemes is lost; as a result of the merger, the marked former is abandoned in favor of the less marked latter.

This dissertation investigates the process of palatalization in Albanian, whereby the palatal stops are merging with the palato-alveolar affricates. The process of palatal stops becoming palato-alveolar affricates in Albanian exemplifies an intermediate step in velar palatalization, coronal palatalization, and glide/spirant fortition. That is, the sound change from /c ɟ/ to /ʧ ʤ/ functions as a present-day snap shot of what could have happened diachronically in many languages (i.e. Slavic, Bantu, Salishan, to name a few). The key to understanding palatalization and fortition (i.e. strengthening) must include and account for not only the beginning and end stages, but also that which happened in between those two points in time, such as is exemplified in Albanian. The evidence for the investigation of such a claim is a coupling of what has been written in the literature regarding this issue with authentic acoustic data on palatal stops and palato-alveolar affricates produced by 100 NSs of Albanian (50 Gheg NSs and 50 Tosk NSs) in Albania which was gathered by the author of this dissertation.

Chapter 2 offers a general overview of palatalization. It begins by examining documented examples of both velar and alveolar palatalization, with a special emphasis placed on those languages where the output is either a palatal stop or palato-alveolar affricate. For the sake of completeness, secondary palatalization is also mentioned. After cross-linguistic examples of palatalization have been provided, a review of the literature regarding the articulatory, acoustic, and perceptual characteristics of the velar and alveolar sounds involved is offered. Chapter 2 concludes with a discussion on various models regarding sound change.

Chapter 3 provides a review of the literature on palatalization in Albanian. The chapter begins with a brief summary of dialectal information and a consonantal inventory for Albanian, which leads into a discussion of various theories in the literature regarding the present state of Albanian palatal stops. Next, the history of palatal stops in Albanian is presented. Thereafter, a summary of what has been proposed in the literature regarding the merger of palatal stops and palato-alveolar affricates in the Balkan Sprachbund is given.

Chapter 4 provides the methodology which was used for the current investigation of acoustic characteristics of palatalization in Albanian, emphasizing palatal stops and palato-alveolar affricates. The methodology section deals with issues in terms of not only how the data were gathered, but also matters related to field research.

Chapter 5 provides the results of the study outlined in Chapter 4 and shows that temporally, the phonemic palatal stops in Albanian pattern more like affricates than stops; the spectral analysis suggests that that a minor difference between the place of articulation exists for between Gheg and Tosk speakers, whereby the phonetic output of the phonemic palatal stops and palato-alveolar affricates for the Gheg speakers is more alveolar-like and that of the Tosk speakers is more palatal-like. The overall findings support the claim that a possible merger of these sounds is taking place, whereby the marked palatal stops are lost for the sake of the less marked palato-alveolar affricates.

In Chapter 6 both language-internal and language-external issues regarding palatalization in Albanian are presented. In terms of the former, a discussion of various phonological issues involving palatalization in Albanian is offered. In terms of the latter, relevant historical and sociolinguistic issues in Albania are also mentioned in light of a merger of palatal stops and palato-alveolar affricates.

Chapter 7 concludes the dissertation by offering a summary and conclusion of the issues discussed in this analysis of palatalization in Albanian. Ideas for future study that can be drawn from this investigation are also provided.

CHAPTER 2

GENERAL BACKGROUND AND LITERATURE REVIEW: CROSS-LINGUISTIC ISSUES REGARDING PALATALIZATION

Palatalization of velar and alveolar stops when followed by front vocoids is a very common process cross-linguistically (Bhat 1978, Hock 1991, Hume 1994, Guion 1996). Although palatalization of velar and alveolar stops may result in secondarily palatalized segments (e.g. secondarily palatalized velar and alveolar stops), the focus of this dissertation is the palatalization of velar and alveolar segments which results in palatal stops and palato-alveolar affricates. In this dissertation, the palatalization of velars is referred to as velar palatalization, and the palatalization of dentals/alveolars is referred to as coronal palatalization. Glide fortition will also be mentioned in this chapter. After examples of palatalization and glide strengthening have been provided, various articulatory, acoustic, and perceptual characteristics of the sounds involved in palatalization will be discussed. Thereafter, a summary of how sound change has been treated in the literature will be offered.

2.1 Velar Palatalization

As mentioned above, velar stops (i.e. [k] and [g]) followed by non-back vocoids (e.g. [i] and [j]), have a tendency to undergo palatalization. In some cases the major point of articulation of the velar does not change, resulting in secondary palatalization (i.e. k, g → k^j, g^j/_ i, j). However, in other cases the primary place of articulation is changed to palatal (i.e. k, g → c, ɟ), or as is more common, to a palato-alveolar affricate (i.e. k, g → ʧ, ʤ), or to an alveo-palatal affricate (i.e. k, g → tɕ, dʑ). In the case of the last two outputs of palatalization (i.e. ʧ ʤ or tɕ, dʑ), a change occurs in not only place of articulation (i.e. from velar or dorsal to alveolar or coronal), but also the manner (i.e. from stop to affricate).

Bhat (1978) refers to velar palatalization which results in a palatalized velar as "tongue-fronting," with the strongest trigger being a stressed front vowel. Bhat also mentions that palatalization may involve stop lenition, whereby friction or stridency is added to the resulting consonant (i.e. a stop becomes an affricate, e.g. k, g → ʧ, ʤ), which Bhat terms as "spirantization." Hume (1994:6) discusses a similar process where a velar stop becomes a palato-alveolar affricate which she refers to as "coronalization," meaning that the original velar undergoes de-dorsalization and becomes a coronal affricate. Hock (1991) refers to the same process as "assibilation." Further, Bhat claims that voiceless velar stops (60%) are more likely to become palato-alveolar affricates than voiced velar stops (40%).

As previously mentioned, velar palatalization is common cross-linguistically. Although the following list is not exhaustive, velar palatalization which results in coronal segments has been documented in both Indo-European and non-Indo-European languages, such as Slavic, Polish, Slovak, Acadian French, Roubaix and Tourcoing

French, Italian, English, Greek, Indo-Iranian, Cowlitz Salish, Bantu, Mam, and Turkish, all of which are discussed below.

The velar stops of the Slavic branch of Indo-European are very well-known for undergoing palatalization. In Slavic velar palatalization, when velars (i.e. k, g, x) were followed by front vocoids, they became coronals segments (i.e. ʧ, ʒ, ʃ, respectively), i.e. k, g, x > ʧ, ʒ, ʃ/_ i, j (Valliant 1950, Kiparsky 1963, Shevelov 1965, Mathews 1967, Lunt 1974, Schenker 1993, Anttila 1989, Schwartz 2000). As can be seen in (1), whereas the voiceless velar stops followed by front vocoids became palato-alveolar affricates (e.g. *wilk-e > vliʧe 'wolf'), the voiced velar stops developed into palato-alveolar fricatives (e.g. *mog-e > moʒe 'was able'), and the voiceless velar fricative became a voiceless palato-alveolar fricative (*dowx-e > duʃe 'ghost'). That is, while the velar stops lenited to an affricate and a fricative, the velar fricative changed place of articulation. This development from velars to coronals is known as the First Velar Palatalization. In (1), the historical evolution of velars from Pre-Proto-Slavic to Old Church Slavonic (OCS, 9th Century AD), the oldest attested form of Slavic, is provided. For the purpose of comparison, additional lexical items, which contain velars followed by non-front vocoids, have been included (based on Guion 1996: 8-9).

(1)

	Pre-Proto Slavic	OCS	Gloss
	*wilk-e	vlitʃe	'wolf' (voc.)
	*pla:k-j-o:-m	platʃo:	'I cry'
	*mog-e	moʒe	'was able' (2/3 sg. aorist)
	*lug-j- o:-m	lŭʒō	'I lie'
	*dowx-e	duʃe	'ghost' (voc.)
	*dowx-j-o:-m	duʃō	'I blow'
	Compare:	OCS	Gloss
		vĭkŭ	'wolf' (nom. sg.)
		plakati	'to cry'
		mogoxŭ	'was able' (1 sg. aorist)
		lŭgati	'to lie'
		duxŭ	'ghost' (nom. sg.)
		duxati	'to blow'

After the First Velar Palatalization took place, Slavic experienced the Second Slavic Palatalization and the Third Slavic Palatalization, which both created coronal affricates, but not palato-alveolars.

Velar palatalization is also exemplified in Polish (Chen 1996:78, Campos 1993, Rubach 1984). In Polish, when velar stops precede front vowels, they become palato-alveolar affricates, as expressed below in (2).

(2)	Polish	Gloss
	so[k]	'juice'
	so[tʃ]ek	'juice' (diminutive)
	zna[k]	'sign'
	zna[tʃ]yc	'to mean'
	roz[g]a	'twig'
	ro[dʒ]ek	'twigs' (diminutive genitive plural)
	wa[g]a	'weigh'
	wa[ʒ]yc	'to weigh'

When the voiced velar is preceded by a sonorant (e.g. a vowel), however, the velar becomes a palato-alveolar fricative (Chen 1996: 78). Whereas the First Velar Palatalization in Slavic refers to a diachronic sound change, the palatalization of Polish is synchronic and is governed by morphology.

Hume (1994) mentions velar palatalization which results in coronal segments also occurs in Slovak and Acadian French (Hume 1994: 7, 19, 127),[1] both of which are Indo-European, the prior belonging to the Slavic branch and the former to the Romance languages. Examples of velar palatalization in Slovak appear in (3).

[1] Hume (1994) refers to the process of velar stops becoming palato-alveolar affricates as "coronalization."

(3)	Slovak		Gloss
	vnuk		'grandson'
	vnúk + ik →	[vnútʃik]	'grandson' (dimin.)
	vnúk + æ →	[vnútʃæ] → [vnútʃa]	'grandson' (dimin.)
	tʃlovek		'man'
	tʃlovek + e →	[tʃlovetʃe]	'man' (voc.)
	tʃlovek + æ →	[tʃlovietʃæ] → [tʃlovietʃa]	'children'
	cveng		'sound'
	cveng + æ + t →	[cvendʒæt]→ [cvendʒat]	'to sound'

As can be seen in (3), in Slovak when front vowels are preceded by velar stops, the velars become palato-alveolar affricates, like in Polish (Hume 1994: 7). As was the case with Polish, velar palatalization of Slovak is synchronic and is governed by morphology.

Similarly, in Acadian French, as it is spoken in New Brunswick, Nova Scotia, and Prince Edward Island in Canada, velar palatalization also results in palato-alveolars, as can be seen below (Hume 1994: 127; see also Lucci 1972, Flikeid 1988: 93-94[2]).

[2] Flikeid (1988:93-94) refers to the process of a velar or alveolar stop becoming a palato-alveolar affricate as "affrication."

(4)	Acadian French	Gloss
	[kø]~[kʲø]~[tʃø]	'tail'
	[kyir]~[kʲyir]~[tʃyir]	'leather'
	[okɛ̃]~[okʲɛ̃]~[tʃɛ̃]	'no, not any'
	[ki]~[kʲi]~[tʃi]	'who'
	[kɛ]~[kʲɛ]~[tʃɛ]	'quay'
	[kœr]~[kʲœr]~[tʃœr]	'heart'
	[gɛte]~[gʲɛte]~[dʒɛte]	'to watch for'
	[gœl]~[gʲœl]~[dʒœl]	'mouth'
	[ka]	'case'
	[gar]	'station'

As the examples demonstrate, the outputs of velar palatalization consist of not only palato-alveolar affricates, but also secondarily palatalized velars[3] and plain velars. This diversity exists mainly because palatalization is optional in Acadian French. It should be noted that velar palatalization in Acadian French occurs only before front vowels, i.e. not before non-front vowels such as [a], as is illustrated by the last two examples in (4).

Pooley (2002), like Hume (1994), investigated velar palatalization in French. Pooley, however, looked at French spoken in the Lille-Roubaix-Tourcoing areas of France from the "mid-nineteenth century to the end of the twentieth century" (Pooley

[3] Although secondary palatalization is not emphasized here, it will be briefly mentioned in coming sections of this dissertation.

2002: 29). Pooley found that whereas the voiceless velar stop is pronounced in various words in Lillois, those same lexical items contain the voiceless palato-alveolar affricate in Roubaix and Tourcoing. Pooley writes:

> A number of frequent lexical items are pronounced with [k] in Lillois and an affricated consonant [tʃ] in Roubaix and Tourcoing, e.g. Lollois [kã] *quand* 'when', [kjɛ̃] *chien* 'dog', [kɛl] *quelle* 'which', Roubaix-Tourcoing [tʃã] [tʃjɛ] [tʃɛl] (Pooley 2002: 37).

It should be noted that the change from the velar stop to the palato-alveolar affricate occurred before not only front vocoids (e.g. [jɛ] and [ɛ]), but also the nasal vowel [ã]. Pooley (2002: 37) points out that "it [is] possible to distinguish speakers from Lille…[and] Tourcoing" based on this k~tʃ opposition (among others).[4]

According to Calabrese (1998:2), velar palatalization which results in palato-alveolar affricates also occurs in Italian, another Romance language. Calabrese offers the following data to support his claim.

[4] Pooley (2002: 37) writes that along with the "affricated consonants" (i.e. [k]→ [tʃ]), the addition or absence of "the yod" is also a distinctive feature which distinguishes speakers from various speech/dialectal communities in France. For example, whereas Lille Picard contains the yod pronunciation (e.g. fête → [fjɛt] 'party', bête → [bjɛt] 'stupid', *beau* → [bjo] 'beautiful'), the Roubaix and Tourcoing varieties are "yodless."

(5)	singular	plural	Gloss
	amiko	amitʃi	‘friend(s)’
	greko	gretʃi	‘greek(s)’
	porko	portʃi	‘pig(s)’
	belga	beldʒi	‘Belgian(s)’
	filologo	filolodʒi	‘philologist(s)’
	antropofago	antropofadʒi	‘cannibal(s)’

In the examples, when the velar stops are followed by the back vowel [o], velar palatalization does not occur. However, when the velar stops are followed by the high front vowel [i], velar palatalization does occur and palato-alveolar affricates result. As with Polish, Slovak, and Acadian French, this sort of velar palatalization in Italian is synchronic and is morphologically conditioned.

Velar palatalization is also exemplified in English, which is in the West Germanic branch of Indo-European (Guion 1996: 20, Emerson 1903, Campbell 1959, Hogg 1979, Crowley 1992, Hock and Joseph 1996). Many linguists would concur that Old English (OE) velars were fronted when preceded or followed by front vowels. (Note that the fronted velars have been marked with the following diacritic placed below the consonant: k̟.) By the time of Middle English (ME), the OE voiceless velar stops were not only fronted, but also raised, so as to develop into palato-alveolar affricates, i.e. k̟ > tʃ / _ front vowels, as in (6). Whereas the output of the palatalization of the voiceless velar stops in OE created affricates in ME, the output of the palatalization of the OE voiced velar fricatives created palatal glides in ME, i.e. ɣ > j / _ front vowels. Further, not only did the fronted non-geminate voiceless velars become affricates, but so did the fronted geminate voiceless and voiced velars, all of which were triggered by front vowels on either side of the target segment.

(6)	OE	Mod. English	Gloss
	k̟irik̟e	tʃɹ̥tʃ	'church'
	k̟e:ake	tʃik	'cheek'
	ɣinian	jan	'yawn'
	ɣeard	jard	'yard'
	wæk̟k̟ing(e)	watʃɪŋ	'watching'
	kyg̟gel	kʌdʒəl	'cudgel'

According to Campbell (1999: 95-96), the English word 'choose' also experienced velar palatalization: PIE root *geus- 'to choose, to taste' > Proto-Germanic *keus-an > choose.[5] Campbell (Pooley 2002: 96) notes:

> [T]he palatalization in English of k to č before front vowels…resulted in different allomorphs with different consonants in the paradigm čVs- and kVr-. Analogical leveling later eliminated these consonant differences, leaving Modern English choose/chose/chosen.

[5] See also Hock and Joseph (1996: 154-156) for a similar analysis of the English lexical item 'choose'.

Although velar palatalization resulted in two different allomorphs, "subsequent analogical changes restored uniformity to the consonants of this paradigm" (Pooley 2002: 96).

Crowley (1992: 53) mentions that velar palatalization also occurred in the English words 'chin', 'cheese', and 'yarn': *kinn → tʃɪn 'chin', *kɛsi → tʃiz 'cheese', and *gearn → ja:n 'yarn, thread'. Crowley (1992: 53) states: "The velar stops [k] and [g] became palatalized to [tʃ] and [j] respectively when there was a following front vowel." Crowley (1992: 53) describes the change from [g] to [j]: "Note that the change of [g] to [j] probably involved palatalization of [g] to [dʒ] first, and then [dʒ] underwent lenition to [j]." That is, the voiced velar stop underwent the same path of palatalization as did its voiceless counterpart. Later, however, it weakened to a palatal glide.

Bynon (1977: 220-221) also discusses the change of voiceless velar stops to voiceless palato-alveolar affricates in English, focusing particularly on the lexical item 'kitchen' from the Latin cocīna (< coquīna).[6] Whereas the word-medial voiceless velar stop underwent palatalization which resulted in a voiceless palato-alveolar affricate in English, the word-initial [k] failed to experience palatalization. Bynon (1977: 220) writes:

> It will be noted that the initial /k/ of Modern English *kitchen* has not been palatalized inspite of the fact that it is followed by a high front vowel and this is an important indicator of the chronology of certain vowel changes in English. For clearly at the time when palatalization was taking place this vowel cannot yet have had its present high front quality, which must therefore be the result of a subsequent change. As in the case of the first vowel of

[6] Note that graphemes <c> and <q> in the Latin examples represent the voiceless velar stop [k].

> *minister* and *mint* (< *monēta*), this must be the result of umlaut on an earlier /u/. This can in fact easily be seen from the Old English spellings *cyene*, *mynster*, and *mynet*, where the orthographic sign *y* represents the rounded front vowel /ü/ which regularly resulted from the umlaut of the back vowel */u/ and which was later to become unrounded and to merge with /i/. The /i/ in these words must then come from an earlier /u/.

That is, at the time when velar palatalization was active, the word-initial velar stop in 'kitchen' was not followed by a high front vowel, but rather by /y/ (i.e. /ü/), which did not trigger velar palatalization. Bynon (1977: 221) offers the following path of development for the lexical item 'kitchen': */koˈki:na/ > */ˈkukina/ > /kütʃene/ > /kitʃən/.

The process of velar palatalization is also demonstrated in Greek, which forms, by itself, a separate branch of Indo-European. According to Sawicka (1997: 45), "velar stops undergo palatalization in all Greek dialects and in quite a number of dialects they shift into affricates or sibilants, which sometimes become hard." Some of the outputs of velar palatalization in Greek are as follows in (7):

(7)	Megara and Rhodes	Cyprus	Standard Greek	Gloss
	[tʃeros]	[tʃeros]	[ceros]	'weather'
	[seri]/[ceri]	[ʃeri]	[çeri]	'hand'

As can be seen from the examples, the outputs of velar palatalization are quite diverse, even within each regional variant. For example, the Megara and Rhodes varieties have a palato-alveolar affricate, an alveolar fricative, and a palatal stop as outputs of velar palatalization. The Cyprus variety, however, has only two outputs of velar palatalization: a palato-alveolar affricate and fricative. Standard Greek, on the other hand, has a palatal stop and fricative as its output for velar palatalization.

Similarly, Newton (1972b) states that in the Cretan, Old Athenian, and south-eastern varieties of Greek, when a velar stop or fricative is followed by a front vowel or glide, the velar often undergoes what he terms 'softening,' which results in a palato-alveolar affricate or fricative. Newton writes:

> In Cretan, Old Athenian, and south-eastern dialects [of Greek] one or more of the velar consonants /k/, /x/ and /γ/ is 'softened' before a front vowel or glide to [č], [š], [ž] respectively (this output being subsequently 'depalatalized' to [t^s], [s], [z] in some dialects). Thus /kerós/ 'weather' is heard as [čerós] in Crete and Cyprus, and as [t^serós] in Megara and Rhodes. /xéri/ 'hand' is [šéri] in Crete and Cyprus, [séri] in Rhodes. In Crete /γí/ 'earth' appears as [ží] (Newton 1972b: 16).

Instead of referring to the process of velar consonants being spirants as "spirantization" (Bhat 1978) or "assibilation" (Hock 1991), Newton uses 'softening', which is a common occurrence in various dialects of Greek.

Indo-Iranian, another branch of Indo-European, has also experienced velar palatalization in the environment of front vowels. Velar palatalization in Indo-Iranian is also referred to as the "Law of Palatals," a defining characteristic of this branch (Guion 1996: 12-13, Mayrhofer 1965, Hoffman 1982). In Proto-Indo-Iranian, it is believed that both voiceless and voiced velar stops became palato-alveolar affricates when followed by front vowels (k, g > tʃ, dʒ/_ front vocoids), as in (8). For the purposes of comparison, examples have been provided from Sanskrit (an ancient Indic language) and Avestan (an Iranian language), Latin, and Greek. It should be noted that the Law of Palatals resulted in creating new segments (i.e. palato-alveolar affricates) in Indo-Iranian.

(8) Pre-Proto-Indo-Iranian	Sanskrit	Avestan	Gloss	cf. Latin/Greek
gi:wo-s (<g^{w}ihwo)	ʤi:vas	ʤi:va-	'alive'	vivus/βιος
*ke (<*kwe)	ʧa	-ʧa	'and'	-que/τε
*jogo-m	juga-	---	'yoke'	sequitur/επομαι
*kru:-	kru:ra-	xru:-	'bloody'	cruor/κρές

As can be seen in the last two examples in (8), only the front vowels [i] and [e] triggered velar palatalization in Indo-Iranian. Also note that in the second example in (8), the front vowel [e] does not appear in Sanskrit and Avestan. Instead of [e], [a] appears after the palato-alveolar affricate which was the output of velar palatalization. According to Bhat, after palatalization occurs, the triggering environment which caused palatalization (i.e. in this case the [e]) often changes or disappears, which often leads to difficulties in reconstructing the original form (i.e. a velar followed by a non-back vowel), thereby making the palatalization process appear opaque.

Velar palatalization can also be found in non-Indo-European languages, such as in various Salishan languages. According to Kinkade (1973), Salishan languages can be divided into the two following groups: (a) k- languages, and (b) ʧ- languages, which is somewhat similar to the kentum/satem division in Indo-European, in that the plain velars of Proto-Salish have been retained in the former, whereas they have changed into palato-alveolar affricates in the latter. Whereas Proto-Salish exemplifies a k- language, Cowlitz Salish exemplifies a ʧ- language, as in (9).

(9)	Proto-Salish	Cowlitz Salish	Gloss
	*k'ilk	tʃ'ilk	'window' (Note: C' = ejective C)
	*kitaq	tʃæ:q	'argue'

It should be noted that the consonants in the first example in (9) with an apostrophe after the velar stop and palato-alveolar affricate are ejective consonants. It is believed that the palato-alveolar affricates developed from velars followed by front vowels (Guion 1996: 13, Kinkade 1973, Thompson 1979). Further, it should be noted that because Salishan languages do not contain voiced stops, only voiceless velars (both ejective and pulmonic) were available to undergo velar palatalization.

Other non-Indo-European language families, such as Bantu, also provide examples of velar palatalization. One Bantu language which displays velar palatalization is Jomvu. In Jomvu, voiceless and voiced velar stops followed by front vowels tend to become palato-alveolar affricates, i.e. k, g > tʃ, dʒ/ _ front vowels (Guion 1996: 17, Guthrie 1967, Hyman and Moxley 1995), as is illustrated in (10).

(10)	Proto-Bantu	Jomvu	Gloss
	*-kéngédé	tʃendʒele	'bell'
	*-pokid-	-potʃe-a	'receive'
	*-ingid-	-ndʒi-a	'enter'

Velar palatalization can also be found in various forms of the Mayan language Mam (Guion 1996: 20-21, England 1990, Campbell 1977). Although in many of the Mam varieties voiceless velar stops followed by front vowels become palato-alveolar affricates (e.g. in Ostmucalco and Ixtahaucan), in the Mam form of Tacana, when the voiceless velars precede front vowels, they become the voiceless palatal stop (e.g. [c]). In Tacan, whereas the voiceless velar turns into a voiceless palatal stop, the voiced velar becomes a palato-alveolar affricate, as is illustrated in (11). Quiche, another Mayan language which belongs to the Quichean branch, contains velars which have not experienced palatalization, and have been included in (11) for the sake of comparison.

(11)	Ostmucalco	Ixtahaucan	Tacana	Quiche	Gloss
	ʧe:j	ʧe:j	ce:j	ke:x	'horse, deer'
	ʤiʔ	ʤiʔ	ʤiʔ	kiʔ	'sweet'

Chinese, an independent branch of the Sino-Tibetan language family, also provides examples of velar palatalization which occurred between Old Chinese and Middle Chinese (Baxter 1992: 52, 177, 569, Pulleyblank 1962: 67-68, Pulleyblank 1984: 169-170, Guion 1996). In Old Chinese, velar stops followed by both a palatal glide and a front vowel would undergo palatalization and become the alveo-palatal affricates and fricatives (i.e. tɕ, dʑ, ʑ) of Middle Chinese, as in (12). It should be noted that Old Chinese did not contain alveo-palatal consonants. It is important to mention that both the palatal glide and front vowel must be present to trigger velar palatalization; that is, if only the glide is present, the velar stop is retained.

(12)	Old Chinese	Middle Chinese	Gloss
	*kje	tɕje	'branch'
	*gjip	dʑjip/ ʑjip	'ten'
	*kaw	kaw	'tall, high'
	*gaj	ha	'(Yellow) river'
	*gjo/ut	gjwot~gjut	'dig out (earth)'

There is also the velar palatalization in Modern Standard Chinese vis-à-vis Cantonese, whereby a velar stop became a denti-alveolar affricate when followed by a glide and vowel: /kjaŋ/ → [tɕiaŋ] 'river' (Jerold A. Edmondson, personal communication).

Velar palatalization can also be found in Turkish, a Turkic language which belongs to the Altaic language family. When a velar stop is followed by a front vowel, the velar is palatalized. Sawicka (1997:39) provides the following examples from Turkish of Gostivar.

(13)	Turkish			Gloss
	öküz	→	ük'üs	'ox'
	gölge	→	g'ülg'e	'shadow'
	gene	→	g'ene	'again'

Sawicka (1997: 39) does not specify whether the velars become fronted velar stops, secondarily palatalized velar stops, or palatal stops. The notation which she uses above is ambiguous; the apostrophe after the velar stops could represent secondary palatalization, fronted velars, or palatals. Despite this ambiguity in the transcription of the output, it should still be noted that velars undergo palatalization when followed by front vowels in Turkish.

As was seen with the velar stops in Acadian French (see Hume 1994, Lucci 1972, Flikeid 1988), the second most common output of velar palatalization is a secondarily palatalized velar (i.e. k, g → k^j, g^j/_ i, j) (Bhat 1978), such as in Russian, Irish Gaelic, and Italian. Although the focus of this dissertation is not secondarily palatalized segments, for the purpose of completeness, they will be briefly discussed below.

After the various Slavic palatalizations (e.g. First Velar Palatalization), Russian experienced secondary palatalization, which created not only secondarily palatalized velars, but also secondarily palatalized labials and alveolars (Guion 1996, see also Schwartz 2000, Lunt 1981, Shevelov 1965). As with the First Velar Slavic Palatalization, the trigger for secondarily palatalized segments in Russian was also a following front vocoid, especially [i] and [j]. The process began with the labials and alveolars, and then later spread to the velars. At first the original non-palatalized phonemes had palatalized allophones. However, in the eleventh century separate non-palatalized/palatalized phonemes had developed. In the fourteenth century the secondarily palatalized velar was written so as to indicate the secondary palatalization with an И [i] (not ы [ɨ]) after the velar consonant.

Gaelic Irish also demonstrates secondary velar palatalization, which had already developed as far back as Old Irish (Guion 1996). As with Russian, secondary palatalization in Irish involved not only velar segments, but also many labial and dental phonemes. The trigger for secondary palatalization was a following front vowel. Secondary palatalized consonants are quite prevalent in modern Irish; they constitute a significant portion of the grammar, e.g. the genitive case marker: [f^{j}ær] 'fear' (nominative single) and [f^{j}ir^j] 'fir' (genitive single).

Secondary velar palatalization can also be found in Italian (Calabrese 1998: 2). Calabrese offers the following examples: sporko (sg.) → spor[k^j]i (pl.) 'dirty', parko (sg.) → par[k^j]i (pl.) 'park(s)', kollega (sg.) → kolle[g^j]i (pl.) 'colleague(s)', mago (sg.) → ma[g^j]i (pl.) 'sorcerer', dyalogo (sg.) → dyalo[g^j]i (pl.) 'dialogue(s)'. In Italian, the trigger of secondary palatalization is a front vowel (e.g. [i]), which follows the targeted velar stops. As was the case with the output of velar palatalization in Italian, Calabrese notes that the sound change from plain velars to secondarily palatalized velars is synchronic and governed by morphology.

2.2 Coronal Palatalization

Like velars, alveolar stops followed by non-back vocoids have a tendency to undergo palatalization. In some cases the alveolar stop becomes a palato-alveolar affricate (i.e. t, d → ʧ, ʤ/__ j). In other cases, however, the outcome is an alveo-palatal affricate (i.e. t, d → tɕ, ʥ), palatal affricate (i.e. t, d → cç, ɟʝ), or palatal stop (i.e. t, d → c, ɟ).

Bhat (1978) refers to the process of an alveolar stop assimilating to the following non-back vocoid as "tongue-raising," with the most likely trigger being an unstressed palatal glide (and the next strongest an unstressed front vowel). Bhat explains that tongue-raising mainly takes place with alveolars, rather than with velars, in that the raising provides a wider surface (than just the tip of the tongue) for articulation, which changes the apicals into laminals. Further, Bhat also mentions that whereas tongue-fronting raises the F2, tongue-raising lowers the F1.

Coronal palatalization, which Bhat claims is the second most common form of palatalization, is found in the Indo-European languages of Lemko, Greek, Romanian, Acadian French and the non-Indo-European languages of Japanese and some dialects of Fijian.

Lemko, a dialect of Ukrainian and "the westernmost Slavic tongue" (Schwartz 2000: 26, 71), provides examples of alveolar palatalization, whereby voiceless and voiced alveolar stops followed by a palatal glide became voiceless and voiced palato-alveolar affricates, respectively. The process of coronal palatalization in Lemko is provided below, where modern Lemko is compared to Proto Slavic and Late Common Slavic.[7]

(1)	Proto-Slavic	Late CS	Mod. Lemko	Gloss
	swait-i-a	svtʃetja*	svitʃa	'candle'
		dj	medʒa	'border'

In Greek, like Lemko, voiceless and voiced alveolar stops undergo palatalization when followed by front vocoids. Sawicka (1997: 39) writes: "In Plumari (Lesbos) and Mesta (Chios) /t/ and /d/ become [c] and [ɟ] before /i/ and /j/...*matia*

[7] Schwartz (2000: 57) states that "the formation of Common Slavic...culminated around the 7th or 8th century A.D."

'eyes' → [maca]." In this case, palatal stops, rather than palato-alveolar affricates result. In Greek Macedonian (a dialect of Siatista), however, /t/ and /d/ palatalize into [tʃ] and [dʒ]: pefti → [peftʃ] 'he falls'. As was the case with velar palatalization in Greek, Greek coronal palatalization also provides a wide variety of outputs.

In Hume's (1994: 149) analysis of palatalization and coronalization, she mentions how when the Romanian voiced alveolar stop precedes a palatal glide, it undergoes palatalization, resulting in a voiced palato-alveolar affricate: aldji > alg' > aldʒ.[8]

Hume (1994: 128; see also Lucci 1972, Flikeid 1988) also mentions that Acadian French undergoes coronal palatalization, as can be seen below.

(2)	Acadian French		Gloss
	/tiɛ̃/	[tjɛ̃]~[tʲɛ̃]~[tʃɛ̃]	'your'
	/amitie/	[amitje]~[amitʲe]~[amitʃe]	'friendship'
	/ɛ̃diɛn/	[ɛ̃djɛn]~[ɛ̃dʲɛn]~[ɛ̃dʒɛn]	'indian'
	/kanadiɛ̃/	[kanadjɛ̃]~[kanadʲɛ̃]~[kanadʒɛ̃]	'Canadian'
	/diamã/	[djamã]~[dʲamã]~[dʒamã]	'diamond'

In Acadian French, when a coronal stop is followed by the high front vowel [i] plus an additional vowel, the [i] can become a palatal glide (e.g. /tiɛ̃/ → [tjɛ̃] 'your'), or it may

[8] Hume (1994: 149) does not provide a translation of the Romanian example used above. Consultation with a NS of Romanian for a translation of the word was fruitless. The NS was not able to identify the lexical item.

secondarily palatalize the preceding coronal stop (e.g. /tiɛ̃/ → [tʲɛ̃] 'your'). Otherwise, the high front vowel may palatalize the preceding coronal stop into a palato-alveolar affricate (e.g. /tiɛ̃/ → [tʃɛ̃] 'your'). As with velar palatalization in Acadian French, the output of coronal palatalization also offers a variety of outputs (Hume 1997).

Japanese also provides examples of coronal palatalization. When alveolar stops precede the high front vowel /i/, they undergo palatalization and become palato-alveolar affricates (Chen 1996:26, Bloch 1950, Vance 1987, Tsujimura 1996). An example of coronal palatalization in Japanese has been provided below, where plain and palatalized versions are shown.

(3)	Plain	Palatalized	Gloss
	katanai (Neg)	katʃitani (volitional)	'win'

Note that whereas the plain alveolar is followed by a non-front vowel /a/, the palatalized version is followed by the front vowel /i/.

Crowley (1992) notes that some dialects of Fijian also experience coronal palatalization, whereby a voiceless alveolar stop becomes a palatal stop when followed by a front vowel. Crowley (1992: 53) writes:

> One good example of palatalization is the change from [t] to [c] before the vowel [i] in many dialects of Fijian. For example, where Standard Fijian has [tinana] 'his/her mother', many of the local dialects have palatalized the initial consonant to produce [cinana].

Like with some forms of Greek, the output of alveolar palatalization in Fijian is not an affricate, but rather a palatal stop.

2.3 Glide Strengthening

A related topic to velar and coronal palatalization is the fortition of palatal glides. Examples of glide strengthening can be found in Cypriot Greek (Newton 1972: 22; Kaisse 1992), Räto-Romansch (Kamprath 1986, Kaisse 1992: 319-321), and Spanish.

According to Newton (1972), in Cypriot Greek when the palatal glide [j] is preceded by most consonants, it hardens to a voiceless fronted velar or palatal stop (see also Kaisse 1992: 316-317), as is expressed below. Note the [k̭] denotes a prevelar/palatal stop.

(1)	underlying form		affixed form		surface form	Gloss
	/aðerfi + a/	→	aðerfja	→	aðerfk̭a	'brother; brothers'
	/mati + a/	→	matja	→	matk̭a/maθk̭a	'eye; eyes'
	/na pi + o/	→	na pjo	→	na pk̭a/na fk̭a	'that I drink'
	/vɣ + enno/	→	vjenno	→	fk̭enno	'I come out'
	/teri + azo/	→	terjazo	→	terkazo	'I match'
	/vari + ume/	→	varjume	→	varkume	'I am bored'

In the above examples, the palatal glide becomes a prevelar/palatal stop after [f t θ p]; however, after the phoneme /r/, the palatal glide changes into [k]. Kaisse (1992: 317) suggests that the palatal glide becomes a velar stop, instead of a prevelar/palatal stop, because "r's and palatals are frequently incompatible in the world's languages (Edwin Pulleyblank, personal communication, 1990)."

As was seen with Cypriot Greek, glide fortition can also be observed in the Räto-Romansch dialect of Bergüner Romansh of Switzerland (Kamprath 1986: 219; Kaisse 1992: 319-321). In Räto-Romansch, however, the glide becomes a velar stop before any consonant. Unlike in Cypriot Greek, in Räto-Romansch, both the /w/ and /j/ undergo fortition; here, however, the palatal glide will be the focus. Also, in Räto-Romansch the trigger is a following consonant, instead of a preceding consonant. Examples of palatal glide fortition are provided below. Note that the word-final liquids (i.e. 'r's and 'l's) appear in upper-case letters to indicate that they are voiceless.

(2)	Räto-Romansch	Gloss	Räto-Romansch	Gloss
	kreja (/krej + a/)	'believes'	krekR (/krej + r/)	'to believe'
	ʒdreja	'destroys'	ʒdrekR	'to destroy'
	rejə	'laughs'	rekR	'to laugh'
	dejt	'finger'	dekt	'finger'
	fejl	'thread'	fekL	'thread'

Glide fortition can also be found in Old Spanish and Porteño Spanish. According to Penny (1991: 53), the word-initial palatal glide in Classical Latin strengthened into a voiced palato-alveolar affricate of Old Spanish (i.e. j → ʤ/#__), and then later lenited into a fricative (i.e. ʤ → ʒ/#__) as is illustrated in (3):

(3)	Classical Latin	Old Spanish			Gloss
	jocu	dʒwégo	>	ʒwégo	'game'
	justu	dʒústo	>	ʒústo	'just'

Citing Penny, Del-Valle-Codesal (1994: 5) writes: "The voiced palatal sibilant /ʒ/ also appeared in initial position, as the result of Classical Latin initial /j/ (represented j). It is normally assumed that between the Latin semiconsonantal pronunciation and the Old Spanish fricative pronunciation was a stage when the sound was the affricate /dʒ/."
In Hume's (1994: 65) analysis of palatalization, she cites the fortition of the syllable-initial palatal glide of Porteño Spanish. In this case, Hume writes that the syllable-initial palatal glide becomes a voiced palato-alveolar fricative, i.e. j → ʒ/ $_{\sigma}$[__, e.g. jendo (< in.do) > [ʒ]endo 'to go', ujendo (< uindo) > u[ʒ]endo 'to flee'. However, if the palatal glide is preceded by a consonant, the glide will not undergo fortition, e.g. *bib[ʒ]endo, bib[j]endo 'to live'. Whereas palatal glide strengthening in Old Spanish is limited to the word-initial position, in Porteño Spanish it is not restricted to only the word-initial position, in that for Porteño Spanish most any syllable-initial position will trigger palatal glide fortition. Whereas in Cypriot Greek and Räto-Romansch, the palatal glide undergoes fortition because of assimilation to a preceding or following consonant, in Old Spanish and Porteño Spanish, the palatal glide undergoes strengthening due to dissimilation to the preceding and following vowels.

In short, both velar/alveolar palatalization and glide fortition have the tendency to create palato-alveolar affricate and fricatives. Whereas front vocoids tend to be the triggers of velar/alveolar palatalization, they are the targets of glide strengthening. Both palatalization and palatal glide fortition are well documented processes in the literature.

2.4 General Phonetic Characteristics of Stops and Affricates

In order to better understand what occurs in palatalization, it is important to note various articulatory, acoustic, and perceptual issues involved. This section provides a review of the literature regarding these matters, with the main emphasis on palatal stops and palato-alveolar affricates.

2.4.1 Articulatory Characteristics

Before discussing the acoustic and perceptual aspects of stops and affricates, their articulatory characteristics need to be examined. Following Keating (1988a: 79): "My method will be to compare palatals with other places of articulation. In this way we will end up with a description not only of palatals, but also of the relation of palatals to coronals and to velars." First, a brief discussion of place of articulation, beginning with alveolar, velar, and palatal, will be given. Next, a brief description of the manner of articulation of stops and affricates will be provided. Thereafter, a more in-depth analysis of palatal stops and affricates will be presented. The purpose of this section is to provide basic background information regarding articulatory issues of stops and affricates which play a role in palatalization. Most attention, however, will be devoted to palatal stops and palato-alveolar affricates, as that is the focus of this dissertation.

In order to form consonants, constriction in the vocal apparatus must be formed, such as at the alveolar, velar, or palatal region. According to Ladefoged (1993: 6), whereas the production of sounds in the alveolar region involves "the tongue tip and the alveolar ridge," which is also referred to as coronal, the articulation of sounds in the velar area involves the "back of the tongue and soft palate," which is also referred to as dorsal. Speech gestures made at the "front of the tongue and hard palate" (Ladefoged 1993: 7) are termed palatal. It is controversial as to whether palatal sounds are coronal or dorsal, or both, more of which will be discussed later in this dissertation. Ladefoged (1993: 7) describes palato-alveolar sounds as being uttered using the "tongue blade and the back of the alveolar ridge." Keating (1993) points out that the alveo-palatal region involves the area between palato-alveolar and palatal. The diagram in Figure 2.1 illustrates these places of articulation (taken from Ladefoged 1993: 6).

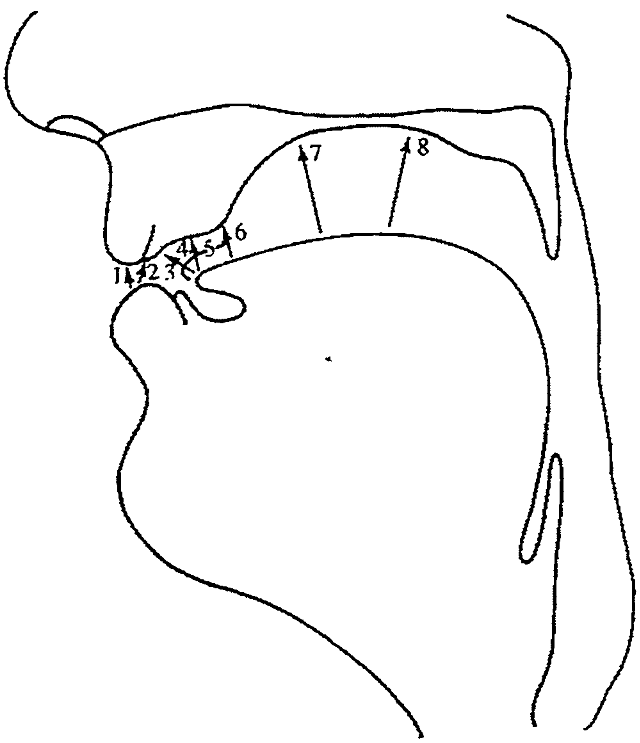


Figure 2.1: Places of articulation (taken from Ladefoged 1993: 6)

In Figure 2.1, while arrow 4 points to the alveolar region, arrows 7 and 8 point to the palatal and velar areas, respectively. Arrow 6 points to the palato-alveolar region. Although the alveo-palatal region is not marked, it is post-palato-alveolar and pre-palatal (i.e. between 6 and 7 in the diagram above). In all three areas, the tongue (i.e. the tip or the back portion of the tongue) and the specific region on the roof of the mouth, (e.g. the alveolar ridge, the hard palate, and soft palate), function as the articulators.

There are many different ways in which articulations can be made. In order to form a stop, "complete closure of the articulators" is needed to prevent any air from escaping "through the mouth" (Ladefoged 1993: 8). For fricatives, partial closure is mandatory. Ladefoged (1993: 10) writes that the requirements for a fricative involve the "[c]lose approximation of two articulators so that the airstream is partially obstructed and turbulent airflow is produced." A segment which consists of a stop followed by a fricative constitutes an affricate.

According to Johnson (1997), the articulation of stops and affricates are much more complex than for that of vowels and fricatives. He states that this is mainly because with stops and affricates, one must consider the "shutting," "closure," and "release" of such sounds, as can be seen in Figure 2.2 (taken on Johnson 1997: 126), where the first stage consists of an articulator moving toward the closure of the stop, the second stage involves the actual closure, and the third stage deals with the closure release.

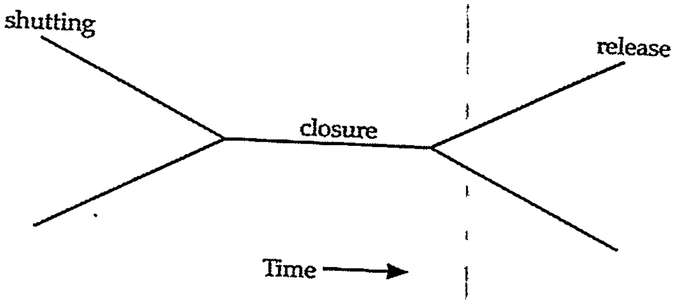


Figure 2.2: Shutting, closure, and release stages of stops and affricates (taken from Johnson 1997: 126).

The release stage of a stop consonant may also involve frication rather than voicing or aspiration, which is the only difference between a stop and an affricate (Johnson 1997: 137). Although the frication (i.e. the fricative portion) and the stop usually share the same place of articulation, as in the affricates [ts] and [tʃ] (Johnson 1997), it is possible to find heterorganic affricates where the stop and the fricative do not have the same point of articulation, such as [tx], which occurs in Navajo (McDonough and Ladefoged 1993).

2.4.1.1 Palatal Stops and Affricates

Since the focus of the dissertation involves palatal stops and palato-alveolar affricates, the preceding paragraphs will deal specifically with this issue.

As mentioned earlier, Ladefoged writes that "[p]alatal sounds can be defined as being made with the front of the tongue approaching or touching the hard palate, and with the tip of the tongue down behind the lower teeth" (Ladefoged 1993:161). Similarly, voiceless and voiced palatal stops (/c ɟ/) are produced by lowering the tip of the tongue so that it is "down behind the lower front teeth, and the center of the tongue [is] raised towards the hard palate" (Ladefoged and Maddieson 1996:30).

In an article entitled "Palatals as complex segments: X-ray evidence," Keating (1988a) discusses the issue of the place of articulation of palatal sounds. Keating analyzed various tracings of X-rays from the literature based the UCLA X-ray database and Dart (1987). She focused on Czech, which she wrote was the most documented language for such sounds, in that data was available from six subjects. In her discussion of palatals, she investigated the issue of articulation of palatal stops by comparing them to a palatal glide, and other palatal segments:

> We began by looking at a palatal stop, since contact is the easiest articulation to see. However, for most people, the prototypical palatal consonant is the glide [j], related to a high front vowel articulation...The glide is like the stop...in having a very long narrowing between the tongue and the palate, with no tip involvement and no space under the tongue. However, the tongue is necessarily less forward for the glide than it was for the stop. The comparison with the vowel shows that the vowel's narrowest section is in the same broad area as that of the glide. Further narrowing of the constriction will result in a fricative, which again will have a very long constriction...[T]he fricative constriction is more front along the palate than the vowel narrowing, and the tongue is higher as well, to make a closer fricative articulation...If you continue all the way to contact, you get a palatal stop. The length of the constriction is so great because the tongue keeps its vowel-like shape. To get a shorter constriction, one more localized along the palate, the overall tongue shape would have to change more. The length of the constriction seen for the palatals means that the palatal articulation is not really a point of articulation in the way that other consonants can be located along the palate. Palatals also do not involve a single part of the tongue. They use the very back of the blade, and the large front of the dorsum (Keating 1988a: 81).

Keating points out that due to the vowel-like shape of the tongue while producing a palatal stop, the length of such a consonant is spatially rather long. Keating proposes that due to the length of palatal segments (e.g. a palatal stop), sounds produced in the palatal region are complex. She provides the following diagram in Figure 2.3 to illustrate the point of articulation of a palatal stop.

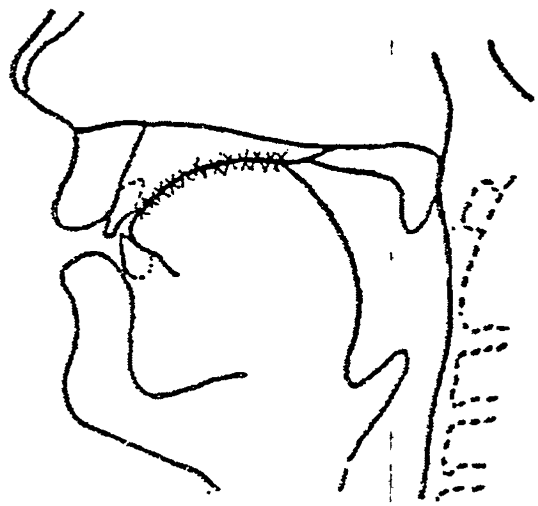


Figure 2.3: Place of articulation of a palatal stop (taken from Keating 1988a: 84).

In the figure above, Keating provides a diagram which illustrates the extreme length of a palatal stop. She also offers a diagram which compares the place of articulation of a palatal stop with a front velar and back velar, which are provided in Figure 2.4.

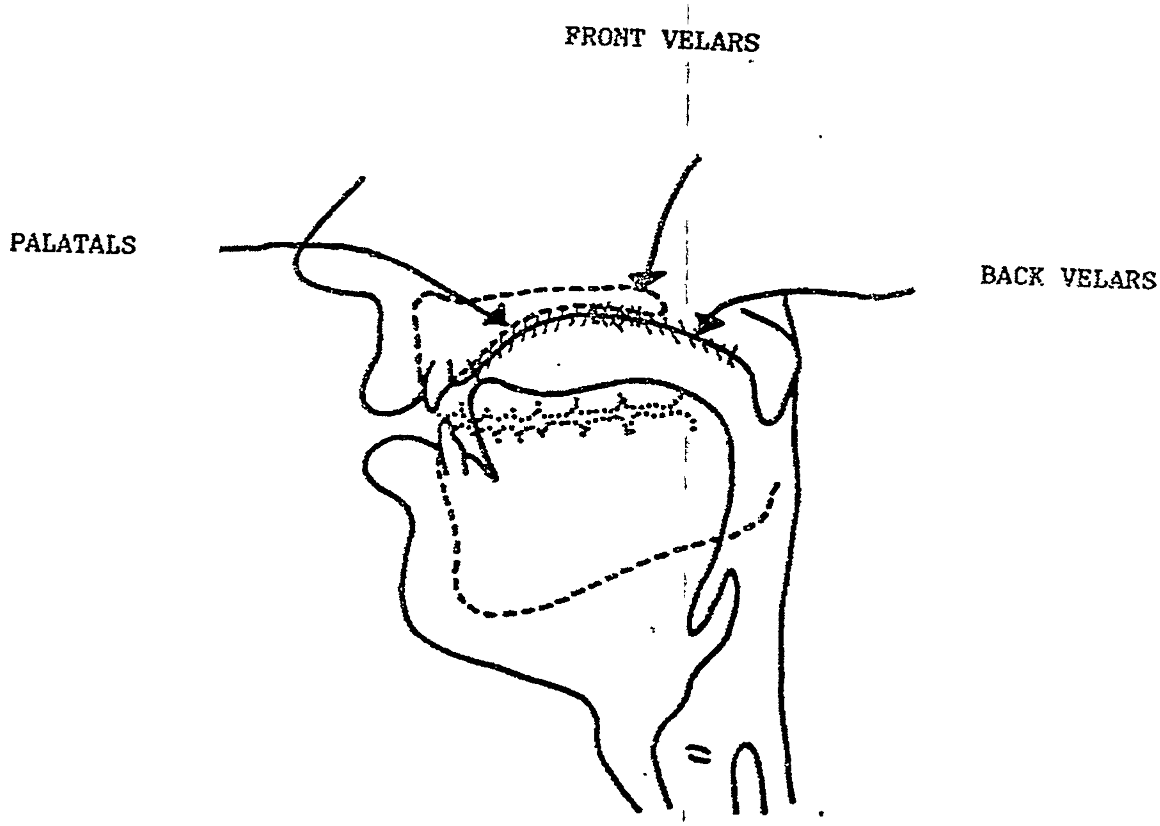


Figure 2.4: Places of articulation for palatal, front velar, and back velar stops (Keating 1988a: 86).

Keating points out that although there might be some overlap in place of articulation of palatals and front velars, palatals are not the same as front velars. That is, palatals constitute an independent category, which covers a much broader region than other places of articulation.

What Keating means by referring to palatal sounds as complex is that they involve more than just one place of articulation, i.e. coronal (alveolar) and dorsal (velar). She writes (1988a: 83-87):

> Given our description of palatals, what feature values should represent them and distinguish them from other places of articulation? First, they are coronal, if that node is taken to include the part of the tongue beyond the very front, as

discussed by Halle and Stevens (1979): that is, from the tip up to the dorsum. Although this part of the tongue is not "raised", as is sometimes taken to be the criterion for coronals, it is involved in forming the constriction. As coronals, palatals must be non-anterior, since the upper teeth and the front of the alveolar ridge are never constricted. They must also be distributed, meaning that they have a long constriction. Palatal constrictions are typically on the order of twice as long as those of velars, and three times as long as those of anterior coronals...Chomsky and Halle were wrong in saying that palatals are the same thing as fronted velars, but they were right in saying that the palatal

ly position as being dorsal ([-back]

ot only coronal in that they involve

e dorsum" as was argued by Halle

volve the high front body of the

990) argues against palatal sounds

artitions of the palate need to be revised. Using evidence based on linguographic, palatographic, electropalatographic, and X-ray data found in previous accounts in the literature (e.g. see Chlumský 1941, Hála 1923, 1962, Pačesová 1969, Catford 1977, Ladefoged 1957, Recasens 1983), Recasens' proposal appears in the Figure 2.5 (taken from Recasens 1990: 268).

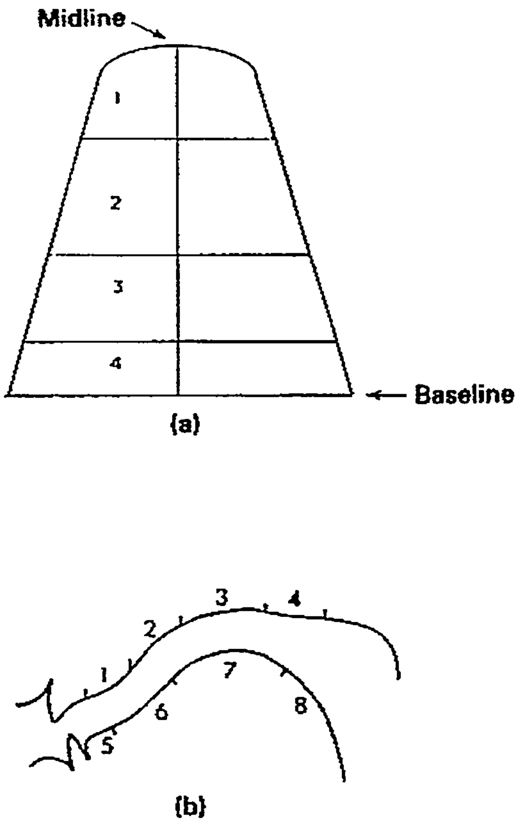
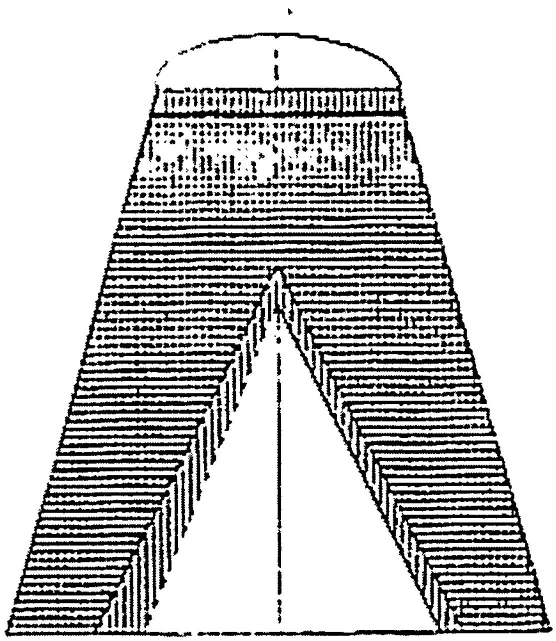


Figure 2.5: Partition revisions for places of articulation (taken from Recasens 1990: 268).

In the palato-graphic configuration in (a), Recasens suggests the following divisions: 1) alveolar zone, 2) prepalatal zone, 3) mediopalatal zone, and 4) postpalatal zone. In the X-ray configuration in (b), he proposes the following subdivisions: 1) alveolar zone, 2) prepalatal zone, 3) mediopalatal zone, 4) postpalatal zone, 5) laminal region, 6) predorsal region, 7) mediodorsal region, and 8) postdorsal region.

Using the revised partitions above, Recasens (1990) argues that the articulation of palatal stops demands much precision in that "complete contact takes place simultaneously at the postalveolar and at the prepalatal zones" (Recasens 1990: 271), whereby the main articulator is primarily predorsal, and not laminal, as is illustrated in Figure 2.6.

(a)



(b)

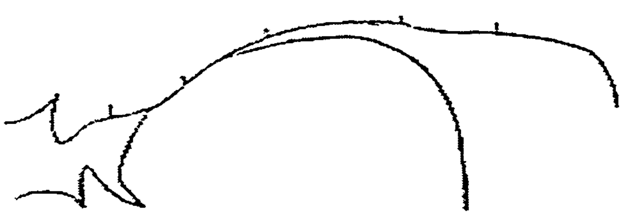


Figure 2.6: (a) Schematic palatographic configurations for the stop [c] and [ɲ] from Hála 1962. (b) Schematic X-ray configurations for [c] and [ɲ] taken from the literature (taken from Recasens 1990: 272).

In the schematic patalatogram in (a), the vertical lines represent the palatal stop /c/, while the horizontal lines represent the palatal nasal /ɲ/. In the schematic X-ray configuration in (b), both the palatal stop and nasal are shown. As can be seen, there is much overlap between these two palatal consonants. In both cases, Recasens argues that only one place of articulation is used. Whereas Recasens (1990) argues that palatals are not complex, Keating (1988a) argues that they are.

Although palatal stops are relatively uncommon, they can be found in Akan in Ghana (Ladefoged 1997:602, 162), Hungarian (Ladefoged and Maddieson 1996:166, Ladefoged 2001: 147-148, Hume 1994: 33-38), Czech (Chlumský 1941, Hála 1923, 1962, Pačesová 1969), and Slovak (Hála 1929); according to some linguists, they are also found phonemically in Albanian (see Wescott 1948, Newmark 1957, Bevington 1974, Camaj 1991, Zymberi 1991, Shkurtaj and Hysa 1996, Demiraj 1997, Newmark 1998, and Byron 1976), which will be discussed more in-depth in Chapter 3.

As was previously mentioned, palatal stops are often released with frication, or a narrowing of two articulators which results in turbulent airflow (Ladefoged 1993). Ladefoged explains:

> Because of the shape of the roof of the mouth, the contact between the front of tongue and the hard palate often extends over a fairly large area. As a result, the formation of a palatal stop is often not as rapid as in the case of other stops, and they tend to become affricates (Ladefoged 1997:162).

This claim of fricated palatal stops is supported by Lowman (1932), Newmark (1957), and Beci (1995), when referring to Albanian, which will be discussed more in-depth later in this dissertation (see Chapter 3).

According to Keating (1988a), unlike palatal stops, palato-alveolar affricates (i.e. / ʧ/ and /ʤ/) "have a cavity under the tongue blade, and a relatively short constriction" (Keating 1988a: 87). Such a configuration is provided in Figure 2.7, where Czech palato-alveolars are used to illustrate this point (Keating 1988a: 88, Figure 8).

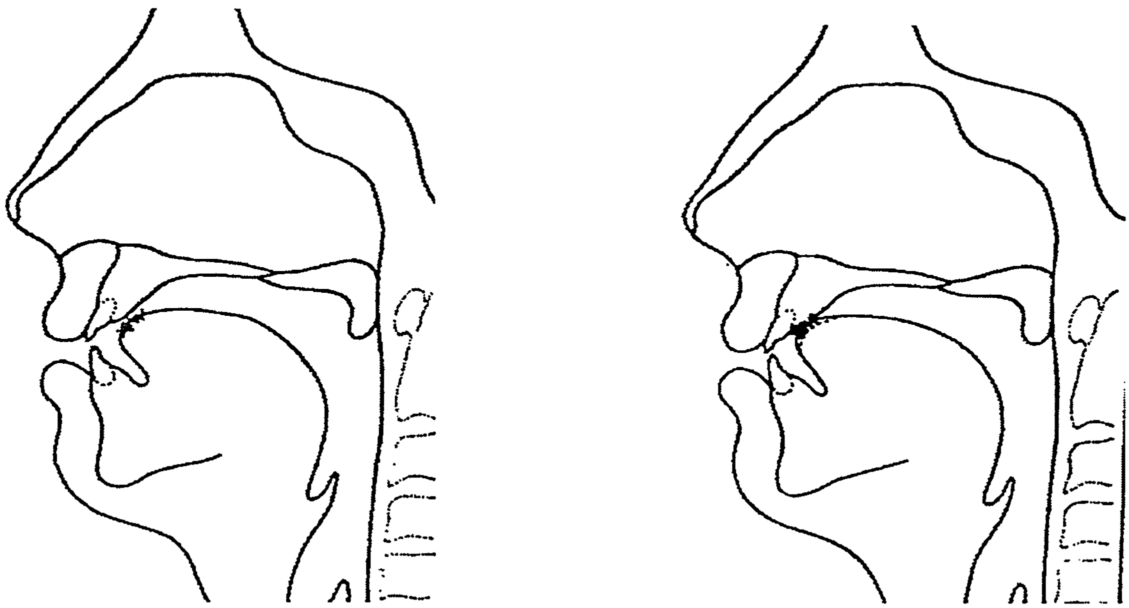


Figure 2.7: Czech palato-alveolar fricative (left) and stop (right) portions of the palato-alveolar affricate (taken from Keating 1988a: 88, Figure 8).

In Figure 2.7, both the voiceless palato-alveolar fricative (i.e. /ʃ/) and stop (i.e. /t/) portions of the palato-alveolar affricate (i.e. /tʃ/) are provided.

Keating also notes that alveo-palatal affricate (e.g. /tç/), such as that found in Mandarin Chinese, and the palato-alveolar affricate are similar in that they

> have a cavity under the tongue blade (though its small for the affricate), and a constriction which, though rather long, is none the less shorter than a palatal constriction, as it does not extend as far back; and in fact it generally varies across tokens. Furthermore, here at least the overall orientation of the tongue is not like that of front vowels or palatals. That is, these are consonants in which the blade is raised up to form a simple constriction (Keating 1988a: 87).

Such a constriction is illustrated in Figure 2.8 with the voiceless alveo-palatal of Mandarin, where the left picture shows the stop portion and the right picture is the fricative portion of the affricate (Keating 1988a: 88, Figure 9).

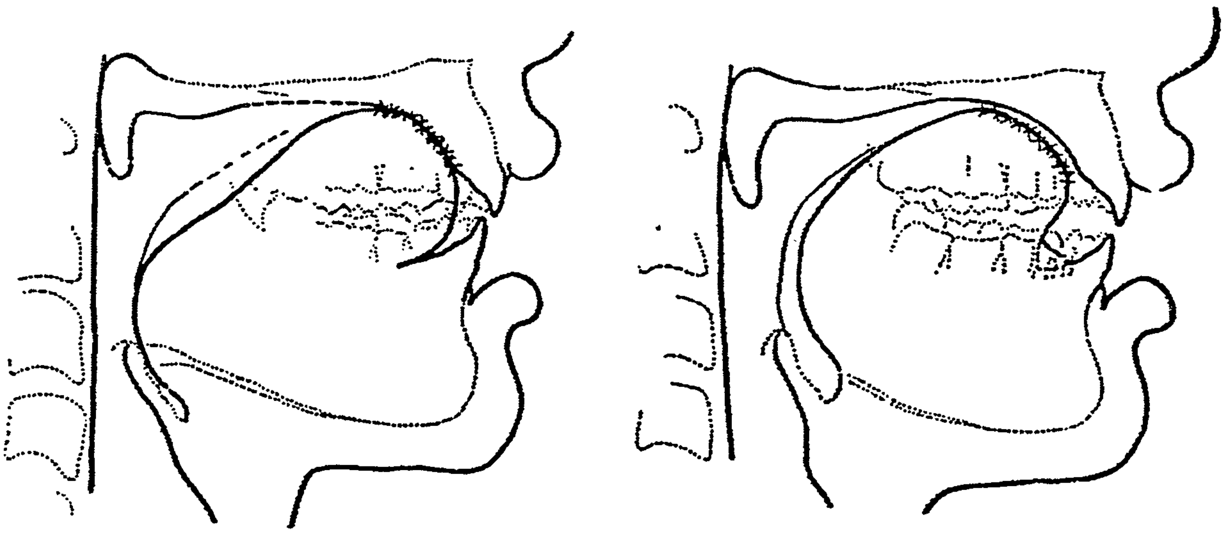


Figure 2.8: Mandarin Chinese alveolo-palatal stop (left) and fricative (right) portions of the alveolo-palatal affricate (taken from Keating 1988a: 88, Figure 9).

Whereas Keating argues that palatal stops are complex, she argues that these nonanterior, distributed coronal affricates involve only one articulator, and thus, are coronal, i.e. alveolar.[9]

Contrary to Keating's description of the alveo-palatal affricate (/tɕ/) of Chinese, Zhōu (1963) states that the tongue comes very close or touches the upper and lower teeth, as is shown in Figure 2.9.

[9] Edmondson takes issue with Keating's characterization and suggests that they are more likely denti-alveolar (Jerold A. Edmondson, personal communication).

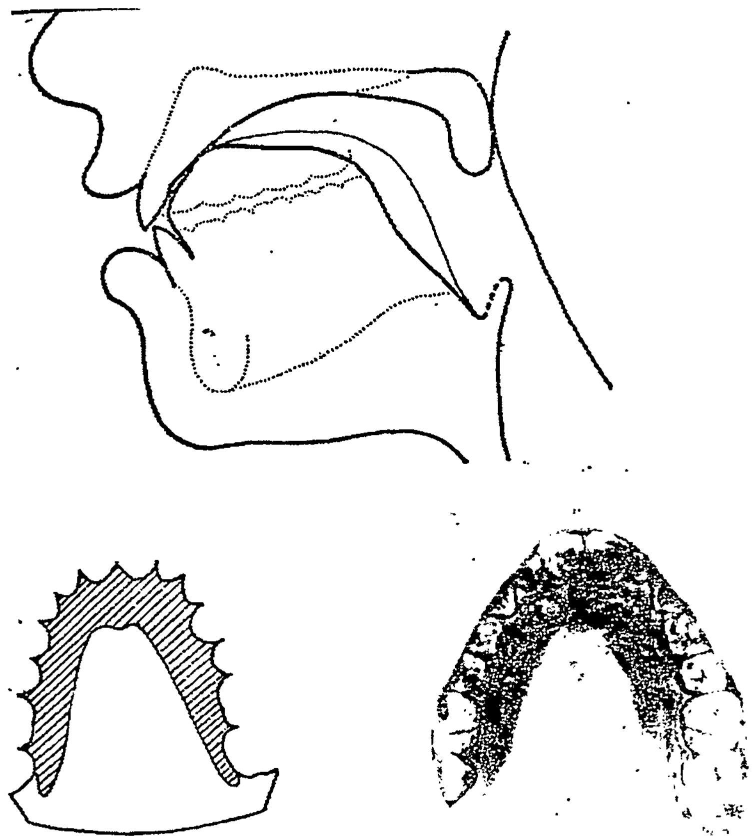


Figure 2.9: X-ray (upper) and palatographic (lower) configurations of the voiceless alveo-palatal affricate /tɕ/ in Chinese (taken from Zhōu 1963: 55).

As illustrated in the x-ray and patalographic configurations of the alveo-palatal affricate /tɕ/ in Figure 2.9, the lower teeth are in contact with the tongue. It should be noted that Zhōu's (1963) research shows that Chinese palatalization results in a voiceless denti-alveolar affricate (Jerold A. Edmondson, personal communication).

According to Recasens (1990: 269), the palato-alveolar affricates (i.e. /ʧ/ and /ʤ/) are mainly "lamino-postalveolar." Recasens points out that there is "less variability" at this area than at other areas of articulation. Recasens also states that contact which involves the "predorsal-prepalatal" region may also take place. He mentions that the tongue tip is not involved in the articulation of this sound. Recasens writes:

> It can be concluded that the two consonants are primarily lamino-postalveolar, in line with the fact that less contact variability occurs at the back of the alveolar zone than at other articulatory zones. Some predorso-prepalatal contact or constriction may also occur. The tongue tip is not active; central contact for the affricate at the front of the alveolar zone (laminal) and behind the front prepalate (dorsal) is much less common. These consonants are thus lamino-postalveolar (predorso-prepalatal) articulations. I will refer to these as lamino-postalveolars (Recasens 1990: 270).

Figure 2.10 illustrates this type of articulation.

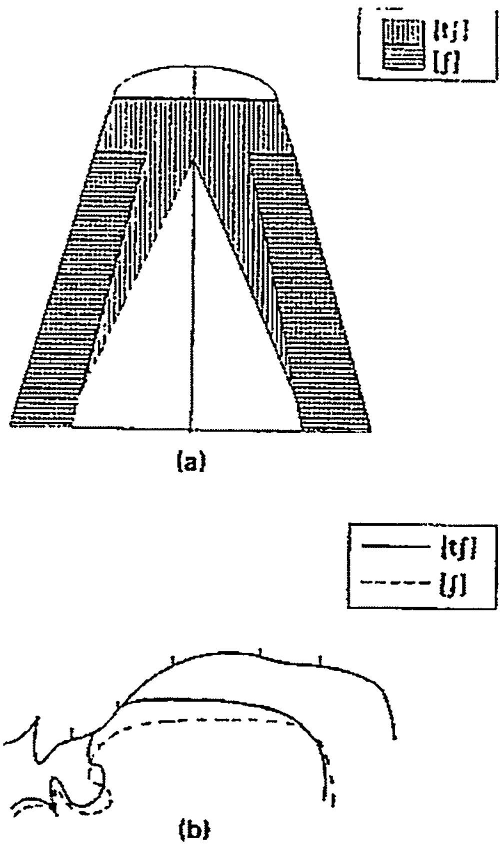


Figure 2.10: (a) Palatographic and (b) X-ray configurations of the palato-alveolar affricate and fricative (taken from Recasens 1990: 269)

In Figure 2.10, (a) a schematic palatographic configuration of both the fricative /ʃ/ and affricate /tʃ/ are provided (based on Hála 1962), where the horizontal lines represent the fricative and the vertical lines represent the affricate. Schematic X-ray configurations of the fricative (dotted line) and the affricate (solid line) are provided in Figure 2.10 (b). Like Keating, Recasens argues for a single place of articulation for these sounds.

Recasens (1990) also mentions the palatal fricative /ç/. Recasens (1990: 277) suggests that this sound, along with the palatal glide /j/, "are mostly predorso-prepalatal-mediodorso-mediopalatal." Recasens adds that constrictions which are "more fronted" are also acceptable in this area. He calls these sounds "front palatals" and illustrates this in Figure 2.10.

In Figure 2.11 (a), Recasens provides a schematic palatographic configuration of the palatal glide (based on Hála 1962). Schematic X-ray configurations of both the palatal glide and palatal fricative are provided in Figure 2.11 (b). Recasens (1990: 276-277) does point out that literature regarding articulatory aspects of /ç/ is scarcer than for the palatal glide; whereas some studies involving palatograms and X-rays indicate "a primary prepalato-mediopalatal constriction," others show "an alveo-palatal constriction."

Recasens (1990), like Keating, also briefly discusses the voiceless alveo-palatal fricative and affricate (i.e. /ç/ and /tç/, respectively). He concludes that these sounds "show the presence of a lamino-predorsal constriction at the alveolo-prepalatal zone (also Keating 1989)" (Recasens 1990: 274).

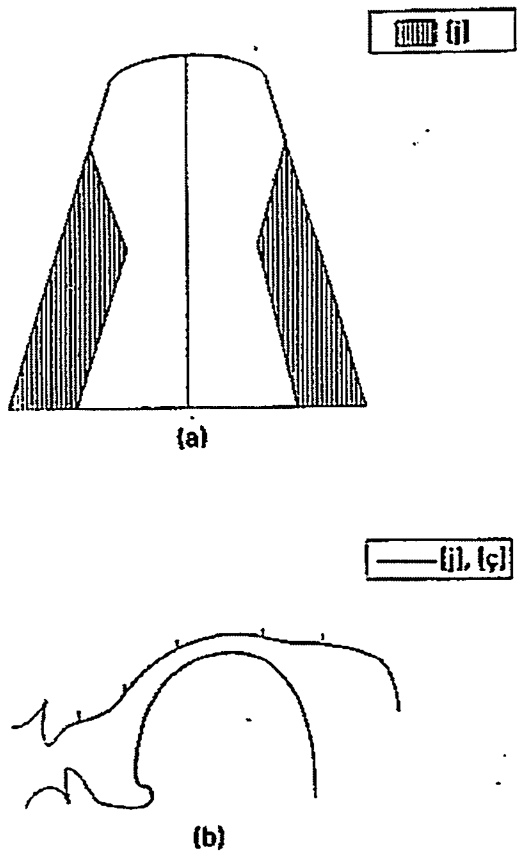


Figure 2.11: (a) Palatographic and (b) X-ray configurations of the palatal glide and palatal fricative (taken from Recasens 1990: 276).

Whereas Keating (1988) worked with traditional partitions of the palate, Recasens (1990) revised them. Their main point of dissention is whether palatals involve more than one articulator. Whereas Keating argues that palatal sounds are complex in that they are both coronal and dorsal, Recasens suggests they are not. Although they seem to differ for palatal stops and affricates, it appears that they basically agree on the place of articulation of palato-alveolar and alveo-palatal affricates.

2.4.2 Acoustic Characteristics

Before discussing the perceptual aspects of stops and affricates, it is important to provide basic background information regarding acoustic issues of stops and affricates which play a role in palatalization. Unlike the previous section on articulation, most attention in this section is devoted to alveolar/velar stops and palato-alveolar affricates. Because very few acoustic studies have been conducted which involve palatal stops, acoustic analysis of palatal stops will not be discussed in this chapter (see Chapter 3).

Before continuing, it is necessary to define some of the basic terms which appear in the literature. Similar to the breakdown of stops and affricates which was given in the previous section (Johnson 1997), Fant (1968, 1973) provides the following five divisions for stops: occlusion, transient, fricative, aspiration, and transitions. The occlusion, or the closure portion of the stop, can either be voiced or voiceless. The transient, which is the release portion of the occlusion, is the vocal tract's response to the release of the buildup of pressure. Although the duration of the transient is usually less than 10 ms, it may last from 2 to 30 ms. The fricative portion is the noise which occurs at the consonantal constriction. The aspirative, which is generally not found in voiced stops in English, usually originates either at the glottis or some supraglottal source which has a wide constriction. Transitions refer to the vowel formant transitions and tend to be influenced by coarticulations with consonants, e.g. stops. Another term which is frequently found in the literature describing stops is "burst." In some cases, burst is used to refer to the transient and fricative portions; other times it is used to mean the transient, coupled with the fricative and the aspirative portions, which are aperiodic noise. In this dissertation, burst will be used in the former sense, which is frequently done because of the difficulty of separating out the transient from the fricative.

2.4.2.1 Acoustic Characteristics for Manner of Articulation: Stops and Affricates

It is possible to ascertain the manner of articulation of stops and affricates by using temporal acoustic characteristics, such as the gap (i.e. closure), noise (i.e. frication), and rise time, which are present in the raw waveform and spectrogram.[10]

According to Ladefoged (1993: 203), whereas a stop is described as a "gap in [the] pattern, followed by burst noise for voiceless stops or [a] sharp beginning formant structure for voiced stops," a fricative appears as a "random noise pattern, especially in higher frequency regions, but [is] dependent on the place of articulation" of the target segment. An affricate is simply a single segment which consists of a stop followed by a fricative. Johnson (1997: 137) writes: "The release phase of a stop may have frication rather than voicing or aspiration. This is the only difference between stops and affricates." Whereas stops are marked by a gap (i.e. closure), affricates have the added components of frication and rise time.

[10] *Visible Speech* (Potter et al. 1947) was the first major spectrographic work done on place and manner of articulation.

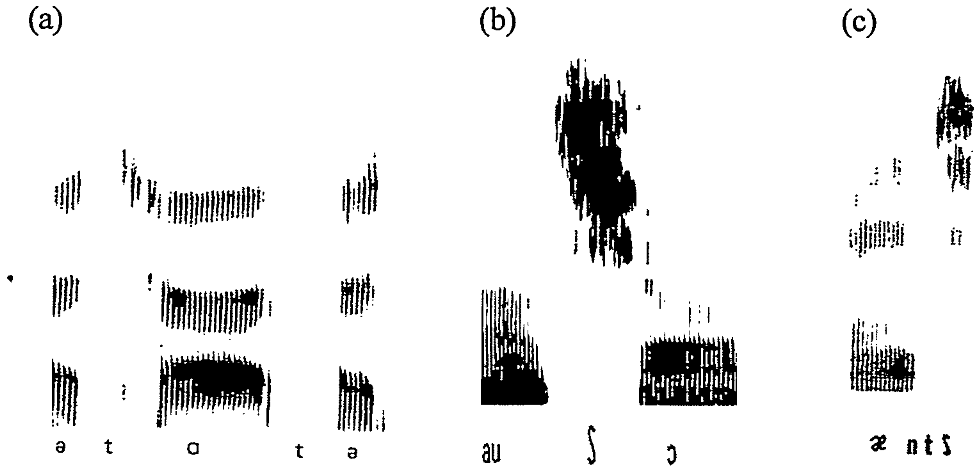


Figure 2.12: Spectrograms of (a) the stop /t/ (Pickett 1999: 133), (b) the fricative /ʃ/ (Pickett 1999: 139), and (c) the affricate/ʧ/ (Pickett 1999: 143).

In the first spectrogram in Figure 2.12, the voiceless alveolar stop is provided in both the word-initial and word-final position in the phrase 'a tote…' (Pickett 1999: 133). As mentioned earlier, the stop is represented by a "gap" (i.e. empty space representing the closure) in the spectrogram. Further, whereas the word-initial /t/ is aspirated (i.e. the small amount of high amplitude aperiodic noise at the release of the stop), the word-final /t/ lacks aspiration. In (b), the spectrogram contains the intervocalic voiceless fricative /ʃ/, which appears on the spectrogram as high intensity aperiodic noise (Pickett 1999: 139). The affricate, as appears in the spectrogram in (c), is a combination of the stop followed by the fricative, i.e. the palato-alveolar affricate /ʧ/ (Pickett 1999: 143).

Johnson (1997: 137-138) points out that the main difference between a fricative and an affricate is the duration of the rise time. Whereas an affricate tends to have a short rise time, a fricative has a long rise time. Johnson (1997: 137) writes: "The main acoustic distinction between an affricate and a sequence of a stop and a fricative is that the amplitude of frication noise rises quickly to full amplitude in affricates, and more slowly in fricatives." Figure 2.13 illustrates this point.

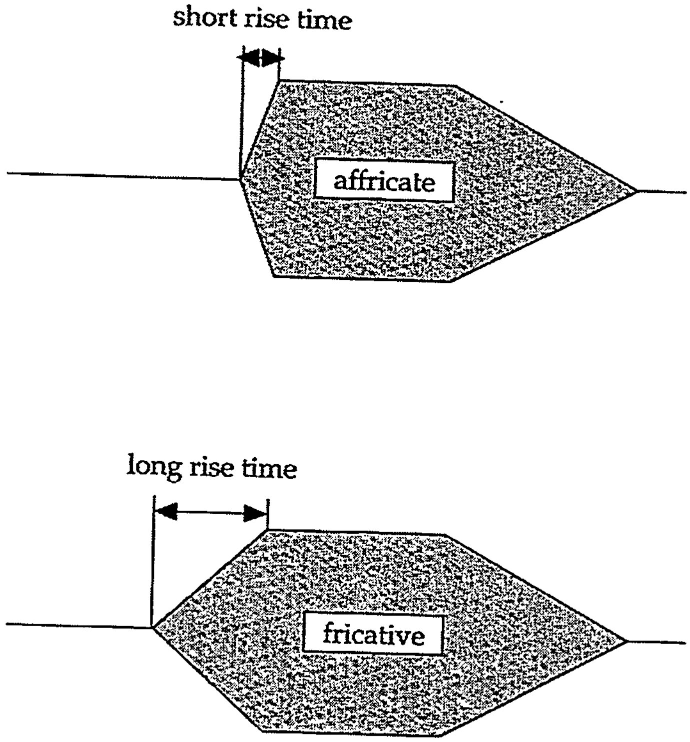


Figure 2.13: Rise time durations for an affricate and fricative (taken from Johnson 1997: 138)

According to Schwartz (2000), the above differentiation of affricates from fricatives according to rise time makes sense aerodynamically. Schwartz (2000: 99) writes:

> The stop portion of an affricate requires a complete closure of the vocal tract, during which pressure builds up behind the constriction. The release of the constriction unleashes the pressure buildup from behind the closure and an almost instantaneous rise of frication noise. Fricatives are not produced with a complete blockage of the airstream and not marked by the same pressure buildup. Thus the frication noise rises more gradually.

That is, a longer rise time in fricatives is to be expected.

McKinney (1990) analyzed temporal acoustic characteristics of fortis and lenis stops and affricates in Tyap and Jju, both of which are in the Benne-Congo language family (Greenberg 1963). Using spectrographic analysis, McKinney (1990: 258) investigated "what specific aspects of articulation are lengthened in fortis consonants." After recording his subjects reading word lists which included the target fortis-lenis segments, he measured the closure duration (i.e. the "gap") and the noise duration (i.e. frication and aspiration) of each target segment. The results indicated that for Jju, the noise duration was 0-100 ms for the lenis consonants, and 0-210 ms for the fortis, which was found to be significantly different ($p < 0.0001$). The Jju closure durations ranged from 45 ms to 140 ms for the fortis, which was not found to be significant ($p > 0.05$). For Tyap, the noise duration ranged from 40 to 105 ms for the lenis and from 80 to 185 ms for the fortis, which was also found to be significant ($p < 0.0001$). Similar to the results for Jju, the closure durations for Tyap were not found to be significant (i.e. 70-150 ms for the lenis and 45-125 ms for the fortis). McKinney notes that based on Lehiste's (1970) work, a change in duration of at least 20% is substantial enough to be perceptible. Hence, although the closure durations in Jju and Tyap are not perceptually salient, the noise durations are.

McKinney 1990 was based on McKinney 1984, which investigated the same temporal acoustic variables, but was limited to Jju. The data in McKinney 1984 revealed that whereas the lenis consonants had frication durations less than or equal to 100 ms, the fortis segments had frication durations greater than 100 ms. The average closure duration of McKinney 1984, however, was the same for the fortis and the lenis segments, which suggests that "the duration of the partial occlusion manifested by the aspiration of a stop or the frication portion of an affricate, was highly correlated with whether or not the consonant was fortis or lenis" (McKinney 1990: 258). That is, as was tested in McKinney 1990, McKinney 1984 suggests that whether or not a stop or affricate is fortis or lenis is related to the length of the noise.

2.4.2.2 Acoustic Characteristics for Place of Articulation

It is possible to ascertain the place of articulation of stops and affricates by using formant transitions, noise bandwidth, and spectral frequency, which are present in the spectrogram and spectra.

Formant transitions in the vowel are useful in determining the place of articulation for the stop (Pickett 1999, Johnson 1997, Ladefoged 1993). For example, "the distinction between labial and alveolar place of articulation can be signaled simply by the direction of the transition of the second formant" (Pickett 1999: 134), whereby the labial stops [p b] are distinguished by upward transitions of F2 (as well as by F1 and F3) and alveolar stops [t d] are distinguished by downward F2 transitions. Regarding the velar stops [k g], "the F2 transitions are similar to those for (the alveolar stop), with the opening transition downward in frequency. The frequency of F3 upon the opening transition is either level or diverging upward from the F2 transition" (Pickett 1999: 137). Johnson notes that palatal stops are dorsal[11] and thus, pattern like velar stops

[11] Note that the issue of palatal stops being dorsal, coronal, or dorsal and coronal is controversial. In this case, Johnson is arguing that palatals are like dorsals in terms of acoustic characteristics.

(Johnson 1997: 137). Examples of formant patterns are provided in Figure 2.14 (taken from Johnson 1997: 139).

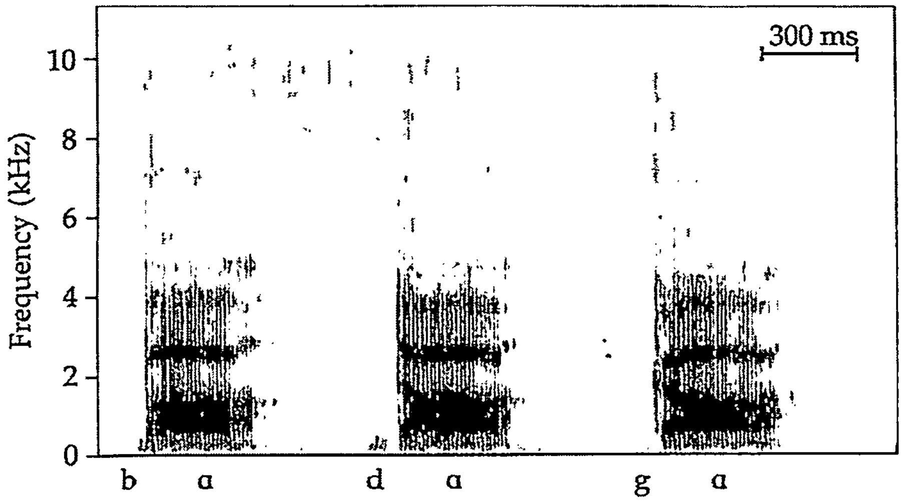


Figure 2.14: Formant positions when preceded by stops (taken from Johnson 1997: 139).

According to Ladefoged (1993: 203) whereas a bilabial sound has a "locus of both second and third formants comparatively low," an alveolar has a "locus of [the] second formant [at] about 1700-1800 Hz." A velar usually has a "high locus of the second formant" and the second and third formant transitions tend to have a "common origin" (Ladefoged 1993: 203).

Further, Pickett (1999: 131) mentions that voiceless stops tend to be shortened when followed by a vowel, whereas voiced stops tend to be longer in the same environment. Pickett also suggests that voiceless stops tend to have a longer closure than their voiced counterparts. Whereas voiceless stops often have a strong release transient (e.g. 30-70 ms), voiced stops frequently have a brief release (e.g. 10-20 ms)

(Pickett 1999). Ladefoged (1993: 203) states that whereas a voiced sound has "vertical striations corresponding to the vibrations of the vocal cords," voiceless sounds have very few or none.

Pickett (1999: 140) states that it is possible to determine the place of articulation of the fricative portion of the affricate by inspecting not only the formant transitions, but also the length of the noise's bandwidth in the spectrogram. For example, in a spectrographic analysis of the palatal-alveolar fricatives [ʃ ʒ], the spectrum is strong at a minimum of 3 kHz and there are no vowel transitions. For the inter-dental fricatives [θ ð], however, the spectrum is diffuse, being strongest at approximately 5 kHz and with a downward F2. Examples of variation in place of articulation of fricatives are provided in Figure 2.15 (taken from Pickett 1999: 139).

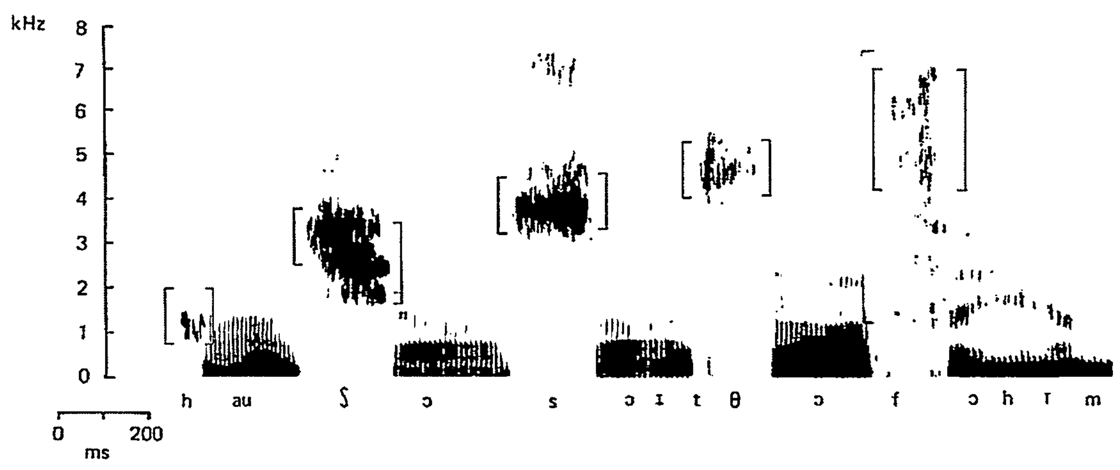


Figure 2.15: Spectrographic analysis of fricatives (taken from Pickett 1999: 139).

Strevens (1960) found that the relative intensity of fricatives varied according to place of articulation. Whereas bilabial, labio-dental, and dental fricatives have relatively low intensity with a long spectrum length (5000-6000 Hz), alveolar, palato-alveolar, and palatal fricatives have relatively high intensity with a short spectrum length (3000-4000 Hz). Strevens found that the voiceless alveolar fricative was usually above 3500 Hz. He also found that whereas the lowest frequency for the voiceless palato-alveolar fricative was between 1600 and 2500 Hz, the lowest frequency for the voiceless palatal fricative was between 2800 and 3600 Hz. That is, the palato-alveolar fricative tends to have a lower frequency level than the palatal. Also, velar, uvular, and glottal fricatives have relatively medium intensity with a medium spectrum length (4000-5500 Hz).

In terms of spectra, according to Wierzchowska (1971), whereas the dental affricate [ts] has a spectral reading above 4500 Hz, the palato-alveolar affricate [tʃ] has noise which ranges from 2000 to 5000 Hz. Similarly, Wierzchowska describes the frication of the alveolo-palatal affricate [tɕ] as being between 3000 and 5000 Hz.

According to Nartey (1982), alveolar and palatal fricatives (and affricates) have two spectral peaks. For example, the alveolar fricative [s] has spectral peaks at 1.0-2.7 kHz and at 4.4-9.5 kHz. Nartey found that whereas the palato-alveolar fricative [ʃ] has spectral peaks at 1.0-2.0 kHz and 2.3-5.3 kHz, the palatal fricative [ç] had peaks at 0.9-1.3 kHz and 2.7-4.4 kHz.

2.4.2.3 Coronal Stops and Affricates

So as to better understand acoustic characteristics of coronal stops and affricates, the following paragraphs focus on various acoustic studies in the literature which investigate such sounds.

Schwartz (2000) investigated palatalization in Lemko (a variety of Ukrainian) and Polish, where he mainly focused on the historical developmental effects of alveolar palatalization in Lemko, Polish, and Russian. He conducted two experiments, the first of which dealt with testing Shevelov's claim: "secondary palatalization developed due to an onglide before front vowels" (Schwartz 2000: 77). Shevelov's claim opposes the proposal that in Common Slavic secondary palatalization was triggered by front vowels. Schwartz writes:

> The question of whether consonants were palatalized before front vowels in Common Slavic has been a central issue in Slavic historical phonology. The data from both Lemko and standard Ukrainian suggest that Common Slavic consonants were not palatalized in this position (cf. Lemko/Ukrainian ходити [xodɪtɪ] 'to go'), and that the opposition of palatalized and non-palatalized consonants developed slightly later in...North Slavic languages such as Russian. One group of scholars (including Kurasziewicz 1970), however, assumes the presence of palatalization in all of the consonants and posits later rules of dispalatalization before front vowels in parts of CS. If we are resistant to the idea of positing two rules, the second of which reverses the first, then it is preferable to assume that secondary palatalization before CS front vowels was not yet the norm. The problem with this assumption is that palatalized consonants DID develop in much of Slavic before the front nasal vowel /ę/. Shevelov (1979) proposed that this vowel developed a prothetic glide /j/ at some early point in its development and the /j/ is what palatalizes these consonants, rather than the vowels themselves. The suggestion that a glide developed in the onset to the nasal vowel is phonetically quite plausible (Schwartz 2000: 77).

Schwartz tests Shevelov's claim by recording three Russian speakers reading words which contain the following sequences of CʲV and CʲjV: [tʲe, tʲje], [tʲu, tʲju], [tʃʲu, tʃʲju]. He then measured the target sequences according to the following phonetic parameters: duration of burst/frication, duration of frication/burst on vowel/glide, F2 frequency at the onset of the vowel/glide, F2 frequency at the midpoint of the vowel, change in F2, and duration and rate of F2 change. The results showed that when the palatal glide was present, the noise parameters increased, the F2 onset was higher, F2 change duration was longer, and the F2 slope was shallower (Schwartz 2000: 84).

Instead of investigating stops, Schwartz's (2000) second acoustic experiment involved voiceless affricates which are present in Lemko, standard Ukrainian, and Polish: the palato-alveolar affricate [tʃ], the alveolo-palatal affricate [tç], and the dental affricate [ts]. It should also be noted that although all three languages contain these affricates, they have different origins. Whereas the Polish alveolo-palatal affricate corresponds to the Lemko and Ukrainian secondarily palatalized alveolar stop, the Polish dental affricate corresponds to the Lemko alveo-palatal affricate and the standard Ukrainian secondarily palatalized dental affricate. The palato-alveolar affricate, however, has a common source for all three languages (Schwartz 2000: 96). Although the contemporary forms of the affricates are identical, the sources are not.

One of the main objectives of Schwartz's second acoustic experiment was to investigate what temporal and spectral characteristics distinguish these three sounds. After recording 14 Lemko/Polish speakers reading the three target segments which were strategically located in various Lemko/Polish sentences, Schwartz analyzed the affricates in terms of the following phonetic parameters: noise range (low and high levels, Hz), frication duration (ms), and rise time (RT, ms). The results suggested that whereas the temporal information (i.e. frication duration and RT) was more salient than the spectral for distinguishing the palato-alveolar affricate from the alveolo-palatal affricate, the spectral cues could be more salient in distinguishing the alveolo-palatal affricate from the dental affricate. Schwartz (2000: 112) comments, "Overall, the temporal distinction is more pronounced." He suggests that this could be connected to the following vowel. "Before a non-high vowel, where the temporal measures are smaller, the extent of temporal contrast is lessened. The spectral distinction as well is lessened somewhat in the non-high vowel context" (Schwartz 2000: 112).

2.4.2.4 Velar Stops and Palato-alveolar Affricates

Various studies (Fischer-Jorgensen 1954, Fant 1973, Klatt 1975, Tekielli and Cullinan 1979) have indicated that velar stops, as opposed to labial and alveolar, have longer transient, burst, and aspiration durations. When studying the length of stops, Fischer-Jorgensen (1954) found that velar stops could have more than one transient. It has been suggested that a suction reaction caused by the Bernoulli effect at the place of constriction could be responsible for such multiple transients (Fant 1973).

After conducting spectrographic analysis of the bursts and aspirations of word-initial stops in English, Klatt (1975) found that when comparing not only place of articulation, but also voicing, the voiceless velar had a longer burst than word-initial /p/ and /t/. Likewise, the voiced velar had a burst which was longer than that of word-initial /b/ and /d/. Klatt also mentioned that the level of aspiration for the voiceless velar was similar to that of the voiceless alveolar /t/.

Like Klatt (1975), Tekielli and Cullinan (1979) also investigated various aspects of aperiodic noise in the word-initial position of the English language. However, unlike Klatt's study, Tekielli and Cullinan (1979) also considered palato-alveolar affricates. Similar to Klatt's findings, while focusing exclusively on stops, the results of Tekielli and Cullinan (1979) indicated that velars have the longest durations of aperiodic noise. They found that whereas the average duration of noise for the voiceless velar stops was 86 ms, the average for the voiced velars was 22 ms. When focusing on the affricates, while the voiceless palato-alveolar affricates were found to have an average noise duration of 86 ms, the voiced palato-alveolars had an average of 45 ms. That is, the voiceless velar stop and the voiceless palato-affricate had the same average duration of aperiodic noise (i.e. 86 ms). The average noise duration for voiced velar, on the other hand, was found to be almost half of the duration of that of the voiced palato-alveolar affricate (i.e. 22 ms and 45 ms, respectively). It has been suggested that the frication and aspiration durations are a function of the vowel which follows, especially high front vowels (Klatt 1975, Tekielli and Cullinan 1979, Ohala 1983).

So as to better understand and explain the cross-linguistic sound change of velar stops becoming palato-alveolar affricates, Guion (1996) analyzed the similarities of velar stops and palato-alveolar affricates, especially before front vowels (i.e. k, g > ʧ, ʤ/_ front vocoids). Whereas other scholars focused on comparing labial, alveolar/dental, and velar, Guion investigated velars and palato-alveolars. In experiment I, she investigated the aforementioned velar and palato-alveolar segments of English in the word-initial position in both fast speech and citation speech in terms of the following acoustic variables: voice onset time (VOT), peak frequency of the burst/aspiration, F2 frequencies at the onset of the vowel, and F2 frequencies at the midpoint of the vowel. The findings support Guion's initial hypothesis that velars, when followed by front vowels, are acoustically similar, especially in terms of the burst release.

2.4.3 Perceptual Characteristics

Whereas the previous sections discussed general articulatory and acoustic issues related to palatalization, this section will focus on various studies which deal with perception as it relates to segments involved in palatalization.

Jongman, Blumstein, and Lahiri (1985) conducted a perceptual study which focused on the acoustic properties for dental and alveolar stops in Malayalam (a Dravidian language), where these sounds are contrastive, and then compared those results to English and Dutch, languages which do not maintain such a contrast. Based on previous acoustic analysis of the dental and alveolar stops (see Hall and Steven 1979, Lahiri, Gewirth and Blumstein 1984), it was shown that dental and alveolar stops both share a common acoustic property: "greater high frequency than low frequency energy at the burst release relative to the onset of voicing" (Jongman, Blumstein, and Lahiri 1985: 236). The results of the Malayalam investigation revealed that the speakers of Malayalam have different energy ratios in the burst amplitudes of dental and alveolar stops, in that the dental burst has a smaller amount of energy than is present in the alveolar burst. This difference in the burst is what distinguishes the dental from the alveolar. In the second experiment, it was found that although the test distinguished dental from alveolar stops in Malayalam (92% were correctly identified), it did not work well for English (68.2% alveolars were correctly identified) and Dutch (63.2% of dentals were correctly identified). In other words, whereas one language maintains a contrast, others do not, as was made evident with this comparative perceptual acoustic study.

Like Jongman, Blumstein, and Lahiri (1985), Kim (1995) also looked at various perceptual aspects carried in the acoustic signal of coronal consonants. Unlike Jongman, Blumstein, and Lahiri's (1985) study, Kim (1995) also included fricatives and affricates. Kim (1995) investigated an assortment of acoustic characteristics of fortis, lenis, and aspirated coronal stops, affricates, and fricatives in Korean: stop closure duration, aspiration duration, percentage of voicing, onset fundamental frequency, and effective frication duration (EFD) in CV and VCV environments. Both the acoustic production and perceptual studies indicated that Korean stops and affricates pattern similarly except in terms of effective frication duration. Whereas Korean stops had average frication durations of zero for the fortis, lenis, and aspirated in CV and CVC environments, Korean affricates had frication durations of 31 ms for both fortis and lenis and 48 ms for aspirated segments in CV environments. This difference, however, was not significant. Kim writes:

> In looking specifically at affricates, it is found that the only difference between affricates and stops is the presence of effective frication duration (EFD) in affricates. The results, however, show that the EFD is not a significant acoustic feature...This suggests that while the Korean affricates are phonetically affricates, they are phonemically stops (Kim 1995: 3).

That is, although EFD did appear to be a distinguishing factor between stops and affricates in Korean, it was not statistically significant. Thus, in Korean, it was found that it is possible for a segment to phonetically belong to one group, and to phonemically belong to another.

Similarly, Dorman, Raphael, and Isenberg (1980) researched various perceptual acoustic cues which differentiate affricates from fricatives: release burst, rise time, and frication duration. In order to better understand the release burst, after digitizing a male's voice uttering "Put it in the ditch," intervals of silence, which ranged from zero to 100 ms in 10 ms increments, were inserted in the first stimulus between the vocalic portion and the burst. For the second stimulus, the burst was removed and silence was inserted between the vocalic portion and the onset of frication in the same manner as for the first stimulus. After generating four tokens of each stimulus, the tokens were randomized. Thereafter, 16 subjects were presented with the test words, where they were asked to identify the target word as either "dish" or "ditch." In order to better understand rise time, they digitized a male's voice saying "Put it in the dish." For the first stimulus in the rise time analysis, silence was inserted in various intervals (i.e. 20-150 ms in 10 ms increments). For a second stimulus in the rise time portion of the test, the initial 30 ms of the voiceless palato-alveolar fricative was removed, which resulted in a reduction of rise time (i.e. from 35 ms to 0 ms). After four tokens of each stimulus were made, the tokens were randomized. Afterwards, the test sequences were given to 16 subjects who were to identify the test words as either "dish" or "ditch." Both the release burst and the rise time were found to be salient perceptual cues in differentiating affricates from fricatives. Additional perceptual tests were done where the closure duration, frication noise duration, and the duration of the preceding vocalic segment were manipulated. All three of these acoustic cues were also found to be perceptually salient.

As in the previous study, Ferrero, Pelamatti, and Vagges (1982) also looked at perceptual acoustic cues which differentiate affricates from fricatives. They investigated the perception of affricates and fricatives by manipulating the frication duration in synthetic speech stimuli using /sa-tsa/ and /ʃa-tʃa/. After frication durations of the fricatives and affricates were altered by increasing and decreasing amounts, subjects were tested on whether what they heard was a fricative or affricate. Although their conclusions are not definitive, the results indicated fricatives are perceived categorically, in that "the stimuli with the shortest frications were more distinctive and were perceived as being more different. This effect may be attributed to the ratio between the duration of the frication noise and duration of the entire stimulus" (Ferrero, Pelamatti, and Vagges 1982: 243).

To better understand various issues in the acoustic signal of palatalization environments, Schwartz (2000) conducted a perceptual test which investigated the speakers' sensitivity to the presence or absence of the palatal glide in secondary palatalizations in Russian in the following C^jV and C^jjV utterances: [t^je, t^jje], [t^ju, t^jju], [$tʃ^j$u, $tʃ^j$ju], [tɕa], and [t^ja]. All but the last two utterances were taken from Schwartz's (2000) acoustic production test discussed in the previous section. After the subjects listened to each token twice, they were instructed to choose which sounds they heard. The results revealed that 79% of the target utterances were identified accurately. Schwartz commented that the secondarily palatalized voiceless alveolar stop (i.e. [t^j]) was frequently confused with the secondarily palatalized voiceless palato-alveolar affricate (i.e. [$tʃ^j$]) and vice versa. Schwartz reported that since the palatalized consonants followed by a palatal glide (and a vowel) (i.e. $C^{j}jV$) had longer burst/frication durations and higher F2s than the palatalized consonants without a full palatal glide (i.e. $C^{j}Vs$), burst/frication plays an important role in the perception of the aforementioned target segments.

In an attempt to better understand the connection between the acoustic signal and perception in velar palatalization, Guion (1996) conducted two perceptual experiments. Her hypothesis was: "Velar palatalization arises from a perceptual reanalysis of velars before front vowels in faster speech" (Guion 1996: 155). In both experiments, after listening to the stimuli, the seven subjects (all NSs of English) were asked to identify if they heard [k], [g], [ʧ], or [ʤ] which were in the word-initial position in various English words. In the first experiment, each target segment was gated; in the second experiment, noise was used to mask the acoustic signal. The results indicated that, firstly, [k] before front vowels was confused with [ʧ] more frequently than when [k] preceded back vowels, secondly, the [k]/[ʧ] confusion was more frequent in fast speech than in citation speech, and thirdly, [g]/ [ʤ] confusion occurred less frequently than [k]/[ʧ] confusion. She found that the [k]/[ʧ] confusion was mainly due to the acoustic similarities in their burst release (i.e. transient and frication). She reported that the burst release is a more salient cue than the formant transitions for information regarding place of articulation.

2.5 Sound Change

Traditionally, the sound change of palatalization was thought to be due to a gradual change in the place of articulation of velars which was conditioned by the following front vowel and took place abruptly throughout the lexicon. However, more recent theories of sound change suggest that palatalization could also be due to lexical diffusion, variation in the speech community, and listener perceptions. The aim of this section is to provide general information regarding theories in sound change, especially in terms of palatalization.

2.5.1 Neogrammarians

According to the Neogrammarians, sound change involves phonetically conditioned gradual changes of articulation. The sound changes which took place were thought to be imperceptible. The Neogrammarians believed that sound change was exceptionless and all irregularities were attributed to either analogy or external factors (e.g. dialect borrowing). Labov (1994: 443) describes the Neogrammarians as viewing sound change "as a uniform gradual process in a homogeneous community, where the old forms give way to the new without oscillation or variation."

The Neogrammarians maintained that language change was not only gradual in terms of articulation, but also lexically abrupt. Del-Valle-Codesal (1994: 72) comments:

> Even though the neogrammarians' manifesto did not explicitly state the phonetic laws affect all words simultaneously, this had always been assumed to be their view of the lexical implementation of changes. This assumption is clearly justified and we could claim that it is the only logical interpretation of the statements...Osthoff and Brugman's statement can only be taken to mean

> that all the relevant words are affected simultaneously by any given phonetic law, i.e., sound changes are lexically abrupt.

That is, they proposed that sound change spread abruptly through the lexicon.

For the Neogrammarians, palatalization is a result of assimilation. In the case of velar palatalization, the articulation of the velar stop moved slightly forward under the phonetic conditioning environment of a following front vowel: k → fronted k/ _ front vowels. According to the Neogramnmarians, the change to a fronted velar was so gradual that it went undetected. That is, the forward movement of [k] was imperceptible (Sievers 1876, Guion 1996).

Grammont (1933), Bhat (1978), Anttila (1989), and Hock (1991), provide similar explanations of palatalization, again focusing on the gradual articulatory movements involved. Although they focus on velar palatalization, they also mention some aspects of coronal consonants in the context of palatalization environments, all of which are seen as gradual articulatory movements involved in sound change.

Grammont (1933) claims that the first step in velar palatalization is the fronting of the velar stop. Thereafter, the fronted velar could either (a) become secondarily palatalized, or (b) develop a fricative release which is voiced. In the case of the latter, the fricative release could then lead to a change in place of articulation to dental or alveolar, while still involving the body of the tongue, thereby resulting in an alveolar/dental affricate. Grammont explains that if this new sound is fortis, the fricative release could devoice into a [s] or [ʃ], finally resulting in a voiceless dental affricate or a palato-alveolar affricate.

As mentioned briefly in an earlier section, Bhat (1978) distinguishes between three different types of palatalization: tongue-fronting, tongue-raising, and spirantization. He claims that whereas tongue-fronting is usually limited to the fronting of velar stops which usually precede stressed front vowels, tongue-raising includes labials, dental/alveolars, and velars which usually precede unstressed palatal glides. According to Bhat, tongue-raising can cause apicals to become laminals which are articulated further back, and frequently become palato-alveolars. For velars, tongue-raising has a tendency to create palato-alveolars and alveolars. Any offglide formation Bhat also considers to be tongue-raising. Although secondary palatalization, which Bhat considers to be a result of tongue-raising and does not result in a change in the primary place of articulation of the segment, can occur with all places of articulation, he finds that shifts in place of articulation are more common. Bhat defines spirantization as any addition of stridency or frication, which occurs more frequently with velars, apicals, and palatals, than with labials. Bhat claims that whereas velars experience fronting, raising, and spirantization, which often results in palato-alveolar affricates, dental/alveolar segments experience spirantization, which can result in alveolar or palato-alveolar affricates.

Similar to Bhat, Anttila (1989: 72, 73, 85) also discusses issues relating to shifts in place of articulation regarding palatalization. Like the Neogrammarians, Anttila (1989: 72-73) states that palatalization is a result of

> an assimilation of a consonant to a high front vowel, usually following; it is an assimilation of tongue position. The vocal tract is narrow for the front vowel, and the stop is shifted into or toward this area...A palatalized [k'] can shift further front and give [t]. When this affricates, the result is [tš] or [ts].

That is, Anttila claims that the voiceless velar often moves forward to such an extent that it becomes a palatalized voiceless alveolar stop. Thereafter, the palatalized alveolar stop undergoes assibilation, resulting in either a palato-alveolar affricate or an alveolar affricate (both of which are voiceless). Anttila uses the palatalization of [k] in Latin which developed into [s] in French as an example of how velar stops developed into coronal segments (e.g. Latin [k]entum > French [s]ent):

> Latin k assibilated into s in French (before front vowels). This was a shortcut, because in reality k palatalized into k', and this gave t' = t^j. [T]hen the narrow transition from stop to vowel [y] was assimilated to the voicelessness of the stop part and the groove tongue shape of the following vowel, giving ts. The assibilation was completed when closure disappeared altogether, yielding s (Anttila 1989: 73).

That is, prior to evolving into the French spirant [s], the Latin velar stop took the following path: Latin [k] > [k'] > [t'] > [t^j] > French [s].

Hock (1991) claims that true palatalization is when a velar followed by front vowels develops an offglide. If the process does not stop there, the next stage is a palatal consonant, e.g. a palatal stop. While noting the articulatory and acoustic similarities of palatal consonants and fronted velars, Hock explains the process of velar palatalization as being one which is driven by phonology, rather than being purely phonetic. Hock also mentions that once the palatal stop has been formed, it may develop a fricative release. If the fricated release is articulated on the palate and with the body of the tongue, [cç] will result. If the fricated release is articulated in the post-dental region and with the tip of tongue, [cʃ] could result, which could then develop into a palato-alveolar affricate [tʃ], whereby the stop portion has assimilated to the place of the following fricative portion. These affricates could either remain as they are, or they could lose the stop or fricative portions, resulting in plain stops or plain fricatives.

2.5.2 Lexical Diffusion and Mergers

In opposition to the view that sound change is lexically abrupt, lexical diffusionists maintain sound change spreads gradually throughout the lexicon, affecting one word at a time. According to the hypothesis of lexical diffusion, sound change is not only lexically gradual, but also a phonetic phenomenon, rather than a phonological one. Chen and Wang, the Chinese historical linguists who developed the hypothesis of lexical diffusion, comment, "[S]ound change appears to be a concrete process of transforming surface representations into surface representations" (Chen and Wang 1975: 266). According to the diffusionists, surface, that is phonetic, representations are changes that have been determined by inherent constraints on the vocal tract and auditory system.

Another approach to language change is that offered by Labov (1972, 1994). According to Labov, sound change involves synchronic variation which is implemented by various societal factors. Unlike the Neogrammarians, Labov maintains that heterogeneity is inherent in language, and thus an essential component of sound change. Labov, one of the first 'variationists', purports that variationism is a rule-based approach to language which involves categorical and variable rules that are allophonic and conditioned either by a certain phonological context or by a social factor. Labov argues that language change takes places when the social factors which constrain the variable rule are relaxed and later eliminated. In such a case, the variable rule is transformed into a categorical rule.

Labov is well-known for his work on not only mergers, but also near-mergers. Whereas a merger represents the elimination of distinctions, a near-merger represents a near-elimination of distinctions. For near-mergers, although a systematic phonetic difference exists in the production of the sounds, the distinction is not perceived by the speakers; the speakers perceive the two sounds to be identical. Labov uses the English examples of *source* and *sauce* in New York City to illustrate this point. For many speakers of English in NYC, although a phonetic distinction is present when uttering *source* and *sauce*, the speakers do not readily perceive the difference. Once the difference is perceived, a split could result.

In an analysis of mergers, Labov (1994) states various issues that are involved in the sound change of mergers, such as Garde's Principle and Herzog's Principle. He first discusses Garde's Principle: "Mergers are irreversible by linguistic means" (Labov 1994: 311). Labov explains that Garde's Principle does not mean that it is impossible to reverse a merger; rather, Garde's Principle "is based on the empirical observation that at no known time in the history of languages has such a reversal been accomplished by enough speakers to restore two original word classes for a given language as a whole" (Labov 1994: 312-313). To explain the diffusion of mergers, Labov mentions Herzog's Principle: "Mergers expand at the expense of distinctions" (Labov 1994: 313). That is, when a merger occurs, one sound triumphs over two. Labov offers Herzog's study on

Yiddish in northern Poland, where /i/ and /i:/ merged into /i/ and /u/ and where /u:/ merged into /u/.

Labov also states that there are mainly three different kinds of merger mechanisms: merger by approximation, merger by transfer, and merger by expansion. Merger by approximation is "the gradual approximation of the phonetic targets of two phonemes until they are nondistinct," whereby "the merged phoneme has the same mean value as one of the members of the merger, but with an enlarged class membership" (Labov 1994: 321), such as French /a/ and /ɑ/. Merger by transfer involves "a unidirectional process in which words are transferred gradually from one phonemic category to another" (Labov 1994: 321). Mergers by transfer usually occur with stable sociolinguistic variables, and are results of "change from above" and tend to occur in the standard language, such as in Belfast with the merger of /a/ and /ɑ/. Merger by expansion is when "the lexical constraints on the distribution of the two phonemes are removed, and the range that was previously divided between the two phonemes is used for the new phoneme, with allophonic distributions" (Labov 1994: 322-323), such as in the merger of /o/ and /oh/ in Tamaqua, Pennsylvania. Labov states that whereas merger by expansion takes one generation, merger by approximation could be complete in perhaps four generations. The slowest, however, is merger by transfer. Labov points out that the task of the researcher is to determine which merger applies to which mechanism.

Labov (1994: 324) notes a study which was conducted by Herold (1990), in which she analyzed some of the misunderstandings that occur in merger settings between two-phoneme speakers (those for whom the merger has not yet taken place) and one-phoneme speakers (those for whom the merger has occurred). She mentions that when two-phoneme speakers encounter one-phoneme speakers, while the two-phoneme speakers will tend to have problems understanding the one-phoneme speakers, the one-phoneme speakers will not have much difficulty understanding the two-phoneme speakers. After enough exposure to the one-phoneme speakers, the two-phoneme speakers may abandon the distinction and become one-phoneme speakers.

One of Labov's motivations for studying mergers and near-mergers was diachronic in nature, in that he was attempting to understand how various English vowels had split (see Labov 1994). He did so by measuring subjects' vowel formants (F1 and F2), which he combined with various experiments to examine the subjects' perception of the sounds. He found that even though subjects did not perceive differences in the formants, the differences did exist. Although Labov does discuss the issue of perception, his studies focus more on societal factors that govern sound change.

2.5.3 Ohala: Listener-Induced Sound Change

A similar view of sound change which assumes variation is inherent in language can be found in Ohala (1981, 1993). Motivated by not only what he saw as the infinite variability of sound change, but also the similarities between sound change and the phonetic variation present in synchronic linguistic study, Ohala focused on the inherent ambiguities in the speech signal.

Ohala viewed sound changes as occurring during interactions between the speaker and the listener. Ohala gave special attention to the limitations and constraints of the speech production mechanism from both the speaker's and the listener's perspective, particularly to that of the listener. In some listener-speaker exchanges, the acoustic signal is phonetically ambiguous and "noisy," and in such a case the "listeners normalize or correct the speech signal in order to arrive at the pronunciation intended by the speaker minus any added contextual perturbations" (Ohala 1993: 245). Ohala (1981) illustrates this point using the following examples. In scenario 1 (see Figure 2.16), what is uttered by the speaker (e.g. /ut/) is "correctly" perceived by the listener (e.g. [ut]). That is, the correction mechanisms function properly and the variation in the acoustic signal does not lead to a sound change. In such a case the listener has recovered the intended pronunciation form of the speaker (i.e. mental representation).

Speaker	Distorted	Heard	Reconstructed	Listener
/ut/	[yt]	[yt]	/ut/	/ut/ (no sound change)

Figure 2.16: Scenario 1

However, in scenario 2 (see Figure 2.17), the listener's correction mechanism fails and as a result, the listener-turned-speaker repeats ("copies") the "uncorrected distortion" (e.g. [y]), resulting in a "mini sound change," which could lead to a macro sound change if social conditions permit such a form to spread.

Speaker	Distorted	Heard	Interpreted	Listener-turned-Speaker
/ut/	[yt]	[yt]	[yt]	[yt] (possible sound change)

Figure 2.17: Scenario 2

In scenario 3 (see Figure 2.18), the sound uttered by the speaker (e.g. /yt/) and perceived by the listener are the same (e.g. /yt/). The listener-turned-speaker, however, utters a second sound (e.g. [ut]) in his or her own speech. As with scenario 2, if the "uncorrected" form has societal success, a mini sound change can develop into a macro sound change.

Speaker	Produced	Heard	Reconstructed	Listener-turned-Speaker
/yt/	[yt]	[yt]	[ut]	[ut] (possible sound change)

Figure 2.18: Scenario 3

In Scenario 2, the "uncorrected distortion" was due to coarticulation affects, whereby the /u/ is fronted under the influence of the apical constriction of the /t/. In Scenario 3, although the sound uttered by the speaker is identical to the sound heard by the listener (e.g. /yt/ and [yt], respectively), the listener overcompensates for the coarticulatory effects and produces a "hypercorrection," e.g. [ut]. Ohala describes the aforementioned scenarios:

> First, the listener recognizes and thus factors out of the speech signal inherent in phonetic variability that would, except for his vigilance, have led to sound change. Second, the listener unknowingly participates in sound change by faithfully copying inherent phonetic variation. Third, in a few cases the listener triggers the sound change by misapplying the reconstructive rules that serve to correct phonetic variability (Ohala 1981: 196-197).

According to Ohala, the preconditions of sound change are found in the inherent variability in the acoustic signal in speaker-listener interactions. The misperception of the acoustic signal by the listener is what initiates the sound change. If the misperception of the acoustic signal is coupled with a positive response from society, a mini sound change can develop into a macro sound change. For Ohala, sound change is a perceptual phonetic phenomenon, which, if successful, can affect phonological aspects of the language.

Ohala also addresses the issue of palatalization and sound change. Based on research conducted by Winitz et al (1972), Ohala (1994) writes that because of the acoustic ambiguity of front vowels, [ki] and [ti] could be perceptually confused. Ohala adds that if the listener fails to perceptually perceive the acoustic signals of a velar stop which are somewhat masked by the front vowel, the following front vowel could create an ambiguous acoustic environment, resulting in a velar stop being perceived as a palato-alveolar affricate.

2.6 Summary

In summation, palatalization is common cross-linguistically. It is attested in both Indo-European and non-Indo-European languages (e.g. Slavic languages and Salishan languages, respectively). Palatalization is not only a diachronic phenomenon (e.g. Slavic and Bantu), but also a synchronic one (e.g. Polish and Japanese). Although the targets of palatalization may include labial consonants, the most frequent targets are velar stops and less often dental/alveolar stops. While the triggers of palatalization tend to be front vocoids, the outputs tend to be palato-alveolar affricates. Various phonetic characteristics of the segments involved in the palatalization environment, e.g. articulation, acoustics, and perception of such sounds, are important elements to consider in the process of palatalization. Such phonetic information provides essential details to the process of palatalization, particularly in terms of investigating what factors cause palatalization and lead to sound change, both diachronically and synchronically. Whereas the Neogrammarians argue that the sound change of palatalization is due to phonetically conditioned gradual changes of articulation in a homogenous community, the diffusionists insist that sound change spreads gradually throughout the lexicon, affecting one word at a time. Like the diffusionists, Labov maintains that variation is inherent in the system. Labov, however, also purports that sound change is dependent on societal factors. Although Ohala agrees with Labov in that variation is inherent, he differs in terms of the motivation of sound change, which he purports is due to perceptual ambiguities in the acoustic signal. The verdict is still out, however, as to which factors combine to result in palatalization. It is hoped that this dissertation will assist in answering some of these questions by addressing various issues regarding the causes of palatalization by adding Albanian to the discussion.

CHAPTER 3

GENERAL BACKGROUND AND LITERATURE REVIEW: PALATALIZATION IN ALBANIAN

In order to fully understand palatalization in Albanian, it is important to consider both the present state of Albanian palatal stops and their historical origins. First, a consonantal inventory of contemporary Albanian will be provided, with special emphasis on palatal stops. Next, a discussion of various articulatory and acoustic aspects of Albanian palatal stops and palato-alveolar affricates will be provided.[12] Thereafter, a historical analysis of palatal stops will be given, where the modern day palatal stops will be traced back to their Indo-European roots. A discussion on various language internal and external factors, as they relate to a possible merger of Albanian palatal stops and palato-alveolar affricates, will also ensue. Once the origins of Albanian palatal stops are coupled with their contemporary counterparts in the Balkan Sprachbund, the process of palatalization in Albanian will become much clearer.

3.1 Albanian Consonantal Inventory

Albanian, an Indo-European language which is thought to be a descendant of Illyrian, has two main varieties: Gheg and Tosk. Gheg is spoken in central and

[12] Any sort of perceptual study regarding palatalization in Albanian could not be found in the literature. Hence, only articulatory and acoustic aspects of palatal stops and palato-alveolar affricates will be included in this chapter.

northern Albania, as well as in Kosova, Macedonia, and Montenegro. Tosk is predominately spoken in southern Albania, northern Greece, and parts of western Macedonia. In terms of Albanian as it is spoken in Albania, the major subvarieties of Gheg are northwestern Gheg, northeastern Gheg, and southern Gheg. The major subvarieties of Tosk are northern Tosk and southern Tosk (Labëria, and Çamëria) (Çabej 1976a, Camaj 1984).[13] The geographical division between Gheg and Tosk is the Skumbini River, as appears in Figure 3.1 (taken from Byron 1976: 48).

[13] The Albanian language is also widely spoken in Italy, where it is called Arberisht (Çabej 1976a). The Arberisht variety of Albanian will not be discussed in this dissertation. Also, for a discussion of Albanian as it is spoken in Greece, see Haebler (1965) and Hamp (1989: 197-210). The focus of this dissertation is Albanian as spoken by Albanians in Albania.

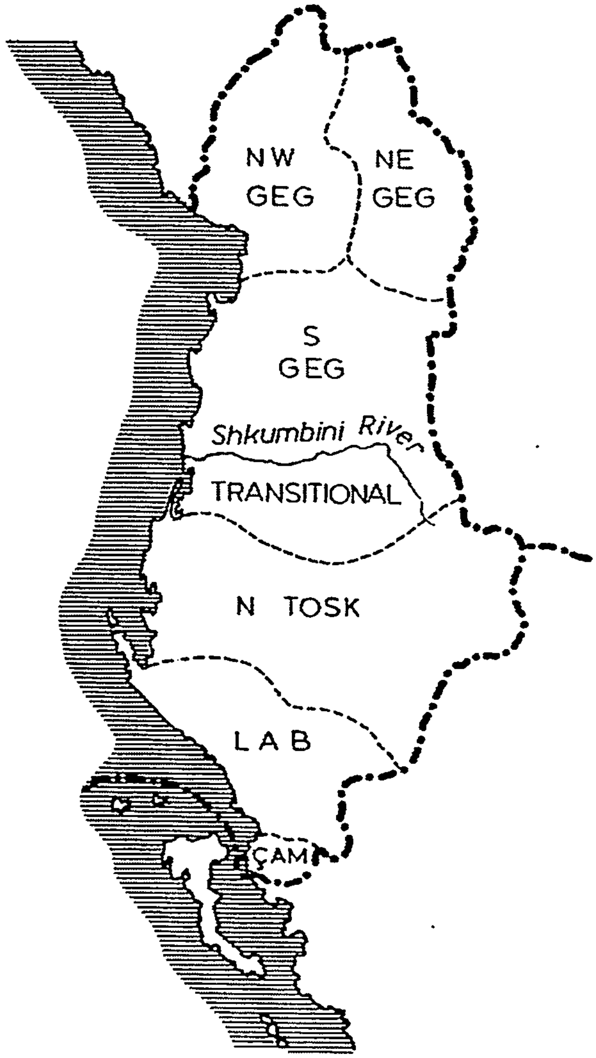


Figure 3.1: A general map of Albania and its subvarieties of Albanian (taken from Byron 1976: 48)

According to Byron (1976), the phonemic consonantal inventories of Gheg and Tosk are identical. Byron writes, "Varieties of Geg and Tosk show no differences in consonant inventory" (Byron 1976: 93). She proposes the following consonantal system for the two varieties of Albanian.

Table 3.1: Albanian consonantal inventory (based on Byron 1976: 94)

	bilabial	labdental	dental	alveolar	pal-alv	palatal	velar	glottal
oral stop	p b		t d			c ɟ	k g	
	p b		*t d*			*q gj*	*k g*	
nasal stop	m		n			ɲ		
	m		*n*			*nj*		
fricative		f v	θ ð	s z	ʃ ʒ			h
		f v	*th dh*	*s z*	*sh zh*			*h*
affricate			ʦ ʣ		ʧ ʤ			
			c x		*ç xh*			
glide			ɹ			j		
			r			*j*		
lateral			l			ʎ		
			ll			*l*		
trill			r					
			rr					

Note that in Table 3.1 the phonemic representation of the consonant is listed above the grapheme, which, if different, appears in italics. The inventory above consists of twenty-nine consonants, which includes the voiceless and voiced palatal stops /c/ and /ɟ/, as well as the voiceless and voiced palato-alveolar affricates /ʧ/ and /ʤ/.

Similar claims regarding the status of phonemic palatal stops in Albanian have been made by other linguists (see Wescott 1948, Bevington 1974, Camaj 1991, Zymberi 1991, Shkurtaj and Hysa 1996, Demiraj 1997), particularly in terms of the Tosk variety. For example, in Bevington's (1974) phonemic description of Albanian, he points out that Albanian, does in fact, have phonemic palatal stops, and describes them as being like velars in that they are [+high] and like the non-velar obstruents in they are [-back]. Bevington writes:

> The palatal stops *q*, *gj* and the velar stops *k*, *g* are articulated with the body of the tongue raised and are therefore [+high]. The two groups are distinguished from one another by the retraction of the body of the tongue in the velar, which are therefore [+back]. The palatal stops like all remaining obstruents in Albanian are [-back] (Bevington 1974: 14). (Italics are mine. The original has the italicized Albanian voiceless and voiced palatal and velar stop graphemes <q>, <gj>, <k>, and <g> underlined.)

Bevington (1974: 3) does explain, however, that the Albanian which he aims to describe is that of "the present-day literary language," i.e. the newly standardized version of Albanian which was based mainly on the Tosk variety.[14]

Whereas Byron purports that both Gheg and Tosk contain 29 consonants, two of which are palatal stops, Lowman (1957), Newmark (1957), Maynard (1996), Lambertz (1948), Cipo (1949), and Beci (1995) suggest otherwise. Lowman (1932) suggests that the Albanian palatal stops could be more narrowly and accurately represented as voiceless and voiced palatal affricates: [cç] and [ɟʝ]. Newmark (1957) proposes that the palatal stops have the aforementioned voiceless and voiced palatal affricates as allophones. Beci (1995) writes that the Gheg variety of Albanian (as spoken in Shkodër

[14] See Pipa (1989) for further discussion regarding how the former communist leader Enver Hoxha implemented language reforms in Albania, which resulted in what is commonly referred to as "literary Albanian," "standard Albanian," and "unified literary Albanian." It should be noted the Enver Hoxha's language reforms sought to create a standardized Albanian which was mainly based on the Tosk variety, rather than the Gheg variety. Enver Hoxha's language reforms are noteworthy because, firstly, Tosk is his native variety, secondly, the majority of Albanians in Albania spoke the Gheg variety at the time the language reforms took effect, and thirdly, the Gheg variety of Albanian has a longer and richer documented history than the Tosk variety.

which is located in the northwestern zone on the map of Albania) has two phonemic inventories: one with phonemic palatal stops and one without. Further, although Beci provides few tokens for his claim, he provides acoustic and palatographic evidence of the variation, where the palatal stops become voiceless and voiced palato-alveolar affricates (/ʧ ʤ /, respectively). On a similar note, Maynard (1996) claims that whereas the palatal stops remain phonemically present in the Tosk variety, they are palato-alveolar affricates in the Gheg variety.

The point of contention here is whether the proposed palatal stops exist in Albanian, both in the Gheg variety and the Tosk variety. If not, what have they developed into? Have the palatal stops merged with the palato-alveolar affricates? If not, what does that mean? If yes, what does that mean? This will be discussed more in-depth in the following sections.

As mentioned above, one possibility is that a merger is taking place, where notably the palatal stops have merged (or are in the process of merging) with the palato-alveolar affricates, as is illustrated in Figure 3.2.

Figure 3.2: Merger of Albanian palatal stops with palato-alveolar affricates

This merger of palatal stops with the palato-alveolar affricates results in the loss of palatal stops. However, to understand fully the reasoning behind why and how

Albanian palatal stops could be merging with the palato-alveolar affricates, one also needs to consider the history of the development of palatal stops and affricates in Albanian, as well as what has been written in the literature regarding their articulatory and acoustic behavior in Albanian.

3.2 Phonetic Characteristics of Palatal Stops and Palato-alveolar Affricates in Albanian

This section will focus mainly on various claims that have been made in the literature regarding the existence of palatal stops in Albanian. Many of the arguments for and against Albanian palatal stops can be found in descriptions of the phonemic inventory of Albanian. In many cases, the descriptions discuss articulatory issues of how the stops are produced, both in terms of place and manner. Since very little research (if any) has been done on perceptual aspects of Albanian palatal stops, the main focus of this section will be on articulatory and acoustic characteristics of Albanian palatal stops and palato-alveolar affricates.

3.2.1 Articulatory and Acoustic Characteristics

Whereas Byron (1976) proposed that both the Gheg and Tosk varieties of Albanian contain palatal stops, Lowman (1957), Newmark (1957), Maynard (1996), and Beci (1995) argue otherwise.

Instead of containing palatal stops, Lowman (1957) purports that the Albanian palatal stops could be more accurately described as alveolo-palatal affricates, e.g. [tɕ]. According to Lowman, the voiceless palatal stop in Albanian

> is formed with the tip of the tongue pressing against the lower teeth, and the blade of the tongue pressing tightly against the alveolar ridge at either side. The point of contact of the central part of the tongue is in the alveolo-palatal

region. The contact of the tongue during the stop is rather weak as in the case of affrication (Lowman 1957: 277).

Lowman does not disagree that Albanian (including both Gheg and Tosk) has 29 consonants; rather, he suggests that instead of Albanian containing palatal stops, the palatal stops are really some sort of alveolo-palatal affricate.

Similarly, Newmark (1957)[15] suggests that the palatal stops of Albanian are perhaps more accurately referred to as affricates or fricatives. Newmark describes the voiceless palatal stop of Albanian as a "voiceless palatal fricative with very close stricture, almost a stop" when it occurs "after voiceless fricatives...and before /t/" (Newmark 1957: 19). Before a word juncture, however, the voiceless palatal stops surfaces as a "voiceless unreleased stop formed by mid-tongue flat contact with mid-palate" (Newmark 1957: 19). When the voiceless palatal stop is elsewhere, it appears as a "voiceless stop formed by mid-tongue flat contact with strong or weak fricative release" (Newmark 1957: 20). When its voiced counterpart is "after [a] voiced fricative" or before a word juncture, it surfaces as a "voiced palatal fricative with very close stricture, almost [a] stop" (Newmark 1957: 20). Elsewhere, the voiced palatal stop was found to be realized as a "voiced stop formed by mid-tongue flat contact with [the] mid-palate, with [a] strong or weak fricative release" (Newmark 1957: 20). Similar to Lowman, Newmark offers an alternative description of the palatal stop in Albanian, one which accounts for the addition of frication.

[15] It should be noted that Newmark's phonemic inventory of Albanian consonants, which was mainly based on the speech of one Albanian speaker from Berat, i.e. a Tosk, contains 28 consonants. It contains all the consonantal phonemes Lowman discussed, except the trilled /r/ (Newmark 1957: 36).

Maynard (1996) argues that while the Tosk variety of Albanian has the same consonantal inventory which Byron proposed, which includes the palatal stops, the Gheg variety does not. In terms of Tosk, Maynard states: "The Tosk dialect has the same phonology as the Standard. There are 29 consonants..." (Maynard 1996: 24). In regards to Gheg, however, Maynard suggests that the palatal stops are pronounced as palato-alveolar affricates. Comparing Gheg to Tosk, Maynard writes the following:

> Gheg has a phonemic inventory containing 27 consonants...Gheg has two fewer consonants...Gheg has no oral palatal stops; instead its speakers have alveo-palatal affricates. The Standard q [k'] is pronounced [č] and gj [g'] is pronounced [ǰ] (Maynard 1996: 22-23).[16]

According to Maynard, whereas the Tosk variety of Albanian contains all 29 consonants, the Gheg variety contains 27. She states that while the Tosk variety contains palatal stops, the Gheg variety lacks such consonants which have developed into palato-alveolar affricates.

Beci (1995) purports that the Gheg variety of Albanian in the town of Shkoder has two phonemic inventories: one which contains 31 consonants and the other with 29.[17] Beci claims that whereas the phonemic inventory with 31 consonants contains palatal stops (i.e. Variety A), the other (i.e. Variety B) lacks palatal stops; Beci proposes that in Variety B, the palatal stops have become palato-alveolar affricates.

[16] It should be noted that what Maynard refers to as "alveo-palatal affricates" are more accurately referred to as palato-alveolar affricates in the IPA system.
[17] The reason why Beci's maximal phonemic inventory of consonants consists of 31 segments (i.e. Variety A) is because he adds both a velar and an alveolar nasal to the already existing list of 29 consonants. By subtracting the palatal stops from the maximal list, he arrives at 29 for the minimal group, i.e. Variety B.

Beci describes the palatal stops of Variety A as patterning more like affricates than stops by referring to them as "gjysmëmbylltore" (Beci 1995: 371, 373), that is half-stops, a.k.a. affricates, which are produced in the palatal region. He explains the articulation of the palatal stops as being produced in a similar manner to that which Ladefoged explained in the previous chapter. As Ladefoged pointed out, Beci (Beci 1995: 371) comments that when the tongue is being lowered from the palate, frication results, in which case a complex segment is formed:

> Gjatë nyëtimit të bashkëtingëllore [c] maja e gjuhës ulet dhe prek dhëmbët e poshtëm. Pjesa e përparme e shpinës së gjuhës ngrihet drejt pjesës së përparme të qiellzës. Anët e gjuhës ngrihen dhe mbështeten tek dhëmbët dhe tek anët e qiellzës në një sipërfaqe më të madhe se për bashkëtingëlloret [t], [d]. Gjatë nyjëtimit të bashkëtingëllores [c], mbyllja e pengesës është e plotë. Pengesa shndërrohet në shteg dhe rryma e ajrit prek anët e shtegut. Kemi pra një nyëtim kompleks që fillon si mbylltore e përfundor si fërkimore në të njëjtën pikë nyjëtimi (Beci 1995: 371). ("During the articulation of the consonant [c], the tip of the tongue lowers and touches the lower teeth. The tongue dorsum raises to the area in front of the palatal region. The sides of the tongue raise and are positioned at the upper teeth and the sides of the palate, which have a larger surface area than that for the consonants [t], [d]. During the articulation of the consonant [c], the closure of the obstruction is complete. The obstruction is radically transformed at the narrow opening as the airstream reaches the sides of the narrow aperture. Thus, we have a complex articulation which begins as a complete stop and concludes as a fricative in the same place of articulation." My translation)

Beci states that the palatal stop begins as a stop and ends with frication, both of which occur at the same place of articulation. Although the above quotation is for the voiceless palatal stop, he describes the same general process for the voiced palatal stop. Even though Beci uses the IPA symbols for palatal stops (i.e. [c] and [ɟ]) to label these sounds, Beci's explanation of the articulation and production of these sounds seems to be describing affricates, rather than stops.

Beci supports his claim of how palatal stops are articulated by conducting research which includes a palatographic study. The palatograms of the voiceless and voiced palatal stops can be seen in Figure 3.3, where the points of contact with the palate are represented with horizontal lines.

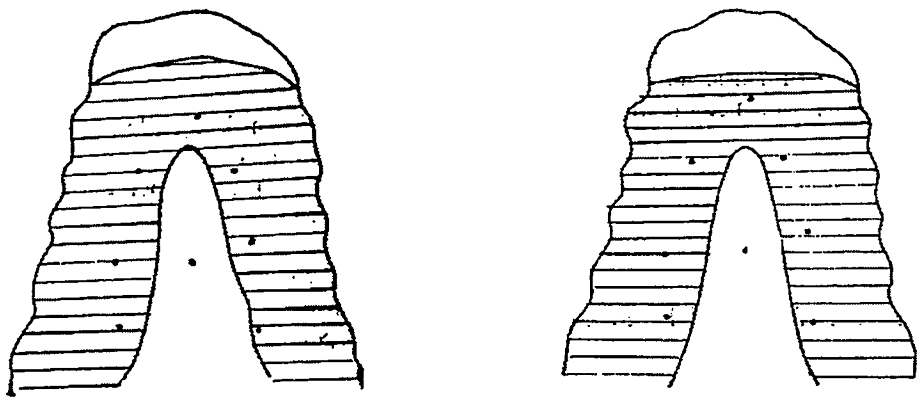


Figure 3.3: Palatograms of the voiceless palatal stop ([ca:f] *qaf(ë)* 'neck', Gheg) and the voiced palatal stop ([ɟã] *gjã*, 'thing', Gheg), respectively (taken from Beci 1995: 371, 373).

As can be seen in the palatograms of the voiceless and voiced palatal stops, the contact is very similar between the voiceless and voiced stops. Although a bit less contact with the palate near the tip of the tongue seems to take place in the voiced palatal stop, Beci makes no mention of this difference.

Beci supports his claims regarding the articulation of palatal stops by using acoustic and sonographic evidence. For the acoustic measurements for the voiceless palatal stop, Beci (1995: 371) found that the average loci of the formant transitions were as follows: F1 was approximately 242 Hz, F2 was about 2225 Hz, and F3 was 3162 Hz. The average frequency of the frication noise was from 2500-3000 Hz to 8000 Hz. Beci found that whereas the longest average frication noise duration was when the palatal stop was in the word-final position (30-35 ms), it was shortest when in the word-initial and word-medial position (10-12 ms); for example, for subject two, the frication duration at the word-medial position was 10 ms, whereas word-initially it was 4-5 ms. For the acoustic readings of the voiced palatal stop, he found that the average loci of the formant transitions were as follows: F1 was about 150 Hz, F2 was approximately 2175 Hz, and F3 was 3090 Hz. As with the voiceless palatal stop, the average frequency of the frication noise ranged from 2500-3000 to 8000 Hz. Similar to the voiceless palatal stop, Beci found that the word-medial position was longer than the word-initial position; for example, for subject two the frication duration was 6.8 ms when word-medial, but 4-5 ms when word-initial. The sonograms for both the voiceless and voiced palatal stops can be seen in Figure 3.4.

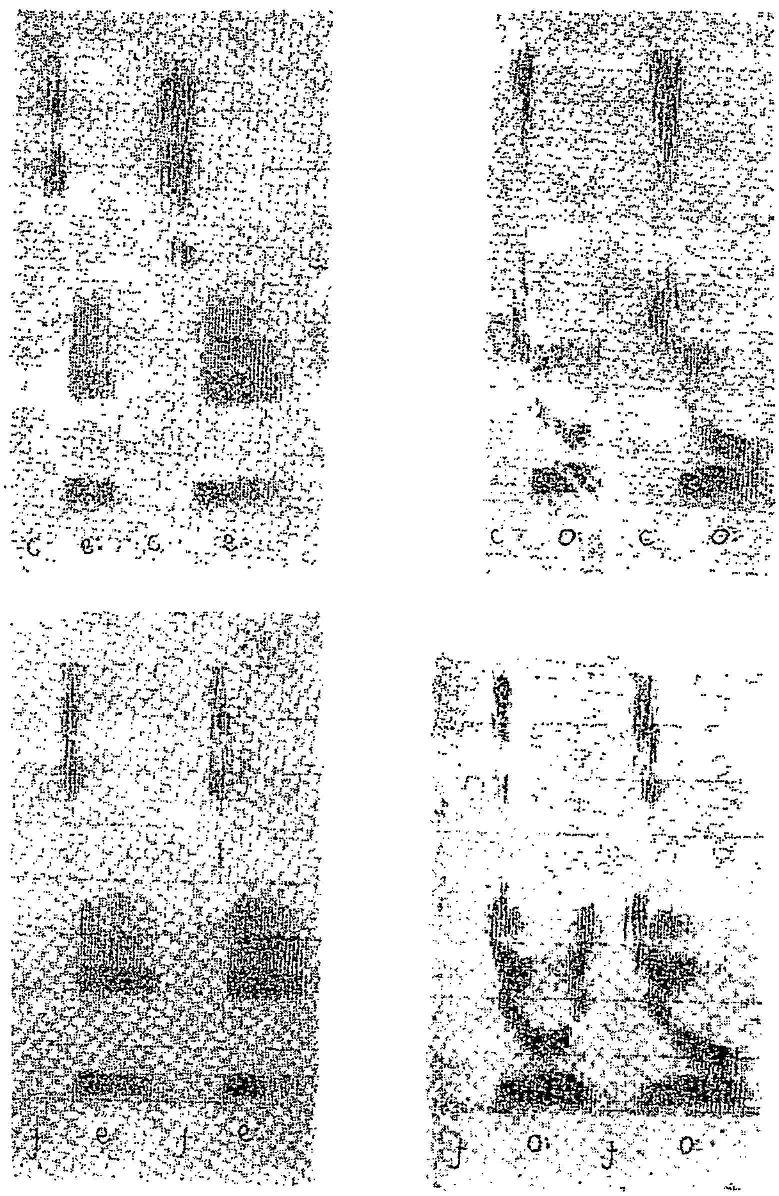


Figure 3.4: Sonograms of Albanian voiceless palatal stops ([ce:ce:] [co:co:]) and voiced palatal stops ([ɟe:ɟe:] [ɟo:ɟo:]), respectively (taken from Beci 1995: 480).[18]

As can be seen in the sonograms of the Albanian palatal stops in Figure 3.4, the initial portion is a stop (i.e. "gap), which is followed by frication (i.e. high frequency "noise").

[18] It should be mentioned that the words which Beci used in the sonograms in the figures 3.4 and 3.5 above are non-sense words.

This stop-frication sequence occurs both when the target segments precede the front vowel [e] and the back vowel [o]. As with Beci's articulatory description of palatal stops, Beci's sonograms seem to suggest that what he calls palatal stops are really some sort of affricate.

Many similarities can be seen between in Beci's sonograms of Albanian "palatal stops" and palato-alveolar affricates. In Figure 3.5 below are some of Beci's sonograms of voiceless and voiced palato-alveolar affricates.

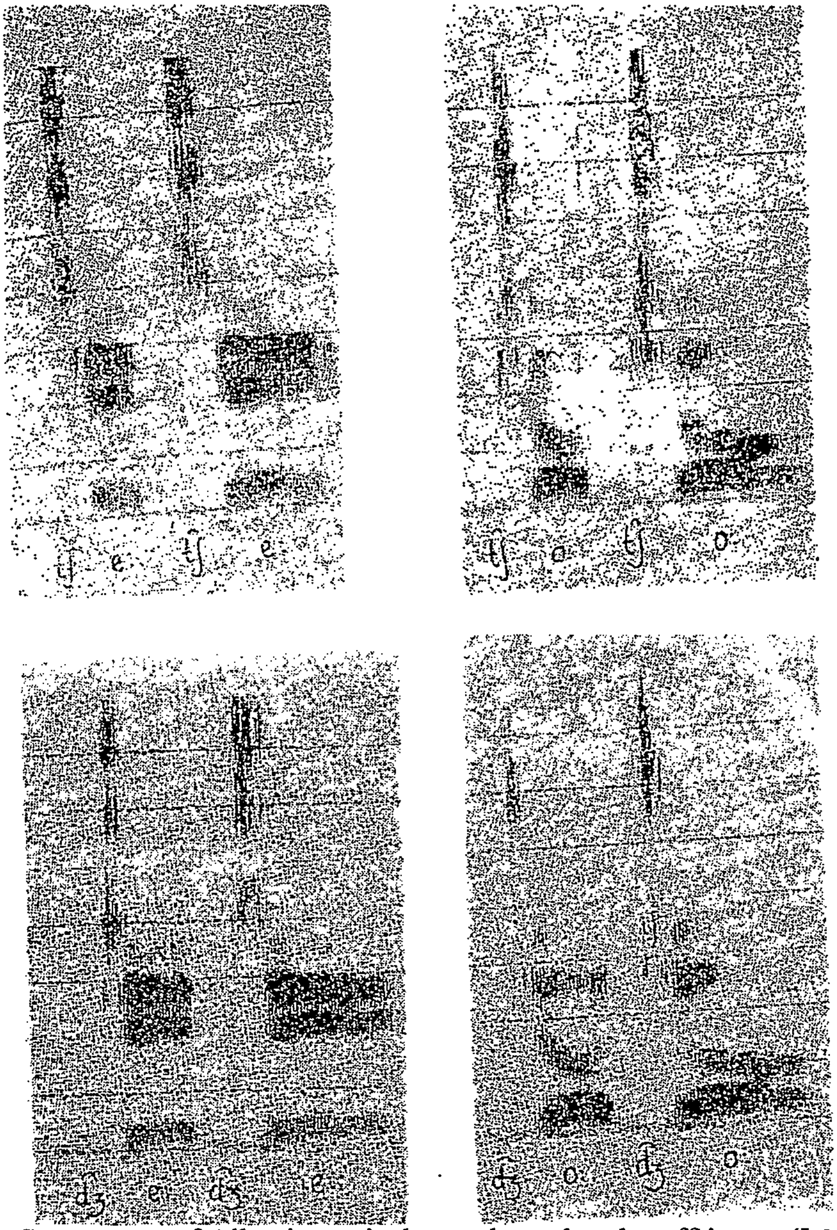


Figure 3.5: Sonograms of Albanian voiceless palato-alveolar affricates ([tʃe:tʃe:] [tʃo:tʃo:]) and voiced palato-alveolar affricates ([dʒe:dʒe:] [dʒo:dʒo:]), respectively (taken from Beci 1995: 477).

As with the palatal stops above, the palato-alveolar affricates begin with a "gap" and end in high frequency "noise," i.e. frication. As with Beci's "palatal stops" above, this stop-frication sequence occurs both when the target segments precede the front vowel

[e] and the back vowel [o]. In short, it seems that Beci's "palatal stops" pattern like affricates, before both front and back vowels.

It is also important to consider Beci's acoustic measurements for locus formant transitions and spectral readings of Albanian palato-alveolar affricates. According to Beci's acoustic measurements for the voiceless palato-alveolar affricate, the average loci of the formant transitions were as follows: F1 was approximately 225 Hz, F2 was about 2187 Hz, and F3 was 2712 Hz. Similar to the voiceless palatal stops (i.e. from 2500 to 8000 Hz.), the average frequency of the frication noise of the voiceless palato-alveolar affricates ranged from 2000 Hz to 8000 Hz. As with the palatal stops, the average frication duration was longest at the word-final position (subject one: 17-26 ms) than word-medially or word-initially (subject one: 5-7 ms). For the voiced palato-alveolar affricate, the average loci of the formant transitions were as follows: F1 was about 207 Hz, F2 was approximately 2112 Hz, and F3 was near 2725 Hz. As with the voiceless palato-alveolar affricate, the frequency of frication noise varied from 2000 Hz to 8000 Hz. Similar to its voiced counterpart, the average frication duration of the voiced palato-alveolar affricate was longest word-medially (subject one: 17-26 ms) than when word-medially or word-initially (subject one: 5-7 ms).

The only difference between Beci's "palatal stops" and palato-alveolar affricates seems to be in the formant transitions and spectral distributions. While the average loci for the voiceless/voiced palatal stops were as follows: F1 242/150 Hz, F2 2225/2175 Hz, and F3 3162/3090 Hz, the average loci for the voiceless/voiced palato-alveolar affricates were as follows: F1 225/207 Hz, F2 2187/2112 Hz, and F3

2712/2725 Hz. Whereas the voiceless palatal stop (i.e. 242 Hz) has a higher F1 than the voiceless palato-alveolar affricate (i.e. 225 Hz), the voiced palatal stop (i.e. 150 Hz) has a lower F1 than the voiced palato-alveolar affricate (i.e. 207 Hz). The voiced and voiceless palatal stops, however, have higher F2s and F3s (i.e. F2 2225/2175 Hz, F3 3162/3090 Hz) than both the voiceless and voiced palato-alveolar affricates (i.e. F2 2187/2112 Hz, F3 2712/2725 Hz). Further, whereas the spectral distributions for the palatal stops ranged from 2500-8000 Hz, the spectral distributions for the palato-alveolar affricates were from 2000-8000 Hz, a difference of 500 Hz.

Now consider the palatograms of the palato-alveolar affricates, as can be seen in Figure 3.6.

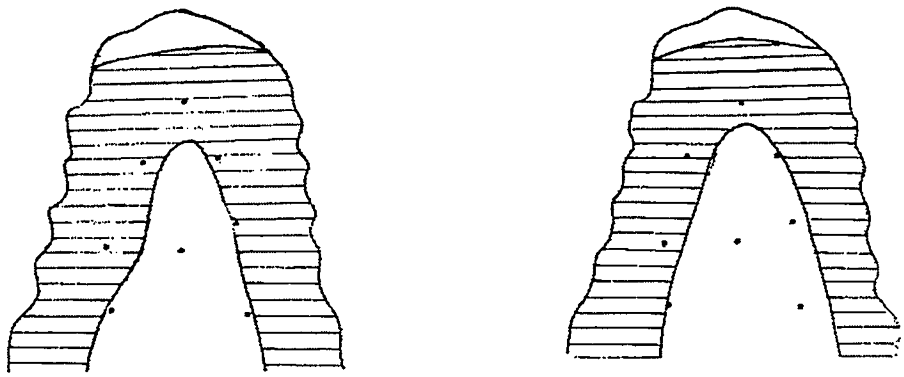


Figure 3.6: The voiceless palato-alveolar affricate ([ʧaj] *çaj* 'tea') and voiced palato-alveolar affricate ([ʤãm] *xham* 'glass'), respectively, in Albanian (taken from Beci 1995: 366, 368).

If the palatograms of the palato-alveolar affricates are compared to that of the palatal stops, many similarities can be seen. The differences are mainly in the amount of contact with the palate and the placement of the tongue. Whereas Beci's palato-alveolar affricates have less overall tongue contact and a more forward position, the palatal stops have more contact and are produced further back.

In short, what Beci describes as palatal stops, seem to be articulatorily and acoustically palatal affricates, and in some cases alveo-palatal and palato-alveolar affricates. Although Beci claims that the difference between Variety A and Variety B is the existence of palatal stops, according to his palatograms, the real articulatory difference is the amount and degree of contact with the tongue, whereby the palato-alveolar affricates have less contact which is produced further forward than the proposed "palatal stops"; according to Beci's acoustic measurements and sonograms, the real acoustic difference appears to be the spectral distributions in the high frication noise, whereby Variety A averages from 2500 to 8000 Hz., and Variety B averages from 2000 Hz to 8000 Hz.

In summation, although various scholars offer alternatives to Byron's claim that both the Gheg and Tosk varieties of Albanian contain the same phonemic consonantal inventory which includes the voiceless and voiced palatal stops, only Beci offers palatographic and acoustic evidence to support or reject such a claim. Although Beci claims Variety A contains "palatal stops," the "palatal stops" actually pattern articulatorily and acoustically like affricates. Thus, based on Beci's evidence (i.e. palatograms and sonograms with acoustic measurements), it could be argued that what might have been a palatal stop is now in the process of becoming an affricate for some speakers. In order to better understand the process of how Albanian palatal stops could be in the process of becoming affricates, the historical roots of Albanian palatal stops need to also be considered, which is the topic of the next section.

3.3 The History of Palatal Stops in Albanian

Albanian voiceless and voiced palatal stops (<q> /c/, <gj> /ɟ/)[19] are thought to have evolved from (1) Indo-European, e.g. *gjak* 'blood': IE *s*(u)*aq*^{w}o-s,[20] and (2) language internal phonological developments, e.g. *gjuhë* 'language' < *gluhë* (Topalli 2002, 2001, Orel 1998, Çabej 1976, 1996, Mann 1952, Cipo 1949, Lambertz 1948). In order for the palatal stops to be manifested, various phonological processes, such as lateral lenition and palatalization, needed to take place in Albanian. In some subvarieties of Albanian, however, palatalization did not occur. Further, some of these subvarieties elected to be faithful to the original form, rather than undergo the aforementioned phonological processes (Lambertz 1948: 20). More recently, Albanian palatal stops have undergone palatal assibilation (Hock 1986), whereby the palatal stops become affricates (Topalli 2002, Beci 1987, Cipo 1949, Lambertz 1948). The aim of this section is to investigate the ranges of sound change that have taken place in the historical development of Albanian palatal stops.

[19] In Albanian the voiceless palatal stop (i.e. the phoneme /c/) is represented with <q>; the voiced palatal stop (i.e. the phoneme /ɟ/) has the grapheme <gj>; the voiceless palato-alveolar affricate (i.e. the phoneme /ʧ/) is orthographically represented with <ç>; the voiced palato-alveolar affricate (i.e. the phoneme /ʤ/) has the <xh> grapheme.

[20] The voiceless velar stop is represented as *k, c,* and *q* in the IE historical data, unless otherwise noted. Further, k^{w}, q^{w}, g^{w}, g^{wh}, and q^{wh} refer to the voiceless and voiced labiovelar stops (unaspirated and aspirated, respectively) in the IE historical data.

3.3.1. Reflexes of Indo-European Palatal Stops in Albanian

Before discussing Albanian palatal stops, it is important to show that the Indo-European (IE) palatal stops did not develop into palatal stops in Albanian. According to Pederson (1900), the IE voiceless palatal stop (represented as *k'*) evolved into the voiceless inter-dental fricative [θ] (represented orthographically as *th*) in Albanian, e.g. *(i) athët* 'bitter, sour, tart': IE *ak'-*, Lat. *acidus* (Topalli 2002: 83) and *bathë* 'bean': IE *b^hak'ā*, Gr *fakos* (Topalli 2002: 83). Pederson also argues that the IE voiced palatal stop and IE voiced aspirated palatal stop (here, represented as *g'* and *g'^h*, respectively) became the voiced inter-dental fricative [ð] (also represented as *dh*) and the voiced alveolar stop [d] word-initially, e.g. *dhëndërr* 'groom': IE *g'em(e)*[21], Lat. *gener* (Topalli 2002: 90), *erdha* 'came (1sg)' : IE *erg'^h-* (Topalli 2002: 90), *derr* 'pig': IE *g'^hoir* (Topalli 2002: 91), and *desha* 'wanted (1sg)': IE *g'eus-* (Topalli 2002: 91), which can be seen in Table 3.2.

Meyer (1892), however, purports that the IE voiceless palatal stop also yielded the voiceless alveolar fricative [s], e.g. *sorrë* 'blackbird': IE *k'ēr* (Topalli 2002: 87) and *sy* 'eye' : IE *k'eu* (Topalli 2002: 88). Further, Meyer proposes that the IE voiced palatal stop and IE voiced aspirated palatal stop produced the voiced alveolar fricative [z] in

[21] This is German *(Bräut)gam* which by folk etymology was remodeled in English to *groom* with an -r- which is the result of a confounding of *goom* with *groo*m, the male who cares for houses (Jerold A. Edmondson, personal communication).

Albanian, e.g. *zemër* 'heart': IE *g'ʰrd* (Topalli 2002: 93) and *zog* 'bird': IE *$*g'^h\bar{a}g^{wh}os$-* (Topalli 2002: 93), in Table 3.2.

Table 3.2: The development of IE palatal stops in Albanian

Pederson	Meyer	Examples
k' > th	k' > th, s	*(i) athët*: IE *ak'-* *bathë*: IE *$b^hak'\bar{a}$* *sorrë*: IE *k'ēr* *sy*: IE *k'eu*
g', g'^h > dh, d	g', g'^h > dh, d, z	*dhëndërr*: IE *g'em(e)* *erdha*: IE *erg'^h-* *derr*: IE *g'^hoir* *desha*: IE *g'eus-* *zemër*: IE *g'^hrd* *zog*: IE *$*g'^h\bar{a}g^{wh}os$-*

Pederson's and Meyer's different points of departure notwithstanding, they agree that the IE palatals are realized as fricatives in Albanian, thereby resulting in Albanian being classified as a satem language (Topalli 2002, Çabej 1976a).

3.3.2 Indo-European Origins of Albanian Palatal Stops: Palatalization and Fortition

Although the development of Albanian palatal stops has mainly been a result of language internal changes, Albanian palatal stops have also developed from Indo-European. One such development is from the word-initial IE spirant [s]. This change from [s] to [ɟ] (i.e. <gj>) took place before non-back vowels, for example, before (a) front vowels, such as in *gjysmë/gjysëm* 'half': IE *sēmi* (Çabej 1996: 340-1), *gjalpë* 'butter'*: IE selp-* (Topalli 2002: 136), and *gjashtë* 'six': IE sek's- (Topalli 2002: 110), and (b) the central vowel *a*, such as *gjak* 'blood': IE *$s(u)aq^wo$-s* (Topalli 2002: 64).

Secondly, the voiced palatal stop is also thought to have developed from the front high tense [i] when in a non-nuclear word-initial position (i.e. palatal glide),[22] e.g. *-gjuej* 'hunt'< IE *iag*^{h} (Topalli 2002: 137). Thirdly, Albanian palatal stops also have developed from IE velar stops which were followed by front vowels, such as in *qerthull* 'isolation' < IE *qert-* (Topalli 2002: 60) and *gjendem* 'happen to be; find oneself' < IE *g*^{h}*end-* (Topalli 2002:62), as is summarized in Table 3.3.

Table 3.3: IE sources of Albanian palatal stops[23]

IE source	example	environment
s[24]	*gjysmë/gjysëm* < *gjimsë* 'half': IE *sēmi* *gjalpë* 'butter': *IE selp-* *gjashtë* 'six': IE *sek's-* *gjak* 'blood': IE *s(u)aq*^{w}*o-s*	IE *s* > *gj*/#___ [-back] vowels ([s] > [ɟ] / # __ [-back] vowels)
i	*gjuej* 'hunt' (1sgPres)'< IE *iag*^{h}	IE *i* > *gj*/#__ ([j] > [ɟ] / # ___)
k,g	*qerthull* 'isolation' < IE *qert-* *gjendem* 'happen to be; find oneself' < IE *g*^{h}*end-*	*k,g* > *q, gj*/___front vowels ([k,g] > [c, ɟ] /__ front vowels)

In all three IE sources, palatalization, whereby "partial assimilation of a consonant to a nearby vocalic segment" (Hock 1986: 73) occurred, which resulted in the non-back features of the following vowel to spread onto the preceding non-syllabic segment.[25]

[22] Hume (1994: 68) refers to this as "Glide Strengthening, a change in the status of the glide's articulator feature[s] from vocoidal to consonantal..[F]voc → [F]cons/ σ[_V...Informally stated, the vocoidal features of a glide changes to consonantal in syllable-initial position." She provides evidence for this using Spanish (61-68).
[23] See Topalli 2002 for a more in-depth analysis regarding this issue.
[24] Note that when IE *s* preceded back vowels, such as *o* or *u*, the *s* became *h* in Albanian, such as in *hyll* 'star': IE sūl, Lat. *sōl* (Topalli 2000: 49). For more information regarding the reflexes of the IE s in Albanian, see Topalli 2002 and class notes/private communication (Topalli 2001: 59-61).
[25] See Ní Chiosáin (1994) for a discussion on how palatalization can be triggered by [-back] vowels.

3.3.3. Language Internal Origins of Albanian Palatal Stops: Velar and Alveolar Palatalization

As was mentioned earlier, Albanian palatal stops have also emerged from language internal developments. This is the case not only for words which belong to Albanian's native stock, but also those which are borrowings. Firstly, as was seen with IE, both the voiceless and voiced palatal stops are thought to have resulted from a velar stop (i.e. [k] and [g]) followed by a front vowel (i.e. [i], [e], and [y]), such as *pleq* (pl.) 'old men' < **plak-ī* (sg.) (Topalli 2002: 146).[26] This also has occurred in loan words from (a) Latin, such as *qen* 'dog' < Lat. *canem* (Orel 1998: 356), *qepë* 'onion' < Lat. *caepa* (Topalli 2002: 128), *qiell* 'sky, heaven' < Lat. *caelum* (Orel 1998: 360), *qytet* 'city'< Lat. *cīvitāte(m)* (Orel 1998: 364), and *gjel* 'rooster' < Lat. *gallus (> galli)* (Çabej 1996: 318), (b) Greek, such as *qiri* 'candle' < MGk *κηρί* (Orel 1998: 362), and (c) Turkish, such as *gjoks* 'breast' < Trk. *göks* (Çabej 1996: 335). Secondly, when [t] and [d] were followed by a palatal glide, they developed into palatal stops in Albanian,[27] e.g. *qetër* 'other' < Alb *tjetër* (Lambertz 1948: 19) and *magje* 'cooking area' < It. *madia* (Topalli 2002: 146).

Thirdly, Albanian palatal stops have also developed from velar stops when followed by laterals, that is *kl* and *gl*, such as in *qumësht* 'milk' < *klumësht* (Topalli

[26] The *a* in *plak* signifies singular and the *e* in *pleq* signifies plural. Other examples: *gardh* (sg. 'fence')/*gjerdhe* (pl. 'fences'), *cjap* (sg. 'billy goat')/*cjep* (pl. 'billy goats'), *dash* (sg. 'sheep, m.')/*desh* (pl. 'sheep, m.'), *gjallë* (sg. 'life')/ *gjellë* (pl. 'food; lives'), *djalë* (sg. 'boy')/*djem* (pl. 'boys') (Topalli 2001, 2002 138-142; Orel 1998: 129, 131). Historically this was also the case with *mbrat (sg 'king'.)/mbret (pl. 'kings'), from Lat. *imperātor,* and **gal* (sg. ' rooster')/*gjel* (pl. 'roosters') from Lat. *gallus*. Both singular forms *mbrat* and *gal* have disappeared/become obsolete. The once plural forms, *mbret* and *gjel*, are now considered the singular forms. The motivation for this *a* to *e* vowel change is due to metaphony (Topalli 2000: 138-142).
[27] Hume (1994: 149) notes that a similar process appears in Hungarian, e.g. ald'i > alg' (> alʤ).

2002: 135), *qaj* 'cry' < *klaj* (Topalli 2002: 117), *qoftë* 'meatball' < *kloftë* (Cipo 1949: 22), *gjuhë* 'language' < *gluhë* (Topalli 2002: 135; Çabej 1996: 338), and *gju* 'knee' < *glun-* (Çabej 1996: 336-7).

Table 3.4: Some language internal sources of Albanian palatal stops[28]

Language internal sources	**example**	**environment**
k, g	*pleq* 'old people' < **plak-ī* *qen* 'dog' < Lat. *canem* *qepë* 'onion' < Lat. *caepa* *qiell* 'sky, heaven' < Lat. *caelum* *qytet* 'city'< Lat. *cīvitāte(m)* *qiri* 'candle' < MGk *κηρί* *gjel* 'rooster' < Lat. *gallus* *gjoks* 'breast' < Trk. *göks*	*k,g > q, gj/___*front vowels ([k,g] > [c, ɟ] /__front vowels)
t, d	*qetër* 'other' < Alb *tjetër* *magje* 'cooking area' < It. *madia*	*t, d > q, gj/___j* ([t, d] > [c, ɟ]/__ [j])
kl, gl	*qumësht* 'milk' < *klumësht* *qoftë* 'meatball' < *k-ioftë* < *kloftë* - *qaj* 'cry' < *klaj* *gjuhë* 'language' < *gluhë* gju 'knee' < glun-	*kl, gl > k-j, g-j > q, gj* ([kl, gl] > [kj, gj] > [c, ɟ])

However, not all lexical items with a word-initial consonant cluster containing a velar plus a lateral (i.e. [kl] and [gl]) have become palatal stops in all subvarieties of Albanian (Topalli 2002). As can be seen in Figure 3.7, the process of becoming a palatal stop involved various stages, the first of which was lateral lenition, whereby the alveolar lateral weakened and became a palatal glide: [kl] > [kj] (e.g. *klumësht* > *k-jumësht*) and [gl] > [gj] (e.g. *gluhë* > *g-juhë*) (Topalli 2002). Since laterals are

[28] See Topalli 2002 for a more in-depth analysis concerning this issue.

relatively unstable (Hock 1986), it is not surprising that a lateral would change into a glide.[29] Other processes which occurred were (a) palatalization,[30] whereby the palatal (i.e. [–back]) features of the following palatal glide spread onto the preceding velar stop, thereby creating a palatal stop: [kj] > [cj] > [c] (e.g. *k-jumësht* > *qumësht*) and [gj] > [ɟj] > [ɟ] (e.g. *g-juhë* > *gjuhë*) and (b) palatal glide deletion, whereby the palatal glide deleted, resulting in a single velar stop: [kj] > [k] (e.g. *k-jumësht* > *kumësht*) and [gj] > [g] (e.g. *g-juhë* > *guhë*) (Topalli 2002). As Hock (1986) points out, deletion of a segment, in this case a glide, is the ultimate outcome of lenition. Further, some subvarieties retained the original velar stop plus lateral consonant cluster and did not undergo palatalization or palatal glide deletion; rather, they remained faithful, resulting in: *klumësht* and *gluhë*.

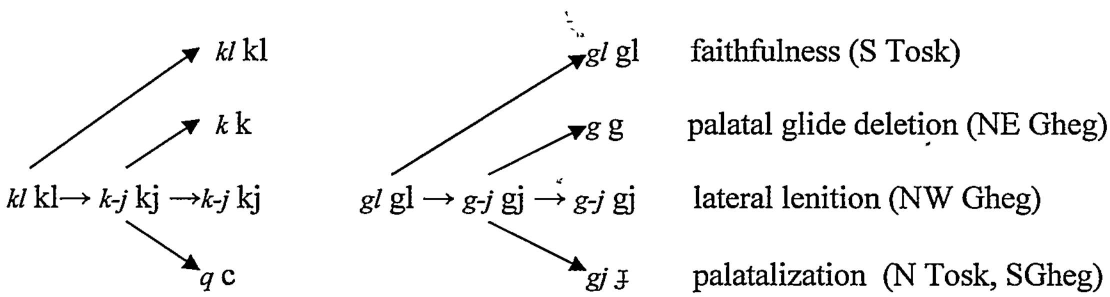


Figure 3.7: Some stages in the development of Albanian palatal stops[31]

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[29] The process of a lateral weakening to a palatal glide is also referred to as iodization. Iodization occurs in many Tai languages, e.g. *plá* 'fish' and *pjá* (Jerold A. Edmondson, personal communication).
[30] See Hume (1986). Here one could argue that the palatal stop and the palatal glide merge into one segment (i.e. palatal stop), or that after palatalization occurs the palatal glide deletes: [kj] > [cj] > [c] and [gj] > [ɟj] > [ɟ].
[31] The orthographic symbols are in italics and in smaller print (10-point), e.g. *kl*; the phonetic symbols are in larger print (12-point), e.g. kl.

As is noted in Figure 3.7, whereas words such as *qumësht* and *gjuhë* have been attested in some subvarieties of the northern Tosk and southern Gheg, particularly that of Budi (1618), *k-jumësht* and *g-juhë* are attested in northwestern Gheg (e.g. Shkoder, Albania), especially in the historical writings of Bogdani (1685), Fishta, and Code of Dukagjini (Topalli 2001). Also, whereas *kumësht* and *guhë* have been found to exist in northeastern Gheg (e.g. Kuks, Albania and parts of Kosova), particularly in the writings of Bogdani (1685), *klumësht* and *gluhë* appear in a select few subvariteties of Tosk (e.g. Çamëria, a subvaritety of southern Tosk), as well as in the writings of Buzuku in 1555 and Matrenga in 1592 (Topalli 2002).

More recently palatal assibilation has taken place in Albanian, whereby "prevelar stops, commonly referred to as 'palatals' [change] into assibilated clusters of stop plus sibilant" (Hock 1986: 442),[32] i.e. [c] > [ʧ] (i.e. <q> becomes <ç>) and [ɟ] > [ʤ] (i.e. <gj> becomes <xh>) (see also Topalli 2002, 2001, Beci 1987, Orel 1998, Çabej 1976, 1996, Mann 1952, Cipo 1949, Lambertz 1948).[33] This has obtained in lexical items which originated not only from a velar stop plus lateral *(e.g. çumësht* < *qumësht* < *k-jumësht* < *klumësht* 'milk' and *xhuhë* < *gjuhë* < *g-juhë* < *gluhë* 'language'), but also from the IE spirant /*s/ (e.g. *xhims* < *xhysmë/xhysëm* < *gjysmë/gjysëm* 'half': IE *sēmi*), IE word-initial [i] (e.g. *xhuaj* <*gjuaj* 'hunt'< IE *iag*^{h}), fronted velars (e.g. *çepë* < *qepë* < Lat. *caepa* 'onion') (Cipo 1949: 24), and palatalized

[32] See Boyd (1997: 66) for affricate assibilation in Contemporary Standard Russian.

alveolar stops (e.g. *maxhe* < *magje* < It. *madia*).[34] In other words, palatal assibilation has taken place across the board,[35] as is illustrated in Table 3.5.

Table 3.5: Evolutionary stages of Albanian palatal stops

Palatal Assibilation (pal-alv affric)	**Palatalization (pal stop)**	**Origin**
[ʧ]*umësht*	[c]*umësht*	Alb.[kl]*umësht*
[ʤ]*ims* < *xhysmë/xhysëm/gjyms*	[ɟ]*ysmë/gjysëm/gjyms*	IE [s]*ēmi*
[ʤ]*uaj*	[ɟ]*uaj*	IE [i]*ag*^{h}
[ʧ]*epë*	[c]*epë*	Lat. [ke]*pa*
ma[ʤ]*e*	*ma*[ɟ]*e*	It. *ma*[dj]*a*

In summation, although the contemporary Albanian palatal stops were not directly inherited from the IE palatal stops, they evolved from the IE word-initial [s], IE semivowel [i], alveolar stops, and velar stops. Their evolution is one which involved such phonological processes as lateral lenition and palatalization. Further, instead of undergoing the aforementioned phonological processes, some subvarieties underwent palatal glide deletion. Others remained faithful to the archaic forms. More recently the

[33] Hock's rule for palatal assibilation is as follows: [+ stop, + palatal] > [+assibilant] (Hock 1986: 442), also stated as k' > ʧ (Hock 1986: 452, 455). Hock mentions that palatal assibilation is also found in the IE branches of Iranian, Indo-Aryan, and Balto-Slavic.

[34] Hume (1994: 127) states: "[T]he change from velar [stop] to palatalized velar or palato-alveolar [affricate] in the context of a front vowel is a common rule attested cross-linguistically." She provides evidence for this sort of process, which she refers to as coronalization which is triggered by front vowels (19) (i.e. k > k' > ʧ and g > g' > ʤ), in Acadian French (127) and Slovak (7).

[35] See also Beci (1987) for a discussion on how in some subvarieties of Gheg, the palatal stop has undergone assibilation and resulted in not only palato-alveolar affricates, but also palato-alveolar fricatives, palatal affricates, palatal fricatives. Beci (1987: 32-36) notes that within some subvarieties of Gheg, more than one phonetic variant is commonly heard and accepted, such as in the Miredite region. Beci (1987: 35-36) also points out that the palatal stops were more than likely present in Albanian in the 16th and 17th centuries, and possibly developed into palato-alveolar affricates no later than the 18th century, as evidenced by the writings of Borgo Erizzos. Beci (1987) will be discussed further in later sections of this dissertation.

Albanian palatal stops have undergone palatal assibilation, yielding palato-alveolar affricates. This later development suggests an additional sound change, whereby the palatal stops merge with the palato-alveolar affricates. Further analysis of the data could include an optimality theoretic approach, whereby each of the aforementioned phonological processes is written as a constraint, and each subvariety ranks the constraints differently.

3.4. Linguistic Change: Internal, External, and Historical Motivation

Thomason and Kaufman (1988) purport that linguistic change is due to not only internal linguistic factors (e.g. articulatory issues), but also external linguistic issues (e.g. linguistic convergence) and facts about external social history (e.g. foreign occupations and political matters). They argue that traditionally, language internal reasons were offered as solutions by historical linguists for why particular changes occured within a linguistic system. Further, they comment that external causations were suggested only after all language internal possibilities were exhausted; it was not uncommon for a weak internal motivation to be chosen over a stronger external motivation. According to Ohala (1974:268 in Thomason and Kaufman 1988), one is to first seek a causation for linguistic change by looking language internally; only after that has failed, is one to attempt an explanation which considers external motivations and historical matters. Thomason and Kaufman, however, disagree with Ohala in that "an explanation should be as complete as possible" (Thomason and Kaufman 1988:55-56). That is, the most accurate explanations are to involve internal and external linguistic causastion, along with the social history of the speakers.

To provide a more comprehensive account of the Albanian phenomena under investigation, one must also consider the internal linguistic causations (e.g. the nature of palatal stops), external linguistic forces (e.g. language contact), and the historical situation of the Balkans (e.g. back-and-forth migration and multi-lingualism) involved (Sawicka 1997, Thomason and Kaufman 1988). Like Thomason and Kaufman, Sawicka (1997: 43-45) suggests that the merger of palatal stops with the palato-alveolar affricates is an example of language convergance in the Balkan Sprachbund which resulted because of the interference of a combination of internal and external linguistic forces coupled with historical social factors.[36]

3.4.1. Internal Motivations

Tagliavini (1942) comments that this process of frication of palatal stops first occured in Albanian when front vowels followed the palatal stops: "Tagliavini (1942) is of the opinion that the Albanian change of [c], [ɟ] into [tɕ], [dʑ] and then into [tʃ], [dʒ] started before front vowels" (Sawicka 1997:45). According to Sawicka (1997), the merger of palatal stops into affricates could, in part, be caused by a simplication of the phonemic system.

[36] See also Campbell (2000) for discussion of palatalization as an areal linguistic feature in other parts of the world (e.g. Northwest Coast of North America and the Baltics). According to Campbell (2000:34), velar palatalization which results in palato-alveolar affricates (i.e. k → tʃ) is a characteristic areal feature for some languages in the Northwest Coast of North America: "Some other traits shared by a smaller number of Northwest Coast languages include: (1) a widely diffused sound change of *k > č, which affected Wakashan, Salishan, Chimakuan and some other Northwest Coast languages." Campbell (2000: 305) also states that the palatalization of consonants is a possible areal feature in Baltics: "The Baltic area is defined somewhat differently by different scholars, but includes at least Balto-Finnic languages (especially Estonian and Livonian), Latvian, Latgalian, Lithuanian and Baltic German. Some would include Swedish, Danish and dialects of Russian as well. The Baltic area is defined by several shared features, some of which are...palatalization of consonants." It should be noted that Campbell (2000) does not provide examples for these claims.

Further, as previously mentioned, according to Ladefoged (1997), palatal stops tend to be released with frication due to the shape of the roof of the mouth and the relatively substantial amount of contact between the tongue and the hard palate. In other words, due to production issues, it is relatively "easier" for the speaker to release the palatal stop with frication than to release it without. This would mean that the eventual frication of palatal stops is not unusual, but rather natural and expected, and perhaps predictable. Hence, one could conclude that this process is an internal change which results because of the ariculatory nature of palatal stops.

Sawicka (1997) comments that this process of palatal stops becoming affricates is common and occurs in other languages besides Albanian, such as Arumanian (a vareity of Romanian). For example, Golab (1984:39 in Sawicka 1997:44) notes that in Arumanian of Kruševo (Macedonia), the voiceless and voiced palatal stops become palatal affricates ([tɕ] and [dʑ]). Hence, this "natural" process of frication of palatal stops has been documented as occuring not only in Albanian, but also in Arumanian.

3.4.2. External Motivations

The Albanian language is situated, moreover, in the Balkan Sprachbund (see Appendix C for a map of the Balkans), geographically a linguistic area where several linguistic features (e.g. the loss of the infinitive, postposed articles, and the incorporation of 'have' in the future tense) of genetically unrelated languages (e.g. Albanian, Greek, Bulgarian, Rumanian, Macedonian, and Turkish) have converged as a result of language contact over the course of hundreds of years (Hock and Joseph 1996).

In Sprachbund situations code-switching is a common phenomonon. Thomason and Kaufman comment regarding code-switching between languages in Sprachbunds as being a possible external motivation for linguistic change:

> It is likely that convergence in a multilateral Sprachbund situation proceeds along the lines proposed by Pfaff (1979) for bilingual code-switching, with bi- and multilingual speakers favoring structures (including ones that are less popular stylistically to begin with) that are common to some or all of the languages. This strategy cannot account for all the results, but we would expect it to be an important mechanism of convergence, especially in morphosyntactic convergence. Joseph's analysis (1983) of Balkan infinitive developments supports this supposition (Thomason and Kaufman 1988: 96).

In other words, according to Thomason and Kaufmann when languages are in contact, where much multi-lingualism exists, it is possible that speakers of one language will begin using the linguistic devices of another language (such as the periphrastic future construction, postposed articles, and the frication of palatal consonants). Further, speakers will do so without abandoning their mother tongue. This is especially the case in the Balkans, where because of the Turkish occupation, many small groups migrated back-and-forth, which resulted in much multilateral multi-lingualism (see Malcolm 1998).

Similarly, Sawicka (1997) argues that the influence of external linguistic features is a possible source for the merger of palatal stops and affricates in Albanian, particularly in the Balkans where convergence of linguistic features occurs. Sawicka (1997) comments:

> The most characteristic process, which occurs in several languages in this region [the Balkans], is the merger of palatal [stops]....([c], [ɟ]) and the alveolar affricates [tʃ], [dʒ]...First of all, the opposition between these two types of affricates is lost; consequently, they can replace each other – more often the

> two pairs are pronounced in the same way...Such a tendency is observed in Serbian, Croatian, Macedonian, and Albanian. It happens that various types of realizations can be heard in one dialect (Carnušanov 1979)...Such a process is also characteristic for a number of Northern Albanian dialects. In Zara and Kosovo the shift of [c], [ɟ] into [ʧ], [ʤ] is a regular fact....According to Gjinari (1988: 64), there exists in [the Gheg] dialect [ʧ], [ʤ] < [c], [ɟ] (Sawicka 1997: 42-44).

That is, the process of frication of palatal stops resulting in affricates is not limited to Albanian. It also occurs in other Balkan languages, such as Serbian, Croatian, Macedonian, and Arumanian (Sawicka 1997).

Further, the process of velar stops becoming palatalized and thereafter turning into palatal or palato-alveolar affricates is commonplace in Balkans, and is perhaps an additional areal feature. For instance, as was mentioned in Chapter 1, Newton (1972 in Sawicka 1997:40, 44-45) mentions that in Greek the velar stops become palatalized when followed by front vowels; these palatalized stops then shift to palato-alveolar affricates (e.g. in Cyprus, /k/ → /k^j/ → [ʧ]; /keros/ → [k^{j}eros] → [ʧeros] 'weather'). In Western Rumelian Turkish, Friedman (1982:13 in Sawicka 1997:44) points out that it is also quite common for velars which have undergone palatalization to become palatal affricates. In the Veles dialect of Macedonian, a similar process takes place (Sawicka 1997).

After having undergone palatalization, some alveolar stops may also experience frication, thereby creating palato-alveolar and palatal affricates (i.e. /t/ → [t^j] → [ʧ]). Such a process has been documented as occuring in various Albanian and Macedonian varieties (Sawicka 1997).

In some cases, the affricate originated as a true palatal stop, but in others, it began as a velar or alveolar stop which was palatalized (Sawicka 1997). Regardless of its origin in terms of place of articulation, Ivic suggests that in the Balkan languages, this merger of stops into affricates is a result of languages being in contact: "The merger of affricates is usually thought to be due to the foreign influence" (Ivic 1957). Whereas Cipo (1949) purports that the process of frication of stops is a result of Slavic influence on Albanian (Sawicka 1997:45), Nemeth (1961) holds that it is a result of Turkish. Sawicka (1997) suggests that the source of this process is convergence. Just as the periphrastic future and the loss of the infinitive are a Balkan areal typological features, so is the frication of palatal stops.

3.4.3. Mixed Motivations

Sawicka (1997: 44) argues that instead of the merger of palatal stops with palato-alveolar affricates in Albanian being a result of exclusively internal or external forces, more realistically, the source of change could be a combination of the two coupled with historical fact, back-and-forth migration, political domination, and other socio-polical factors. Sawicka comments: "It is possible that, as in some other cases, two independent factors collaborate here – an inner tendency towards a reduction of palatalization and, on the other hand, the Turkish (or Slavic) influence" (Sawicka 1997:45). Whereas this process of frication of palatal stops could be soley due to language internal motivations (such as articulatory issues which deal with natural processes involving restriction of the vocal apparatus), Sawicka (1997), Ivic (1957) and Nemeth (1961) also attribute the merger of palatal stops and affricates to foreign influence, or phonological code-switching resulting in convergence; in order for this claim to hold, however, it may not be divorced from the historical facts of the region, which involved much migration and multi-lateral multilingualism among the people of the Balkan region (Thomason and Kaufman 1988, Sawicka 1997).

3.5. Summary

Once the historical origins of Albanian palatal stops are coupled with palatographic and acoustic findings of contemporary palatal stops in Albanian, the process of palatalization becomes much more transparent. The process of palatal stops becoming palato-alveolar affricates in Albanian exemplifies an intermediate step[37] in velar palatalization, coronal palatalization, and glide/spirant fortition, as is illustrated in Figure 3.8:

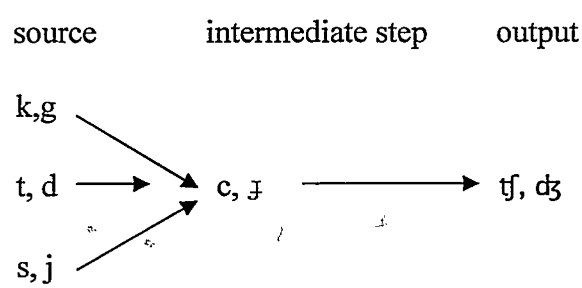

Figure 3.8: Various stages in the development of the Albanian palatal stop

That is, the sound change from /c ɟ/ to /tʃ dʒ/ functions as a present-day snap shot of what could have happened in many languages (i.e. Slavic, Bantu, Salishian, to name a

[37] See also Schwartz (2000: 62), Lunt (1981) and Channon (1972) for arguments and discussion regarding a similar sort of intermediate step in Slavic. "Lunt (1981) and Channon (1972) also mention a probable intermediate step in all velar shifts, positing a palatal stop (in their notation /k'/) for all environments relevant to the palatalization" (Schwartz 2000: 62).

few). The key to understanding palatalization and fortition must include and account for not only the beginning and end stages, but also that which happened in between those two points in time. Evidence from glide and spirant strengthening only adds to the diversity of sources and environments for palatalization. Considering not only the language internal factors involved, but also the various external linguistic factors coupled with the historical context of the Balkans, a possible merger of palatal stops with palato-alveolar affricates in Albanian seems more plausible. Although much research still needs to be done in the area of palatalization, it is hoped that this work will contribute to better understanding the forces involved in palatalization and glide/spirant strengthening.

CHAPTER 4

METHODOLOGY

Although Lowman (1932) and Newmark (1957) have suggested that the palatal stops in the Tosk variety of Albanian could phonetically be palatal affricates, and Maynard (1996) has stated that in the Gheg variety the palatal stops are palato-alveolar affricates, other than what Beci (1995) has offered, little acoustic data has been presented to verify these claims. In attempts to confirm these claims scientifically, an acoustic study of a large corpus was conducted. For the purposes of ascertaining the phonetic manner of articulation of phonemic palatal stops and palato-alveolar affricates in Albanian, temporal characteristics of the palatal stops and palato-alveolar affricates were analyzed. Also, in order to identify the phonetic place of articulation of these phonemes, spectral analysis of the release portions of these segments was performed.

4.1. The Subjects

The data for the acoustic study are taken from a sample of speech produced by one hundred Native Speakers (NSs) of Albanian, fifty of the Gheg variety and fifty of the Tosk variety. The Gheg speakers include both males (n = 35) and females (n = 15), ranging from 18 years old to 71. The Tosk speakers include both males (n = 24) and females (n = 26), ranging from 18 years old to 68. Although the subjects used in this research originate from Albania, Kosova, Macedonia, Montenegro, Romania, and

Greece, they all were residing in Albania at the time this research took place. The occupations of the subjects include housewives, teachers, university professors, business men, baristas, factory workers, politicians, actors and actresses, attorneys, university students, reporters, museum curators and workers, general laborers, and retired people (see Appendix A for subject information). The subjects were recorded in a variety of natural settings: the researcher's home, local restaurants and coffee shops, museums, theatres, newspaper headquarters, homes' of the subjects, and parks. Being that the interviews were conducted in naturally occurring environments, background noise, such as ringing telephones and slamming doors, sometimes interfered with the recording. Under such conditions the subjects were asked to repeat a particular utterance and they agreed in all instances. For example, on one occasion a telephone rang during the recording session; once the phone ceased to ring, the subject re-read the same test utterances that had been interrupted. In another instance, a door was slammed during the recording of a subject; once the door had been closed, the subject re-read the same utterance.

4.2. The Data

The subjects were asked to read four sets of frame sentences, each containing ten items. The first set of frame sentences contained the target voiceless palatal stop /c/ (orthographic <q>); the second set contained the target voiced palatal stop /ɟ/ (<gj>); the third set contained the target voiceless palato-alveolar affricate /ʧ/ (<ç>); and the fourth set contained the target voiced palato-alveolar affricate /ʤ/ (<xh>) (See Table 4.1). Further, each target segment in this study was in the word-initial position in real lexical items (i.e. nonsense words were not used). The lexical items were chosen based on previous acoustic studies on Albanian (Beci 1995), claims in the literature regarding the status of these four sounds in Albanian (Beci 1995, Beci 1987, Lowman 1932, Newmark 1957, Camaj 1984, Camaj 1991, Çabej 1976, Cipo 1949, Lambertz 1948, Mann 1952, Meyer 1892, Pedersen 1900, Sawicka 1997, Shkurtaj and Hysa 1996, Toma, Karapici, and Radovicka 1989, Zymberi 1991, Maynard 1996, Byron 1976), and a pilot study for this dissertation (Kolgjini 2001). Each target segment was followed by one of six vowels shared by both varieties of Albanian: /i e y u o a/, as in Table 4.1. The frame sentence is as follows: "*Thuaj* ________ *prapë*" "Say ________ again." The stimuli appeared on individual 5" x 8" index cards, with one sentence per index card.

Table 4.1: Target segments /c ɟ ʧ ʤ/ in the target words (with gloss)

target segment	target lexical item	as appeared in the test	gloss
/c/	/c/*afë*	*qafë*	neck
	/c/*aj*	*qaj*	tea
	/c/*enë*	*qenë*	dog
	/c/*epë*	*qepë*	onion
	/c/*iell*	*qiell*	sky; heaven
	/c/*iri*	*qiri*	candle
	/c/*oftë*	*qoftë*	meatball
	/c/*ull*	*qull*	wet
	/c/*umesht*	*qumesht*	milk (T)
	/c/*ytet*	*qytet*	city
/ɟ/	/ɟ/*ak*	*gjak*	blood
	/ɟ/*ashtë*	*gjashtë*	six
	/ɟ/*alpë*	*gjalpë*	butter (T)
	/ɟ/*el*	*gjel*	rooster
	/ɟ/*el deti*	*gjel deti*	turkey
	/ɟ/*imnastikë*	*gjimnastikë*	gymnastics
	/ɟ/*oks*	*gjoks*	breast
	/ɟ/*u*	*gju*	knee
	/ɟ/*uhë*	*gjuhë*	language
	/ɟ/*ysmë*	*gjysmë*	half
/ʧ/	/ʧ/*adër*	*çadër*	umbrella
	/ʧ/*antë*	*çantë*	bag
	/ʧ/*akmak*	*çakmak*	cigarette lighter
	/ʧ/*arçaf*	*çarçaf*	bed sheet
	/ʧ/*elës*	*çelës*	key
	/ʧ/*aj*	*çaj*	tea
	/ʧ/*ikë*	*çikë*	girl (G); a little (T)
	/ʧ/*oj*	*çoj*	stand
	/ʧ/*ast*	*cast*	moment
	/ʧ/*ull*	*cull*	haircloth
/ʤ/	/ʤ/*aketë*	*xhaketë*	jacket
	/ʤ/*ami*	*xhami*	mosque
	/ʤ/*am*	*xham*	glass

Table 4.1 - *continued*		
/ʤ/*axha*	*xhaxha*	uncle
/ʤ/*ep*	*xhep*	pocket
/ʤ/*az*	*xhaz*	jazz
/ʤ/*eloz*	*xheloz*	jealous
/ʤ/*evahir*	*xhevahir*	jewel; precious stone
/ʤ/*ungël*	*xhungël*	jungle
/ʤ/*enet*	*xhenet*	Paradise

Each card was read three times consecutively in a predetermined, fixed order (that is given in Table 4.1), beginning with the target lexical items containing the word-initial voiceless palatal stops, then the voiced palatal stops, which were followed by the voiceless palato-alveolar affricates, and finally the voiced palato-alveolar affricates.

Due to various pronunciation issues, such as unnatural speech and performance issues, 283 of the 12,000 gathered tokens were not considered for the final analysis. For example, due to speech production errors which were extremely slow and exaggerated, two out of the original 100 speakers were not included (120 tokens per speaker). Also, because of obvious performance errors and artifacts, 23 additional tokens were excluded. For example, instead of pronouncing the target word *çast* (/ʧast/) 'moment', one speaker uttered *rast* (/rast/) 'occasion' three times. Further, three tokens of *qaj* 'cry' were excluded because the speaker uttered a voiceless velar stop instead of a voiceless palatal stop (e.g. /k/*aj* for /c/*aj* '(I) cry'). Additionally, 17 other tokens were eliminated because they were pronounced as palatal glides instead of voiced palatal stops (e.g. [j]*imnastikë* for [ɟ]*imnastikë* 'gymnastic'). As a result of the exclusions, 11,717 tokens were included in the final analysis.

4.3. Data Management

The speech of the subjects was recorded using a Toshiba Satellite 1755 laptop computer running Speech Analyzer (Version 1.06a) software; input was collected by means of a Laptech microphone and a Shure microphone[38] attached directly to the computer, providing on-site digitization of all data.

Figure 4.1 provides a sample of one token from the corpus for the voiceless palato-alveolar affricate in the frame sentence, i.e. *Thuaj* /ʧ/*aj prapë* ('Say tea again.') as spoken by speaker 9 (a female Gheg speaker). As illustrated in figures 4.3-4.4, each target segment was measured based on the temporal acoustic cues which were used by Dorman, Raphel, and Isenberg (1980) for the perception of affricates:

a) affricate duration (i.e. segment duration). Total duration of the target segments was measured beginning with the onset of the consonantal silence (where the F1 and F2 of the preceding vowel end) and ending at the point where the F1 and F2 of the following vowel begin.

b) stop duration (i.e. closure duration). Duration of the stop portion of the target segment was measured beginning with the onset of the silence until the end of

[38]Initially an external handheld Labtech microphone (unidirectional Noise Canceling and Amplification Technology, NCAT) with specifications of a sensitivity level of –67 dB/uBar, -47dBV/Pascal +/-4dB, a mic power source voltage of 1.5V DC, an impedance of 2000 ohms, and a frequency response of 100-16,000 Hz was used. However, due to technical problems, later a handheld Shure microphone (Model 16A cardioid unidirectional, with output level at 1kHz, open circuit voltage at -68.0dB, maximum SPL at 1 kHz of 120 dB, and weight of 127 g) was used.

the burst (i.e. release) and the onset of the frication of the following fricative portion.

c) frication duration (i.e. release duration). Duration of the release portion of the target was measured beginning at the onset of frication in the waveform and the spectrogram (i.e. once the 'noise' appears in both the raw waveform and spectrogram) and ending at the onset of F1 and F2 in the following vowel (i.e. at the end of the frication).

d) rise time of frication (RT). RT of the target segment was measured at the onset of frication in the waveform (i.e. onset of 'noise' in the raw waveform) and ceased at the peak of frication in the raw waveform.

It should be noted that before the measurements were made, noise interferences (i.e. background noise and murmurs) were filtered out using Cool Edit 2000.

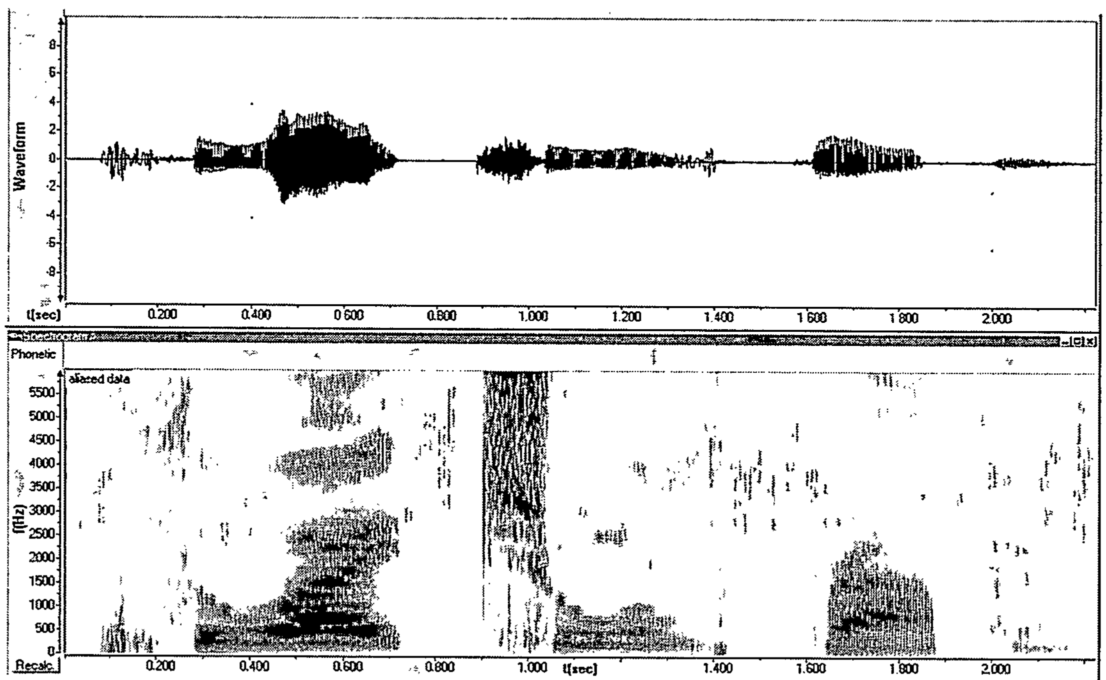

Figure 4.1: Waveform and spectrogram of the frame sentence *Thuaj çaj prapë.* 'Say tea again.' /θuaj ʧaj pɹap/, which contains the target voiceless palato-alveolar affricate /ʧ/ in the target word *çaj* 'tea'. (This sample of speech is taken from speaker nine, a female native speaker of Gheg.)

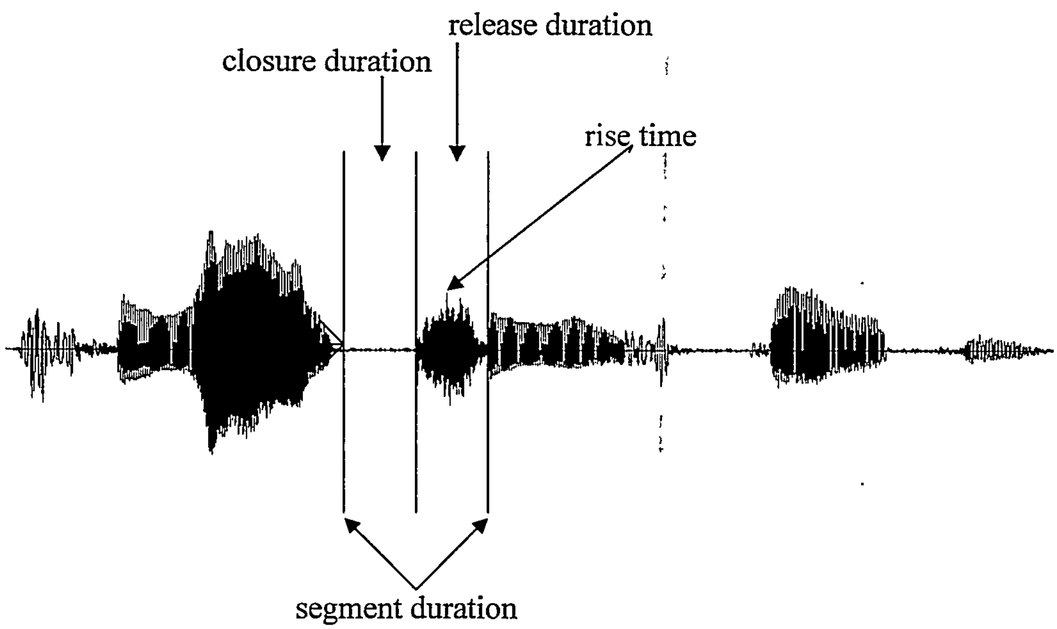

Figure 4.2: Temporal waveform measurements

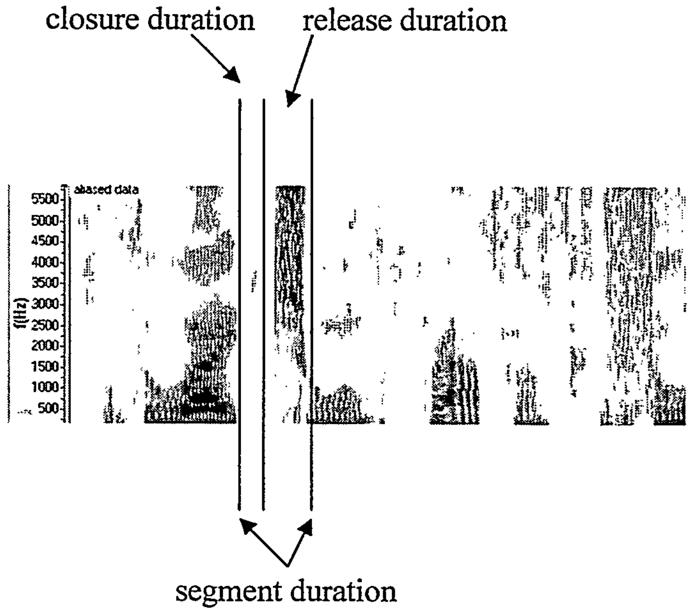

Figure 4.3: Temporal spectrographic measurements

Based on the aforementioned temporal acoustic measurements, the following calculations were made:

e) relative frication duration (i.e. relative release duration). Relative release duration of the target segment was calculated by dividing the release duration by the total duration of the same target segment. This measurement can theoretically range from 0% (a release-free stop) to 100% (a true fricative).

f) relative Rise Time (RT divided by release duration). Relative RT of the release portion of the target segment was calculated by dividing the RT by the release duration of the same target segment. According to Johnson (1997: 138), shorter relative rise times are most often associated with affricates, while longer relative RTs are usually associated with fricatives.

Table 4.2 provides an example of the temporal acoustic variable measurements and calculations for the phonemic voiceless palatal stop and voiceless palato-alvoelar affricate in Albanian. In Table 4.2, the target segment /c/ in the frame sentence *Thuaj qaj prapë* 'Say cry again' has a segment duration of 153 ms, a closure duration of 64 ms, a release duration of 89 ms, a relative release duration of 58%, a RT of 37 ms, and a relative RT of 41%. Similarly, the target segment /ʧ/ in the frame sentence *Thuaj çaj prapë* 'Say tea again' has a segment duration of 151 ms, a closure duration of 67 ms, a release duration of 84 ms, a relative release duration of 56%, a RT of 33 ms, and a relative RT of 39%.

Table 4.2: Temporal acoustic variable measurements and calculations for /c/ of *qaj* (i.e. /c/*aj* '(I) cry') and /ʧ/ of *çaj* (i.e. /ʧ/*aj* 'tea'), respectively. (These samples of speech are from speaker nine, a female native speaker of Gheg uttering the frame *Thuaj* ___ *prapë* 'Say ___ again')

subject	target segment	segment dur.	closure dur.	release dur.	RT	relative release dur.	rel RT
9	/c/	153 ms	64 ms	89 ms	37 ms	58%	41%
9	/ʧ/	151 ms	67 ms	84 ms	33 ms	56%	39%

In order to answer the basic question as to whether there are significant differences in the discerned acoustic behavior of the (palatal) stops and (palato-alveolar) affricates, a series of statistical tests to compare the mean values for the following six temporal acoustic properties (see dependent variables below) of each token in the corpus was conducted using SPSS (version 11.5).

Dependent Variables (i.e. acoustic variables):

1. segment duration
2. closure duration
3. release duration
4. relative release duration
5. rise time (RT)
6. relative RT

The primary independent variable that serves as the basis of comparison in t-tests and ANOVAs is the target segments' manner of articulation: stop vs. affricate. Also of potential importance is the subjects' native variety (i.e. Gheg vs. Tosk), gender (i.e. male vs. female), and age. Other independent variables that may help to explain any observed systematic differences in the corpus include those based on segmental attributes of the target segment, such as:

a. phonemic manner of articulation (i.e. stop or affricate)
b. phonemic place of articulation (i.e. palatal or palato-alveolar)
c. phonemic voicing (i.e. voiceless or voiced)
d. target segment (i.e. /c ɟ tʃ dʒ /)

Other independent variables that could account for the observed differences in the data could be those based on context, such as

e. phonological stress level (i.e. whether in a stressed or unstressed syllable) and

f. number of syllables in the word (i.e. monosyllabic -1 , bisyllabic - 2, polysyllabic – 3+.).

Analysis began by conducting t-tests for each of six dependent acoustic variables. Subsequent analyses included more complex ANOVAs, whereby one was able to discern potential interactions among the dependent variables. The ultimate goal was to understand which (if any) language-internal and –external variables could be involved in understanding the observed acoustic variation among the data.

In an attempt to ascertain the exact place of articulation of the target segments, an additional analysis was conducted which dealt with the spectral characteristics of the release. According to Nartey (1982, see also Kent and Read 1992: 129), palato-alveolar and palatal sibilants (i.e. stridents, such as palato-alveolar and palatal fricatives) have two spectral peaks (i.e. 1.0-2.0 kHz and 2.3-5.3 kHz for palato-alveolars; 0.9-1.3 kHz and 2.7-4.4 kHz for palatals). However, Beci (1995: 366, 369, 371, 374) found that the release portion of the Albanian palatal stop has an average frequency range from 2500-3000 to 8000 Hz and the release portion of the Albanian palato-alveolar affricate has an average frequency range from 2000 Hz to 8000 Hz. Further, Guion's (1996: 82-83) findings indicate a single "peak spectral frequency" for palato-alveolar affricates and velar stops before front and back vowels in English. In Schwartz's (2000: 83, 105) investigation of spectral characteristics of [ts], [tʃ], and [tɕ] in Lemko, he measured the low and high spectral frequencies of the release (i.e. frication) in the target segments; Schwartz also measured the onset of the second formant in the preceding vowel and the spectral peaks in the release.

The five additional acoustic measurements which were made for each target segment include: (1) Low Hz (i.e. the lowest frequency of the noise), (2) High Hz (i.e. the highest frequency of the noise), (3) F2 Onset (i.e. the onset of the second vowel formant in the vowel following the target segment), (4) minimal spectral peak, and (5) and maximal spectral peak (i.e. the primary spectral peak). Measurements (1) through (3) were taken from the spectrograms, as is illustrated in Figure 4.4; measurements (4) and (5) were taken from the spectrum based on the Fast Fourier Transform (FFT), as is illustrated in Figure 4.5. As can be seen in Table 4.3 , the measurements in figures 4.4 and 4.5 are as follows: Low Hz is 2182 Hz, High Hz is 9721 Hz, F2 Onset is 2308 Hz, Minimal Spectral Peak is 275 Hz, and Maximal Spectral Peak is 3058 Hz:

Low Hz	High Hz	F2 Onset	Min Spectral Peak	Max Spectral Peak
2182 Hz	9721 Hz	2308 Hz	275 Hz	3058 HZ

This second analysis was conducted using Praat,[39] which allows one to obtain very accurate frequency readings. Further, this second analysis included four subjects who were used in the first analysis: two native speakers of Gheg (one male and one female) and two native speakers of Tosk (one male and one female). No new recordings were made for this second analysis; rather, data already collected for the first analysis were used. As with the first analysis on the temporal characteristics for manner

[39]Version 4.0.41, copyright 1992-2003 by Paul Boersma and David Weenink.

of articulation, univariate ANOVAs were used to discern various interactions which account for variation in the data.

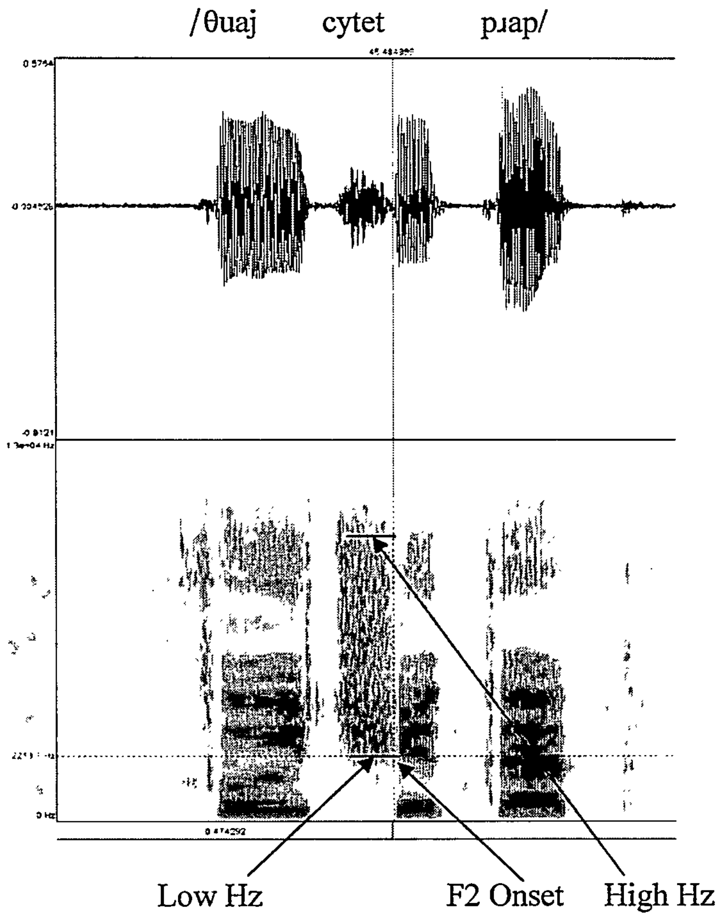

Figure 4.4: Spectrographic measurements for target segment /c/ in the target word /c/*ytet* 'city' from the frame sentence *Thuaj qytet prapë* 'Say city again' /θuaj cytet pɹap/. (This sample of speech is taken from speaker nine, a female native speaker of Gheg.)

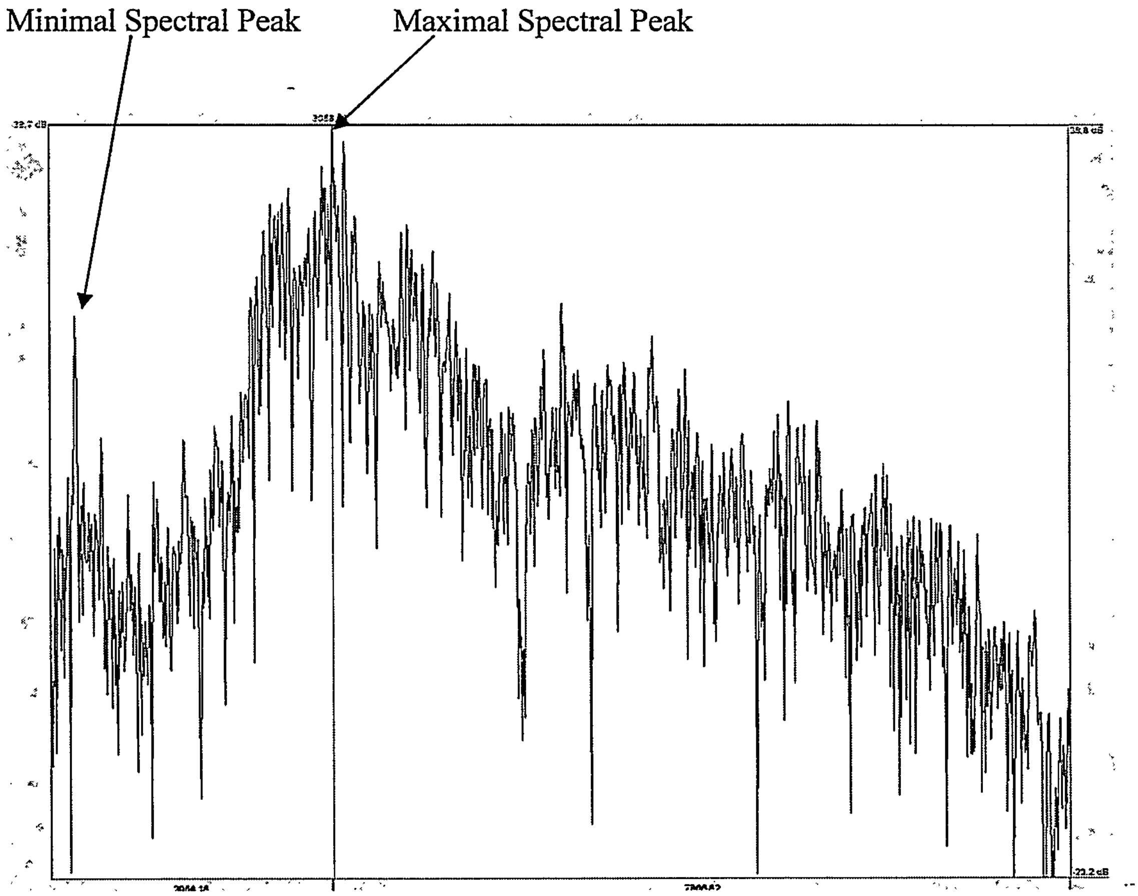

Figure 4.5: Spectral measurements of the FFT for the target segment /c/ in the target word /c/*ytet* 'city' from the frame sentence *Thuaj qytet prapë* 'Say city again' /θuaj cytet pɹap/. (This sample of speech is taken from speaker nine, a female native speaker of Gheg.)

Table 4.3: Temporal and spectral acoustic variable measurements in Hz for the target segment /c/ in the target word /c/*ytet* 'city' from the frame sentence *Thuaj qytet prapë* 'Say city again' /θuaj cytet pɹap/. (This sample of speech is taken from speaker nine, a female native speaker of Gheg.)

subject	target segment	Low Hz	High Hz	F2 Onset	Min Spectral Peak	Max Spectral Peak
9	/c/	2182	9721	2308	275	3058

4.4. Summary

The goal of this chapter was to lay out the procedures involved in collecting, measuring, and analyzing the acoustic data for the acoustic study of palatal stops and palato-alveolar affricates in Albanian, both in terms of their temporal and spectral characteristics. In the following chapter the results are presented and contextualized in terms of phonological and sociolinguistic issues regarding palatalization in Albanian.

CHAPTER 5

RESULTS AND DISCUSSION OF THE ACOUSTIC STUDY

As has previously been mentioned, the main hypothesis which this dissertation sets out to test is whether Albanian palatal stops pattern more like stops or like affricates. The results of the temporal acoustic analysis reported in this chapter indicate that the phonemic palatal stops pattern phonetically like affricates: there is little or no statistically significant difference between the levels of frication (especially relative release duration) for palatal stops and palato-alveolar affricates across varieties in Albanian. The results of the spectral analysis, however, indicate that across varieties there is a slight difference in terms of place of articulation for the phonemic palatal stops and palato-alveolar affricates. Overall, the findings support the claim that a merger of these sounds is taking place in the language, i.e. a sound change in progress, whereby the marked palatal stops are being lost in favor of the less marked palato-alveolar affricates.

5.1. Temporal Characteristics of the Target Segments

5.1.1 Distribution of Phonetic Realizations

Although phonemic voiceless and voiced palatal stops and phonemic voiceless and voiced palato-alveolar affricates were the target segments of the acoustic study, initial impressionistic evaluation revealed that affricate productions predominated: out of 11,717 tokens considered in the final analysis, voiceless and voiced palato-alveolar, alveo-palatal, and palatal fricatives were also produced by the subjects as surface representations. It should be noted that the majority of the affricates and fricatives which surfaced were palato-alveolar. As is illustrated in the Table 5.1 (see also Figure 5.1), when the target segment was a phonemic palatal stop, 11 (0.2%) palatal stops, 10,784 (88.8%) affricates, and 922 (11%) fricatives were uttered. When the target segment was a phonemic palato-alveolar affricate, 5,589 (95.2%) affricates and 279 (4.8%) fricatives were produced, as would be expected (see also Figure 5.2). In short, although the phonemic inventory of Albanian does contain palatal stops, these stop phonemes tend to be phonetically realized more frequently as affricates, particularly in the palato-alveolar region, and less frequently as fricatives.

Table 5.1: Frequency of possible phonetic realizations according to target segment (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all subjects)

		Phonetic	Realization	(SR)	
		palatal stop	palato-alveolar affricate	palato-alveolar fricative	total
Phonemic Form (UR)	voiceless palatal stop	0	2,526 (86.3%)	400 (13.7%)	2,926 (100%)
	voiced palatal stop	11 (0.4%)	2,669 (91.3%)	243 (8.3%)	2,923 (100%)
	subtotal	11 (0.2%)	5,195 (88.8%)	643 (11%)	5,849 (100%)
	voiceless palato-alveolar affricate	0	2,791 (95.3%)	137 (4.7%)	2,928 (100%)
	voiced palato-alveolar affricate	0	2,798 (95.2%)	142 (4.8%)	2,940 (100%)
	subtotal	0	5,589 (95.2%)	279 (4.8%)	5,868 (100%)
	total	11 (0.1%)	10,784 (92.0%)	922 (7.9%)	11,717 (100%)

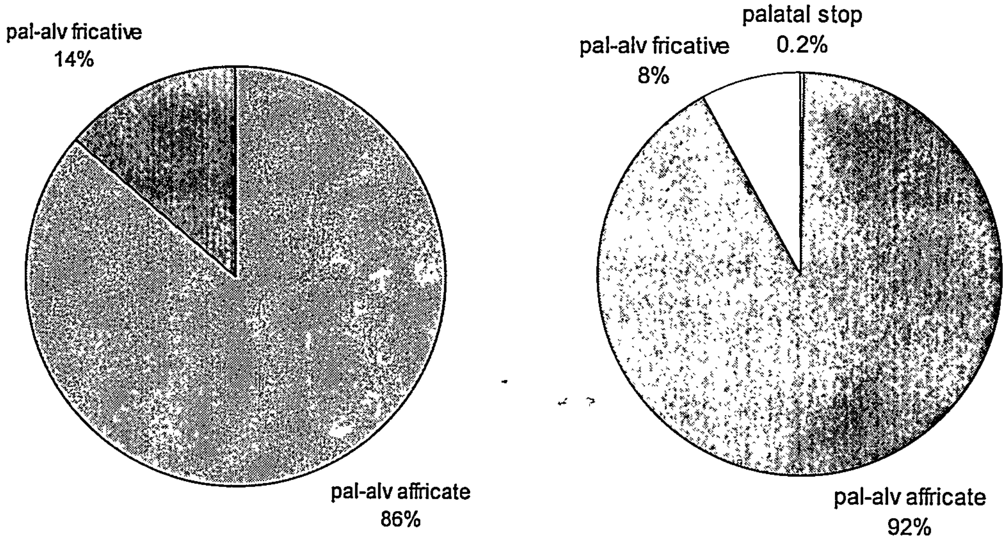

Figure 5.1: Surface representations (SR) of palatal stop phonemes (UR) for the Gheg and the Tosk varieties, respectively. (Note that no palatal stops were realized phonetically for the Gheg speakers; also for the Tosk speakers only 0.2% of the phonemic palatal stops were realized phonetically as palatal stops.)

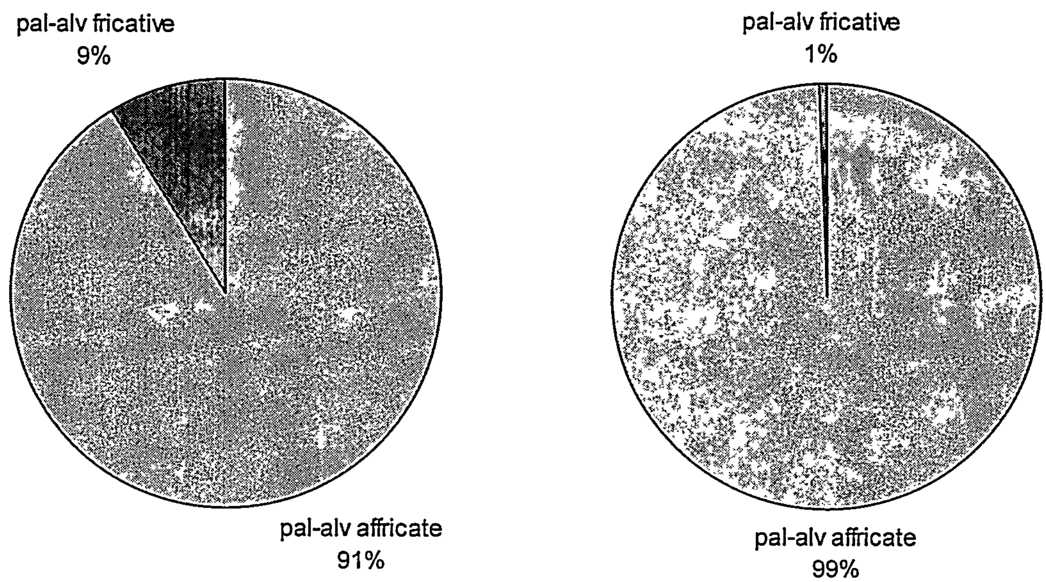

Figure 5.2: Surface representations (SR) of palato-alveolar affricate phonemes (UR) for the Gheg and Tosk varieties, respectively. (Note that mainly palato-alveolar affricates were realized phonetically for both the Gheg speakers.)

5.1.2 Segment Duration

In terms of segment duration, although Tosk speakers have longer mean durations for both the phonemic palatal stops (134.81 ms) and phonemic palato-alveolar affricates (135.73 ms) than the Gheg speakers (131.47 ms and 129.47 ms, respectively), as illustrated in Table 5.2,[40] these differences were not statistically significant (see Table 5.3). Also, whereas the Gheg speakers have a longer mean duration for the phonemic palatal stop (131.47 ms) than for the phonemic palato-alveolar affricate (129.47 ms), the Tosk speakers have a longer mean duration for the phonemic palato-alveolar affricate (135.73 ms) than for the phonemic palatal stop (134.81 ms). As occurred with the phonemic palatal stops, the apparent differences for phonemic affricates, however, were not found to be statistically significant (see Table 5.3).

The results of the univariate ANOVA in terms of segment duration are summarized in Table 5.3. In terms of segment duration, variety, manner of articulation, and repetition were not found to be statistically significant. These statistical findings suggest that the overall segment duration of palatal stops and palato-alveolar affricates in Albanian appears to be the same, even across varieties.

[40]The mean values, standard deviations, and univariate ANOVA results are provided below for all the phonetic realizations (SR) of the phonemic palatal stops and palato-alveolar affricates (UR), which include the (1) palatal stops (n= 11), (2) palato-alveolar affricates (n= 10,784), and (3) the fricatives (n= 922). It should be noted that when performing all the univariate ANOVAs in this study, variety and manner were considered fixed factors and repetition was considered a random factor.

Table 5.2: Mean values (and standard deviation) for segment duration (ms) according to variety (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	131.47 (34.9)	134.81 (40.1)	133.14 (37.6)
	palato-alveolar affricate	129.47 (36.9)	135.73 (38.4)	132.60 (37.8)
	total	130.46 (36.0)	135.28 (39.2)	132.87 (37.7)

Table 5.3: ANOVA summary for segment duration (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all subjects)

		degrees of freedom	F-value	level of sig. (p < 0.05)
main effects	variety (Gheg, Tosk)	1	4.412	0.170
	manner (stop, affricate)	1	2.638	0.246
	repetition (1, 2, 3)	2	10.156	0.097
interactions				
	variety*manner	1	9.456	0.091
	variety*rep	2	22.960	0.042*
	manner*rep	2	0.461	0.684
	variety*manner*rep	2	0.481	0.618

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.1.3 Closure Duration

In terms of closure duration, as illustrated in Table 5.4 and Table 5.5, the Tosk speakers have statistically significant longer mean durations for the phonemic palatal stop (71.26 ms) and phonemic palato-alveolar affricate (76. 87 ms) than the Gheg speakers (64.01 ms and 66.65 ms, respectively). Also, both the Tosk and Gheg speakers have longer mean durations (p = 0.005) for the phonemic palato-alveolar affricates (76.87 ms and 66.65 ms, respectively) than for the phonemic palatal stops (71.26 ms and 64.01 ms, respectively).

The results of the univariate ANOVA in terms of the acoustic variable closure duration are provided in Table 5.5. In terms of closure duration, both variety and manner of articulation were found to be statistically significant. Repetition, however, is not significant. That is, for closure duration, variety and manner of articulation account for some of the variation.

Table 5.4: Mean values (and s.d.) for closure duration (ms) according to variety (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	64.01 (33.3)	71.26 (36.1)	67.62 (34.9)
	palato-alveolar affricate	66.65 (30.5)	76.87 (25.5)	71.76 (28.5)
	total	65.33 (31.9)	74.07 (31.3)	69.70 (31.9)

Table 5.5: ANOVA summary for closure duration (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	23.935	0.039*
	manner (stop, affricate)	1	196.199	0.005*
	repetition (1, 2, 3)	2	4.668	0.184
interactions				
	variety*manner	1	14.421	0.063
	variety*rep	2	20.768	0.046*
	manner*rep	2	0.568	0.638
	variety*manner*rep	2	0.454	0.635

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.1.4. Release Duration

In terms of release duration, the Gheg speakers have longer mean durations ($p = 0.017$) for both the phonemic palatal stop (67.46 ms) and the phonemic palato-alveolar affricate (62.81 ms), than the Tosk speakers (63.56 ms and 58.86 ms, respectively), as is expressed in Table 5.6. The Gheg and Tosk speakers have longer mean durations for the phonemic palatal stops (67.46 ms and 63.56 ms, respectively), than for the phonemic palato-alveolar affricates (62.81 ms and 58.86 ms, respectively), $p = 0.001$.

Detailed results of the univariate ANOVA in terms of the acoustic variable release duration are provided in Table 5.7. In terms of release duration, variety, manner of articulation, and repetition were found to be statistically significant. Their interactions, however, are non significant.

Table 5.6: Mean values (and s.d.) for release duration (ms) according to variety (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	67.46 (32.7)	63.56 (30.7)	65.51 (31.8)
	palato-alveolar affricate	62.81 (28.2)	58.86 (24.9)	60.84 (26.7)
	total	65.13 (30.6)	61.20 (28.0)	63.17 (29.4)

Table 5.7: ANOVA summary for release duration (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	59.067	0.017*
	manner (stop, affricate)	1	1903.905	0.001*
	repetition (1, 2, 3)	2	46.987	0.028*
interactions				
	variety*manner	1	0.013	0.919
	variety*rep	2	11.205	0.082
	manner*rep	2	0.492	0.670
	variety*manner*rep	2	0.080	0.923

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.1.5 Relative Release Duration

In terms of relative release duration, the Gheg speakers have statistically significant longer mean durations for the phonemic palatal stop (51.86 ms) and the phonemic palato-alveolar affricate (49.01 ms), than the Tosk speakers (47.66 ms and 42.94 ms, respectively), as is expressed in Tables 5.8 and 5.9. As was the case with the acoustic variable release duration, the Gheg and Tosk speakers have longer mean durations for the phonemic palatal stop (51.86 ms and 47.66 ms, respectively) than for the phonemic palato-alveolar affricate (49.01 ms and 42.94 ms, respectively). Repetition was not found to be statistically significant.

Table 5.8: Mean values (and s.d.) for relative release duration according to variety (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	51.86% (0.216)	47.66 % (0.204)	49.76 % (0.211)
	palato-alveolar affricate	49.01% (0.187)	42.94% (0.122)	45.98% (0.161)
	total	50.43% (0.203)	45.29% (0.170)	47.87% (0.189)

Table 5.9: ANOVA summary for relative release duration (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	228.844	0.004*
	manner (stop, affricate)	1	793.434	0.001*
	repetition (1, 2, 3)	2	0.504	0.710
interactions				
	variety*manner	1	18.597	0.050
	variety*rep	2	2.448	0.290
	manner*rep	2	0.383	0.723
	variety*manner*rep	2	0.397	0.673

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.1.6 Rise Time

In terms of Rise Time, as appears in Table 5.10, although it seems that the Tosk speakers have shorter mean durations for the phonemic palatal stop (36.44 ms) and phonemic palato-alveolar affricate (30.24 ms) than do the Gheg speakers (38.08 ms and 33.28 ms, respectively), the results of the univariate ANOVA in Table 5.11 indicate that this difference is not statistically significant. Also, as can be seen in Table 5.10, the phonemic palato-alveolar affricate appears to be shorter than the phonemic palatal stop, as occurred with release duration and relative duration. However, as is illustrated in Table 5.11, this difference in RT is not statistically significant. Also, although repetition is not statistically significant, manner of articulation is statistically significant.

Table 5.10: Mean values (and s.d.) for Rise Time (ms) according to variety (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	38.08 (22.6)	36.44 (21.6)	37.26 (22.1)
	palato-alveolar affricate	33.28 (19.2)	30.24 (16.4)	31.76 (17.9)
	total	35.68 (21.1)	33.33 (19.4)	34.51 (20.3)

Table 5.11: ANOVA summary for Rise Time (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	7.262	0.115
	manner (stop, affricate)	1	1086.443	0.001*
	repetition (1, 2, 3)	2	12.625	0.077
interactions				
	variety*manner	1	12.735	0.070
	variety*rep	2	19.561	0.049*
	manner*rep	2	0.723	0.580
	variety*manner*rep	2	0.281	0.755

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.1.7 Relative Rise Time

In terms of relative Rise Time, as is illustrated in Table 5.12, although the Tosk speakers have a longer mean duration for the phonemic palatal stop (57.27%) than the

Gheg speakers (56.61%), and the Gheg speakers have a longer mean duration for the phonemic palato-alveolar affricate (53.02%), than the Tosk speakers (51.83%), the findings of the univariate ANOVA indicate that these differences are not statististically significant, as is expressed in Table 5.13. Further, as is illustrated in Table 5.13, repetition is not significant, but manner is statistically significant (as was the case with RT). That is, for relative RT, variety and repetition are not responsible for the variation; manner of articulation, however, is responsible for at least some of the variation.

Table 5.12: Mean values (and s.d.) for relative Rise Time according to variety (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	56.61% (0.166)	57.27% (0.167)	56.94% (0.166)
	palato-alveolar affricate	53.02% (0.169)	51.83% (0.172)	52.42% (0.171)
	total	54.81% (0.168)	54.54% (0.172)	54.67% (0.170)

Table 5.13: ANOVA summary for relative Rise Time (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	0.103	0.779
	manner (stop, affricate)	1	2600.136	0.000*
	repetition (1, 2, 3)	2	5.298	0.180
interactions				
	variety*manner	1	17.616	0.052
	variety*rep	2	14.150	0.066
	manner*rep	2	0.163	0.860
	variety*manner*rep	2	0.496	0.609

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.2 Distributions for Phonetic Realizations of Affricates

So as to better understand the acoustic characteristics of the majority of the phonetic realizations, that being segments which contain both a closure duration component (i.e. stop) and a release component (i.e. frication), sections 5.2-5.4 will focus specifically on the surface representations of the affricates (n = 10,784).

5.2.1 Segment Duration

In terms of segment duration, as appears in Table 5.14, Tosk speakers have longer mean durations for both the phonemic palatal stops (137.09 ms) and phonemic palato-alveolar affricates (136.11 ms) than the Gheg speakers (133.37 ms and 131.48 ms, respectively). Also note that, overall, the Tosk speakers have longer segments than the Gheg speakers (136.58 ms and 132.40 ms, respectively). As is illustrated in Table

5.15, the results of the univariate ANOVA indicate that these apparent differences are not statistically significant. Also, manner of articulation and repetition were not found to be statistically significant. One important observation is that the random factor, i.e. repetition, is indeed statistically insignificant, as was expected. As was the case when all the phonetic surface representations were considered, these statistical findings suggest that the overall segment duration of palatal stops and palato-alveolar affricates in Albanian appears to be the same, even across varieties.

Table 5.14: Mean values (and s.d.) for segment duration (ms) according to variety (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	133.37 (33.6)	137.09 (39.3)	135.28 (36.7)
	palato-alveolar affricate	131.48 (36.4)	136.11 (38.2)	133.90 (37.4)
	total	132.40 (35.1)	136.58 (38.7)	134.56 (37.1)

Table 5.15: ANOVA summary for segment duration (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	3.284	0.212
	manner (stop, affr)	1	28.737	0.053
	repetition (1, 2, 3)	2	9.522	0.095
interactions				
	variety*manner	1	4.011	0.183
	variety*rep	2	76.658	0.013*
	manner*rep	2	1.003	0.499
	variety*manner*rep	2	.135	0.874

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.2.2 Closure Duration

In terms of closure duration, although whereas Gheg speakers have a mean duration of 74.27 ms for the phonemic palatal stop, Tosk speakers have a mean duration of 77.66 ms, as appears in Table 5.16, these differences were not found to be statistically significant (see Table 5.17). Similarly, even though Gheg speakers also have a shorter mean duration for the phonemic palato-alveolar affricates (73.13 ms) than the Tosk speakers (77.37 ms), these differences are not statistically significant (see Table 5.17). Further, the results of the univariate ANOVA, which are provided in Table 5.17, also indicate that manner of articulation and repetition are not statistically significant and do not account for the variation in closure duration.

Table 5.16: Mean values (and s.d.) for closure duration (ms) according to variety (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	74.27 (22.9)	77.66 (30.5)	76.01 (27.1)
	palato-alveolar affricate	73.13 (23.4)	77.37 (24.8)	75.34 (24.2)
	total	73.68 (23.1)	77.51 (27.7)	75.67 (25.6)

Table 5.17: ANOVA summary for closure duration (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	8.340	0.102
	manner (stop, affricate)	1	8.359	0.102
	repetition (1, 2, 3)	2	7.788	0.107
interactions				
	variety*manner	1	11.319	0.078
	variety*rep	2	93.913	0.011*
	manner*rep	2	3.143	0.241
	variety*manner*rep	2	0.076	0.927

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.2.3 Release Duration

In terms of release duration, Tosk speakers had a longer mean duration (59.43 ms) than the Gheg speakers (59.10 ms) for the phonemic palatal stops, as in Table 5.18.

Likewise, the Tosk speakers also have a longer mean duration for the phonemic palato-alveolar affricates (58.74 ms) than the Gheg speakers (58.35 ms). These differences in terms of variety, however, were not found. However, the results of the univariate ANOVA in terms of the acoustic variable release duration, provided in Table 5.19, indicate that these differences are not significant. The only factor which was found to be statistically significant was manner of articulation. That is, differences in manner of articulation do account for some of the variation present regarding release duration.

Table 5.18: Mean values (and s.d.) for release duration (ms) according to variety (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	59.10 (21.8)	59.43 (25.4)	59.27 (23.7)
	palato-alveolar affricate	58.35 (22.8)	58.74 (24.8)	58.55 (23.9)
	total	58.71 (22.3)	59.07 (25.1)	58.90 (23.8)

Table 5.19: ANOVA summary for release duration (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	0.120	0.762
	manner (stop, affricate)	1	102.613	0.010*
	repetition (1, 2, 3)	2	13.470	0.105
interactions				
	variety*manner	1	0.038	0.863
	variety*rep	2	8.455	0.106
	manner*rep	2	0.043	0.958
	variety*manner*rep	2	0.529	0.589

*** indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).**

5.2.4 Relative Release Duration

In terms of relative release duration, as is illustrated in Table 5.20, Gheg speakers have longer mean durations for both the phonemic palatal stops (44.14%) and the phonemic palato-alveolar affricates (44.06%) than the Tosk speakers (43.19% and 42.57%, respectively), which is contrary to the mean release durations, where the Tosk speakers had longer mean durations than the Gheg speakers.

The results of the univariate ANOVA in terms of the acoustic variable relative release duration are provided in Table 5.21. In terms of relative release duration, while manner of articulation and repetition were not found to statistically account for the variation found in relative release duration, the variety does seem to matter. Although variety, alone, accounts for some of the variation, when it interacts with manner and/or repetition, it does not. These statistical findings suggest that the phonemic palatal stops pattern more like affricates than stops.

Table 5.20: Mean values (and s.d.) for relative release duration (ms) according to variety (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	44.1% (0.106)	43.1% (0.135)	43.6% (0.122)
	palato-alveolar affricate	44.0% (0.104)	42.5% (0.114)	43.2% (0.109)
	total	44.1% (0.105)	42.8% (0.124)	43.4% (0.115)

Table 5.21: ANOVA summary for relative release duration (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	130.417	0.008*
	manner (stop, affricate)	1	3.972	0.184
	repetition (1, 2, 3)	2	98.979	0.990
interactions				
	variety*manner	1	1.737	0.318
	variety*rep	2	0.286	0.778
	manner*rep	2	0.752	0.571
	variety*manner*rep	2	0.803	0.448

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.2.5 Rise Time

In terms of RT, whereas the Tosk speakers have a longer mean duration for the phonemic palatal stops (33.19 ms), than the Gheg speakers (33.06 ms), the Gheg speakers have a longer mean for the phonemic palato-alveolar affricates (30.66 ms), than the Tosk speakers (30.09 ms), as is shown in Table 5.22. However, the results of the univariate ANOVA in terms of the acoustic variable Rise Time, summarized in Table 5.23, indicate that these differences between varieties, are not statistically significant. Further, in terms of Rise Time, while repetition was not significant, manner of articulation was, and therefore accounts for some of the variation.

Table 5.22: Mean Values (and s.d.) for Rise Time (ms) according to variety (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	33.06 (15.6)	33.19 (16.7)	33.13 (16.2)
	palato-alveolar affricate	30.66 (16.3)	30.09 (16.2)	30.36 (16.2)
	total	31.82 (16.0)	31.58 (16.5)	31.69 (16.3)

Table 5.23: ANOVA summary for Rise Time (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

		degrees of freedom	F-value	level of sig. (p < 0.05)
main effects	variety (Gheg, Tosk)	1	0.049	0.846
	manner (stop, affricate)	1	2514.103	0.000*
	repetition (1, 2, 3)	2	9.959	0.146
interactions				
	variety*manner	1	0.615	0.515
	variety*rep	2	6.637	0.131
	manner*rep	2	0.017	0.983
	variety*manner*rep	2	1.767	0.171

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.2.6 Relative Rise Time

In terms of relative RT, as is expressed in Table 5.24, whereas the Tosk speakers have a longer mean duration (56.52%) for the phonemic palatal stop than the Gheg speakers (56.23%), the Gheg speakers have a longer mean duration for the phonemic palato-alveolar affricates (52.64%) than the Tosk speakers (51.73%), which is similar to the mean RT durations. However, the results of the univariate ANOVA in terms of the acoustic variable relative RT, summarized in Table 5.25, indicate that these differences are not statistically significant, as is also the case with repetition. In terms of relative RT, only manner of articulation was found to be statistically significant.

That is, since variety and repetition were not found to be statistically significant, they do not account for the variation.

Table 5.24: Mean values (and s.d.) for relative Rise Time according to variety (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	56.2% (0.160)	56.5% (0.168)	56.3% (0.164)
	palato-alveolar affricate	52.6% (0.167)	51.7% (0.172)	52.1% (0.170)
	total	54.3% (0.165)	54.0% (0.172)	54.1% (0.168)

Table 5.25: ANOVA Summary for relative RT (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	0.168	0.721
	manner (stop, affricate)	1	672.410	0.001*
	repetition (1, 2, 3)	2	7.644	0.165
interactions				
	variety*manner	1	3.305	0.211
	variety*rep	2	5.968	0.144
	manner*rep	2	0.252	0.799
	variety*manner*rep	2	0.999	0.368

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.2.7 Distribution of Phonetic Realizations According to Manner of Articulation

As illustrated in Table 5.26, the mean values, standard deviations, and results of the one-way ANOVA are provided below for the phonetic realizations (SR) of the phonemic palatal stops and palato-alveolar affricates (UR) which contain both a closure (i.e. stop) component and a release component (i.e. frication), i.e. the affricates (n= 10,784), in terms of manner of articulation (i.e. stop or affricate).

As can be seen in the Table 5.26, while the mean segment duration for the phonemic palatal stops was 135.28 ms, the mean segment duration for the phonemic palato-alveolar affricates was 133.90 ms. Also, whereas the mean closure duration for the phonemic palatal stops was 76.01 ms, the mean closure duration for the phonemic palato-alveolar affricates was 75.34 ms (see also Figure 6). As was the case with the segment duration and closure durations, both the release duration (see also Figure 7) and relative release duration (see also Figure 8) were longer for the phonemic palatal stops (59.27 ms and 43.6%, respectively) than for the phonemic palato-alveolar affricates (58.55 ms and 43.2%, respectively). Similarly, both the RT (see also Figure 9) and relative RT (see also Figure 10) were longer for the phonemic palatal stops (33.13 ms and 56.3%) than for the phonemic palato-alveolar affricates (30.36 ms and 52.1%).

Table 5.26: Means, standard deviations, and ANOVA summary for manner of articulation (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

acoustic variable	manner	mean value	s.d.	difference (stop-affric)	level of sig. ($p \leq 0.05$)
segment duration	stop affricate	135.28 ms 133.90 ms	36.7 37.4	1.38 ms	0.053
closure duration	stop affricate	76.01 ms 75.34 ms	27.1 24.2	0.67 ms	0.177
release duration	stop affricate	59.27 ms 58.55 ms	23.7 23.9	0.72 ms	0.117
relative release duration	stop affricate	43.6% 43.2%	0.122 0.109	0.4%	0.101
Rise Time	stop affricate	33.13 ms 30.36 ms	16.2 16.2	2.77 ms	0.000*
relative RT	stop affricate	56.3% 52.1%	0.164 0.170	4.2%	0.000*

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$)

Although the mean values of the segment durations, closure durations, release durations, and relative release durations for the phonemic palatal stops and phonemic palato-alveolar affricates are different, they are not statistically different. The mean differences for the RT and relative RT for the phonemic palatal stops and phonemic palato-alveolar affricates, however, are statistically significant. That is, whereas the means for RT and relative RT were different enough to be statistically different, the means for segment duration, closure duration, release duration, and relative release duration for the target palatal stops and palato-alveolar affricates were not different enough to be considered statistically significant. It should be noted that according to the RT and relative RT durations, whereas the phonemic palatal stops seem to be behaving more fricative-like (i.e. longer RT), the phonemic palato-alveolar affricate are patterning more like affricates (i.e. shorter RT).[41] In short, the phonemic palatal stops pattern more like palato-alveolar affricates in terms of segment duration, closure duration, release duration, and relative release duration, but not in terms of RT.

5.2.8 Distribution of Phonetic Realizations According to Voicing

As was the case with manner of articulation, the majority of the output in terms of phonemic voicing resulted in palato-alveolar affricates. As is illustrated in the Table 5.27, whereas 5,317 (90.8%) out of 5,854 voiceless tokens resulted in affricates, 537 (9.2%) were fricatives. Similarly, whereas 5,467 (93.2%) out of 5,863 voiced tokens were affricates, 385 (6.6%) resulted in fricatives. Unlike the voiceless segments, however, 11 voiced tokens surfaced as palatal stops (.2%), as was mentioned earlier.

As is expressed in Table 5.28, whereas the voiceless segments (i.e. the phonemic voiceless palatal stop and voiceless palato-alveolar affricate) were found to have a mean segment duration of 151.69 ms, closure duration of 77.11 ms, release duration of 74.58 ms, relative release duration of 49.5%, RT of 37.56 ms, and relative RT of 49.5%, the voiced segments (i.e. the phonemic voiced palatal stop and voiced palato-alveolar affricate) were found to have a mean segment duration of 117.91 ms, closure duration of 74.26 ms, release duration of 43.65 ms, relative release duration of 37.5%, RT of 26 ms, and relative RT of 58.7%. For all the acoustic variables, the voiceless segments had longer mean durations than the voiced segments. The differences in mean values for all six acoustic variables in terms of voicing were found to be statistically different.

[41] See Schwartz (2000) for a similar finding regarding Lemko.

Table 5.27: Frequency of possible phonetic realizations (SR) according to phonemic voicing (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

		Phonetic Realization (SR)			
		palatal stop	palato-alveolar affricate	palato-alveolar fricative	total
Phonemic Voicing	voiceless	0	5,317 (90.8%)	537 (9.2%)	5,854 (100%)
	voiced	11 (0.2%)	5,467 (93.2%)	385 (6.6%)	5,863 (100%)
	total	11 (0.1%)	10,784 (92.0%)	922 (7.9%)	11,717 (100%)

Table 5.28: Means, standard deviations, and ANOVA summary according to phonemic voicing (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

acoustic variable	voicing	mean value	s.d.	difference (vls-vcd)	level of sig. ($p < 0.05$)
segment duration	voiceless	151.69 ms	35.4	33.78 ms	0.000*
	voiced	117.91 ms	30.5		
closure duration	voiceless	77.11 ms	26.2	2.85 ms	0.000*
	voiced	74.26 ms	25.0		
release duration	voiceless	74.58 ms	21.3	30.93 ms	0.000*
	voiced	43.65 ms	14.4		
relative release duration	voiceless	49.5%	.100	12%	0.000*
	voiced	37.5%	.098		
Rise Time	voiceless	37.56 ms	17.5	11.56 ms	0.000*
	voiced	26.00 ms	12.6		
relative RT	voiceless	49.5%	.146	-9.2%	0.000*
	voiced	58.7%	.176		

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.2.9 Distribution of Phonetic Realizations According to Gender

The frequency, mean values, standard deviations, and results of the one-way ANOVA are provided below for the phonetic realizations (SR) of the phonemic palatal stops and palato-alveolar affricates (UR) which contain both a closure (i.e. stop) component and a release component (i.e. frication), i.e. the affricates (n= 10,784), in terms of gender.

As is expressed in Table 5.29, whereas the males uttered 6,127 (90%) affricates and 677 (9.9%) fricatives, the females produced 4,657 (94.9%) affricates and 245 (5%) fricatives. Further, while 5 (0.1%) palatal stops were uttered by males, 6 (0.1%) were produced by females. Although the females uttered one more palatal stop than the males, the percentage is the same, i.e. 0.1%. As was mentioned earlier, the larger number of tokens associated with the males is largely due to the fact that more males (n=59) than females (n=41) were included in this study.

The statistical results according to gender are summarized in Table 5.30. Whereas the mean segment duration was 134.02 ms for the male speakers, the mean segment duration for the females was 135.28 ms. Just as the mean segment duration was shorter for the males than the females, the same applies to the mean closure duration; while the males involved in the study had a mean closure duration of 74.69 ms, the females had a mean closure duration of 76.95 ms. In terms of mean release duration, relative release duration, RT, and relative RT, however, the males have longer mean durations (59.33 ms, 44.2%, 33.99 ms, and 57.5%, respectively) than the females (58. 33 ms, 42.4%, 28.68 ms, and 49.7%, respectively). Although the mean differences for segment duration are not significantly different (0.081), the mean differences for closure duration, release duration, relative release duration, RT, and relative RT are statistically significant.

Table 5.29: Frequency of possible phonetic realizations (SR) according to gender (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

		Phonetic	Realization	(SR)	
		palatal stop	palato-alveolar affricate	palato-alveolar fricative	total
Gender	male	5 (0.1%)	6,127 (90.0%)	677 (9.9%)	6,809 (100%)
	female	6 (0.1%)	4,657 (94.9%)	245 (5.0%)	4,908 (100%)
	total	11 (0.1%)	10,784 (92.0%)	922 (7.9%)	11,717 (100%)

Table 5.30: Means, standard deviations, and ANOVA summary according to gender (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for all subjects)

acoustic variable	gender	mean value	s.d.	difference	level of sig. ($p < 0.05$)
segment duration	male female	134.02 ms 135.28 ms	37.1 37.0	1.26 ms	0.081
closure duration	male female	74.69 ms 76.95 ms	26.7 24.2	2.26 ms	0.000*
release duration	male female	59.33 ms 58.33 ms	23.1 24.7	1 ms	0.030*
relative release duration	male female	44.2% 42.4%	0.114 0.117	1.8%	0.000*
Rise Time	male female	33.99 ms 28.68 ms	16.6 15.3	5.31 ms	0.000*
relative RT	male female	57.5% 49.7%	0.164 0.163	7.8%	0.000*

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

It should also be mentioned that the words which contained the output of palatal stops were [ɟ]imnastikë (n=1) 'gymnastics', [ɟ]ysmë (n=4) 'half', [ɟ]oks (n=1) 'breast', and [ɟ]uhë (n=5) 'language, tongue' (See Appendix E for a complete listing of results according to target word). That is, the palatal stop surfaced before the front high vowels [i] and [y], as well as before the non-low vowels [u] and [o]. The palatal stop, however, was not found to surface before the front vowel [e] or the low vowel [a].

5.3 Acoustic Accounts of Gheg Native Speakers

In this section, the data for all the NSs of Gheg (n= 49) were separated out and analyzed. As in the previous section, the phonemic palatal stops and palato-alveolar affricates are described in terms of phonetic output and analyzed in terms of the six temporal acoustic variables of segment duration, closure duration, release duration, relative release duration, RT, and relative RT. Statistical summaries of mean values, standard deviations, and one-way ANOVAs are also provided. Further, manner of articulation (i.e. stop or affricate), phonemic voicing (i.e. voiceless or voiced), and gender (i.e. male or female) are also considered.

As was mentioned earlier, the phonetic output for the Gheg speakers was either a palato-alveolar affricate (n= 5,201 or 88.6%) or fricative (n= 665 or 11.4%). When the phoneme was a palatal stop, the Gheg speakers uttered 2,526 (86.2%) palato-alveolar affricates and 405 (13.8%) palato-alveolar fricatives. That is, the majority of the phonemic palatal stops surfaced phonetically as affricates, and not palatal stops. As would be expected, when the phoneme was a palato-alveolar affricate, 2,675 (91.1%) affricates were produced. However, 260 (8.9%) of the phonemic palato-alveolar affricates were uttered as palato-alveolar fricatives.

5.3.1 Distribution of Phonetic Realizations According to Target Segments

In terms of each target segment, when the phoneme was a voiceless palatal stop, the Gheg speakers produced 1,243 (85.1%) palato-alveolar affricates and 218 (14.9%) palato-alveolar fricatives, as is illustrated in Table 5.31. Likewise, when the phoneme was a voiced palatal stop, the Gheg speakers uttered 1,283 (87.3%) palato-alveolar affricates and 187 (12.7%) palato-alveolar fricatives. As with the palatal stops, when the phoneme was a voiceless palato-alveolar affricate, the Gheg speakers produced 1,336 (91.2%) palato-alveolar affricates and 129 (8.8%) palato-alveolar fricatives. Similarly, when the phoneme was the voiced palato-alveolar affricate, 1,339 (91.1%) palato-alveolar affricates and 131 (8.9%) palato-alveolar fricatives were pronounced phonetically. With all four target segments, the majority of the cases were uttered as palato-alveolar affricates (n=5,201), rather than palatal stops (n=0) or palato-alveolar fricatives (n=665).

Table 5.31: Frequency of possible phonetic realizations (SR) according to segment (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for Gheg speakers)

		Phonetic	Realization	(SR)	
		palatal stop	palato-alveolar affricate	palato-alveolar fricative	total
Phonemic Form (UR)	voiceless palatal stop	0	1,243 (85.1%)	218 (14.9%)	1,461 (100%)
	voiced palatal stop	0	1,283 (87.3%)	187 (12.7%)	1,470 (100%)
	subtotal	0	2,526 (86.2%)	405 (13.8%)	2,931 (100%)
	voiceless palato-alveolar affricate	0	1,336 (91.2%)	129 (8.8%)	1,465 (100%)
	voiced palato-alveolar affricate	0	1,339 (91.1%)	131 (8.9%)	1,470 (100%)
	subtotal	0	2,675 (91.1%)	260 (8.9%)	2,935 (100%)
	total	0	5,201 (88.6%)	665 (11.4%)	5,866 (100%)

5.3.2. Distribution of Phonetic Realizations According to Manner of Articulation

The mean values, standard deviations, and results of the one-way ANOVA are provided below for the phonetic realizations (SR) of the phonemic palatal stops and palato-alveolar affricates (UR) which contain both a closure (i.e. stop) component and a release component (i.e. frication), i.e. the affricates (n= 5,201), in terms of manner of articulation (i.e. stop or affricate).

Whereas the mean segment duration for the target palatal stops was 133.37 ms, it was 131.48 ms for the phonemic palato-alveolar affricates, as is illustrated in Table 5.32. Just as the mean segment duration was longer for the phonemic palatal stop than for the phonemic palato-alveolar affricate, the mean values for closure duration, release duration, relative release duration, RT, and relative RT were longer for the phonemic palatal stop (74.27 ms, 59.11 ms, 44.1%, 33.06 ms, and 56.2%, respectively) than for the phonemic palato-alveolar affricate (73.13 ms, 58.35 ms, 44.0%, 30.66 ms, and 52.6%, respectively). Further, albeit the mean differences for RT and relative RT were statistically significant, the differences between the mean values for closure duration, release duration, and relative release duration were not found to be statistically significant for the Gheg speakers in terms of manner of articulation. Also, for segment duration, there appears to be a tendency for Gheg speakers to phonetically utter the phonemic palatal stops and palato-alveolar affricates similarly in regards to manner of articulation. That is, the phonemic palatal stops appear to pattern more like the palato-alveolar affricates, at least in terms of segment duration, closure duration, release duration, and relative release duration for the Gheg speakers.

Table 5.32: Means, standard deviations, and ANOVA summary according to manner of articulation (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for Gheg speakers)

acoustic variable	manner	mean value	s.d.	difference (stop-affric)	level of sig. ($p < 0.05$)
segment duration	stop affricate	133.37 ms 131.48 ms	33.6 36.4	1.89 ms	0.053
closure duration	stop affricate	74.27 ms 73.13 ms	22.9 23.4	1.14 ms	0.078
release duration	stop affricate	59.11 ms 58.35 ms	21.8 22.8	0.76 ms	0.219
relative release duration	stop affricate	44.1% 44.0%	0.106 0.104	0.1%	0.782
Rise Time	stop affricate	33.06 ms 30.66 ms	15.6 16.3	2.4%	0.000*
relative RT	stop affricate	56.2% 52.6%	0.160 0167	3.6%	0.000*

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.3.3. Distribution of Phonetic Realizations According to Voicing

In terms of voicing (i.e. voiceless and voiced), when the target phoneme was a voiceless palatal stop or palato-alveolar affricate, the NSs of Gheg produced 2,579 (88.1%) voiceless palato-alveolar affricates and 347(11.9%) voiceless fricatives, as in Table 5.33. Likewise, when the target phoneme was a voiced palatal stop or palato-alveolar affricate, they uttered 2,622 (89.2%) voiced palato-alveolar affricates and 318 (10.8%) voiced fricatives.

Whereas the mean segment duration for the phonemically voiceless sounds was 147.87 ms, the phonemically voiced segments had a mean segment duration of 117.18 ms, as in Table 5.34. Likewise, just as the mean segment duration was longer for the phonemically voiceless segments than the phonemically voiced ones, the same applies to the closure duration, release duration, relative release duration, and RT; whereas the mean closure duration is 76.04 ms for the phonemically voiceless sounds, it is 71.37 ms for the voiced segments. Also, while the mean release duration and relative release duration is 71.83 ms and 48.7% (respectively) for the phonemically voiceless, it is 45.81 ms and 39.5% (respectively) for the phonemically voiced. Further, whereas the mean RT for the phonemically voiceless segments is 36.48 ms, it is 27.25 ms for the phonemically voiced articulations. The relative RT, however, is longer for the phonemically voiced sounds (58.8%) than their phonemically voiceless counterparts (49.8%). For all the acoustic variables, all of the mean values were considered to be significantly different in terms of phonemic voicing.

Table 5.33: Frequency of possible phonetic realizations according to phonemic voicing (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for Gheg speakers)

		Phonetic Realization (SR)			
		palatal stop	palato-alveolar affricate	palato-alveolar fricative	total
Phonemic Voicing (UR)	voiceless	0	2,579 (88.1%)	347 (11.9%)	2,926 (100%)
	voiced	0	2,622 (89.2%)	318 (10.8%)	2,940 (100%)
	total	0	5,201 (88.6%)	665 (11.4%)	5,866 (100%)

Table 5.34: Means, standard deviations, and ANOVA summary according to voicing (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for Gheg speakers)

acoustic variable	voicing	mean value	s.d.	difference (vls-vcd)	level of sig. ($p < .05$)
segment duration	voiceless voiced	147.87 ms 117.18 ms	34.0 28.9	30.69 ms	0.000*
closure duration	voiceless voiced	76.04 ms 71.37 ms	23.6 22.4	4.67 ms	0.000*
release duration	voiceless voiced	71.83 ms 45.81 ms	21.3 14.4	26.02 ms	0.000*
relative release duration	voiceless voiced	48.7% 39.5%	0.096 0.093	9.2%	0.000*
Rise Time	voiceless voiced	36.48 ms 27.25 ms	17.6 12.7	9.23 ms	0.000*
relative RT	voiceless voiced	49.8% 58.8%	0.145 0.170	9.0%	0.000*

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.3.4 Distribution of Phonetic Realizations According to Gender

In terms of gender, the male Gheg speakers uttered 3,571 (87.7%) palato-alveolar affricates and 500 (12.3%) fricatives when the target phoneme was either a palatal stop or affricate, respectively, as in Table 5.35. Similarly, the female Gheg speakers pronounced 1,630 (90.8%) palato-alveolar affricates and 165 (9.2%) fricatives when the target sound was a phonemic palatal stop or palato-alveolar affricate, respectively.

Whereas the mean segment duration for the male speakers was 130.79 ms, it was 135.91 ms for the female speakers, as is expressed in Table 5.36. Just as the mean segment duration was longer for the females than the males, the same was for the mean closure duration and mean release duration. Whereas the mean closure duration for the males was 72.96 ms, it was 75.26 ms for the females. Also, while the mean release duration was 57.84 ms for the males, it was 60.65 ms for the females. However, the mean relative release duration, mean RT, and mean relative RT was longer for males than the females. Whereas the mean relative release duration was 44.1% for the males, it was 44.0% for the females. Also, while the mean RT was 30.40 ms for the females, it was 32.48 ms for the males. Additionally, the relative RT was 50.3% for the females, while it was 56.2% for the males. Further, albeit the means were significantly different for segment duration, closure duration, release duration, RT, and relative RT, the mean values for relative release duration (0.731) were not statistically significant. That it, according to gender, there is no statistical difference between the means for relative release duration for the Gheg speakers.

Table 5.35: Frequency of possible phonetic realizations according to gender (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for Gheg speakers)

		Phonetic	Realization	(SR)	
		palatal stop	palato-alveolar affricate	palato-alveolar fricative	total
Gender	male	0	3,571 (87.7%)	500 (12.3%)	4,071 (100%)
	female	0	1,630 (90.8%)	165 (9.2%)	1,795 (100%)
	total	0	5,201 (88.6%)	665 (11.4%)	5,866 (100%)

Table 5.36: Means, standard deviations, and ANOVA summary according to gender (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for Gheg speakers)

acoustic variable	gender	mean value	s.d.	difference	level of sig. ($p < .05$)
segment duration	male female	130.79 ms 135.91 ms	34.4 36.3	5.12 ms	.000*
closure duration	male female	72.96 ms 75.26 ms	23.5 22.2	2.3 ms	.001*
release duration	male female	57.84 ms 60.65 ms	21.3 24.4	2.81 ms	.000*
relative release duration	male female	44.1% 44.0%	.104 .108	.1%	.731
Rise Time	male female	32.48 ms 30.40 ms	15.9 16.1	2.08 ms	.000*
relative RT	male female	56.2% 50.3%	.164 .159	5.9%	.000*

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.4 Acoustic Accounts of Tosk Native Speakers

In this section, the data for all the NSs of Tosk (n= 49) were separated out and analyzed. As in the previous section, the phonemic palatal stops and palato-alveolar affricates are described in terms of phonetic output and analyzed in terms of the six temporal acoustic variables of segment duration, closure duration, release duration, relative release duration, RT, and relative RT. Statistical summaries of mean values, standard deviations, and one-way ANOVAs are also provided. Further, manner of articulation (i.e. stop or affricate), phonemic voicing (i.e. voiceless or voiced), and gender (i.e. male or female) are also considered.

5.4.1 Distribution of Phonetic Realizations According to Target Segments

As was mentioned earlier, the phonetic output for the Tosk speakers consisted of palatal stops (n= 11 or 0.2%), palato-alveolar affricates (n= 5,583 or 95.4%), and fricatives (n= 257 or 4.4%). When the phoneme was a palatal stop, the Tosk speakers uttered 11 (0.4%) palatal stops, 2,669 (91.4%) palato-alveolar affricates and 238 (8.2%) fricatives. That is, the majority of the phonemic palatal stops were pronounced phonetically as affricates, rather than stops. As would be expected, when the target phoneme was a palato-alveolar affricate, 2,914 (99.4%) affricates were produced. However, 19 (0.6%) of the phonemic palato-alveolar affricates were uttered as fricatives.

When the target phoneme was a voiceless palatal stop, the Tosk speakers produced 0 palatal stops, 1,283 (87.6%) palato-alveolar affricates and 182 (12.4%) fricatives, as is illustrated in Table 5.37. Likewise, when the target phoneme was a voiced palatal stop, the Tosk speakers uttered 182 (12.4%) palatal stops, 1,386 (95.4%) palato-alveolar affricates and 56 (3.8%) fricatives. As would be expected, when the target phoneme was a voiceless palato-alveolar affricate, the Tosk speakers produced 1,455 (99.5%) palato-alveolar affricates and 8 (0.5%) fricatives. Similarly, when the target phoneme was the voiced palato-alveolar affricate, 1,459(99.3%) palato-alveolar affricates and 11 (0.7%) palato-alveolar fricatives were pronounced. With all four phonemes, the majority of the cases were uttered as palato-alveolar affricates (n= 5,583), rather than palatal stops (n= 11) or palato-alveolar fricatives (n= 257).

Table 5.37: Frequency of possible phonetic realizations (SR) according to segment (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for Tosk speakers)

		Phonetic	Realization	(SR)	
		palatal stop	palato-alveolar affricate	palato-alveolar fricative	total
Target Segment	voiceless palatal stop	0	1,283 (87.6%)	182 (12.4%)	1,465 (100%)
	voiced palatal stop	11 (0.8%)	1,386 (95.4%)	56 (3.8%)	1,453 (100%)
	subtotal	11 (0.4%)	2,669 (91.4%)	238 (8.2%)	2,918 (100%)
	voiceless palato-alveolar affricate	0	1,455 (99.5%)	8 (0.5%)	1,463 (100%)
	voiced palato-alveolar affricate	0	1,459 (99.3%)	11 (0.7%)	1,470 (100%)
	subtotal	0	2,914 (99.4%)	19 (0.6%)	2,933 (100%)
	total	11 (0.2%)	5,583 (95.4%)	257 (4.4%)	5,851 (100%)

5.4.2 Distribution of Phonetic Realizations According to Manner of Articulation

The mean values, standard deviations, and results of the one-way ANOVA are provided below for the phonetic realizations (SR) of the phonemic palatal stops and palato-alveolar affricates (UR) which contain both a closure (i.e. stop) component and a release component (i.e. frication), i.e. the affricates (n= 5,583), in terms of manner of articulation (i.e. palatal stop and palato-alveolar affricate).

Whereas the mean segment duration for the phonemic palatal stops was 137.09 ms, it was 136.11 ms for the phonemic palato-alveolar affricates, as in Table 5.38. Just as the phonemic palatal stops had a longer average segment duration than the target palato-alveolar affricates, the same applies to the closure duration, release duration, relative release duration, RT, and relative RT. That is, while the phonemic palatal stop has a mean closure duration of 77.66 ms, the phonemic palato-alveolar affricate has a mean closure duration of 77.37 ms. Also, whereas the phonemic palato-alveolar affricate has a mean release duration of 58.74 ms and a mean relative release duration of 42.5%, the phonemic palatal stop has a release duration mean of 59.43 ms and a relative release duration mean of 43.1%. Additionally, while the phonemic palatal stop has a mean RT of 33.19 ms and a mean relative RT of 56.5%, the phonemic palato-alveolar affricate has a mean RT of 30.09 ms and a mean relative RT of 51.7%. Further, whereas the mean differences for RT and relative RT are statistically significant, the mean differences for segment duration, closure duration, release duration, and relative release duration are not significantly different. That is, whereas the mean differences are statistically significant for RT and relative RT, that is not the situation for the other acoustic variables. In other words, as was the case with the Gheg speakers, in regards to manner of articulation for the Tosk speakers, the phonemic palatal stops pattern more like affricates than stops, at least in terms of segment duration, closure duration, release duration, and relative release duration.

Table 5.38: Means, standard deviations, and ANOVA summary according to manner of articulation (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for Tosk speakers)

acoustic variable	manner	mean value	s.d.	difference (stop-affric)	level of sig. ($p < 0.05$)
segment duration	stop	137.09 ms	39.3	0.98 ms	0.348
	affric	136.11 ms	38.2		
closure duration	stop	77.66 ms	30.5	0.29 ms	0.696
	affric	77.37 ms	24.8		
release duration	stop	59.43 ms	25.4	0.69 ms	0.309
	affric	58.74 ms	24.8		
relative release duration	stop	43.1%	0.135	0.6%	0.065
	affric	42.5%	0.114		
Rise Time	stop	33.19 ms	16.7	3.1 ms	0.000*
	affric	30.09 ms	16.2		
relative RT	stop	56.5%	0.168	4.8%	0.000*
	affric	51.7%	0.172		

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.4.3 Distribution of Phonetic Realizations According to Voicing

In terms of phonemic voicing (i.e. voiceless and voiced), the NSs of Tosk produced 0 voiceless palatal stops, 2,738 (93.5%) voiceless palato-alveolar affricates and 190 (6.5%) voiceless fricatives when the target phoneme was a voiceless palatal stop or palato-alveolar affricate, as in Table 5.39. Likewise, they uttered 11 (0.4%) voiced palatal stops, 2,845 (97.3%) voiced palato-alveolar affricates and 67 (2.3%) voiced fricatives when the target phoneme was a voiced palatal stop or palato-alveolar affricate.

Whereas the phonemically voiceless segments had a mean segment duration of 155.29 ms and mean closure duration of 78.12 ms, the phonemically voiced segments had a mean segment duration of 118.58 ms and a mean closure duration of 76.93 ms, as appears in Table 5.40. Similarly, the phonemically voiceless segments had a longer mean release duration (77.17 ms) and relative release duration (50.2%) than their phonemically voiced counterparts (41.65 ms and 35.7%, respectively). Although the phonemically voiceless segments (38.57 ms) have a longer mean RT than the voiced sounds (24.84 ms), the phonemically voiced segments (58.6%) have a longer mean relative RT than their voiceless counterparts (49.1%). In terms of phonemic voicing, the mean values were found to be statistically significant for all the acoustic variables, except for closure duration. That is, whereas the mean differences for segment duration, release duration, relative release duration, RT, and relative RT are significantly different, that is not the case for closure duration.

Table 5.39: Frequency of possible phonetic realizations according to voicing (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for Tosk speakers)

		Phonetic	Realization	(SR)	
		palatal stop	palato-alveolar affricate	palato-alveolar fricative	total
Phonemic Voicing (UR)	voiceless	0	2,738 (93.5%)	190 (6.5%)	2,928 (100%)
	voiced	11 (0.4%)	2,845 (97.3%)	67 (2.3%)	2,923 (100%)
	total	11 (0.2%)	5,583 (95.4%)	257 (4.4%)	5,851 (100%)

Table 5.40: Means, standard deviations, and ANOVA summary according to voicing (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for Tosk speakers)

acoustic variable	voicing	mean value	s.d.	difference (vls-vcd)	level of sig. ($p < 0.05$)
segment duration	voiceless voiced	155.29 ms 118.58 ms	36.2 32.0	36.71 ms	0.000*
closure duration	voiceless voiced	78.12 ms 76.93 ms	28.4 26.9	1.19 ms	0.107
release duration	voiceless voiced	77.17 ms 41.65 ms	20.9 14.2	35.52 ms	0.000*
relative release duration	voiceless voiced	50.2% 35.7%	0.102 0.099	14.5%	0.000*
Rise Time	voiceless voiced	38.57 ms 24.84 ms	17.4 12.3	13.73 ms	0.000*
relative RT	voiceless voiced	49.1% 58.6%	0.146 0.181	9.5%	0.000*

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.4.4 Distribution of Phonetic Realizations According to Gender

In terms of gender, the male Tosk speakers uttered 5 (0.2%) palatal stops, 2,556 (93.3%) palato-alveolar affricates and 177 (6.5%) fricatives when the phoneme was either a palatal stop or affricate, as appears in Table 5.41. Similarly, the female Tosk speakers pronounced 6 (0.2%) palatal stops, 3,027 (97.2%) palato-alveolar affricates, and 80 (2.6%) fricatives when the phoneme was a palatal stop or palato-alveolar affricate.

Whereas the male Tosk speakers had a mean segment duration of 138.53 ms, the female Tosk speakers had a mean of 134.94 ms, as in Table 5.42. Also, while the male Tosk speakers had a mean closure duration of 77.10 ms, the females had a mean of 77.86 ms. Additionally, whereas the mean release duration is 61.43 ms for the Tosk males, it is 57.08 ms for the Tosk females. Likewise, the mean relative release duration is 44.3% for the males and 41.6% for the females. The male Tosk speakers also have a longer RT (36.10 ms) and relative RT (59.4%) than the female Tosk speakers (27.75 ms and 49.4%, respectively). As was the case for voicing, the only acoustic variable which is not statistically significant in terms of gender is closure duration. All the other acoustic variables have statistically significant mean differences in terms of gender for the Tosk speakers.

Table 5.41: Frequency of possible phonetic realizations according to gender (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for Tosk speakers)

		Phonetic	Realization	(SR)	
		palatal stop	palato-alveolar affricate	palato-alveolar fricative	total
Gender	male	5 (0.2%)	2,556 (93.3%)	177 (6.5%)	2,738 (100%)
	female	6 (0.2%)	3,027 (97.2%)	80 (2.6%)	3,113 (100%)
	total	11 (0.2%)	5,583 (95.4%)	257 (4.4%)	5,851 (100%)

Table 5.42: Means, standard deviations, and ANOVA summary according to gender (for surface representations of the phonemic palatal stops and palato-alveolar affricates which contain both closure and frication, for Tosk speakers)

acoustic variable	gender	mean value	s.d.	difference	level of sig. ($p < 0.05$)
segment duration	male	138.53 ms	40.2	3.59 ms	0.001*
	female	134.94 ms	37.4		
closure duration	male	77.10 ms	30.4	0.76 ms	0.304
	female	77.86 ms	25.1		
release duration	male	61.43 ms	25.4	4.35 ms	0.000*
	female	57.08 ms	24.7		
relative release duration	male	44.3%	.127	2.7%	0.000*
	female	41.6%	.120		
Rise Time	male	36.10 ms	17.3	8.35 ms	0.000*
	female	27.75 ms	14.8		
relative RT	male	59.4%	.163	10%	0.000*
	female	49.4%	.165		

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.5 Spectral Characteristics of the Target Segments

In attempts to ascertain the exact place of articulation of the target segments (i.e. the phonemic voiceless and voiced palatal stop and the phonemic voiceless and voiced palato-alveolar affricate), measurements of the lowest (Low Hz) and highest (High Hz) levels of frication in the release portion of the target segment and measurements of the F2 onset in the following vowel were taken. Also, spectral measurements (i.e. minimal spectral peak and maximal spectral peak) which provide an additional picture of the release portion were also recorded, as was outlined in Chapter 4. The descriptive and statistical results of this second study are provided below.

5.5.1 Low HZ

In terms of Low Hz, whereas the Tosk speakers (2425.78 Hz) have a higher mean value for the phonemic palatal stop than the Gheg speakers (2205.48 Hz), the Gheg speakers (2440.10 Hz) have a higher mean value for the phonemic palato-alveolar affricate than the Tosk speakers (2179.67 Hz), as is illustrated in Table 5.43. The results of a univariate ANOVA in Table 5.44 indicate that these differences, however, are not statistically significant. In general, the Gheg speakers (2322.79 Hz) uttered higher mean values for Low Hz than the Tosk speakers (2302.73 Hz). It should be noted that alveolar strident fricatives tend to have higher frequency levels than palatals for Low Hz.[42] These overall differences between the Gheg and Tosk varieties were not found to be statistically significant. Further, repetition and manner of articulation were also found to be not significant.

[42] See Kent and Read (1992: 123): "Spectra for alveolar fricatives contain relatively higher frequency energy than the spectra for palatals." Kent and Read used the strident (sibilant) alveolar fricative [s] and the palato-alveolar fricative [ʃ] in their discussion.

Table 5.43: Mean values (and s.d.) for Low Hz (in Hz) according to variety (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all four subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal (stop)	2205.48 (323.8)	2425.78 (408.3)	2315.63 (383.9)
	palato-alveolar (affricate)	2440.10 (465.5)	2179.67 (265.8)	2309.88 (400.1)
	total	2322.79 (417.0)	2302.73 (365.2)	2312.76 (391.7)

Table 5.44: ANOVA summary for Low Hz (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all four subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	0.343	0.558
	place (palatal, pal-alv)	1	0.028	0.867
	repetition (1, 2, 3)	2	0.879	0.416
interactions				
	variety*place	1	49.277	0.000*
	variety*rep	2	0.390	0.677
	place*rep	2	0.226	0.798
	variety*place*rep	2	0.900	0.407

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.5.2 High Hz

In terms of High Hz, although it appears in Table 5.45 that the Gheg speakers have a higher mean value than the Tosk speakers for the phonemic palatal stop (9240.97

Hz and 9148.37 Hz, respectively), and the Tosk speakers have a higher mean value than the Gheg speakers for the phonemic palato-alveolar affricate (9421.45 Hz and 9333.86 Hz, respectively), the results of the univariate ANOVA, summarized in Table 5.46, indicate that these apparent differences are not statistically significant.[43] Whereas the differences for mean values for variety and repetition were non-significant, the mean differences involving place of articulation were found to be significant for High Hz.

Table 5.45: Mean values (and s.d.) for High Hz (in Hz) according to variety (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all four subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	9240.97 (341.7)	9148.37 (580.5)	9194.67 (477.6)
	palato-alveolar affricate	9333.86 (335.8)	9421.45 (296.4)	9377.65 (318.7)
	total	9287.41 (341.0)	9284.91 (479.8)	9286.16 (415.)

[43]It should be mentioned that when performing the univariate ANOVAs for the three dependent variables, variety and place of articulation were considered fixed factors and repetition was considered a random factor.

Table 5.46: ANOVA summary for High Hz (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all four subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	0.013	0.919
	place (palatal, pal-alv)	1	116.806	0.008*
	repetition (1, 2, 3)	2	6.943	0.104
interactions				
	variety*place	1	56.448	0.017*
	variety*rep	2	3.333	0.231
	place*rep	2	1.994	0.334
	variety*place*rep	2	0.105	0.900

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.5.3 F2 Onset

In terms of F2 Onset, according to Table 5.47 it appears that the Gheg speakers have a higher mean value than the Tosk speakers for the phonemic palatal stops (2057.22 Hz and 1945.73 Hz, respectively), and the Tosk speakers have a higher mean value than the Gheg speakers for the phonemic palato-alveolar affricates (1871.48 Hz and 1849.36 Hz, respectively); however, the results of the univariate ANOVA, summarized in Table 5.48, show that these differences between varieties are not statistically significant. Similar to Low Hz and High Hz, for F2 Onset, the Gheg speakers have a higher mean value than the Tosk speakers (1953.29 Hz and 1908.29 Hz , respectively). As is illustrated in Table 5.48, these differences in terms of variety were not found to be significant. Further, as was the case with the statistical findings for High Hz, whereas the differences of mean values for variety and repetition were non-significant, the mean difference regarding place of articulation was statistically significant for F2 Onset.

Table 5.47: Mean values (and s.d.) for F2 Onset (in Hz) according to variety (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all four subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	2057.22 (393.2)	1945.73 (288.1)	2001.47 (348.4)
	palato-alveolar affricate	1849.36 (304.4)	1871.48 (244.2)	1860.42 (275.6)
	total	1953.29 (366.0)	1908.29 (269.1)	1930.94 (321.7)

Table 5.48: ANOVA summary for F2 Onset (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all four subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	5.326	0.147
	place (palatal, pal-alv)	1	1410.967	0.001*
	repetition (1, 2, 3)	2	0.279	0.876
interactions				
	variety*place	1	18.044	0.051
	variety*rep	2	1.516	0.397
	place*rep	2	0.057	0.946
	variety*place*rep	2	0.300	0.741

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.5.4 Minimal Spectral Peak

In terms of the measurement Minimal Spectral Peak, as shown in Table 5.49, the Gheg speakers have higher mean values than the Tosk speakers for both the phonemic palatal stop (193.76 Hz and 113.36 Hz, respectively) and phonemic palato-alveolar affricate (183.88 Hz and 113.62 Hz, respectively). Therefore, the Gheg speakers also have, in general, a higher overall mean value than the Tosk speakers (188.82 Hz and 113.49 Hz, respectively). As is illustrated in Table 5.50, the results of a univariate ANOVA indicate that the differences between variety are statistically significant. It should be noted that a lower spectral values tend to represent more palatal sounds, and higher values more alveolar sounds (see also Kent and Read 1992; Nartey 1982). Further, whereas the mean differences were found to be statistically significant for variety, that was not the case for place of articulation and repetition.

Table 5.49: Mean values (and s.d.) for Minimal Spectral Peak (in Hz) according to variety (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all four subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal stop	193.76 (85.9)	113.36 (59.5)	153.56 (84.0)
	palato-alveolar affricate	183.88 (74.7)	113.62 (47.8)	148.75 (71.8)
	total	188.82 (80.4)	113.49 (53.8)	151.15 (78.1)

Table 5.50: ANOVA summary for Minimal Spectral Peak (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all four subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	496.344	0.002*
	place (palatal, pal-alv)	1	4.596	0.165
	repetition (1, 2, 3)	2	0.491	0.660
interactions				
	variety*place	1	11.663	0.076
	variety*rep	2	5.195	0.161
	place*rep	2	2.285	0.304
	variety*place*rep	2	0.055	0.946

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

5.5.5 Maximal Spectral Peak

In terms of the spectral measurement Maximal Spectral Peak, as occurred with Minimal Spectral Peak, the Gheg speakers had higher mean values than the Tosk speakers for both the phonemic palatal stops (3436.83 Hz and 2971.31 Hz, respectively) and the phonemic palato-alveolar affricate (4018.08 Hz and 3334.57 Hz, respectively), as illustrated in Table 5.51. Hence, the Gheg speakers also had a higher overall mean value than the Tosk speakers (3727.46 Hz and 3152.94 Hz, respectively). As with Minimal Spectral Peak, lower spectral values for Maximal Spectral Peak tend to represent more palatal sounds, and higher values more alveolar sounds (see also Kent and Read 1992; Nartey 1982). As is illustrated in Table 5.52, the results of the univariate ANOVA confirm the descriptive differences in mean values regarding variety, where the differences in mean values according to variety were found to be statistically significant. Further, although manner of articulation was also significant, repetition was non significant.

Table 5.51: Mean values (and s.d.) for Maximal Spectral Peak (in Hz) according to variety (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all four subjects)

		Variety		
		Gheg	Tosk	total
Phonemic Form (UR)	palatal (stop)	3436.83 (756.8)	2971.31 (558.3)	3204.07 (703.4)
	palato-alveolar (affricate)	4018.08 (952.9)	3334.57 (431.6)	3676.33 (813.7)
	total	3727.46 (906.7)	3152.94 (530.1)	3440.20 (795.7)

Table 5.52: ANOVA summary for Maximal Spectral Peak (for all surface representations of the phonemic palatal stops and palato-alveolar affricates, for all four subjects)

		degrees of freedom	F-value	level of sig. ($p < 0.05$)
main effects	variety (Gheg, Tosk)	1	270.421	0.004*
	place (palatal, palato-alveolar)	1	124.207	0.008*
	repetition (1, 2, 3)	2	1.641	0.485
interactions				
	variety*place	1	9.476	0.091
	variety*rep	2	0.974	0.507
	place*rep	2	1.432	0.411
	variety*place*rep	2	0.301	0.740

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$).

In terms of the spectral measurements, whereas variety was found to be a significant factor in terms of Minimal Spectral Peak and Maximal Spectral Peak, place of articulation was found to be significant only in terms of Maximal Spectral Peak. That is, not only does variety play a role in accounting for some of the variation in the data, so does place of articulation. Although the phonemic palatal stop and phonemic palato-alveolar affricate pattern similarly in terms of manner of articulation, a small difference does exist in the place of articulation of these segments.

5.6 Summary

Although the differences for the mean values of RT and relative RT for the phonemic palatal stops and palato-alveolar affricates in Albanian (both Gheg and Tosk) were found to be statistically significant, the findings indicate that there is little or no statistically significant difference between the levels of segment duration, closure duration, release duration, and relative release duration for the phonetic realization of the target segments, especially when concerning the phonetic output with both a closure and release component (see Table 5.26). That is, the results of the temporal acoustic analysis suggest that the phonetic realizations of the phonemic palatal stops in Albanian pattern more like affricates than stops, at least in regards to segment duration, closure duration, release duration, and relative release duration. Further, albeit the majority of the surface representations were articulated in the palato-alveolar region, the phonetic output also included sounds uttered in the palatal and alveo-palatal areas. The findings of the second analysis, which involved spectral inspection of the release (i.e. frication) in attempts to ascertain the exact place of articulation of the phonetic realizations of the target segments, suggest that a minor difference in place of articulation exists between Gheg and Tosk speakers, whereby the acoustic output of the palatal stops and palato-alveolar affricates for the Gheg speakers is more alveolar-like and that of the Tosk speakers is more palatal-like. Although the overall results appear to support the claim that a merger of these sounds is taking place, whereby the marked palatal stops are lost for the sake of the less marked palato-alveolar affricates, in order to ascertain if a sound change is actually occurring, the age of the subjects needs to be taken into consideration, which will discussed further in Chapter 6. Future research would involve (1) a more detailed spectral analysis of the tokens which would include a larger sample size and (2) a perceptual study of Albanian palatal stops, palato-alveolar affricates, and fricatives.

CHAPTER 6

IMPLICATIONS

The key to understanding how palatalization operates involves investigating both language internal and language external factors. This chapter will address the former by considering palatalization as a phonological process. The latter will be analyzed in terms of various sociolinguistic forces at work within Albania.

6.1. Language Internal Factors: Phonology

Although palatalization has received much attention in the literature (Bhat 1978, Sagey 1990, Ní Chiosáin 1994, Hume 1994, Guion 1996, Chen 1996, Calabrese 1998, Schwartz 2000), only a few of the investigations offer an explanation which accurately accounts for both the articulatorily-based and phonologically-based issues involved. According to Calabrese (1998), this inadequacy is mainly due to the limitations of the feature specifications of palatal segments. The inadequacy also involves various restrictions in the hierarchical tree structure, where the feature [consonantal] is at the root node (see Kaisse 1992). Following Calabrese (1998), it will be proposed here that palatal segments are to be specified for both Coronal and Dorsal. Also, following Sagey (1990) and Kaisse (1992), it will be suggested that [consonantal] be demoted from its inert root node position so that both assimilation and dissimilation of [consonantal] are possible. The proposed nonlinear model with its corresponding feature specifications for palatal consonants appears in Figure 6.1.

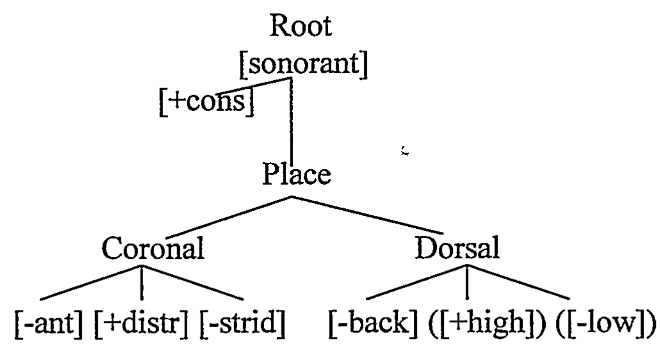

Figure 6.1: Feature specifications for palatal consonants

In what follows, an account of palatalization in Albanian is presented, whereby (1) velar and alveolar stops followed by front vocoids become palatal stops and palato-alveolar affricates and (2) palatal glides and alveolar spirants undergo fortition (strengthening), resulting in palatal stops which then become palato-alveolar affricates. By allowing palatal segments to be specified for both Coronal and Dorsal and by permitting the feature [consonantal] to be demoted from the root node position, palatalization and fortition in not only Albanian, but also other languages (e.g. Cypriot Greek, Räto-Romansch), can fully be explained.

6.1.1. Palatalization, Coronalization, and Fortition in Albanian

So as to avoid confusion regarding terminology, the following provides definitions of terms commonly found in palatalization literature. Here palatalization will be used "as a general cover term to refer to all consonantal changes triggered by front vowels" (Calabrese 1998: 1), such as secondary palatal articulation, velar fronting, and changing the place of articulation to the palatal region. Also, coronalization, which is a subtype of palatalization, is used to refer to the process of velar and palatal stops changing their place of articulation and becoming dominated solely by the coronal place node (see Hume 1994, Calabrese 1998, and Chen 1996). In most phonological accounts of palatalization and coronalization, the triggers are described as being front vocoids, with the targets being velar and alveolar stops (Guion 1998, Schwartz 2000, Ní Chiosáin 1994, Hume 1994, Sagey 1990, Chen 1996, Calabrese 1998). In this investigation, the targets will also include palatal stops and the spirant [s]. Although palatalization processes may be regressive and/or progressive, this analysis will focus on the former, rather than the latter.

According to Bhat (1978), the most common segments to undergo palatalization are velar stops (e.g. [k] and [g]).[44] When a velar stop is followed by a front vocoid, the velar becomes:

(1) a secondarily palatalized segment, where (non-back) [i]-like features of the vocoid are superimposed on the velar stop, as in [k] → [k^j],[45]

(2) a palatal stop,[46] where (non-back) [i]-like features of the vocoid either spread onto or fuse with the velar, as in [k] → [c], e.g. Lat. [ke]*pa* > Albanian [c]*epë*

[44]IPA symbols will be used to represent the sounds in this investigation, e.g. [k g] represent voiceless and voiced velar stops, [c ɟ] represent voiceless and voiced palatal stops, and [ʧ ʤ] represent voiceless and voiced palato-alveolar affricates.

[45] Because Albanian does not have secondarily palatalized velar phonemes, the process of how velar stops become secondarily palatalized will not be analyzed here. Although secondarily palatalized velars are not present in Albanian, they can be found in Russian (see Bhat 1978), Japanese (see Chen 1996), and Italian (see Calabrese 1998).

[46] Evidence for the existence of true palatal stops in Albanian comes from: (1) historical written documents, such as those of Gjon Buzuku (1555) who used non-Roman script for palatal stops (It has been suggested that because the Roman script in Buzuku's time did not contain characters specifically for

'onion' (Topalli 2002: 128), Alb.([kl]*umësht* >) [kj]*umësht* > [c]*umësht* 'milk' (Topalli 2002: 135), MGk [ki]*pí* > [c]*iri* 'candle' 'candle'(Orel 1998: 362), and Trk. [gö]*ks* > [ɟ]*oks* 'breasts' (Çabej 1996: 335), or

(3) a coronal segment,[47] where the features of the vowel spread onto the consonant, thereby fronting the velar to such an extent that it becomes a coronal, i.e. a palato-alveolar affricate (see Maddieson 1984), as in [k] (→[c]) → [tʃ], e.g. Lat. [ke]*pa* > (Albanian [c]*epë* >) [tʃ]*epë* 'onion' (Cipo 1949: 24).

Similar to the velars, alveolar stops (i.e. [t] and [d]) can also undergo palatalization, when followed by front vocoids (Bhat 1978). In such a case, the alveolar stops can become:

(1) secondarily palatalized segments, as in [t] → [tʲ],[48]

(2) palatal stops, where the [i]-like features fuse with or spread onto the alveolar, as in [t] → [c] and [d] → [ɟ], e.g. It. *ma*[dj]*a* > Albanian *ma*[ɟ]*e* 'cooking area' (Topalli 2002: 146), or

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palatal stops, he incorporated non-Roman characters which were used in Bosnia for a palatal stop sort of sound) (see Çabej 1976), (2) scholarly descriptions of Albanian, and (3) native speakers. According to Maddieson (1984: 224-225), Albanian has voiceless and voiced palatal affricates. He uses Newmark (1957) as his reference; Newmark's analysis deals mainly with the Tosk variety of Albanian (rather than Gheg, which the majority of Albanians speak natively) for his source. Maddieson (1984: 32) also mentions, "Typically languages with stops in the palatal area....have 4 or more places" for the articulation of stops, which is historically true for Albanian: labial, alveolar, palatal, and velar (Topalli 2002). Also, Maddieson (1984: 212) claims that 41 languages have voiceless palatal stops and 31 languages have voiced palatal stops; as mentioned earlier, Albanian is not included.

[47] This process is also referred to as coronalization (see also Hume 1994 and Calabrese 1998).

[48] Because Albanian does not have secondarily palatalized dental/alveolar phonemes, the process of how dental/alveolar stops become secondarily palatalized is not analyzed here. Although this process does not occur in Albanian, it can be found in Lemko, which is a variety of Ukrainian (Schwartz 2000), and many other languages (see Bhat 1978).

(3) affricates,[49] where [tj] (→ [c]) → [tʃ], e.g. Albanian [tj]*etër* > [tʃ]*etër* 'other'.

Also, after palatal glides and alveolar spirants have been strengthened (whereby they become palatal stops), they may undergo coronalization, resulting in palato-alveolar affricates (see Topalli 2002). The process of segment fortition followed by coronalization is attested in Albanian, e.g. IE [j]*ag*^{h} > Albanian [ɟ]*uej* > [ʤ]*uej* 'hunt' (Topalli 2002: 137) and IE [s]*ēmi* > [ɟ]*ysmë* > [ʤ]*ims* 'half' (Çabej 1996: 340-1).[50] The process of stop consonants in the palatal region changing into affricates has also been referred to as assibilation (Hock 1991) and affrication (see Flikeid 1988).[51]

[49] This process is also referred to as coronalization (see also Hume 1994 and Calabrese 1998).
[50] The path of [s] becoming a palatal stops will be discussed later in this chapter.
[51] Hock's rule for palatal assibilation is as follows: [+ stop, + palatal] > [+assibilant] (Hock 1986: 442), also stated as k' > ʧ (Hock 1986: 452, 455). Hock mentions that palatal assibilation is also found in the IE branches of Iranian, Indo-Aryan, and Balto-Slavic. Hume (1994: 125) states that the change from a velar stop to palatalized velar or palato-alveolar affricate in the context of a front vowel is a common rule attested cross-linguistically. She provides evidence for this sort of process, which she refers to as coronalization which is triggered by front vowels (19) (i.e. k > k' > ʧ and g > g' > ʤ), in Acadian French (127) and Slovak (7).

Table 6.1: Summary of palatalization and coronalization in Albanian

Origin	Palatal stop (Alb.)	Palato-alveolar affricate (Alb.)	Gloss
a. Lat. [ke]*pa*	[c]*epë*	[tʃ]*epë*	'onion'
Alb.([kl]*umësht* >) [kj] *umësht*[52]	[c]*umësht*	[tʃ]*umësht*	'milk'
MGk [ki]*pí*	[c]*iri*	[tʃ]*iri*	'candle'
Trk. [gö]*ks*	[ɟ]*oks*	[dʒ]*oks*	'breast'
Alb. [ke]*të*	-------	[tʃ]*etë*	'this'
Alb. pla[k-i]	*ple*[c]	*ple*[tʃ]	'the old person(s)'
b. It. *ma*[dj]*a*	*ma*[ɟ]*e*	*ma*[dʒ]*e*	'cooking area'
Alb. [tj]*etër*	--------	[tʃ]etër	'other'
c. IE [j]*ag*ʰ	[ɟ]*uej*	[dʒ]*uej*	'hunt'
d. IE [s]*ēmi*	[ɟ]*ysmë*	[dʒ]*ims* < *xhysmë*	'half'

The types of palatalization and coronalization which will be focused on in this investigation will be limited to the forms which have been attested in Albanian (see Table 6.1 and Table 6.2).

Table 6.2: Palatalization and coronalization in Albanian

Historical environment	Palatal stops	Palato-alveolar affricates
a. [k, g] > [c, ɟ]/__front vocoids	k > c g > ɟ	> tʃ > dʒ
b. [t, d] > [c, ɟ]/__ [j]	t > c d > ɟ	> tʃ > dʒ
c. [j] > [ɟ]/# ___	j > ɟ	> dʒ
d. [s] > [ɟ]/# __ front vocoids	s > ɟ	> dʒ

In Table 6.2, although the process of palatalization, whereby a non-palatal consonant (e.g. velar or alveolar) becomes a palatal segment by changing its place of articulation, occurs in (a), (b) and (d), it does not in (c). However, in (c), instead of the palatal glide changing its place of articulation, it changes its manner of articulation from glide (i.e. [-consonantal]) to stop (i.e. [+consonantal]). Other than the palatal glide being strengthened to [+consonantal], the historical details as to how this occurred are not well known (see Topalli 2002). Also, it could be argued that the spirant [s] in (d) underwent palatalization and then later fortition, which changed not only the place features, but also the stricture features, e.g. [+continuant] → [-continuant]; otherwise, it could be argued that the change from a spirant to a palatal stop was merely consonant strengthening. Once the original segments in (a)-(d) have undergone palatalization and/or fortition to become palatal stops, coronalization occurs, whereby the palatal stops become palato-alveolar affricates.

It is important to note that, historically, first the velar/alveolar stops and the palatal glide/spirant became palatal stops (Meyer 1892, Pedersen 1900, Lambertz 1948, Cipo 1949, Mann 1952, Çabej 1976, Çabej 1996, Orel 1998, Topalli 2002). Thereafter, the newly formed palatal stops underwent coronalization, where they became palato-alveolar affricates (Meyer 1892, Lambertz 1948, Cipo 1949, Topalli 2002). Whereas the process of becoming a palatal stop is mainly historical, the process of palatal stops becoming palato-alveolar affricates is relatively new. More recently, however, some of the velar and dental/alveolar stops followed by front vocoids have not become palatal stops, but rather palato-alveolar affricates, e.g. Alb. [ke]*të* → [ʧ]*etë* 'this' and

[52] [kl] > [kʲ] > [ʧ] and [gl] > [gʲ] > [ʤ] also have been attested in Latin (Repetti 1984: 1, 4, 15, 17, 19-22).

[tj]*etër*→[tʃ]*etër* 'other' (Sawicka 1997: 39). That is, whereas the process of velar and dental/alveolar stops becoming palatal stops is no longer productive, spirantization (i.e. assibilation) is.[53]

Further, in Albanian the processes of palatalization and coronalization are lexical. Although these processes have been attested to occur word internally, e.g. Alb. pla[k-i][54] > *ple*[c] > *ple*[tʃ] 'old person(s)' (Topalli 2002: 146), they do not apply across word boundaries.[55]

6.1.2. Feature Specifications for Palatalization, Coronalization, and Fortition[56]

There has been much debate in the literature on palatalization regarding whether the triggers of palatalization, e.g. front vocoids, are specified for the features Coronal and/or Dorsal. Whereas Sagey (1990) supports the claim that dorsality is involved,[57] Hume (1994) argues that such segments are specified only for Coronal.[58] Calabrese

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[53] See Bhat (1978) for more information regarding spirantization. Also see Hock (1991) for more information regarding assibilation.

[54] In Standard Literary Albania (based on the Tosk variety of Albanian), the definite form is *plak-u* 'the old person', where *-u* is the definite marker. The original form is *plak-i*, where *–i* is the definite marker. So as to prevent the velar stop which is followed by a front vowel from becoming a palatal stop, a rule was made that says when a noun ends in a velar stop, the definite article marker will be changed from *–i* to *–u*. In many varieties of Gheg, *plak-i* is still used as the definite form (see Topalli 2001). Also, according to Camaj (1984:23-24), *-i also served as a plural marker for masculine nouns, which resulted in velar stops becoming palatal stops, i.e. k > [c] and g > [ɟ]. Camaj (1984:24) also notes the following: "In nouns ending in *k* or *g*, there is a stem vowel change in the plural form *a* to *e* and from *e* to *i*: indef. sg. *plak* 'old man' - indef. pl. *pleq*..."

[55] See Rubach (1984) for a similar analysis of Polish.

[56] In this dissertation the following abbreviations will be used: [cons] = [consonantal], [ant] = [anterior], [distr] = [distributed], [cont] = [continuant], [strid] = [strident].

[57] See also Chomsky and Halle (1968) for a similar argument, i.e. palatalization spreading the feature [-back].

[58] See Chen (1996: 8) for an Optimality Theory (OT) account of palatalization, which is described as the spreading of Coronal. Also see Mester and Ito (1989), Broselow and Niyondagara (1990, 1991), and Clements and Hume (1995) for additional accounts of palatalization involving the spread of the Coronal place node.

(1998), however, suggests that any segment which involves a narrowing in the palatal region is to be specified for both Coronal and Dorsal.

If front vocoids, such as palatal glides and front vowels, are specified as Dorsal, i.e. [-back], as argued by Sagey (1990), then a palatal glide would be represented as in Figure 6.2 (taken from Sagey 1990: 78).

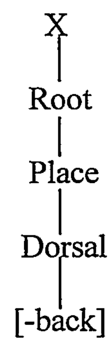

Figure 6.2: Palatal glide and front vowel feature specifications (Sagey 1990)

On the other hand, if front vocoids are assumed to be specified for Coronal, i.e. [-anterior] and [+distributed], as suggested by Hume (1994), then a palatal glide would appear as in Figure 6.3 (taken from Hume 1994: 67).

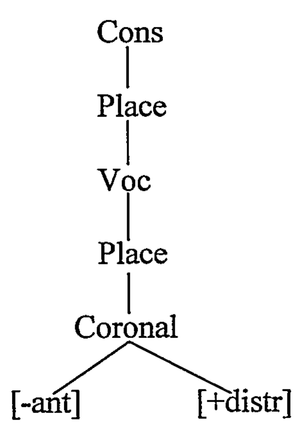

Figure 6.3: Front vocoid feature specifications for Coronal (Hume 1994)

However, if front vocoids are both Coronal and Dorsal, i.e. [-anterior], [+distributed], and [-back], as purported by Calabrese (1998), then a palatal glide could be illustrated as in Figure 6.4 (taken from Calabrese 1998: 19).

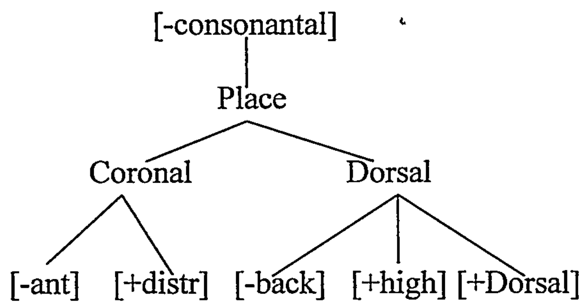

Figure 6.4: Front vocoid feature specifications (Calabrese 1998)

According to Calabrese (1998: 10), a distinction must be made between the "designated articulator," i.e. primary articulator, and the secondary articulator. In the case of the palatal glide in Figure 6.4, Dorsal, rather than Coronal, is the designated articulator, and hence is shown as [+Dorsal] (and not [+Coronal]). In the case of palatal consonants, e.g. palatal stops, according to Keating and Lahiri (1992), "both the tongue blade and tongue dorsum are active" (in Calabrese 1998: 17). That is, "palatal stops...are made with the tongue blade as well as the tongue body" (Calabrese 1998: 17). In such a case, palatal stops have both Dorsal and Coronal as the designated articulators, as is expressed in Figure 6.5 (taken from Calabrese 1998: 17).

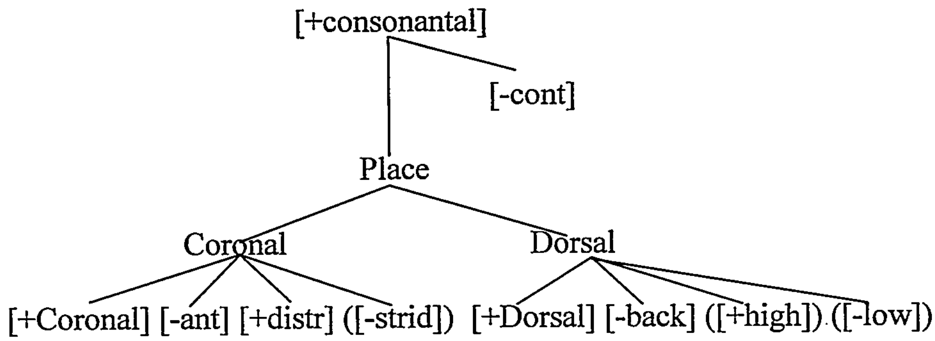

Figure 6.5: Palatal stop feature specifications (Calabrese 1998)

If one of the goals of phonology is to represent (more or less abstractly) what is occurring in the vocal tract of speakers, it is important that the feature specifications for the various segments reflect the reality of the articulation.[59] Keating (1988b: 5) claims that due to the articulatory and phonetic aspects of palatal segments, "palatals are simultaneously coronal ([-anterior]) and [+high, -back]."[60] In a theory in which [high] and [back] are dependents of the Dorsal node and [anterior] is a daughter of the Coronal node, it thus follows that palatal sounds are to be represented as both Dorsal and Coronal. If palatal segments are specified for both Dorsal and Coronal, they can very easily change place of articulation from velar to alveolar, and vice versa. If this is true, we would need to reject the claims of Sagey (1990) and Hume (1994), which do not allow for such a feature specification. Although the feature specification combination offered by Calabrese (1998) may be complex in that it requires two articulator nodes, it

[59] Although manner of articulation is of equal importance, this section specifically focuses on the place of articulation.

[60] Keating (1988b:5) treats palatals as laminal (i.e. [+distributed]) and [-anterior]. See also Hume (1994: 76).

accounts for the articulatory complexity of palatal sounds.[61] Also, the claim that palatal stops are articulatorily complex supports the fact that such segments are rare. Moreover, it is not unreasonable to assume that because maintaining contact in such a broad region is complicated (i.e. involves both Coronal and Dorsal articulation), palatal stops have been found to develop into less articulatorily complex segments (in terms of place), such as palato-alveolar affricates, as is the case in Albanian. Calabrese (1998: 54-56) supports this argument and suggests that segments specified as [-continuant, +distributed] (e.g. palatal stops) are difficult to produce, and hence avoided. Calabrese (1998: 54-55) writes:

> [T]here is little doubt that the configuration [-continuant, +distributed] must be characterized by a high degree of complexity, or in other words, that laminal stops, i.e., the stops in which the primary constriction is implemented with the tongue blade, are very complex segments...[T]he reason for the complexity of this configuration lies in the fact that given the length of the constriction characterizing laminal stops, the tongue blade cannot have sufficient mobility to obtain the abrupt release which is crucial for the proper articulation of a stop consonant (cf. Catford's passage p. 28). Support for this can be found in Stevens and Keyser (1989), who claim that the optimal coronal stop has a short constriction, i.e., it is characterized by the feature [-distributed]. The complexity...is also supported by the fact observed by Lahiri and Blumstein (1984) that these types of stops are very rare: few languages in the world show [palatal stops] in their consonantal systems (see also Ladefoged (1964) and Chomsky and Halle (1968)).

Calabrese (1998: 57) suggests that what is preferred over a [-cont, +distr] (i.e. a palatal stop) feature bundle is a segment which consists of: [-cont, +distr] [+cont, +distr], i.e. a palato-alveolar affricate. Hence, the less complex palato-alveolar affricate with a single

[61] See also Keating (1988b: 5): "In Keating (in preparation) I present cross-language evidence gleaned from UCLA X-ray database (Dart 1987) which suggests that palatals are articulatorily more complex than palato-alveolars." By "complex", Keating means that palatals involve both Coronal and Dorsal articulators.

articulator node (i.e. Coronal), is preferred over the more complex palatal stop with two articulator nodes (i.e. Dorsal and Coronal). The shift from palatal stop to palato-alveolar affricate also represents a movement from a more marked to a less marked place of articulation, i.e. coronal.

Further, the process of palatal stops developing into less complex segments is not limited to Albanian; it has also been reported to have historically occurred in Serbian, Croatian, and Macedonian (Sawicka 1997: 37-45). Sawicka (1997: 40-45) suggests that the process of palatal stops becoming palato-alveolar affricates is a possible areal feature in Balkan Sprachbund. The process of velar stops being palatalized before front vocoids and then becoming coronalized (i.e. becoming less complex in terms of having only one articulator node) is even more common, in that it has been found to occur in some dialects of Italian (Calabrese 1998), Slavic (i.e. the First Velar Palatalization), Mam, Bantu languages, Salishian languages, and Chinese, just to name a few (see Guion 1996).

6.1.3. The Position of [consonantal] in Feature Geometry

So as to separate out the natural class features [consonantal] and [sonorant] (henceforth [cons] and [son], respectively), some feature geometries have placed [cons] and [son] at the root node (see Figure 6.3-6.5). Kaisse (1992: 313) writes:

> Current versions of feature geometry generally locate the features [consonantal] and [sonorant] as annotations on the root node, rather than dependents of that or some other node. This geometry is intended to reflect the observation that, unlike other features, the major class features do not participate in phonological processes such as assimilation (spreading of a feature) or dissimilation (delinking of that feature).

Such a hierarchical structure, where [cons] is an inert feature, does not allow for partial spreading or delinking of the major class feature, but rather only total assimilation, which would create a geminate, or dissimilation, which could result in segmental deletion. Kaisse (1992: 315) states:

> Given such a geometry, the only way that either major class feature can appear to spread is if the entire root node spreads. In other words, only total assimilations resulting in geminates should exhibit a change in consonantality or sonorancy in one segment caused by its neighbor.

The issue of the location of the natural class feature [consonantal] is of particular importance when discussing processes of partial assimilation and dissimilation, as it occurs in palatalization, coronalization, and segment fortition. If [cons] is located at the root node (as is shown in Figure 6.4), only total assimilation and dissimilation of [cons] can occur. However, if [cons] is subordinate to the root node where it has a greater level of independence, partial assimilation (i.e. spreading) and dissimilation (i.e. delinking) of [cons] is possible (see Sagey 1990 and Kaisse 1992 below). By incorporating Calabrese's feature specification of palatal segments using Sagey's and Kaisse's [cons] demotion representation, it is possible to accurately describe palatalization and fortition/lenition in not only Albanian, but also other languages, e.g. Cypriot Greek (Newton 1972a) Räto-Romansch (Kamprath 1987), Athna (Kaisse 1992), and Halland (Kaisse 1992).

According to Kaisse (1992: 318, 324), whereas [consonantal] is demoted from the root node position, [sonorant] is not: "I do not think that [sonorant]...spread[s]...and...maintain the position that [sonorant] is an inert feature." Kaisse (1992: 324) points out that when the feature [+cons] spreads, a [-son] segment usually results. To resolve the issue of a [+son] segment changing to [-son] as a consequence of consonantal spreading, she stipulates the following principle:

> Sonority Redundancy Principle: The result of spreading [consonantal] to the root node is to delink the sonoracy annotation on that node and replace it with [-sonorant] in case of [+consonantal] and with [+sonorant] in the case of [-consonantal] (Kaisse 1992: 324).

Kaisse's Sonority Redundancy Principle works well, except if the result of consonantal spreading involves (1) [+cons] segments which are also [+son], such as nasal stops, liquids, and trills, or (2) [-cons] segments which are also [-son], such as what some linguists have proposed for glottal stops and fricatives (Anderson 1974: 298). Kaisse explains the above two cases by stating that the "usual result of consonantalizing a glide is an obstruent" (Kaisse 1992: 324) and that

> consonantality involves making a constriction in the oral cavity at least as narrow as that of a fricative. If we do this to a nonconsonant, we will produce a configuration which will prevent the result from being a sonorant any longer, unless additional adjustments are made. Sonorants are produced with a vocal tract configuration that results in more or less equal air pressure outside and inside the mouth. To achieve this result with a narrow oral tract obstruction, either the velum must be opened, producing a nasal, the sides of the tongue must be brought down, producing a lateral, or the articulators must be vibrated, producing a trill. All of these are rather major adjustments, so it is not surprising that the outcome we have encountered in our sample is rather that the new consonant becomes an obstruent (Kaisse 1992: 324-325).

Because the result of consonantal spreading tends to be an obstruent, the Sonority Redundancy Principle resolves the issue of dealing with [son].

6.1.4 The Sagey Model (1990) and Kaisse Model (1992)

As was previously mentioned, Sagey (1990) and Kaisse (1992) demote the feature [cons] so it is a daughter of the root node, as in Figure 6.6 (based on Sagey 1990: 205 and Kaisse 1992: 313).[62]

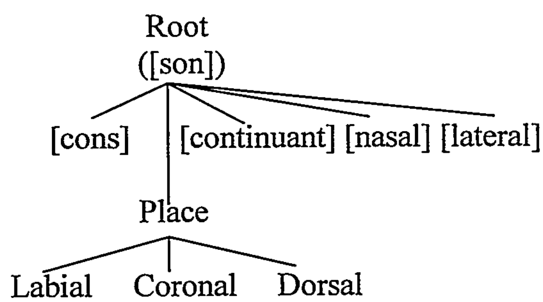

Figure 6.6: The Sagey model (1990) and Kaisse model (1992): Demotion of [consonantal]

The model in Figure 6.6, which follows Clements (1985), builds on the notion that in order to account for various phonological processes, [cons] must be able to spread and delink independently of the other features in the hierarchy. Hence, it is demoted to the level of other stricture features, such as [continuant], [lateral], and [nasal].

Since the tree construction must be able to account for the various phonological processes that occur in human language, independence of [cons] should be incorporated into the hierarchical organization.[63] Further, if the hierarchical structure is to reflect the importance of the features, [cons] should be an accessible feature (Kaisse 1992: 331). As Kaisse (1992: 330) points out, although "cases supporting this new feature

[62] Only features which are central to the main argument of this discussion are presented here. See also Sagey 1990 and Kaisse 1992.

geometry...are comparatively rare," they are not unheard of. The following subsections will demonstrate how the demotion of [cons] functions and how it is beneficial to the phonological tree organization in terms of palatalization and fortition/lenition issues.

6.1.5. Velar Palatalization[64]

As was previously mentioned, historically in Albanian velar stops followed by front vocoids became palatal stops, i.e. [k] > [c]/ __ front vocoids, e.g. Lat. [ke]*pa* > Albanian [c]*epë* 'onion', as is expressed in Figure 6.7, following Calabrese (1998: 10, 17, 19) and Sagey (1990: 205).

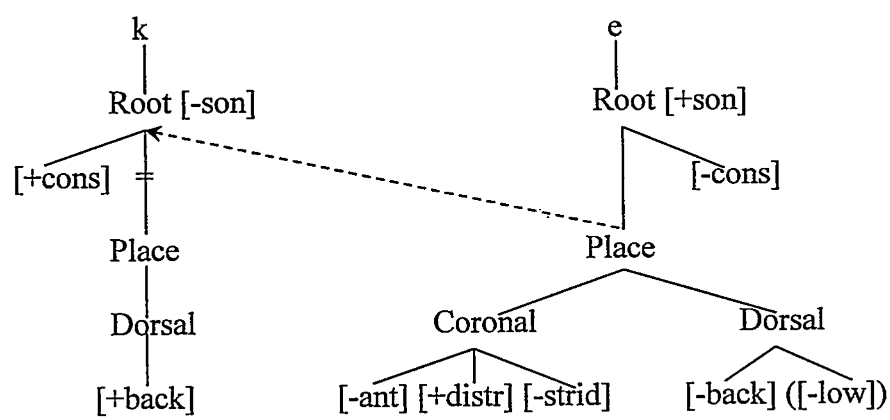

Figure 6.7: Velar palatalization feature specifications

In Figure 6.7, although [k] is already specified for Dorsal, it is also [+back], which is not desired for a palatal stop, where [-back] is required. Instead of simply spreading the

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[63] "Our feature geometries must recognize the existence of...assimilations and dissimilations of consonantality in their descriptions of glide hardening" (Kaisse 1992: 331).

[64] Note that only relevant features will be mentioned in the phonological tree constructions. For example, although palatal segments are specified for both Coronal and Dorsal, notation as to which is the primary articulator (as was done in Calabrese 1998) will not be made in the discussion here. Also, the following abbreviations have been made: [anterior] = [ant], [distributed] = [distr], [strident] = [strid], and [continuant] = [cont].

Coronal place node of the vowel leftward, we delink the original place node of the voiceless velar stop, and then spread the entire place node of the [-back] vocoid leftward. The end result is a palatal stop. This process also works for the voiced velar stop, i.e. /g/→ [ɟ], e.g. Trk. [gö]*ks* > [ɟ]*oks* 'breast' (Çabej 1996: 335).

6.1.6. Coronal Palatalization

Further, as was already noted, dental/alveolar stops followed by front vocoids have historically become palatal stops in Albanian, i.e. [d] → [ɟ]/__ front vocoids, e.g. It. *ma*[dj]*a* > *ma*[ɟ]*e* 'cooking area', as is expressed in Figure 6.8, following Calabrese (1998: 22-23) and Sagey (1990: 205).

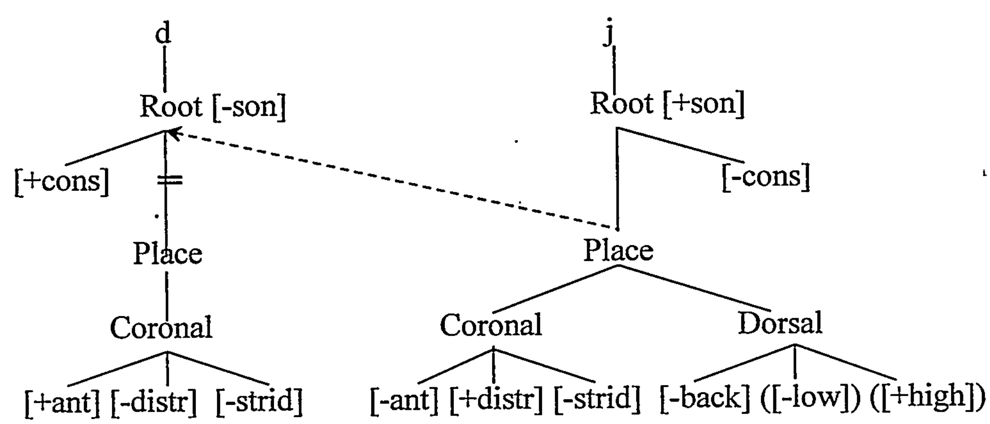

Figure 6.8: Coronal palatalization feature specifications

In Figure 6.8, the dental/alveolar stop [d] has Coronal as its designated articulator. In order for the alveolar stop to become a palatal stop, we could (a) delink terminal nodes [+ant] and [-distr] under the Coronal node and (b) spread the terminal nodes [-ant] and [+distr] and the Dorsal place node of the following palatal glide leftward. However, instead of delinking and spreading the terminal nodes, we could simply delink the place node of the alveolar stop and spread the place node of the palatal glide leftward. In doing so, we are able to express that palatalization is assimilation.

6.1.7 De-Dorsalization

As previously mentioned, coronalization, here renamed de-dorsalization, whereby a palatal stop becomes a palato-alveolar affricate also has occurred historically and can be found synchronically in Albanian, i.e. [c] → [tʃ][65] e.g. Albanian [c]*epë* > [tʃ]*epë* 'onion', as in Figure 6.9.

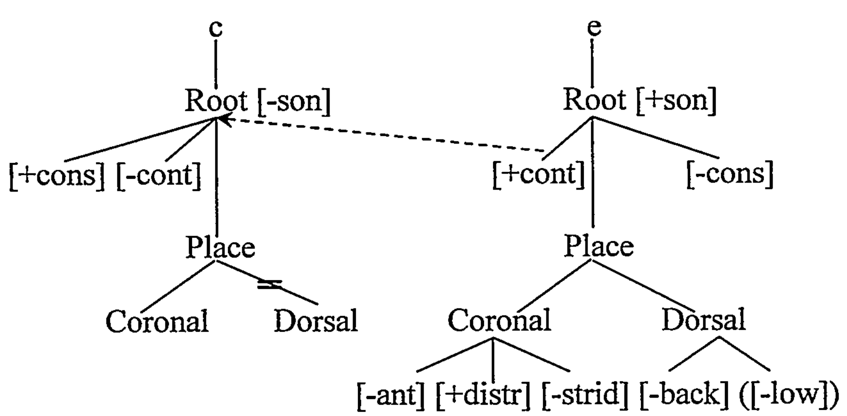

Figure 6.9: De-dorsalization feature specifications

In Figure 6.9, besides the Dorsal place node of the palatal stop being delinked, the palatal stop changes from being a [-continuant] stop to a [-/+continuant] affricate.[66]

[65]In SPE Chomsky and Halle (1968: 413) point out that the voiceless palato-alveolar is [+high], [-back], [-ant], [+Coronal], [+delayed release], and [+strident].
[66]See Sagey (1990) for further explanation regarding affricates in terms of being specified for both [-continuant] and [+continuant].

6.1.8. Fortition

Historically in Albanian, word-initial palatal glides, as previously stated, have become palatal stops, i.e. [j] → [ɟ]/#___ , e.g. IE [j]ag^h > [ɟ]*uej* 'hunt', as appears in Figure 6.10.

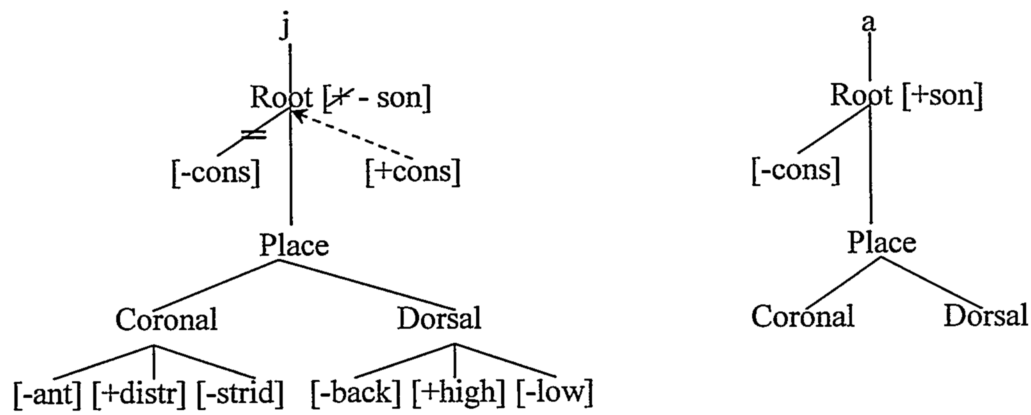

Figure 6.10: Glide fortition feature specifications

In Figure 6.10, since the palatal glide is already produced in the palatal region, the main change which occurs is [-cons] becomes [+cons], whereby [-cons] is delinked and [+cons] is filled in. Also, by applying Kaisse's Sonority Redundancy Principle, the [+son] of the glide is changed to [-son]. Although partial spreading of [cons] is not required in Albanian, it is required in languages such as Cypriot Greek (Kaisse 1992, Newton 1972a: 53) and Räto-Romansch (Kamprath 1986) where a palatal glide is strengthened to a palatal stop (e.g. [aðerfja] → [aðerfca] 'brothers') and a velar stop (e.g. *krej* + *r* → *krekr* 'to believe'), respectively.[67] Kaisse (1992) argues that in Cypriot Greek and Räto-Romansch, the [+cons] from a surrounding consonant spreads onto the palatal glide, changing the [-cons] glide to [+cons].

Further, although palatal glide fortition in Albanian does not utilize the spreading of [cons] (i.e. assimilation), it could be argued that the Albanian palatal glide undergoes dissimilation, whereby [cons] is delinked. According to Kaisse (1992: 326-327), dissimilation involves delinking the feature [cons],[68] such as was done with the palatal glide in Figure 6.10 for Albanian. The only difference between Kaisse's examples of dissimilation and the Albanian examples, is that whereas Kaisse's data for Athna and Halland involve obstruents becoming glides (i.e. lenition), the Albanian data deal with glides becoming obstruents (i.e. fortition). Regardless of whether the dissimilation process involves obstruents or glides, the process is the same: delinking [cons]. For Kaisse (1992: 326-327), [+cons] (when followed by [+cons])[69] delinks and becomes [-cons]; for Albanian, [-cons] (when followed by [-cons]) delinks and becomes [+cons]. In both cases, the only way that [cons] can be separated out and delinked, is if

[67] Instead of using [c] to represent a voiceless palatal stop, Kaisse (1993: 351) uses [k^j]: "One of the striking facts about Cypriot Greek dialect is that it turns /y/ to the voiceless palatal stop [k^j] after a consonant…y →[k^j] /C__ … /aðelfi + a/ (→ aðelfya) → aðelfk^ja 'brothers'". Kaisse (1993: 352) also mentions that when the palatal glide becomes a palatal stop the following features are involved: [-cons, -obstruent, +cont, +hi, -bk] → [+cons, +obstruent, -cont, -vc]/C, which supports the idea of demotion of the feature [consonantal].

[68] Kaisse (1992: 326) addresses the issue of dissimilation: "McCarthy 1988 argues that evidence for feature geometry can be found not only in assimilations (spreading) but in dissimilations (delinking) as well. I present here two examples of dissimilation of [consonantal], both involoving the change of a consonant, be it obstruent or sonorant, into a vowel or glide when the focus consonant is adjacent to another consonant." Kaisse uses data from Ahtna (an Athabaskan language of Alaska based on Kari 1990) and Halland (a native dialect of Swedish that is spoken in the Halmstad region of southern Sweden, which is based on Kaisse's personal communication with Jan-Olof Svantesson 1991) for her examples.

[69] See Kaisse (1992: 329) for more information regarding dissimilation: "[W]e see dissimilation of the feature [consonantal] before consonants of every place and manner in the language."

it is a daughter of the root node, as occurs in Figure 6.10. Kaisse's Sonority Redundancy Principle takes care of changing the status of [son] to [+son] for the glides and to [-son] for the obstruents.

Further, historically in Albanian, the word-initial IE spirant [s], as was previously mentioned, became a palatal stop, i.e. [s] > [ɟ], e.g. IE [s]*ēmi* > [ɟ]*ysmë* 'half' (Topalli 2002), as appears in Figure 6.11.

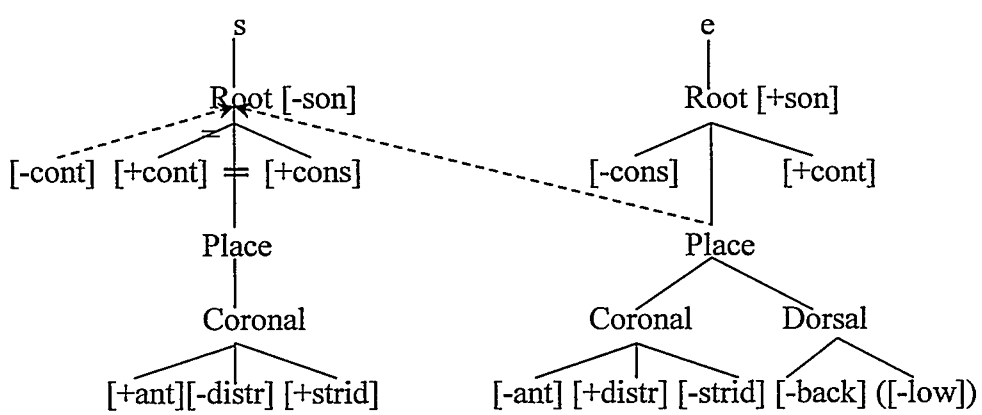

Figure 6.11: Spirant fortition feature specifications

In this case, the place node of the spirant [s] is delinked and then the place node of the following front vocoid is spread leftward. Also, the spirant's [+cont] is delinked and [-cont] is filled in. As with coronal palatalization in Figure 6.8, when we delink and spread the place node, palatalization is represented as being a process of assimilation to the following vocoid.

The actual path [s] took to become a palatal stop is not known. It could be the case that [s] underwent palatalization and became [ʃ] and later [ʒ], which then underwent palatalization for a second time resulting in a palatal stop: [s] → [ʃ → ʒ]

→ [ɟ]. Otherwise, the [s] could have been strengthened to an alveolar stop (where the voiceless stop changed to voiced), which then underwent palatalization, resulting in a palatal stop: [s] → [t → d] → [ɟ]. Further research is needed in this area.

In Albanian, the aforementioned palatal glide and spirant strengthening have been historically attested only in the word-initial position, not in any other environment. Although Kaisse (1992: 320-321)[70] argues against the syllable onset position motivating segment fortition, it could be that at one point in the historical development of Albanian there was a constraint which allowed only for oral and nasal stops to be in the word-initial position,[71] which applied not only to the spirant [s], but also the palatal glide [j].

The phonological process of palatalization is very common cross-linguistically. It has been attested not only in Albanian, but also in other languages in the Balkans, as well as in Bantu, Salishan, and other non-IE language families. Whereas the targets of palatalization are usually (1) velar, i.e. Dorsal [+back], and (2) dental/alveolar, i.e. Coronal [+anterior], the triggers are usually front vocoids, i.e. Dorsal [-back] and Coronal [-anterior]. If palatal segments (e.g. palatal stops and glides) are permitted to

[70] Kaisse (1992: 320-321) writes: "We now need to discuss the possible influence of syllable structure on rules of consonantalization. Onset position tends to favor strengthening processes, of which consonantalization is surely one, while coda position generally favors weakening. Therefore, to show that [consonantal] has spread from one segment to another, I must rule out the analysis in which all consonantalizations occur independently of the features surrounding segments and the result simply from the fact that the target segment is in an onset. The two cases (Cypriot Greek and Räto-Romansch) presented above should be sufficient to argue against a syllable-position analysis." When discussing dissimilation of [cons], Kaisee (1992: 327) comments: "But in some languages it many also have to do with maximizing the difference between the feature content of nuclei, which should be [-consonantal] in the unmarked case, and the content of the onset or coda, which should be [+consonantal]...[A] newly [+consonantal] segment will become an obstruent while a newly [-consonantal] segment will become a sonorant."

[71] Kaisse (1992: 324) supports the claim of palatal glides being strengthened to obstruents: "[T]he usual result of consonantalizing a glide is an obstruent."

be specified for both Dorsal and Coronal, the palatalization of velars and dental/alveolars can be explained by assimilation to the following vocoid. If [consonantal] demotion is allowed, more opportunities for segmental assimilation and dissimilation (e.g. fortition and lenition) exist. That is, the articulatorily-based and phonologically-based issues of palatalization and coronalization will be accounted for and explained. Further, future research regarding palatalization in Albanian could include (1) investigating how the IE [s] evolved into a palatal stop in Albanian and (2) treating the present account of Albanian palatalization in terms of Optimality Theory.

6.2 Language External Factors: Sociolinguistics and Sound Change

The current linguistic status of palatal stops in the Albanian language must also be considered in terms of various sociolinguistic issues regarding historical, social, and political developments which occurred in Albania, before, during, and after the reign of the former communist leader Enver Hoxha (1944-1985).

6.2.1. Historical, Social, and Political Developments

To begin with, the Albanian language has a long oral and literary tradition (Kastrati 2000, Hamiti 1998). The first historical record of the existence of Albanians dates back to the 11th century in the writings of the Byzantine scholars Michael Attaliate, John Skylitze, and Anne Comnenus. Konica, a well-known Albanian scholar, writes that as early as 1272, during the time of the reign of the Albanian king Sharl Anzhu, the Albanian language was used for not only verbal communication, but also official state business; no written documents, however, can be found to verify this claim. According to the Albanologist Çabej, in 1332 the German scholar Brocardos

Teutonicus wrote that the Albanians, although they have a language completely different from Latin, used the Latin script in their books.[72]

Although the aforementioned sources make mention of Albanian as a written language, the first known document to be written in Albanian surfaced during the 15th century. *Formula e Pagëzimit*[73] (Baptismal Formula), the earliest document written in the Albanian language, appeared in 1462 and written by the Archbishop of Durrës Pal Engjëlli; it was in the Gheg variety (as spoken in Mat) using Latin characters.[74] In 1497 Arnold von Harf, a German explorer, created a small Albanian-German dictionary consisting of a combination of 26 Albanian words and 8 Albanian phrases, which was based on Albanian words in the Gheg variety that he heard being uttered while traveling in the Tivar and Ulqin regions of present-day Montenegro. The first document to have appeared in the Tosk variety, *Ungjilli i Pashkëve*, dates back somewhere between the 13th and 15th centuries and was written using the Greek Alphabet. *Meshari* (Missal) by Gjon Buzuku was the first book rendered in the Albanian language; it was written and published in the Gheg variety of Albanian in 1555. In 1592 *Embsvame e Krështerë* (Catechism) was written and published in Italy by the Arberesh-Albanian Leke Matrënga in the Arberesh variety of Albanian (i.e. Albanian as it is spoken in Italy). In 1633 *Fjalorth*, an Italian-Albanian etymological dictionary for the Albanian language,

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[72] It is important to note that although mention is made of Albanian as a written language, no written documents in the Albanian language have been found which correspond with this time period. See Hamiti (1998: 10) for further details regarding this issue.

[73] *Formula e Pagëzimit* was discovered by the Rumanian historian Nikollae Jorga in 1915 (Hamiti 1998: 7).

was created by Pjeter Mazrreku. In 1618 Pjeter Budi wrote *Doktrina e krishtenë* and in 1653 the first Latin-Albanian dictionary was written by Frang Bardhi, both of which were written in the Gheg variety. Another well-known writer of this time was Pjeter Bogdani (*Çeta e profetëve*, 1685), who also wrote in Gheg.

Although most of the aforementioned authors used the Latin Alphabet as the basis to render Albanian sounds, later in the 18th and 19th centuries Arabic and Greek scripts were also frequently used for writing the Albanian language. In 1724, Muçi Zade composed a poem of 17 verses in the Albanian language using the "Arabo-turk" script.[75] Also, in the 1860s when Kostandin Kristoforidhi translated the New Testament into Albanian, he used Latin orthography for the Gheg translation, and Greek orthography for the Tosk translation (Osmani 1999: 191).[76] In 1908, however, at *Kongresi i Manastirit* (The Congress of Manastir), the Latin script was selected as the official orthography for Albanian by a group of Albanian scholars.[77]

Although an official script had been chosen, there was still much debate as to which variety should be used to unify the Albanian people. In 1917 *Komisia Letrare* (the Literary Commission), which was founded in Shkodër, decided that the literary

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[74] It is interesting to note that NSs of Gheg from the Mat region where *Formula e Pagëzimit* was composed still maintain many of the same subdialectal features (e.g. [i] is pronounced as [e]) as were used in 1462.

[75] For more information regarding the use of Arabic and Arabo-Turk scripts for the Albanian language, see Osmani (1999: 136-142).

[76] It should be noted that in terms of Christianity, whereas Ghegs tend to be Catholic, Tosks tend to Orthodox. Therefore, it seemed quite natural for the Gheg translation to use the Latin Alphabet and the Tosk translation to use the Greek Alphabet. For more information regarding this issue, see Osmani (1999: 188-206).

[77] Some of the Albanian scholars included were Mithat Frashëri , Gjergj Fishta, Luigj Gurakuqi, Ndre Mjeda, Shefqet Frashëri, Hilë Mosi, Gjergj Qiriazi, Thoma Avrami, and Nyzhet Vrioni.

language should be similar to that which is used in Elbasan, which is located geographically in the central region of present-day Albania and linguistically in the southern Gheg area. Prior to 1944, when the communists seized political power of Albania, two literary varieties were widely in use, that of literary Gheg and literary Tosk. Albanians freely spoke and wrote in which ever variety that was most comfortable.[78]

During this time, Albania was in political upheaval. In 1912 Albania received its independence from the Ottoman Empire. Prior to the outbreak of World War I, in 1914 a German prince by the name of William Weid was appointed king of Albania by the European powers (Zavalani 1998: 237). In 1920 the first democratic parliamentary elections in Albania took place, which were directed by Ilaj Vrioni (Zavalani 1998: 272). Later in 1923 the first constitutional elections occurred, with Ahmet Zogu being chosen as Prime Minister (Zavalani 1998: 276). In July of 1924 Fan Noli organized a military coup to overthrow the government; Fan Noli's government was dissolved on 24 December 1924 (Zavalani 1998: 278-9). Thereafter, Ahmet Zogu became president of the Republic of Albania, which lasted until 1928. In 1928 Ahmet Zogu was named king of Albania (Zavalani 1998: 288). From 1936 to 1944, however, Italy occupied Albania (Zavalani 1998: 303). After Albania was annexed by Italy, World War II began. Thereafter, the Albanian Nationals and the Albanian Communists battled for power,

[78] Some well-known Albanian authors of this time were: Sh. Gjeçovi, Gj. Fishta, V. Shanto, N. Mjeda, V. Prenushi, Migjeni, etc.

resulting in the creation of the People's Socialist Republic (PSR) of Albania in 1946, with Enver Hoxha as its leader.[79]

In 1950, under the communist leadership of Enver Hoxha, various language programs were initiated.[80] During Hoxha's reign, it was decided that the official language of the PSR of Albania should be *Gjuha Letrare Shqipe* (Standard Literary Albanian), which was mainly based on the Tosk variety of Albanian, with very little influence from Gheg. Various works, such as *Rregullat e Drejtshkrimit të Shqipës* (The Orthographic Rules of Albanian, 1967), *Drejtshkrimi i Gjuhës Shqipe* (The Orthography of the Albanian Language, 1974), and *Fjalori Drejtshkrimor i Gjuhës Shqipe* (The Dictionary of Albanian Orthography, 1976) were published. The only variety that was allowed to be used for publication was that of the new standard, *Gjuha Letrare Shqipe*. Much pressure was put on educators, actors, the media, and officials at all levels to use only this variety. Documents which were written in Gheg were destroyed.[81]

Refusing to write and speak in *Gjuha Letrare Shqipe* had more than just a linguistic impact, but also political ramifications. Enver Hoxha was from southern Albania (Gjirokastër) and spoke the Tosk variety natively. It was commonly believed that many native speakers of Gheg, like the former King Zog, were anti-communist. To write in and speak the Gheg variety was to identify with the old 'aristocratic' political regime, and therefore take an anti-communist stance, i.e. be considered an enemy of the

[79] On 29 November 1944 the communist Albanians officially seized power (Zavalani 1998: 329).
[80] See Pipa (1989), Zavalani (1998), and Beci (2000a) for more information regarding language policies in Albania during communism.
[81] Some Albanian authors (both Gheg and Tosk) who were in exile during communism are: Namik Resuli, Ernest Koliçi, Tahir Kolgjini, Arshi Pipa, Martin Camaj, Tajar Zavalani, etc.

state, which was punishable by law.[82] Many who chose not to conform to the communist language policies were imprisoned and their writings were destroyed. Many times family members of the non-conformists, or "reactionaries," were banished to isolation camps and not allowed to be educated.

As a result of the prescriptive norms of communist language policies, most Albanians in Albania were taught how to speak, read, and write *Gjuha Letrare Shqipe.* Although the native speakers of Gheg learned the Tosk variety via *Gjuha Letrare Shqipe*, the native Tosk speakers were not educated in the Gheg variety. In terms of the prototypical palatal stop, whereas native Gheg speakers would hear the prescriptive palatal stop (with very little frication in the release) being uttered in "official" settings (e.g. at school, in the media, at the office), they would hear them articulated as affricates at home.

In 1992 when the communist party of Albania officially dissolved and a democratic government was elected, attitudes towards communist ideals, including language policies, began to be openly challenged. However, despite the fact that the communist government was no longer in power in Albania, the communist mentality continued to persist at many levels of society, including education. For example, many of the language textbooks that were used during communism are used today. Also, lectures and exams at state supported educational institutions are to be given only in *Gjuha Letrare Shqipe.* Further, books published by state institutions are also still only

[82] For more information regarding Albanian language policies and linguistic discrimination during communism, see Beci (2000a: 65).

allowed to be published in *Gjuha Letrare Shqipe.* Recently, however, some Albanian authors, such as Willy Kamsi, Irhan Jubica, Bledi Kraja, Shpetim Kelmendi, Ledia Dushi, Arben Prendi, Arben Marku, Agim Morina, Dardan Ibrani, Gazmend Berlajolli, and Sulejman Dida, have started to write and be published in the Gheg variety. Also, the acceptance of "Ghegisms" is becoming less stigmatized, and therefore more acceptable and prevalent in society. For example, as was mentioned earlier, according to Enver Hoxha's prescriptive norms for communist language initiatives, pronunciation of the prototypical palatal stop was to be with very little frication, if any, in the release; however, as is evidenced by the acoustic study findings (see Chapter 5), few NSs of Albanian produce the prototypical palatal stop without frication. Instead, the tendency is to produce a palato-alveolar affricate (and in some cases a fricative), which originated as a Ghegism.

6.2.2. Sound Change and Age

As Labov (1994) points out, one major aspect of studying sound change involves considering the age of the speakers. Labov writes:

> The first and most straightforward approach to studying linguistic change in progress is to trace change in apparent time: that is, the distribution of linguistic variables across age levels. If we discover a monotonic relationship between age and the linguistic variable, or a significant correlation between the two, then the issue is to decide whether we are dealing with a true change in progress or with age-grading (Hockett 1950), a regular change of linguistic behavior with age that repeats in each generation (Labov 1994: 45-46).

So as to ascertain if a sound change is taking place, whereby the Albanian phonemic palatal stops are in the process of becoming palato-alveolar affricates, this section will focus on the age of speakers in the acoustic analysis. In this section the age of the speaker is referred to by the year the subject was born (for the actual age of the speakers in the acoustic analysis, see Appendix A). Each subject is grouped into one of three "year of birth" (YOB) categories, each of which was determined based on various political developments which were in place in Albania at the time:

1) 1931-1952[83] (1928: Ahmet Zogu was named King of Albania; 1936-1944: Italy occupied Albania; 1946: PSR of Albania was created with Enver Hoxha as its leader)

2) 1953-1972[84] (1950s: Enver Hoxha's communist language policies initiated)

3) 1973-1984[85] (1973: Communist language policies reinforced; 1985: Enver Hoxha died; 1992: Democracy)

If the phonemic palatal stops in Albanian are becoming palato-alveolar affricates, the following should be reflected in the data over time:

a.) an increase in relative release duration, and

b.) a decrease in relative Rise Time.

Both (a) and (b) are evidenced in the data when the subject's year of birth is taken into consideration.

Table 6.3 provides the means and ANOVA summary for the temporal acoustic variables according to the subject's year of birth for all subjects (both Gheg and Tosk

[83] This category includes the older speakers who were between the ages of 50 and 71 at the time of the interviews.
[84] This category includes the middle-aged speakers who were between the ages of 30 and 49 at the time of the interviews.
[85] This category includes the younger-aged speakers who were between the ages of 18 and 29 at the time of the interviews. Many of these subjects just finished high school or were in college at the time of the interviews.

varieties). As is expressed in Table 6.3, the mean differences for the temporal acoustic variables of segment duration, closure duration, release duration, Rise Time, and relative RT in terms of the subject's year of birth were found to be statistically significant. However, the mean differences for relative release duration regarding the subject's year of birth express a tendency towards not being significant.

Although the mean values of segment duration, closure duration, and release duration are decreasing over time, as can be seen in Figure 6.12, Figure 6.13, and Figure 6.14, respectively, the mean relative release duration increases for the younger speakers, as is expressed in Figure 6.15. That is, albeit there was a decline in the relative release duration between 1931-1952 and 1953-1972, the data indicate that the mean values of the relative release duration increased for the Albanian speakers born between 1973 and 1984. This fluctuation in relative release duration could be explained by examining various sociolinguistic issues, such as communist language policies which were in effect at the time. As previously mentioned, many of the Enver Hoxha's language reforms were initiated in the early 1950s; this could be a possible cause for a decrease in the relative release duration for speakers born during 1953-1972. One reason for the increase in relative release duration for the speakers born between 1973 and 1984 could be that many of the younger speakers were educated at a time when communist language policies were relaxed and openly challenged. Further, the mean values for both Rise Time and relative Rise Time also decreased over time, as is illustrated in Figure 6.15 and Figure 6.16, respectively. As was previously mentioned, a lower Rise Time is characteristic of more affricate and alveolar like pronunciations. That is, the younger speakers (those born between 1973 and 1984) have more affricate-like and less fricative-like (and less stop-like) articulations than do the two older groups. This reduction could also be partially attributed to various language policies which were enforced during the time the speakers were being educated.

Table 6.3: Means, standard deviations, and ANOVA summary for the temporal acoustic variables according to the subject's year of birth (for all surface representations, for all subjects)

acoustic variable	YOB	mean value	s.d.	level of sig. ($p \leq 0.05$)
segment duration	1973-1984	126.21 ms	32.9	0.000*
	1953-1972	134.11 ms	37.8	
	1931-1952	137.92 ms	41.3	
closure duration	1973-1984	65.35 ms	27.5	0.000*
	1953-1972	70.88 ms	32.5	
	1931-1952	72.09 ms	35.0	
release duration	1973-1984	60.86 ms	28.8	0.000*
	1953-1972	63.23 ms	28.7	
	1931-1952	65.82 ms	31.2	
relative release duration	1973-1984	48.0%	18.0%	0.057
	1953-1972	47.6%	18.6%	
	1931-1952	48.6%	20.5%	
Rise Time	1973-1984	31.11 ms	18.4	0.000*
	1953-1972	33.91 ms	19.0	
	1931-1952	39.53 ms	23.8	
relative RT	1973-1984	51.5%	16.2%	0.000*
	1953-1972	54.1%	17.0%	
	1931-1952	59.2%	17.2%	

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$)

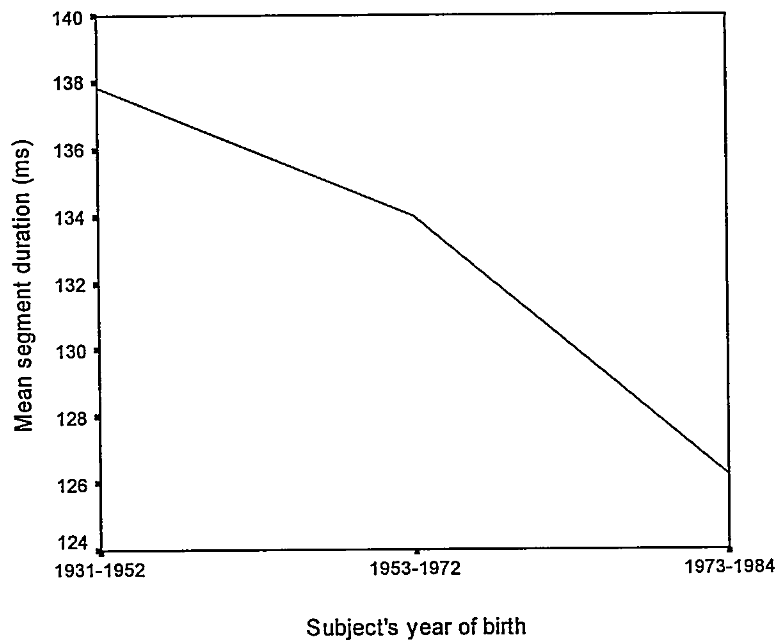


Figure 6.12: Mean segment duration (ms) according to the subject's year of birth

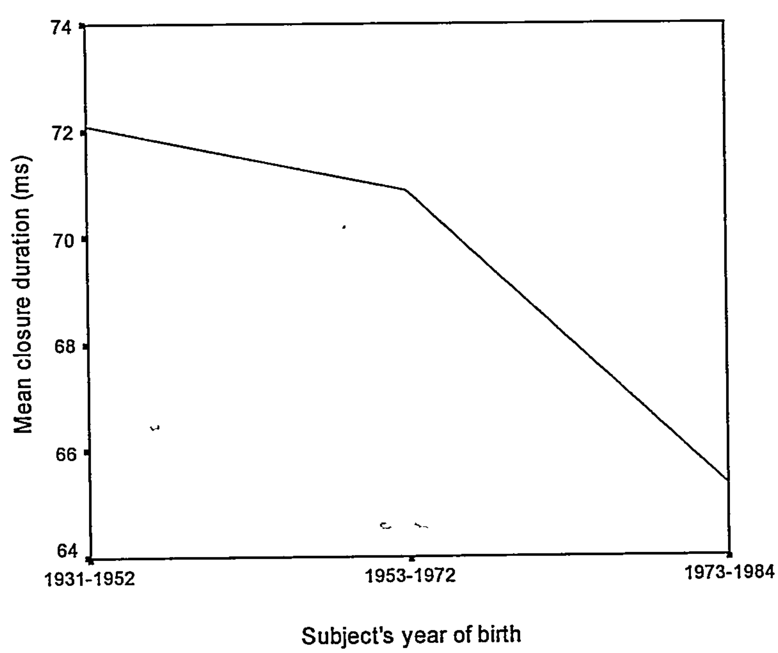


Figure 6.13: Mean closure duration (ms) according to the subject's year of birth

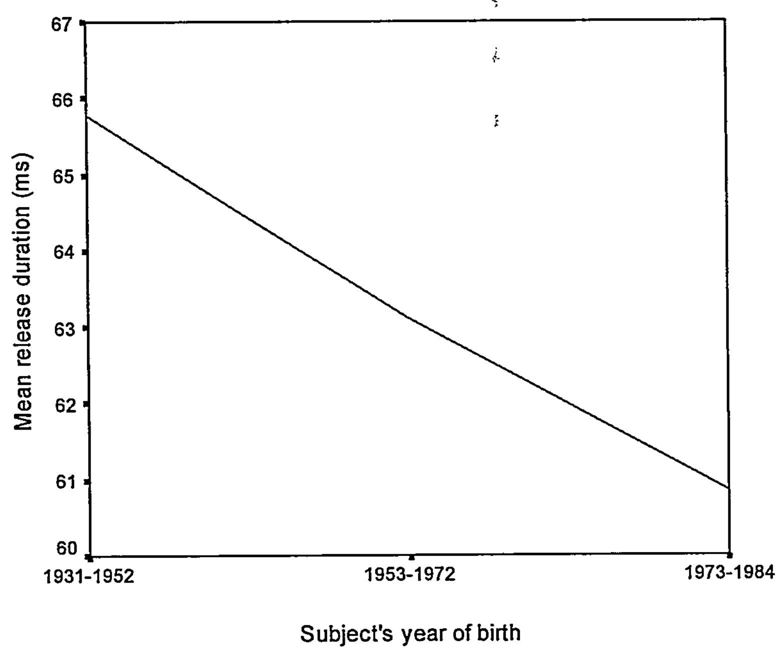


Figure 6.14: Mean release duration (ms) according to the subject's year of birth

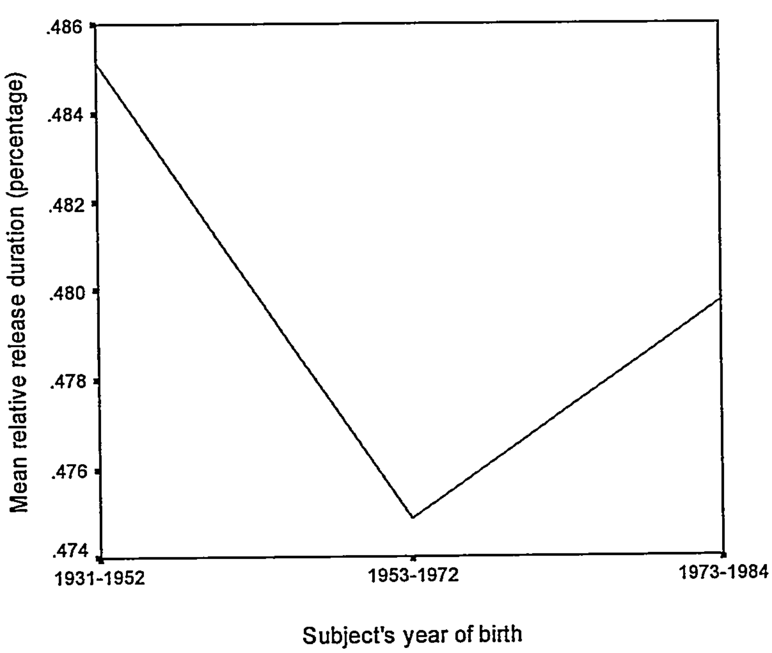


Figure 6.15: Mean relative release duration (percentage) according to the subject's year of birth

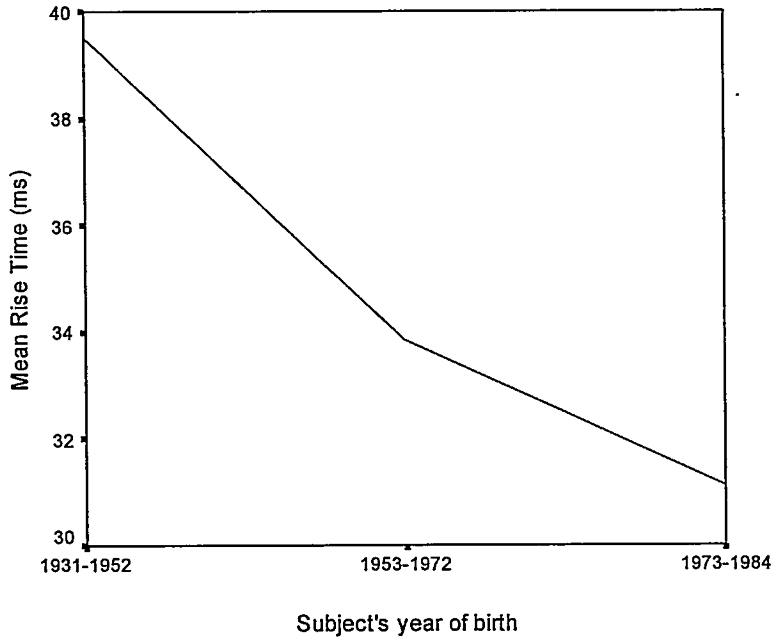


Figure 6.16: Mean Rise Time (ms) according to the subject's year of birth

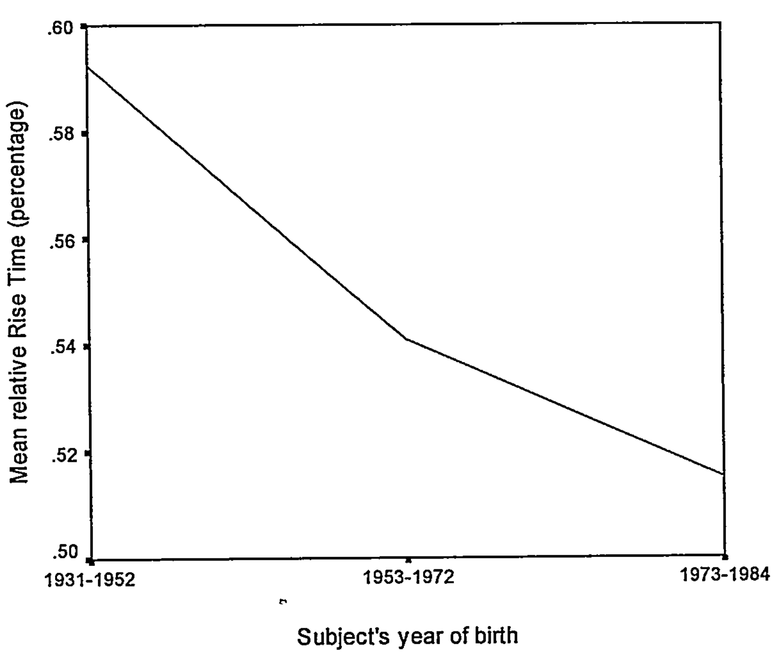


Figure 6.17: Mean relative Rise Time (percentage) according to the subject's year of birth

Table 6.4 provides the means and ANOVA summary for the temporal acoustic variables according to the subject's year of birth (YOB) for the Gheg speakers. As is expressed in Table 6.4, the mean differences for the temporal acoustic variables of segment duration, closure duration, release duration, Rise Time, and relative RT in terms of the subject's year of birth were found to be statistically significant. However, the mean differences for relative release duration regarding the subject's year of birth were not significant. The findings for the Gheg speakers confirm the findings of that in Table 6.3.

Table 6.4: Means, standard deviations, and ANOVA summary for the temporal acoustic variables according to the subject's year of birth (for all surface representations, for Gheg speakers)

acoustic variable	YOB	mean value	s.d.	level of sig. ($p \leq 0.05$)
segment duration	1973-1984	118.97 ms	29.6	0.000*
	1953-1972	133.38 ms	35.2	
	1931-1952	137.09 ms	40.8	
closure duration	1973-1984	58.67 ms	26.7	0.000*
	1953-1972	66.50 ms	31.9	
	1931-1952	70.21 ms	35.9	
release duration	1973-1984	60.30 ms	31.1	0.000*
	1953-1972	66.88 ms	30.1	
	1931-1952	66.88 ms	30.6	
relative release duration	1973-1984	50.1%	19.5%	0.611
	1953-1972	50.7%	20.2%	
	1931-1952	50.3%	21.4%	
Rise Time	1973-1984	31.55 ms	19.6	0.000*
	1953-1972	35.63 ms	19.5	
	1931-1952	40.25 ms	24.7	
relative RT	1973-1984	52.8%	16.3%	0.000*
	1953-1972	54.0%	16.7%	
	1931-1952	58.7%	17.3%	

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$)

Table 6.5 provides the means and ANOVA summary for the temporal acoustic variables according to the subject's year of birth (YOB) for the Tosk speakers. As is expressed in Table 6.5, the mean differences for the temporal acoustic variables of segment duration, closure duration, release duration, relative release duration, Rise Time, and relative RT in terms of the subject's year of birth were found to be statistically significant. The overall mean values for Rise Time and relative Rise Time express similar findings to that of Table 6.3, which suggests that the pronunciations of the target segments for the younger speakers is becoming more affricate-like.

Table 6.5: Means, standard deviations, and ANOVA summary for the temporal acoustic variables according to the subject's year of birth (for all surface representations, for Tosk speakers)

acoustic variable	YOB	mean value	s.d.	level of sig. ($p \leq 0.05$)
segment duration	1973-1984	133.44 ms	34.4	0.001*
	1953-1972	134.84 ms	40.1	
	1931-1952	138.75 ms	41.9	
closure duration	1973-1984	72.01 ms	26.9	0.005*
	1953-1972	75.29 ms	32.4	
	1931-1952	74.00 ms	33.9	
release duration	1973-1984	61.43 ms	26.3	0.000*
	1953-1972	59.55 ms	26.7	
	1931-1952	64.76 ms	31.8	
relative release duration	1973-1984	45.9%	15.8%	0.000*
	1953-1972	44.4%	16.1%	
	1931-1952	47.0%	19.4%	
Rise Time	1973-1984	30.67 ms	17.0	0.000*
	1953-1972	32.18 ms	18.2	
	1931-1952	38.80 ms	23.0	
relative RT	1973-1984	50.3%	16.0%	0.000*
	1953-1972	54.2%	17.2%	
	1931-1952	59.8%	17.2%	

* indicates it is statistically significant at the 95% confidence level ($p \leq 0.05$)

As mentioned earlier, an increase in relative release duration and a decrease in relative Rise Time suggest that the Albanian palatal stops are in the process of becoming (palato-alveolar) affricates. However, in order to be sure that the observed variation in the data is a result of sound change, rather than age-grading, trend and panel studies which focus on the same population and acoustic variables need to be conducted.

6.3 Summary

When considering palatalization in Albanian, language internal (e.g. phonological issues) and language external (e.g. sociolinguistic concerns) factors must be brought to light. That is, language usage is governed not only by the individual speaker, but also by the society in which the language is spoken. In modern day post-communist Albania, in the case of Albanian palatal stops, the phonological rules of de-dorsalization are taking precedence over linguistic constraints of the former communist party of Albania, as is evidenced in the acoustic findings regarding the age of the speaker for the phonemic palatal stop in Albanian (see also Chapter 5). That is, the natural process of de-dorsalization of the palatal stops, thereby resulting in palato-alveolar affricates, is attested in Albanian, as can be observed in the acoustic findings.

CHAPTER 7

CONCLUSION AND FINAL REMARKS

7.1. Conclusion

As has been illustrated throughout this dissertation, palatalization of velar and alveolar stops when followed by non-back vocoids which results in coronal affricates is a very common process cross-linguistically; it has been widely attested in both Indo-European (e.g. Slavic, Acadian French, Indo-Iranian and English) and non-Indo-European (e.g. Salishian, Bantu, and Chinese) languages. Palatalization has been observed both synchronically (e.g. Polish and Japanese) and diachronically (e.g. Slavic and Bantu). In Albanian, the initial output of velar and alveolar palatalization was the palatal stop, which recently has become a palato-alveolar affricate for many NSs of Albanian, as is evidenced in the acoustic findings in Chapter 5. The growing acceptance and proliferation of the palatal stop becoming an affricate (particularly a palato-alveolar affricate) could be viewed as a sound change from below which began in the Gheg variety of Albanian and appears to be in the process of spreading to the Tosk variety. This sound change from palatal stop to palato-alveolar affricate is reported to have occurred in other languages in the Balkan Sprachbund and has been suggested to be an areal feature of languages in this particular region (see Sawicka 1997.). The acoustic findings in Chapter 6 suggest that once the political constraints of communist language policies began to disintegrate, the shift from the palatal stop to palato-alveolar affricate was found to be common place and not just limited to the Gheg variety. The experimental results presented in Chapter 5 support the main hypothesis that the palatal stops of Albanian phonetically pattern more like affricates than stops, both in the Gheg and Tosk varieties. Also, the experimental findings support the claim that a merger of palatal stops with palato-alveolar affricates in Albanian is occurring, whereby the marked palatal stops are being replaced by the less marked palato-alveolar (and sometimes alveo-palatal) affricate.

7.2 Future Directions

Additional investigations related to the current analysis of palatalization in Albanian could involve various phonological, sociolinguistic, perceptual, and articulatory issues not discussed in this dissertation.

Future research regarding the phonological process of palatalization could include a more in-depth investigation of how the IE [s] and [j] evolved into palatal stops in Albanian. Such an analysis could seek to answer questions as to which path these sounds followed to become stops. In terms of the spirant, did [s] undergo palatalization and became [ʃ] and later change into [ʒ], which then underwent palatalization for a second time resulting in a palatal stop: [s] → [ʃ → ʒ] → [ɟ]? Or was [s] strengthened to an alveolar stop (where the voiceless stop changed to voiced), which then underwent palatalization, resulting in a palatal stop: [s] → [t → d] → [ɟ]? In terms of the palatal glide, did it simply harden to a stop? Additional research is needed in this area.

Further, the current phonological account of Albanian palatalization could be treated in terms of Optimality Theory (OT), whereby the phonological processes of palatalization and glide/spirant fortition are translated into markedness and faithfulness constraints. The constraints would need to focus on the specific place and manner features of the target velar, alveolar, and palatal stops, as well as those of the non-back vocoids and palato-alveolar affricates. Such an analysis could illustrate the progression of more marked place features (e.g. Coronal-Dorsal for palatal stops) becoming less marked (e.g. Coronal for palato-alveolar affricates) due to a re-ranking of place of articulation constraints, whereby Place Coronal outranks Place Coronal-Dorsal. Also, in terms of de-dorsalization, the OT analysis could also point out that whereas the optimal segment (i.e. the palato-alveolar affricate) is faithful to Place Coronal, it is unfaithful to Place Dorsal. Such an investigation would also need to express the re-ranking of more marked manner features (i.e. [-/+continuant] for the palato-alveolar affricates) over less marked ones (i.e. [-continuant] for the palatal stops). Further, casual observation of the synchronic variation of velar and alveolar stops with palato-alveolar affricates (e.g. [k]*etë*~[ʧ]*etë* 'this' and [tj]*etër*~[ʧ]*etër* 'other'), could also be treated in terms of OT, whereby each subvariety re-ranks the constraints.

Future research could involve a perception test of the phonetic realizations of palatal stops and palato-alveolar affricates, which would provide additional information regarding the process of velar and alveolar palatalization and de-dorsalization in Albanian. Such a study could involve altering the levels of frication (i.e. release duration), the spectral measurements of the release, and the F2 Onset. Also, by conducting such a study, more detailed information could be obtained regarding how sound change occurs, i.e. who (e.g. the speaker and the listener) or what (e.g. sociolinguistic forces, such as political and socio-economic) causes sound change. That is, such a perception test could seek to answer questions relating to the level of speaker and listener involvement in sound change. In the case of Albanian palatal stops, regardless of the fact that the former communist government attempted to censor language, the sound change still persisted, as is evidenced in the acoustic findings in Chapter 5 and reiterated in Chapter 6. Such an investigation could also include a sociolinguistic study which focuses on NS attitudes toward the specific phonetic output of the prototypical prescriptive palatal stop.

So as to ascertain the exact place of articulation of the palatal stops in Albanian, an articulatory analysis could be conducted using a custom-made artificial palate and an electropalatographic system (e.g. Rion Electropalatograph model DP-01) or some other palatographic device which identifies the precise place of articulation for the Albanian phonemic palatal stops. An articulatory investigation using such a mechanism could provide insightful information regarding not only the place of articulation, but also the manner of articulation of the phonemic palatal stops. Such data would be beneficial in terms of understanding both synchronic and diachronic issues related to palatalization and de-dorsalization.

Additional linguistic investigations of Albanian palatal stops could examine the acquisition of phonemic palatal stops by Albanian NSs. This sort of study could incorporate sociolinguistic issues which deal with age of acquisition, gender, variety of

Albanian, socio-economic background, level of education, urban versus rural setting, profession and educational level of parents, orthographic and spelling issues, and language policies. Such a study could involve analyzing which places and manners of articulation are acquired first for Albanian children. For example, would a palato-alveolar affricate be acquired before a palatal stop? If so, what influence does the acquisition of a fricative and an affricate have on that of a stop, particularly in terms of the articulation and perception of these sounds? Also, such a study could seek to answer questions pertaining to the levels of release duration and Rise Time for a palatal stop versus a palato-alveolar affricate. Also, if the palatal stops are not heard at home, but only in official settings (e.g. school and in the media), how do Albanian children perceive and learn such sounds? Further, how does the acquisition process of phonemic palatal stops affect learning to read and write these sounds? So as to understand which acoustic cues are most salient for Albanian children and in which order they assign features to the phonemic category of palatal stops, it would be worth pursuing these issues.

So as to present a more complete picture of the articulation, acoustics, perception, and acquisition of the phonemic palatal stops by Albanian NSs, further research could also include not only the speech of Albanians in Albania, but also that of Albanians in Kosova, Macedonia, Montenegro, Austria, Germany, France, Turkey, Bulgaria, Sweden, South Africa, Canada, the USA, and other countries where Albanians reside. Further linguistic investigations could also examine how the host language environment (e.g. Swedish in Sweden) effects the articulatory, acoustic, perceptual, and acquisition processes of the phonemic palatal stops of the NSs of Albanian living outside Albania (e.g. in Sweden).

Although this work is not the definitive answer to any one question or issue, this dissertation is valuable in that it touches on an issue which is not frequently discussed in the literature, i.e. palatalization in Albanian, from its Indo-European roots to the present. This dissertation also serves as a foundation for further scholarship.

APPENDIX A

SUBJECT INFORMATION

Subject Information:

subject	gender	age (in years)	variety of Albanian	highest level of education	profession	region of origin
7	female	42	Tosk	college (economics)	housewife	Fieri, Albania
8	male	40	Gheg	college (economics)	economist; accountant	Tropoja, Albania
9	female	44	Gheg	college (economics)	economist	Kuksi, Albania
10	male	48	Gheg	college (Art Academy)	artist; teacher	Kuksi, Albania
11	male	22	Gheg	college student (computer programming)	student	Kuks, Albania
12	male	59	Gheg	college (Art Academy)	musician; teacher	Shkodra, Albania
13	female	58	Tosk	college	English teacher	Gjirokastra, Albania
14	female	33	Tosk	college (medicine)	pharmacist	Berati, Albania
15	male	43	Gheg	college (medicine)	doctor; pharmacist; university instructor	Tropoja, Albania
16	female	64	Tosk	elementary school	housewife; grandmother	Tropoja, Albania
17	male	40	Tosk	high school	taxi driver	Vlora, Albania
18	female	35	Tosk	high school	waitress	Tepelena, Albania
19	female	45	Tosk	high school	waitress	Pogradeci, Albania
20	female	22	Tosk	high school	waitress	Pogradeci, Albania
21	female	25	Tosk	high school	sales lady	Pogradeci, Albania
22	male	60	Tosk	high school	former government spy; guard	Vlora, Albania

Table - *continued*

23	male	45	Tosk	high school	butcher	Tepelena, Albania
24	female	42	Tosk	high school	waitress	Vlora, Albania
25	female	54	Tosk	elementary school	custodian	Fieri, Albania
26	female	21	Tosk	high school	waitress	Gjirokastra, Albania
27	male	26	Gheg	college (art)	artist; chef	Tetova, Macedonia
28	male	60	Tosk	college	administrator	Delvine-Saranda, Albania
29	male	35	Gheg	college	artist; computer instructor	Tirana, Albania
30	female	41	Gheg	college (economics)	economist	Tirana, Albania
31	female	39	Tosk	college (engineering)	engineer	Delvine-Saranda, Albania
32	female	29	Tosk	college	computer instructor	Permeti, Albania
33	male	36	Tosk	college (engineering)	engineer; computer instructor	Çameria, Greece
34	male	18	Gheg	high school	student	Tirana, Albania
35	female	43	Tosk	high school	hospital worker	Çameria, Greece
36	female	30	Gheg	college	English instructor	Kuksi, Albania
37	male	25	Gheg	high school	computer analyst	Kuksi, Albania
38	female	35	Tosk	high school	computer specialist	Vlora Albania
39	female	40	Tosk	college (economist)	economist	Vlora, Albania
40	male	32	Gheg	college	newspaper reporter; writer	Kuksi, Albania

Table - *continued*

41	male	31	Gheg	college (law school and tele-communications)	business man; cellular phone programmer	Ferizaji, Kosova
42	male	30	Gheg	high school	business man	Ferizaji, Kosova
43	female	39	Tosk	high school	guard at the Gallery of Art	Fieri, Albania
44	male	55	Tosk	college	newspaper reporter	Permeti Albania
45	male	49	Tosk	high school	retired soldier	Gjirokastra, Albania
46	female	50	Tosk	high school	guard at the Gallery of Art	Permeti, Albania
48	male	68	Tosk	college	teacher	Fieri, Albania
49	female	47	Tosk	high school	accountant	Berati, Albania
50	male	52	Tosk	college (economics)	economist	Skrapari, Albania
51	female	28	Tosk	college (economics)	economist	Fieri, Albania
52	female	20	Tosk	college	student; secretary	Pogradeci, Albania
53	male	57	Gheg	college	teacher; deputy; secretary of a political party	Kruja, Albania
54	male	67	Gheg	high school	assistant	Mati, Albania
55	female	19	Gheg	high school	student	Tirana, Albania
56	female	43	Tosk	high school	guard at the Gallery of Art	Gjirokastra, Albania
57	female	42	Gheg	high school	guard at the Gallery of Art	Shkodra, Albania

Table - *continued*						
58	male	49	Gheg	high school	business man	Kuksi, Albania
59	male	42	Tosk	college (Academy of Art)	artist; art instructor	Korça, Albania
60	male	44	Gheg	graduate school (Ph.D.) (electrical engineering)	instructor	Elbasani, Albania
61	female	70	Gheg	high school	retired	Gjakova, Kosova
62	female	21	Gheg	college	student	Gjakova, Kosova
63	male	71	Gheg	college	retired	Gjakova, Kosova
64	male	18	Gheg	high school	student	Gjakova, Kosova
65	female	44	Gheg	high school	tapestry weaver	Tirana, Albania
66	male	32	Gheg	college (medicine)	veterinarian	Gjilani, Kosova
67	male	18	Gheg	high school	student	Tropoja, Albania
68	male	18	Gheg	high school	student	Gjilani, Kosova
69	male	18	Tosk	high school	student	Korça, Albania
70	male	43	Gheg	college (Academy of Art)	art manager; assistant art director	Durrësi, Albania
71	male	49	Gheg	college (Academy of Art)	art researcher and historian	Shkodra, Albania
72	male	45	Tosk	graduate school (Academy of Art)	art director	Çameria, Greece
73	male	57	Tosk	college (agronomy)	officer; agronomist	Korça, Albania
74	male	54	Gheg	college (Academy of Art)	sculptor	Gjakova, Kosova

Table- *continued*						
75	female	47	Gheg	college (Academy of Art)	sculptor	Dibra e Madha, Macedonia
76	female	40	Gheg	art high school	art librarian	Tropoja, Albania
77	female	46	Gheg	high school	teacher	Tropoja, Albania
78	male	18	Tosk	high school	student	Korça, Albania
79	male	24	Gheg	college (Academy of Art)	sculptor	Mirdita, Albania
80	male	50	Tosk	college	officer	Gjirokastra, Albania
81	male	38	Gheg	college (agronomy)	agronomist	Tropoja, Albania
82	male	33	Tosk	college	newspaper reporter	Librazdi, Albania
83	male	23	Gheg	high school	beverage distributor	Kuksi, Albania
84	female	23	Tosk	college	newspaper reporter	Vlora, Albania
85	male	66	Gheg	college (Academy of Art)	art instructor	Peja, Kosova
86	male	69	Gheg	college	ballet dancer	Peja, Kosova
87	male	45	Gheg	college	actor	Elbasani, Albania
88	female	27	Gheg	college	actress	Gjakova, Kosova
89	male	35	Tosk	college	theater director	Korça, Albania
90	male	30	Gheg	college	soldier	Mirdita, Albania
91	female	27	Tosk	college (economics)	housewife	Vlora, Albania
92	male	71	Gheg	elementary school	retired	Mirdita, Albania
93	female	58	Gheg	elementary school	retired	Mirdita, Albania

Table - *continued*

94	female	37	Gheg	high school	assistant veterinarian	Mirdita, Albania
95	female	18	Tosk	high school	student	Vlora, Albania
96	male	58	Gheg	college	architect; restaurant owner (Institute of Cultural Monuments)	Tirana, Albania
97	male	63	Tosk	college	architectural historian (Institute of Cultural Monuments)	Korça, Albania
98	female	28	Tosk	college	economist (Institute of Cultural Monuments)	Berati Albania
99	female	27	Tosk	college (law school)	lawyer (Institute of Cultural Monuments)	Gjirokastra, Albania
100	male	62	Tosk	high school	worker (Institute of Cultural Monuments)	Korça, Albania
101	male	55	Tosk	high school	restaurant owner (Institute of Cultural Monuments)	Kolonja, Albania
102	male	49	Tosk	high school	restaurant owner (Institute of Cultural Monuments)	Berati, Albania

Table - *continued*						
103	female	28	Gheg	high school	assistant restaurant owner (Institute of Cultural Monuments)	Tirana, Albania
104	male	40	Gheg	high school	mechanic restaurant owner (Institute of Cultural Monuments)	Tirana, Albania
105	male	30	Tosk	high school	artist (Institute of Cultural Monuments)	Skrapari, Albania
106	male	39	Tosk	high school	artist (Institute of Cultural Monuments)	Fieri, Albania

APPENDIX B

TARGET SEGMENTS AND TARGET WORDS IN FRAME SENTENCE

Frame sentence: *Thuaj* ____________ *prapë* "Say ____________ again."

Target Segments:

descriptive label	phoneme	grapheme
voiceless palatal stop	c	q
voiced palatal stop	ɟ	gj
voiceless palato-alveolar affricate	ʧ	ç
voiced palato-alveolar affricate	ʤ	xh

Voiceless palatal stop /c/ <q>:

Word	gloss
qafë	'neck'
qaj	'tea'
qenë	'dog'
qepë	'onion'
qiell	'sky; heaven'
qiri	'candle'
qoftë	'meatball'
qull	'wet'
qumesht	'milk' (T)
qytet	'city'

Voiced palatal stop /ɟ/ <gj>:

word	gloss
gjak	'blood'
gjashtë	'six'
gjalpë	'butter' (T)
gjel	'rooster'
gjel deti	'turkey'
gjimnastikë	'gymnastics'
gjoks	'breast'
gju	'knee'
gjuhë	'language'
gjysmë	'half'

Voiceless palato-alveolar affricate /ʧ/ <ç>:

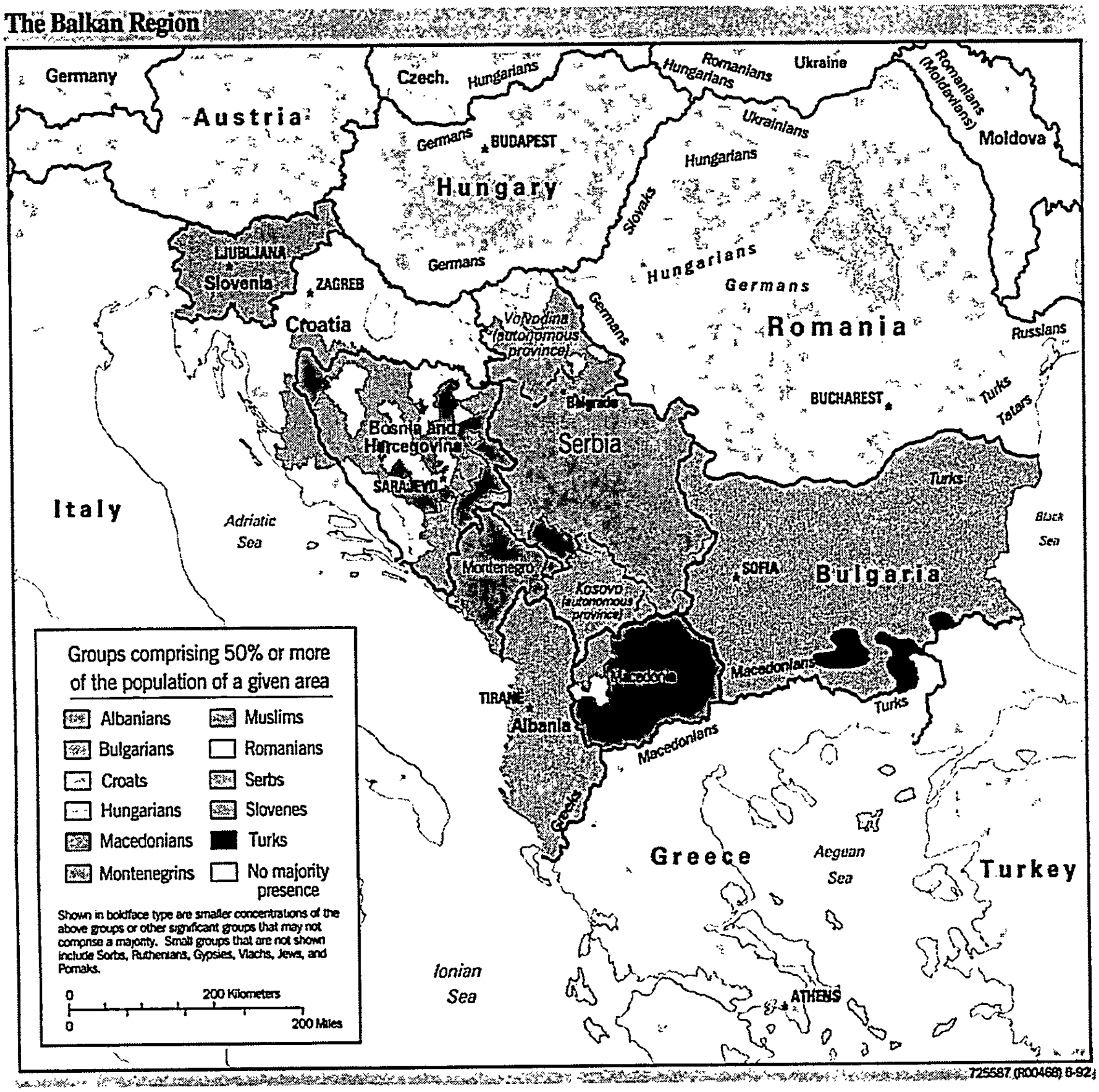
word	gloss
çadër	'umbrella'
çantë	'bag'
çakmak	'cigarette lighter'
çarçaf	'bed sheet'
çelës	'key'
çaj	'tea'
çikë	'girl; a little'
çoj	'stand'
çast	'moment'
çull	'haircloth'

Voiced palato-alveolar affricate /ʤ/ <xh>:

Word	gloss
xhaketë	'jacket'
xhami	'mosque'
xham	'glass'
xhaxha	'uncle'
xhep	'pocket'
xhaz	'jazz'
xheloz	'jealous'
xhevahir	'jewel'
xhungël	'jungle'
xhenet	'Paradise (Moslem)'

APPENDIX C

MAP OF THE BALKANS



(Map produced by the Central Intelligence Agency.
http://www.lib.utexas.edu/Libs/PCL/Map_collection/europe/Balkans.jpg)

APPENDIX D

PHONETIC REALIZATIONS (SR) OF TARGET SEGMENTS ACCORDING TO TARGET WORD

Frequency of phonetic realizations (SR) of target segments according to target word

Target Word	Phonetic palatal stop	Realization palato-alveolar affricate	(SR) palato-alveolar fricative	total
[c]afë	0	255	39	294
[c]aj	0	270	20	290
[c]enë	0	254	39	293
[c]epë	0	269	23	292
[c]iell	0	230	62	292
[c]iri	0	221	72	293
[c]oftë	0	267	26	293
[c]ull	0	257	35	292
[c]umesht	0	266	27	293
[c]ytet	0	237	57	294
subtotal	0	2,526	400	2,926
[ɟ]ak	0	270	24	294
[ɟ]ashtë	0	275	19	294
[ɟ]alpë	0	273	21	294
[ɟ]el	0	270	24	294
[ɟ]el deti	0	251	38	289
[ɟ]imnastikë	1	255	35	291
[ɟ]oks	1	267	23	291
[ɟ]u	0	271	20	291
[ɟ]uhë	5	267	20	292
[ɟ]ysmë	4	270	19	293
subtotal	11	2,669	243	2,923
[tʃ]adër	0	281	12	293
[tʃ]antë	0	281	13	294
[tʃ]akmak	0	280	14	294
[tʃ]arçaf	0	276	17	293
[tʃ]elës	0	280	13	293
[tʃ]aj	0	283	11	294
[tʃ]ikë	0	278	14	292
[tʃ]oj	0	281	12	293
[tʃ]ast	0	277	13	290
[tʃ]ull	0	274	18	292
subtotal	0	2,791	137	2,928

Table - *continued*

[ʤ]aketë	0	282	12	294
[ʤ]ami	0	281	13	294
[ʤ]am	0	280	14	294
[ʤ]axha	0	279	15	294
[ʤ]ep	0	280	14	294
[ʤ]az	0	282	12	294
[ʤ]eloz	0	277	17	294
[ʤ]evahir	0	278	16	294
[ʤ]ungël	0	280	14	294
[ʤ]enet	0	279	15	294
subtotal	0	2,798	142	2,940
total	11	10,784	922	11,717

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BIOGRAPHICAL INFORMATION

Julie M. Kolgjini (formerly Julie M. May) was born 2 March 1972 in Devils Lake, North Dakota, where she received much of her early education. She graduated from Anoka High in Anoka, Minnesota in the spring of 1990. Julie attended Concordia University (St. Paul, Minnesota), the University of Washington (Seattle), and the University of Minnesota (Minneapolis), where she received an Austrian Studies scholarship to study at Karl-Franzens Universität in Graz, Austria. In the spring of 1994 Julie graduated from the University of Minnesota with a B.A. in International Relations (Diplomacy) and German with honors (Phi Beta Kappa and magna cum laude). She later went on to teach English in the chemistry department at Moscow State University in Russia (1994-1996), which led her to pursue an advanced degree in Teaching English as a Second or Other Language and Linguistics at the University of Minnesota (1997-1999). In the autumn of 1999 she enrolled in The University of Texas at Arlington's doctoral program in Linguistics, where she was awarded a Fulbright scholarship to study under the supervision of Dr. Kolec Topalli at the University of Tirana in Albania (2001-2002). In May 2004 she received her PhD in Linguistics. While at The University of Texas at Arlington (UTA), Julie taught courses for both the Linguistics Program (e.g. LINGUISTICS 3330: Phonetics and Phonology and ESOL 4301: Academic Presentations) and the English Department (e.g. ENGLISH 0301: ESL

Developmental Reading and Writing and ENGLISH 1301: ESL Expository Writing). While at UTA, Julie also served as the president of the student-run linguistic organization Lingua, and coordinated its annual linguistics conference UTASCIL (UTA's Student Conference in Linguistics).