SEGMENTAL AND PROSODIC COMPLEXITY IN NIVAĈLE: LARYNGEALS, LATERALS, AND METATHESIS

by

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Abstract

This dissertation investigates a series of phonological and phonetic aspects of Nivaĉle, a Mataguayan language spoken in the Argentinean and Paraguayan Chaco. The data is based on original fieldwork done by the author, with several Nivaĉle speakers in the communities of Uj'e Lhavos and Santa Teresita (Paraguay).

This research has a twofold contribution. On the one hand, it adds to the documentation of an endangered and understudied Chaco language. On the other hand, it deepens our understanding of Nivaĉle segmental phonology and advances an Optimality Theoretic analysis of Nivaĉle prosodic phonology.

One of the central topics of this dissertation is the interaction between prosodic constituency, stress, and the realization of the constricted glottis ([c.g.]) feature in vowels. Contra Stell (1989), I propose that there is no phonological opposition between modal vowels vs glottalized vowels; rather, Nivaĉle glottalized vowels are sequences of /Vʔ/, a vowel plus moraic glottal stop with different prosodic parsings.

A superficially complex stress system in Nivaĉle is shown to reduce to systematic regularities of three types. First, it is shown that stress is quantity-sensitive, with a consistent correlation between bimoraic weight (tautosyllabic /Vʔ/) and stress prominence. Secondly, primary/secondary stress patterns reflect competing edge-alignment constraints where prosodic foot domains align with internal morphological category (MCat) edges. Thirdly, it is argued that a CVC syllable, which constitutes the Minimal Prosodic Word in Nivaĉle, can function as a degenerate foot. The generalization that it characteristically surfaces with secondary (rather than primary) stress is shown to be an emergent consequence of independently motivated constraint rankings.

With regards to the Nivaĉle lateral obstruents, it is argued that the typologically rare velar lateral /k͡l/ is a complex segment that is the diachronic result of lateral hardening of Proto-Mataguayan **l*. Based on its phonological patterning, it is proposed that /k͡l/ is specified for DORSAL and [lateral].

Integrating multiple facets of these prosodic and segmental analyses, vowel-consonant metathesis further deepens our understanding of the complex interplay of Nivaĉle phonological constraints. Metathesis is shown to be motivated by satisfaction of the Syllable Contact Law, interacting with constraints governing complex codas, derived complex onsets, epenthesis, and deglottalization.

Preface

This dissertation consists of original and independent work by the author, Analía Gutiérrez. The following is a list of presentations and publications in which various parts of this dissertation were first introduced.

1. Preliminary analysis included in Chapter 3 and 4 were presented in CILLA VI (2013), SSILA 2015, and WCCFL 33 (2015).
2. Parts of the discussion in Chapter 5 were presented at WECOL 2011, SSILA 2012, and published in Gutiérrez (2014).
3. Some aspects of the data and analysis included in Chapter 6 were presented at WSCLA 15 (2010), SSILA 2011, and published in Gutiérrez (2010, 2012).

The fieldwork undertaken for this dissertation was approved by the UBC Behavioural Research Ethics Board, under the Ethics Certificate Number: H11-00662.

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List of Symbols

μ = mora

σ = syllable

´ = primary stress

` = secondary stress

'.' = syllable boundary

'-' = affix boundary

'=' = clitic boundary

( ) = foot boundary

List of Abbreviations

1 = first person
2 = second person
3 = third person
alv. = alveolar
A = agentive
ANTIP = antipassive
AR = area
ART = artifact
AUG = augmentative
BEN = benefactive
C = consonant
CAUS = causative
CISL = cislocative
CLASS = classifier
CLPN = Linguistic Committee of the Nivaĉle People
COM = comitative
COL = colective
CON = container
COMP = complementizer
COORD = coordinative
dB = decibels
DET = determiner
DIST = distal
EXCL = exclusive
F = feminine
Ft = foot
F1 = first formant
F2 = second formant
Ft = foot
Hz = Hertz
H = homorganic
HUM = human
IMP = imperative
INC = inclusive
INDEF = indefinite
INT = intransitivizer

IPFV = imperfective

IT = itive

LOC = locative

MAL = malefactive

MARK = mark/trace

MAT = material

MED = mediative

MCat = morphological category

MSt = morphological stem

MWd = morphological word

ms = milliseconds

N = nucleus

N = non

NEG = negation

NMLZ = nominalizer

O = obstruent

O = object

OT = Optimality Theory

P = patient

PL = plural

PLANT = plant

POSS = possessive

PR = pronominal

PRO = pronoun

PUNC = punctual

PrWd = Prosodic Word

R = resonant (sonorant)

REL = relative

REFL = reflexive

RES = resultative

S = subject

s = second

s.o. = someone

s.t. = something

T = stop

V = vowel

VENT = ventive

VBLZ = verbalizer

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Dedication

Para mis padres, Amparo y Oscar, por su fortaleza y amor

Chapter 1: The Nivaĉle language: Background

1.1 Goals

This dissertation investigates a series of phonological and phonetic aspects of Nivaĉle, a Mataguayan language spoken in the Argentinean and Paraguayan Chaco. The data and generalizations presented here are based on original fieldwork done by the author between 2009-2013. This study focuses on several phenomena that deal with the representation, distribution, and organization of the sounds in this language, which are of interest from both typological and theoretical perspectives. Specifically, the phenomena investigated in this thesis include the phonological status of glottal stop and glottalized vowels, the lateral obstruents [ɬ] and [k͡l], and some morpho-phonological processes such as VC-metathesis. One of the central topics of this dissertation is the interaction between prosodic constituency, stress and the realization of the constricted glottis ([c.g.]) feature in vowels.

The goals of this dissertation are twofold. First, the description and analysis of the abovementioned phenomena aim to deepen our understanding of the segmental and prosodic phonology of the Nivaĉle language. Also, it is the hope that the implications of my analysis of glottalization can set the basis for a comparative phonological study within the Mataguayan language family. Secondly, as this study explores the relationship between glottalization and metrical structure in phonological theory, it hopes to contribute to the literature on glottalization in languages of the Americas, and the relationship between glottalization and prosody (England 1983, Macaulay & Salmons 1995, Gerfen 1999, Blankenship 2002, Avelino 2004, 2011, Kehrein & Goldston 2004, Picanço 2005, Gerfen & Baker 2005, Stenzel 2007, Arellanes 2009, Elías-Ulloa 2009, Frazier 2009, Herrera Zendejas 2009, Baird 2011, Baird & Pascual 2012, Storto & Demolin 2012).

1.2 The Nivaĉle language and its speakers

This section provides an overview of the Nivaĉle language and the people who speak it. The family relations of the Nivaĉle language are reported in §1.2.1. Geographic and sociolinguistic aspects of the Nivaĉle language are summarized in §1.2.2.

1.2.1 The Mataguayan family and the Gran Chaco

Nivaĉle [niβaˈk͡le] (ISO 639-3: *cag*) is a Mataguayan language spoken in the Argentinean and Paraguayan Chaco by approximately 16,350 speakers in Paraguay (DGEEC 2012) and 553 in Argentina (INDEC, 2004-2005). The word Nivaĉle means "human being" in a broad sense (Chase Sardi 1990: 7); for the Nivaĉle people, it means "person" and "man" (Fritz 1994: 35). According to Stell (1989:17) the first reference of the name Nivaĉle in the literature can be found in Susnik (1961:47), who maintains that "*niwaqli*" means "men", and that this name includes the whole (Nivaĉle) nation.

The Nivaĉle language has also been referred to in the literature as *Gentuse/Wentusi/Wentusix* (Espínola 1794, Greenberg 1956, Loukotka 1968, as cited in Stell 1989:20, *Ashlushlay* (Nordenskiöld 1910, Henry 1939, Wicke & Chase-Sardi 1969, Stell 1972), *Chorupí* (Lehmann-Nitsche 1936) Churupí (Schmidt 1940), *Chulupí* (Junker, Wilkskamp & Seelwsiche, 1968; Stell 1989), *Chunupí* or *Suhin* (Hunt 1915, 1924*),* and *Chunupí* (Palavecino 1936, Mason 1950, Tovar 1964).[1] While *Chulupí* is commonly used in Argentina, Nivaĉle is the term used in Paraguay.[2] Here I adopt the spelling Nivaĉle, rather than Nivaclé, Nivakle, or Niwakle, following the conventions established during the II Nivaĉle Linguistic Conference (Uj'e Lhavos, Paraguay, December 3-5 2010). During that conference the Linguistic Committee of the Nivaĉle People (Comisión Linguística del Pueblo Nivaĉle, CLPN) was created. One of the goals of the CLPN, formed by Nivaĉle teachers and specialists on the Nivaĉle language and culture, was to revise and consolidate the two Nivaĉle orthographies, one proposed by the Catholic missionaries and the other proposed by the Mennonite missionaries.

Besides Nivaĉle, the Mataguayan language family (Swadesh 1959, Najlis 1984, Fabre 2005) comprises three other languages: Chorote, Maká, and Wichí. This language family has also received alternative names in the literature, such as *Mataco* (Loukotka 1968: 53-55, Voegelin & Voegelin 1977:

[1] This name has caused some confusion in the literature because *Chunupí* is an alternative name of Vilela (Lule-Vilela), a genetically unrelated Chaco language.

[2] According to Hunt (1915) and Stell (1989:17) *Chulupí* derives from Wichí *tsonape/sonape* "shepperd". According to Nordenskiöld (1910), the name *Ashlushlay* was given by the Chorote people: from [ału] lizard, [ɬaj] "people or fruits", meaning "the people that eat lizard". The name *Wentusix* has been attributed to the Maká people (Stell 1989, Fabre 2014): "to cut one's hair".

223-224) *Mataco-Mataguayan* (Tovar 1951: 400, 1961, 1964), *Mataco-Maka* (Kaufman 1990:46), and *Matacoan* (Campbell 2012).

Within the Mataguayan family, Tovar (1964: 371) proposes that Wichí and Chorote are more closely related with each other than any other language of the family because of 50% shared vocabulary. It is also worth mentioning some interesting phonological similarities between these two languages; e.g., the presence of preglottalized resonants (Carol 2014, Nercesian 2014a).

Based on Tovar's lexical study of the Mataguayan languages (Tovar 1964), Fabre (2005:3) proposes the existence of two branches within the Mataguayan family; on the one hand, Chorote and Wichí, and on the other hand, Nivaĉle and Maká (which share 43% of their vocabulary). Yet, this classification deserves a word of caution, as there are morphosyntactic features, for instance, the determiner system, that makes Chorote more similar to Maká and Nivaĉle (Fabre 2005, Carol 2014). According to Campbell (2012: 98), Mataguayan languages are "diversified on a scale similar to Germanic languages". In sum, even though the relationships between these languages are clearly supported, a thorough and systematic comparative study within this language family is yet to be done.

The location of the Mataguayan languages and peoples spans across Northeastern Argentina, Southeastern Bolivia, and Southwestern Paraguay; a region known as the Gran Chaco (from Quechua *chaku* "hunting land"). The Gran Chaco comprises about 1,000,000 square kilometers divided between Northern Argentina, Eastern Bolivia, Western Paraguay and South-Eastern Brazil. Approximately twenty-nine languages belonging to seven language families with different degrees of vitality (Arawakan, Guaycuruan, Lule-Vilela, Mataguayan, Tupí-Guaraní, Maskoyan (or Enlhet-Enenlhet) and Zamucoan) and two language isolates, Chiquitano (or Besiro) and Guató, are spoken in this region (Golluscio & Vidal 2009-2010).

With regards to the relationship between the Mataguayan and other language families, several proposals have linked the Mataguayan and Guaycuruan language families in a Macro-Guaycuruan group

(Henry 1939, Mason 1950, Greenberg 1956, 1987, Kaufman 1990, Viegas Barros 1993, 2004).[3] According to Greenberg (1987), the Macro-Guaycuruan group belongs to the Macro-Panoan branch, which, along with Macro-Carib and Macro-Ge-Bororo comprise the Ge-Pano-Carib phylum. Besides the hypotheses regarding the genetic affiliations of the Mataguayan and Guaycuruan languages, it has been proposed that the Chaco languages share morphosyntactic and phonological features that stem from their extensive historical contact (Comrie et. al 2010, Golluscio & Vidal 2009-2010, González 2014), and thus constitute a linguistic area.

1.2.2 The regions and the sociolinguistic situation

It is believed that the original, pre-contact territory of the Nivaĉle people used to be located between the Bermejo and the Pilcomayo rivers (Hunt 1913-15, Fritz 1994, Andrés Crespo, p.c., (cf. Figure 1.1). At the beginning of the 20th century, due to pressures from European colonizers, the Argentine military, and numerous battles with the Toba people, the Nivaĉle people retreated to the Pilcomayo River and crossed it.[4] Later (1920-1930), the Nivaĉle people would be invaded and fought by the Bolivian militaries prior to the Chaco War (1932-1935), where Paraguay and Bolivia disputed what is now the Paraguayan Chaco.

In 1925 and 1927, the first Catholic Missions, San José de Esteros and San Leonardo (Fischat), were established in Nivaĉle territory, next to the Pilcomayo River; it is considered that the first prolonged contact between the Nivaĉle and the white people occurred there (Andrés Crespo, p.c.). During the Chaco War, the Catholic missionaries protected the Nivaĉle who were in the firing line of Bolivian and Paraguayan troops (Fritz 1994: 29). It was also during the wartime that many Nivaĉle people abandoned their villages and migrated to Argentina to work in the sugar plantations (Stell 1989:8). After the war, the migration reversed direction and the Nivaĉle began their annual migration to

[3] The Guaycuruan languages comprise Mocoví, Pilagá, Toba (or Qom), Kadiwéu (or Caduveo) and Abipón, no longer spoken.

[4] According to Hunt (1913-15: 258), cited in Stell (1989:8), in 1913 "the last village on the Bermejo River was broken up and its members joined their compatriots across the Pilcomayo River".

(and settled down around) the Mennonite colonies of Neuland and Fernheim, Boquerón County, Paraguay, in search of agricultural work (Chase Sardi 1972: 26, cited in Stell 1989:9). [5]

Nowadays, the Nivaĉle language is spoken across twenty-four communities in the Boquerón and Presidente Hayes Department in Paraguay (DGEEC, http://www.dgeec.gov.py), and in the provinces of Salta and Formosa in Argentina (UNICEF, http://www.unicef.org):

Figure 1.1 The Gran Chaco region and the approximate location of the Uj'e Lhavos, Santa Teresita and other Nivaĉle communities. (Source: Wikipedia, public domain)[6]

There has not been complete agreement about the number of subgroups that constitute the Nivaĉle people, not only within the literature but also among the Nivaĉle people. Klein & Stark (1977: 392) maintain that there are two groups: the inland or 'bush' Chulupí, and the 'river' Chulupí. In contrast, Chase-Sardi (1981) and Stell (1989), maintain that there are five groups (see map in Figure 1.3):

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[5] The Mennonite settlers arrived in the Paraguayan Chaco in the late 1920; the Meno, Fernheim, and Neuland colonies were established near present day Filadelfia. It is estimated that more than 10,000 Mennonites live in the Paraguayan Chaco; they are the largest employers of the indigenous peoples of the Central Chaco and approximately 60% of the Paraguayan indigenous population inhabit their colonies and surrounding [or "nearby"] areas (Miller 1999:17).

[6] This image is on the public domain due to its age; its copyright has expired. The editor has released the changed image in the public domain. http://commons.wikimedia.org/wiki/File:GranChacoApproximate.jpg

(1) *chishamne' lhavos* 'the highlanders (Upriver)', who live around the Pedro P. Peña area (Paraguay) and Salta (Argentina).

(2) *shichaam lhavos* 'the lowlanders (Downriver)', who live around the Missions of San José de Esteros and San Leonardo/Fischat. Both (i) and (ii) belong to *tovoc lhavos* 'people of the (Pilcomayo) river'.

(3) *yita' lhavos* 'people of the scrub', who live in the Mission Santa Teresita (Mariscal Estigarribia). This group is also known as *c'utjaan lhavos* 'people of the thorns.'

(4) *jotoy lhavos* 'people of the feathergrass' who live in the communities around Campo Loa, 58 kms Southeast of Mariscal Estigarriba (FR, p.c).

(5) *tavashay lhavos* 'people from the inland', who live north of San José de Esteros, and Southeast of Filadelfia, close to the Mennonites colonies.

In turn, Fritz (1994) and Siffredi (1989) maintain there are only three groups (i), (ii), and (iii). Below, I present the map with the aforementioned five Nivaĉle subgroups presented by Stell:

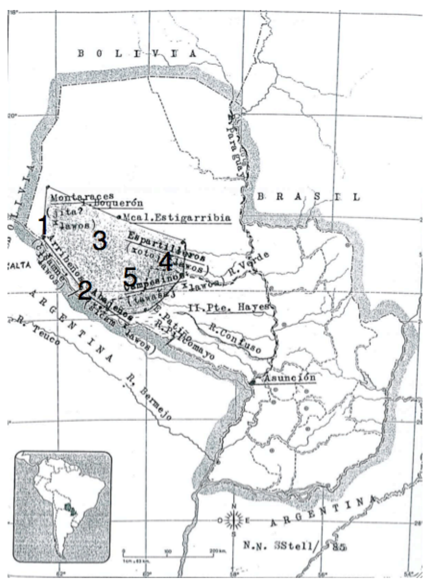

Figure 1.2 Nivaĉle subgroups in Paraguay (1: *chishamnee lhavos*, 2: *shichaam lhavos,* 3: *yita' lhavos*, 4: *jotoy lhavos*, 5: *tavashay lhavos.* Source: Stell 1989:24)

Based on my fieldwork and interviews with Nivaĉle speakers, those five major regional subgroups are recognized within the Nivaĉle people. However, it is not very clear what the systematic linguistic differences are (if any) between the *jotoy lhavos,* the *tavashay lhavos* and the other subgroups. I can report some regional variants pertaining to the following subgroups: *chishamnee lhavos*, *shichaam lhavos* and *yita' lhavos.* The regional dialectal differences mostly consist of (i) vocabulary, this is quite evident between the *chishamne' lhavos* and the *shichaam lhavos* speakers, (ii) phonology: (a) in the *jotoy lhavos* variety there is no low back unrounded vowel /ɑ/ contrasting with /a/ (see minimal pairs in §2.2.2), (b) in the *yita' lhavos* variety*,* the sequence /k͡lʔ/ is pronounced as [k'], rather than [k͡lʔ] (§3.3.4), (iii) phonetics: the epenthetic vowel [e] is mostly used in in the *chishamnee lhavos* variety in contrast to [i] in the *shichaam lhavos* variety (§6.2.4).

Besides the regional variants, I have documented a number of morphosyntactic and lexical differences that have been arising between younger and older generations. In fact, these intergenerational differences have been a concern among older speakers and teachers of the semi-urban community of Uj'e Lhavos (§1.4) as there is the feeling that young people "do not speak the language very well and mix it with Spanish". In turn, the younger speakers (in their twenties) I have consulted with, mentioned that sometimes they do not understand certain words or expressions used by their grandparents, or that their grandparents say "things differently".

It is worthy of mention that many of the Nivaĉle traditional practices have been abandoned in the semi-urban communities such as Uj'e Lhavos where there is a closer contact with the Paraguayan and the Mennonite societies; for instance: "elders are no longer telling the myths to the kids at night (…) we started to forget things because we are inside of a town, the town of the white people" (FR, p.c.).[7] The role of media is also signaled as a threat: "there is no time now, we have television, we listen to the radio and the news; it is impossible to remember things from the past" (FR, p.c). Also, traditional Nivaĉle practices such as hunting, honey harvesting, the celebration of female rites of passage along with the associated festivities (traditional dances, games, and drinks) are domains of intertwined cultural and language knowledge and use that are not directly accessed by younger generations anymore. It is

[7] Note that all "p.c." quotes and citations from Stell (1989) are given in my own translation from Spanish.

thus felt within the community that along with the loss of cultural practices, and due to the pressure from Spanish, the Nivaĉle language will start shrinking. Remarkably, all the speakers of younger generations I worked with, who are between 20 and 45 years old are bilinguals; they are fluent in Spanish as well as in Nivaĉle. This is not exactly the case for speakers that are more than 60 years old; 'monolinguals' in Nivaĉle can be found within this age group, some of whom can understand Spanish but who mostly rely on their children and grandchildren to interact with the '*samto*', the white people.

Nevertheless, a number of crucial factors that promote the maintenance of this language in Paraguay should be highlighted.

First, the Nivaĉle language is still transmitted, spoken at home – by 99% of community members (Melià 2010) – and in the community. Second, even though some Nivaĉle communities live together with the Manjui (the Nivaĉle name given to the Chorote people, and the one used in Paraguay to refer to this group), Enlhet-Enenlhet and Guaraní peoples, bilingualism levels are low and have not motivated language shift to the indigenous languages in contact. For instance, only 6.53% of the Nivaĉle people speak Guaraní, making it one of the indigenous groups in Paraguay that speak Guaraní the least (Melià 2010). Different is the sociolinguistic situation in the multicultural Misión La Paz (Salta, Argentina). There is linguistic exogamy and everyday interactions are made in Nivaĉle, Chorote and Wichí (Campbell & Grondona 2010). The language is not taught in schools, and so the Nivaĉle people from Misión La Paz have asked the Nivaĉle peoples in Paraguay for literacy materials and to help them in the preservation of their language (Erasmo Pintos, p.c.). Third, the Nivaĉle people have positive attitudes towards their language, especially the middle-aged and older generations.[8] Fourth, in the Paraguayan Chaco, Nivaĉle writing and reading skills are taught until the sixth grade of Catholic primary school and until the third grade of Mennonite Schools.[9] Education in Nivaĉle is either supervised by the Catholics, the Apostolic Vicariate of the Pilcomayo (VAP)

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[8] This positive attitude has been noted in the literature: "It is felt that the Chulupí are the proudest tribe in the Chaco as far as language and culture are concerned" (Klein & Stark 1977:391-392).

[9] Very recently, Nivaĉle teachers have become "national teachers" and so they can teach until grade 4 and 5 of Mennonite schools, though this has not been implemented in all the schools (Wilmar Stahl and Gundolf Niebuhr, p.c.)

(http://www.vicpilcomayo.org.py), or the Association for the cooperative services between indigenous communities and the Mennonites (ASCIM http://www.ascim.org) in the areas administered by the Central Mennonite Committee; for example Uj'e Lhavos, Fernheim Colony (Filadelfia).

Regarding the second and third factors, two Nivaĉle linguistic conferences, organized by Nivaĉle teachers in collaboration with VAP and ASCIM, took place in Filadelfia in 2006 and 2010. During the last conference, the Linguistic Committee of the Nivaĉle People (CLPN) was created with the goals of: (i) revising and unifying the orthographies that were used in Catholic and Mennonites schools, (ii) creating a new dictionary on the basis on Seelwische's (1980) original dictionary (§1.3), (iii) developing new literacy materials, and (iv) promoting the use and preservation of the Nivaĉle language and culture.

1.2.3 The typological profile of the Nivaĉle language: An overview

It is considered that Nivaĉle tends to polysynthesis and agglutination (Fabre 2014). The morphology (especially on the verb) is very rich, with both inflectional and derivational prefixes, suffixes and clitics. It is a head marking language and there are no adpositions, that is, prepositions or postpositions; locative functions are signaled by applicatives, relational names and verb serialization (Fabre 2014). There are five verbal conjugations (Stell 1989, Fabre 2014) based on the semantics and syntax of the verb. Verb marking displays both active and inverse (hierarchical) alignment in this language.

Like many of the Chaco languages, the basic word order is SVO. Another common trait is that Nivaĉle makes a distinction between alienable nouns and inalienably possessed nouns, and inclusive versus exclusive first person plural pronouns.

The determiner system is very complex and besides tense interpretations (Stell 1989) evidentiality distinctions are made through determiner choice (Gutiérrez 2011).

With regards to the phonological features, like in all Mataguayan languages, there is a distinction between plain and ejective stops, no opposition between voiceless and voiced obstruents, and the presence of lateral obstruents.

1.3 Previous linguistic research and descriptions on the Nivaĉle language

This section provides an overview of the linguistic research done on the Nivaĉle language, in chronological order.

As mentioned in §1.2.2, the contact between the Nivaĉle people and the religious missionaries occurred fairly late in comparison to other indigenous peoples of the area. The traditional territory of the Nivaĉle, along the north margins of the Pilcomayo River, remained unreached from the Spanish colonizers and missionary settlements during the 17th and 18th centuries (Stell 1989:4). Even though the Anglicans made contact with the Nivaĉle people at the end of the 19th century and tried to establish a mission in 1899, it floundered and was abandoned. Likewise, the second mission, Nanawa, established around 1916, failed shortly after its inception (Fritz 1994:26-27). However, the earliest sources on the Nivaĉle language were written by an Anglican preacher, Richard Hunt (1915, 1924), who stayed for two months in the Nanawa mission.[10] He published a *Chunupí or Suhin-English* vocabulary, and a *Chunupi or Suhin* grammar with lessons. In the vocabulary, Hunt presents the orthographic systems used to represent the sounds, a *Chunupí-English* vocabulary and a general overview of the language. In the grammar, Hunt also presents the sound system of the language. Interestingly, Hunt makes a distinction between short and long vowels. He also presents palatalized alternants [f^j h^j k^j n^j] (*fy, hy, ky, ñ*) of [f h k n] preceding front vowels, and notes "the *hy* sound is very strongly aspirated, closely akin to *sh* and *fy*" (Hunt 1915:1). Also, it is important to note that, besides [h], Hunt includes *j*: "guttural as in Spanish".

Judging by the examples he cites, the difference between short and long vowels mentioned by Hunt must correspond to the difference between modal and glottalized vowels (cf. Chapter 3), though it is not clear if glottalization was present at this diachronic stage of the language. Whereas the palatalized variants of the labiodental fricative and the nasal have not been attested in my fieldwork, the status of the patalalized laryngeal and velar will be later discussed (§2.5.1). The *Chunupi or Suhin* grammar comprises a description of the primary parts of speech along with exercises and test questions for "the student".

[10] Hunt also did work on Chorote and Wichí, and developed the first Wichi alphabet (1937).

The Missionary Oblates of Mary Immaculate were also pioneers in the study and description of the Nivaĉle language in Paraguay. Junker, Wilkskamp & Seelwische (1968) published a Nivaĉle grammar (123 pp.), with lessons and a vocabulary, which was the antecedent of Priest José Seelwische's (1975a) Nivaĉle-Spanish pedagogical grammar. Another fundamental piece of work made by Seelwische was the first Nivaĉle-Spanish Dictionary (1980, 1990), and a number of pedagogical materials and texts for formal education, some in collaboration with Nivaĉle teachers (Seelwische & Avalos 1972; Seelwische 1975a, b, 1980, 1990, 1993 a, b). These constitute the published work on the language currently available to the Nivaĉle communities in Paraguay.

In turn, a Slovenian linguist based in Paraguay, Branislava Sušnik, published a descriptive grammatical sketch (1954, 60 pp.), and two articles on different aspects of the language (1954, 1959), such as the phonological system, morphological processes, and similarities between the Nivaĉle and the Maká verb. There have also been some brief comparative lexical studies between the Nivaĉle and other Chaco languages (Henry 1939, Tovar 1962, 1964, Loukotka 1964).

At the end of the 1960s, an Argentine linguist, Nélida N. Stell, started doing fieldwork in Salta and published a phonological sketch (1972). This sketch consists of a list of phones with their (i) articulatory description, (ii) phonological environment and (iii) relevant examples. Stell also presents the Nivaĉle phonemic inventory, where she claims a contrast between modal and glottalized vowels (cf. Chapter 4), with some notes on stress and consonant clusters. Stell's (1989) doctoral dissertation on the Nivaĉle grammar is based on original fieldwork carried out in Misión Chaqueña "El algarrobal", Misión La Paz (Salta, Argentina), and Misión San Leonardo de Escalante (Paraguay). This descriptive grammar is divided in five sections: phonology, morpho-phonology, morphology, syntax and texts. The phonology section provides examples with each phoneme, some minimal pairs, lists of words illustrating the types of consonant clusters and syllable types, and a generalization about stress. The morpho-phonology section presents the attested morphophonemic alternations in the language with numerous examples. The morphology section focuses on nominal and verbal paradigms, and presents a list of derivational and inflectional affixes with their possible combinations. The syntax section discusses the nominal and verbal phrases and subordinate clauses. At the end of the grammar, Stell presents 10 texts with their translations. Stell's work represents a remarkably valuable and quite extensive description of the Nivaĉle language.

The most recent linguistic publications on the Nivaĉle language include work by Campbell & Grondona (2007, 2010, 2012) and Campbell (2013) on historical reconstruction in Nivaĉle, the sociolinguistic situation of the Nivaĉle in Misión La Paz, and a general overview of the language (Campbell & Grondona 2012:625-633). In turn, Fabre studied several aspects of the verbal morphology, such as inverse alignment (Fabre 2009-2010, 2012) and has proposed a grammatical sketch of the language (Fabre 2014). Aside from the present dissertation, I have done work on the determiner system and studied some aspects of the phonology, such as metathesis, glottalized vowels, and the status of the complex segment *k͡l* (Gutiérrez 2010, 2011, 2012, 2014).[11]

It is worth mentioning that Stell and Campbell & Grondona worked with the *chishamne lhavos* group. In addition, Stell (1989) worked with some *shichaam lhavos* consultants. However, independently of my own research reported on here, no documentation of the *yita' lhavos* variety has been carried out. This is the subgroup that includes the Nivaĉle community of Santa Teresita, where part of my fieldwork has been carried out.

My major complementary source of data comes from Stell's (1989) doctoral thesis. The main differences between Stell's and my data lies in my careful attention to documentation of the phonetic realization of vowel-glottal coda (§3.2.2), and the locus of primary and secondary stress in some forms (§4.4.1). Another difference is the distribution of /k͡l/ in the *shichaam lhavos* variety. Whereas Stell had noticed that /k͡l/ consistently delateralized to [k] in coda position, I show that /k͡l/ can occur before /ʔ/ (cf. Chapter 5). Further, given that my fieldwork included the documentation of the regional variant

[11] Also, there is an ongoing documentation research project on the Nivaĉle language: "Documentation and Comparative Lexicon and Morphosyntax of Nivaĉle and Pilagá, of Northern Argentina", National Science Foundation Research Grant BCS-DEL 1263817 (PIs: Alejandra Vidal & Doris Payne).

yita' lhavos, another novel observation is that /k͡ɬ/ + /ʔ/ is realized as k' in the speech of *yit'a lhavos* speakers. However, the metathesis data which I documentated was entirely consistent with the data documented by Stell (cf. Chapter 6).

1.4 Methodology

The major source of data for this study comes from my own fieldwork with both female and male native speakers of Nivaĉle (mostly *shichaam lhavos* who migrated to Uj'e Lhavos, and *yita' lhavos* speakers). Complementary sources of data are Stell's (1989) doctoral thesis, and Seelwische's (1990) dictionary; whenever an example is taken from either of these two sources, an appropriate citation will be used.

My fieldwork was primarily conducted in two Nivaĉle communities of the Paraguayan Chaco: Uj'e Lhavos "people that live in the big (place)" and Santa Teresita.

Uj'e Lhavos is a semi-urban community located less than 1 km West of Filadelfia (Fernheim Colony), the capital of the Boquerón Department.[12] According to the last Indigenous Census (DGEEC 2010), there are 1,772 Nivaĉle living in this community. Interestingly, 97% of the interviewed people use Nivaĉle, 2% Spanish, and only 0,4 % speak Guaraní. As previously mentioned, and despite being settled in a semi-urban environment, the Nivaĉle still, and pervasively, speak their language. The majority of the Nivaĉle people residing in Uj'e Lhavos come from Misión San José de Esteros and Misión San Leonardo (Fischat), and they recognize themselves as *shichaam lhavos* ('Lowlanders'). As discussed in §1.2.2, the Nivaĉle started migrating to the Mennonite colonies in the middle of the 20th century in search for agricultural work. Nowadays, the economy of the Nivaĉle, and other indigenous people, depends on Mennonite sources of employment. Most of the Nivaĉle men work at Mennonite

[12] Despite its multiculturality, there is not much interaction between the different cultures in Filadelfia. This situation can be seen in the space distribution: each culture is placed in a separate area of the town. There are three indigenous communities: Guaraní (Yvopey Renda), Nivaĉle (Uj'e Lhavos) and Enlhet (Macheto), situated in non-adjacent outskirts of Filadelfia. Only the Nivaĉle people have ownership deed (since 2005). Also, there are a number of Ayoreo families that dwell at the entrance of the town. The center and north of the town is occupied by Mennonite families, who are members of the Mennonite Colony, and on the east side of the town, the "latinos" neighbourhood. The "latinos" is a term used by the Mennonites to refer to the Paraguayan and the Brazilians, who started migrating to Filadelfia twenty years ago. There are thus eight languages spoken: Western Guaraní, Nivaĉle, Enlhet, Ayoreo, Plattdeutsch (Low German), Spanish, Paraguayan Guaraní and Portuguese. With a total of approximately 16,000 inhabitants, only 37% are non-indigenous peoples.

farms and industries, and the young and middle-aged *nivacche* "women" work full-time or part-time as maids in Mennonite households.[13]

I visited Uj'e Lhavos for several weeks from 2009 to 2013, for a total of seven months. In July 2009, I introduced my work to the leader of the Uj'e Lhavos community, Paulino Chávez, and asked for permission to work in the community. I met several families and started working with Félix Ramírez Flores (FR, 67 years old, *shichaam lhavos*), and Sara Rojas Núñez (SR, 29 years old, *shichaam lhavos*). FR has been my main consultant for this study; he is now a retired Nivaĉle teacher who collaborated with Priest Seelwische in the elaboration of the Nivaĉle dictionary and pedagogical materials. FR has also been one of the advocates for the organization of the Nivaĉle Linguistic Conferences and the CLPN.

In subsequent fieldtrips (2010-2013) I worked with the following speakers: Andrés Crespo (AC), Faustino Ramírez (FAR), Rosalina Rojas (RR), José Rojas (JR), José González (JG), Francisco Fleitas (FF), Celestina Céspedes (CC), Teresita Sánchez (TS), Graciano Ramírez (GR), Agustín Juárez (AJ), Raquel Fleitas González (RF), Myriam González (MG), Celestina Sánchez (CS), Mauricio Valdéz (MV) and Sofía (SD).[14]

During my stay in 2010, I was invited to collaborate with the organization of the Second Linguistic Nivaĉle Conference, which took place in Uj'e Lhavos at the end of that year, and in 2011, I was invited to form part of the CLPN constituted during that conference (December 2010). My main role in the group was to assist the CLPN in the discussion of the Nivaĉle sound system and the orthography revisions. As mentioned in §1.2.1, one of the goals of the CLPN was to consolidate the orthographies that were being used in the Catholic and Mennonite schools.

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[13] Note that "Nivaĉle" refers to the Nivaĉle people, but also to Nivaĉle men. "Nivacche" refers only to women that belong to the Nivaĉle people.

[14] Here I present information about the (approximate) age of the consultants at the time of the recording (for some of the consultants) and the (self assessed) dialectal variety: FR: 67, *shichaam lhavos*, AC: 65, *shichaam lhavos*; FAR: 66 *shichaam lhavos*; RR: 70 *shichaam lhavos*; JR: 70, *shichaam lhavos*; JG: ~ 85, *yita' lhavos*; FF: ~70 *yita' lhavos;* CC: 64, *shichaam lhavos*, TS: 49, *shichaam lhavos*, AJ: 47, *shichaam lhavos*; SR: 29 *shichaam lhavos*, MG: 23, *yita' lhavos*; RF: 30, *yita' lhavos*, CS: 28, *tavashay lhavos*, MV: 24, *shichaam lhavo*s, SD; 20. Note that I received permission to reveal all this information.

Between February and June 2012, I conducted fieldwork in Uj'e Lhavos and the rural community of Santa Teresita. Besides collecting data, I participated in bimonthly meetings with the Nivaĉle Linguistic Team and helped in the organization of the first training workshop for Nivaĉle teachers (May 17-19, 2012, Uj'e Lhavos). In June 2013, I returned to the field to work on the transcriptions of various texts with the help of Teresita Sánchez and Elizabeth Rojas, and to double-check previously collected data.

The methodology followed during fieldwork consisted of: (i) semi-structured interviews (in some sessions one of the Nivaĉle speakers would make the interview or ask for a specific vocabulary item or construction) (ii) text collection of different genres (myths, personal narratives, prayers, and speeches, description-explanations of traditional cultural practices) (iii) translations from/to Spanish (iv) description of photographs and storyboards (v) elicitation of target words in different contexts (word lists and paradigmatically related sets of data). This was the most frequently used methodology for the elicitation of targeted phonological phenomena. The general methodology used for phonetic data collection would consist of asking the speaker to repeat the target word five times and then to give an example of that target word in a sentence.

Audio recordings of elicitation sessions with consultants were done with a digital recorder (Zoom H4N), an AT803 Omnidirectional Condenser Lavalier Microphone, a Countryman lapel microphone (phantom power), and a Superlux E-523 stereo microphone (for recording of conversations). For the most critical phonetic recordings, I was able to work in a quiet small room in the school of Uj'e Lhavos, outside class hours, and in a recording studio in Filadelfia. The editing of the recordings, the data segmentation, and acoustic analysis were done in Praat for Mac (Boersma & Weenink 2014). Statistical analyses were done in R (R Core Team 2013).

In this thesis, certain aspects of the phonological analysis will be presented within the approach of Optimality Theory (OT, Prince & Smolensky 1993/2004, McCarthy 2002, 2007).

1.5 Representation of data and examples

This section provides a brief overview of the conventions used in this thesis for representing linguistic data. Section 1.5.1 presents the basic correspondences between the International Phonetic Alphabet (IPA), the orthography used in Seelwische's (1990) dictionary and the modifications introduced by the CLPN. Section 1.5.2 explains the presentation of linguistic examples.

1.5.1 Transcriptions and alphabets

The default level of transcriptions will be broad and phonemic. When necessary, a distinction between a broad phonemic transcription or and input/underlying representation / / and a narrow phonetic transcription or an output/surface representation [ ] will be made. For clarity purposes, primary stress will be represented with an acute accent and secondary stress with a grave accent. In the body of the text and in certain examples, the orthographic transcription will be used. However, given the general goal of this thesis, the majority of the examples will only have a phonemic transcription.

Table 1.1 below presents the basic correspondences between the orthography proposed by Seelwische, the International Phonetic Alphabet (IPA), and the orthography proposed by the CLPN. Note that the orthography developed by Seelwische is influenced by both the Spanish and English orthographies; e.g., the use of "qu" before /i e/, "sh" = /ʃ/, respectively. The CLPN did not introduce many modifications to Seelwische's orthrography. Basically, the letters *ĉ* and *ĵ* are introduced as variants of *c* and *j* to represent uvular articulations. Importantly, the CLPN decided to change *cl* to *ĉl* in order to differentiate it from the Spanish consonant cluster [kl] (§5.3.2). Whereas the representation of the glide in onset position remains the same, that is, as *y*, consensus about the glide in syllable final position has not been reached yet; it is either represented as *y* or as the vowel *i.*

Table 1.1 Correspondences between orthographies and the IPA

Seelwische's orthography	IPA	Orthography ELN
p	[p]	p
t	[t]	t
c + [a ɑ o u]	[k]	c
	[q]	ĉ
qu (+ [e i])	[k]	c
p'	[p']	p'
t'	[t']	t'
c' (+ [a ɑ o u])	[k']	c'
	[q']	ĉ'
qu' (+ [e i])	[k']	c'
ch	[t͡ʃ]	ch
ts	[t͡s]	ts
ch'	[t͡ʃ']	ch'
ts'	[t͡s']	ts'
cl	[k͡l] ~ [q͡l]	ĉl
f	[f]	f
s	[s]	s
sh	[ʃ]	sh
lh	[ɬ]	lh
m	[m]	m
n	[n]	n
j	[x]	j
	[χ]	ĵ
w	[w] ~ [β]	v
y/i	[j]	y/i
'	[ʔ]	'
i	[i] ~ [ɪ]	i
e	[e] ~ [ɛ]	e
a	[a] ~ [ə]	a
ô	[ɑ]	ô
o	[o] ~ [ɔ]	o
u	[u] ~ [ʊ]	u
VV	[V̰] ~ [Vʔ$^{\text{v̰}}$]	VV

1.5.2 Conventions used in examples

To a large extent, the linguistic examples in this thesis follow the Leipzig Glossing Rules (Comrie et al. 2008). Most textual examples consist of three lines. The first line is the phonemic broad transcription. When relevant, periods (.) are used to represent syllable boundaries; hyphens (-) are used to represent morpheme boundaries, i.e., between prefixes, suffixes, and their bases. The equal sign (=) is used to represent clitic boundaries. The second line of each example is aligned word by word with the second line and provides morpheme-gloss of the material in the first line. Spanish words are given in italics. See the list of abbreviations (p. xi) for values of grammatical abbreviations used in glosses. The third line of an example gives an English translation of the example, in single quotes. As mentioned in §1.5.1, for certain examples, a very first line with the phonetic transcription, and a line with the Nivaĉle orthography (between the phonemic transcription and the morpheme-gloss lines) are included. The source of each example is from my fieldwork; otherwise the source is noted next to or beneath the translation line.

1.6 Structure of the dissertation

In this chapter, I provided an overview of the Nivaĉle language and its speakers, and I presented the methodology used in this research.

Chapter 2 presents an overview of the Nivaĉle phonological system building on Stell (1989) with proposed modifications based on my own fieldwork. This overview includes the Nivaĉle consonant and vowel inventories, the phonotactic constraints in the language such as syllable structure and consonant clusters, and an overview of phonological processes, such as palatalization, epenthesis, vowel harmony, and deglottalization of ejectives and glottalized vowels, which will be investigated in detail in subsequent chapters.

Chapter 3 examines the featural specification and prosodic representation of the Nivaĉle glottal stop and the glottalized vowels. It is proposed that the glottal stop is a moraic root node specified for [c.g.] and that it is unspecified for PLACE. One of the most important outcomes of this chapter is the proposal that Nivaĉle glottalized vowels are not contrastive phonemes, contra Stell (1989). I propose a prosodic representation of these vowels as /Vʔ/ sequences where the glottal stop is hosted by a mora. This mora is parsed to the Nucleus of the syllable, and depending on prosodic context rearticulated/creaky vowels and vowel-glottal coda result. Importantly, Nivaĉle glottalized vowels deglottalize when the [c.g.] feature is not parsed to the head foot.

Chapter 4 examines the internal structure of the Prosodic Word and stress assignment in Nivaĉle in both the nominal and verbal domains. It is proposed that the Minimal Word is a closed monosyllable: CVC, and that glottalized vowels bear weight, that is, they only surface under stress. Further, it is posited that Nivaĉle has a quantity sensitive stress system, and that the rhythmic type is iambic. The following foot types are thus attested LL, H, and LH. The role of prefixes and suffixes with regards to stress placement is discussed, as there are L-edge and R-edge stress generalizations that apply; e.g. there is a different pattern found in alienable and inalienable nouns. A major generalization at the uppermost prosodic level is that primary stress falls on the rightmost foot of the PrWd.

Chapter 5 advances an analysis of the Nivaĉle lateral system, composed of two lateral obstruents: the lateral fricative /ɬ/ and the complex segment /k͡l/. First, it is proposed that /k͡l/, which is the diachronic result of Proto-Mataguayan *l, is a complex segment, specified for DORSAL and [lateral]. Regarding the phonetic explanations behind said sound change, I hypothesize that the lateral approximant was realized with a brief stop closure which was misinterpreted as a real stop burst and reanalyzed as a laterally released stop. Further, the development of *l into [k͡l] and not into [t͡l] can be explained by the perceptually ambiguous nature of laterals in consonant clusters; it has been shown that the lateral release has a substantial effect on the acoustics of coronal stops, shifting them acoustically closer to velars (Kawasaki 1982, Flemming 2007, Hallé, Best & Bachrach 2003).

Chapter 6 provides an Optimality Theory account of syllable-sensitive processes in Nivaĉle such as of vowel-consonant metathesis and vowel epenthesis. My major claim in this chapter is that Nivaĉle metathesis is driven by syllable requirements: (a) the avoidance of complex codas, and (b) the satisfaction of the *Syllable Contact Law* (Hooper 1976, Murray & Vennemann 1983, Vennemann 1988, Gouskova 2004). Vowel epenthesis occurs when VC-metathesis would yield illicit consonant clusters. I also compare my proposal with the historical vowel deletion account presented by Campbell & Grondona (2007), and discuss alternative analyses such as *pseudometathesis* (Blevins & Garrett 2004).

Chapter 7 concludes with the major outcomes of this thesis, and establishes the topics for future research.

Chapter 2: Overview of the Nivaĉle phonological system

2.1 Introduction

This chapter provides an overview of the Nivaĉle phonological system and phonological processes, following and contrasting both Stell's (1989) thesis and my own fieldwork data. The goal of this chapter, then, is to present the Nivaĉle segmental inventory (§2.2), the phonotactic patterns in the language (§2.3, 2.4), and various phonological processes (§2.5) that will serve as a background for the rest of the thesis.

2.2 Phonological inventory

2.2.1 Consonants

The phonemic inventory of consonants is presented in Table 2.1. Of special interest for this study are, on the one hand, the series of ejective stops and affricates and the presence of a glottal stop (cf. Chapter 3), and, on the other hand, the status of a complex segment /k͡l/, which I argue is specified for DORSAL place of articulation (cf. Chapter 5). Note that segments in square brackets represent allophonic variants of the segments to their left, the variation being indicated by the ~ symbol.

Table 2.1 Nivaĉle consonants

		labial	dent-alv.	palato-alv.	palatal	velar	uvular	glottal
stop	plain	p	t			k ~	[q]	
	ejective	p’	t’			k’ ~	[q’]	ʔ
	laterally released					k͡l ~	[q͡l]	
nasal		m	n					
affricate	plain		t͡s	t͡ʃ				
	ejective		t͡s’	t͡ʃ’				
fricative		f ~ [ɸ]	s	ʃ ɬ		x ~	[χ] ~	[h]
approximants		w ~ [β]			j			

Similar to other Mataguayan languages (Chorote, Maká and Wichí), Nivaĉle has a two-way laryngeal distinction in stops and affricates (plain vs. ejectives) and no voicing contrast (only voiceless) within this class (§1.2.3). Unlike Wichí (Nercesian 2014a), aspiration is not a contrastive feature in stops, affricates and sonorants; and unlike Maká (Gerzenstein 1994), Wichí (Nercesian 2014a), and Chorote (Carol 2014), [h] does not have a clear phonemic status. A remarkable contrast with Chorote, Maká and Wichí is that Nivaĉle has a palato-alveolar fricative /ʃ/ (§ 2.5.1).

With regard to the laterals, there is an interesting cross-linguistic difference within this class across the family. While the other Mataguayan languages have a lateral fricative /ɬ/ and a sonorant lateral /l/, Nivaĉle has the former but not the latter. By contrast, there is a complex segment /k͡l/, which “has a simultaneous articulation and release of a dorsal and a lateral” (Stell 1989:58). Comparative data show that Nivaĉle /k͡l/ corresponds to /l/ in the other Mataguayan languages. The analysis of the development of *l into [k͡l] will be discussed in §5.7.

The glides [w] and [j] pattern with consonants; they can occupy onset and coda position. They can precede and follow all of the six Nivaĉle vowels (§2.2.2) but *VwC and *VjC are unattested tautosyllabic sequences in the language. I conclude therefore that /w/ and /j/ do not function as off-glides in a diphthongal relationship with the preceding vowel nucleus. Rather, they function as a consonantal “coda”, fulfilling the final C position of the Nivaĉle CVC Minimal Foot constraint (§4.2). It is significant as well that there are (to my knowledge) no vowel-glide alternations in the language: the glides /j/ and /w/ do not vocalize. The hypothesis that /j/ and /w/ are fundamentally consonantal receives further support from vowel epenthesis behaviour. Specifically, given an inviolable constraint against complex codas in Nivaĉle (§2.3.1), it is noteworthy that glide-final stems pattern with C-final stems (§2.3.1) in triggering V-epenthesis if a single C suffix is added. A further question is whether the approximants /j/ and /w/ pattern with the laryngeal /ʔ/. On the one hand, all three can be parsed into the final consonant (“coda”) position of a syllable. On the other hand, however, /ʔ/ has a unique relationship with a prosodically prominent (stressed) nucleus in that, under conditions outlined in §3.4, the [c.g.] feature of /ʔ/ can be incorporated into the nucleus.

2.2.1.1 Consonant distribution

Instances of phonemic contrasts for onset and, in some cases, coda position, are given through the illustrative minimal and near-minimal pairs in (1)-(14):

Stops, affricates, and /ʔ/: Contrasts in PLACE and in Plain vs. Ejective [c.g.]

(1) a. /pała/   /p/ ≠ /p’/
‘in a little while’
b. /p’ałaʔ/
‘myth’
c. /napuʔ/
‘two’
d. /nap’u/
‘to lick’

(2) a. /ti/   /t/ ≠ /t’/
‘that’
b. /t’iʔ/
‘broth’
c. /jitex/
‘carob’

d. /ji-tʼeʃ/
3S-say
‘s/he says’

(3) a. /ɬa-kuʔ/ /k/ ≠ /k’/
3POSS-cheek
‘his/her cheek’
b. /ɬa-k’uʔ/
3POSS-weapon
‘his/her weapon’
c. /kus/
‘hot’
d. /k’us/
‘happy’

(4) a. /amʔɑ/ /ʔ/ ≠ /p/
‘rat’
b. /ampa/
‘nothing’

(5) a. /t͡sut/ /t͡s/ ≠ /t͡s’/
‘lucky you!’
b. /t͡s’ut/
‘tasteless’ Stell (1989:96)

(6) a. /ɑjt͡ʃe/ /t͡ʃ/ ≠ /t͡ʃʼ/
‘accompany (you)!
b. /ɑjt͡ʃʼe/
‘feel it (you)’! Stell (1989:96)

Fricatives: Contrasts in PLACE

(7) a. /k’uts.fa-s/ /f/ ≠ /x/
friend-PL
‘friends’

b. /k'u͡ts.xas/
elder-PL
'elders'

(8) a. /xa/ /x/ ≠ /ɬ/
DET[15]
b. /ɬa/
F.DET

(9) a. /a-sas/ /s/ ≠ /ʃ/
2S-dirty.bad.ugly
'you are dirty'
b. /a-ʃaʔ/
2POSS-price.salary
'your salary'

(10) a. x-an /x/ ≠ /ʃ/
1S-put
'I put'
b. xan
REL.PR
'the one that'
c. ∅-ʃan
3S-silence/quiet
'it is quiet'

Laterals

(11) a. /xa-ɬɑn/ /k͡l/ ≠ /ɬ/
1S-light
'I light'
b. /xa-k͡lɑn/
1S-kill
'I kill'

[15] The Nivaĉle determiner system consists of four morphemes: *na*, *xa*, *ka,* and *pa*. In Gutiérrez (2011), I propose that Nivaĉle determiners encode both (i) evidential and (ii) deictic information. For ease of exposition, though, I only use "DET" in the gloss of the examples throughout this thesis.

(12) a. /tkamk͡lɑj/ /k͡l/ ≠ /k/
's/he makes s.o. suffer'
b. /tkamkɑj/
's/he makes flour'

Nasals

(13) a. /jim/ /m/ ≠/ n/
'empty'
b. /jin/
's/he paints'
c. /namat͡ʃ/
'axe'
d. /xa-nat͡ʃ/
1S-come
'I come from' Stell (1989:97)

Glides

(14) a. /ji-waʔʃ/ /w/≠ /j/
1POSS-den
'den'
b. /ji-jaʔʃ/
1POSS-quality
'my quality' Stell (1989:97)

A central component of my thesis relies on the analysis of phonological processes that involve a constricted glottis feature [c.g.]. Let us, therefore, consider the realization of the series of ejective obstruents in Nivaĉle.

According to the documented cross-linguistic surveys cited, ejective sounds are found in 18% of the world's languages (Ladefoged & Maddieson (1996:78), and in approximately 12% of South American Indigenous languages (González 2003). Specifically, as previously mentioned, the contrast between plain and ejective non-continuant obstruents is a characteristic feature of Mataguayan languages.

Ejective sounds are produced with an approximately simultaneous closure at the oral cavity and at the glottis (Ladefoged & Johnson 2011:137). The larynx is raised during both closures and increases the air pressure trapped in the vocal tract area, between the two closures. When the oral closure is released, the compressed air is generally expelled in a way that causes the release burst to have high amplitude, auditorily associated with a ‘popping’ sound not found in plain stops. The glottis remains closed at the point of oral release, and opens some time after. The relative timing between the oral and glottal releases has motivated one of the distinctions between strong and weak ejectives (Lindau 1984, Kingston 1985, Bird 2002, Wright et al. 2002). For example, Kingston (1985) proposes that “strong” or “fortis” ejectives have longer VOT. Yet this parameter can be subject to a place-based constraint; a dorsal ejective [k’] tends to be stronger than labial or coronal ejectives (Bird 2002, Hajek & Stevens 2005). An initial (non-statistically validated) inspection of spectrograms of recordings, shows that in the velar ejective there is a longer delay between the release of the glottal closure and the onset of the vowel voicing than in labial and coronal ejectives.

Figures 2.1-2.2, 2.3-2.4, 2.5-2.6, show waveforms and spectrograms of the contrast between plain and ejective stops, in minimal and near minimal pairs with bilabial, alveolar and velar place of articulation, respectively. Note the stronger burst of the ejectives in comparison to the burst of the voiceless stops, and laryngealization of the vowel preceding the ejective stops, visible as irregular spacing between the glottal pulses (see Figures 2.2, 2.4 and 2.6).

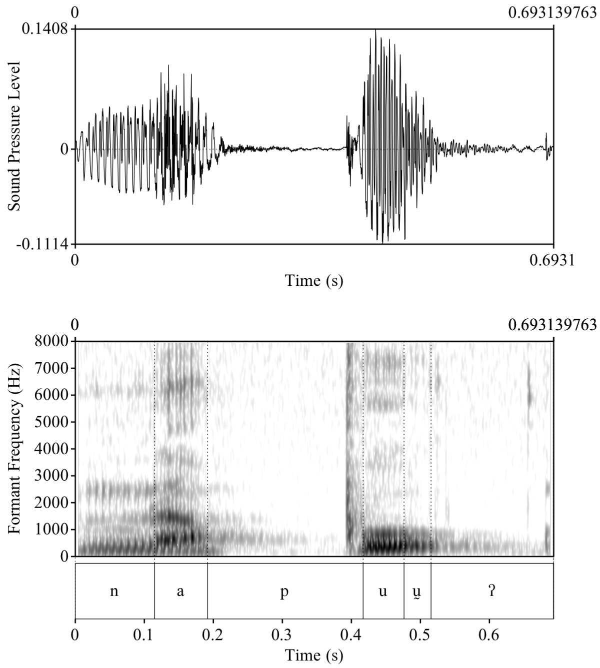

Figure 2.1 Waveform and spectrogram of [napúʔ] ‘two’ by male speaker FR

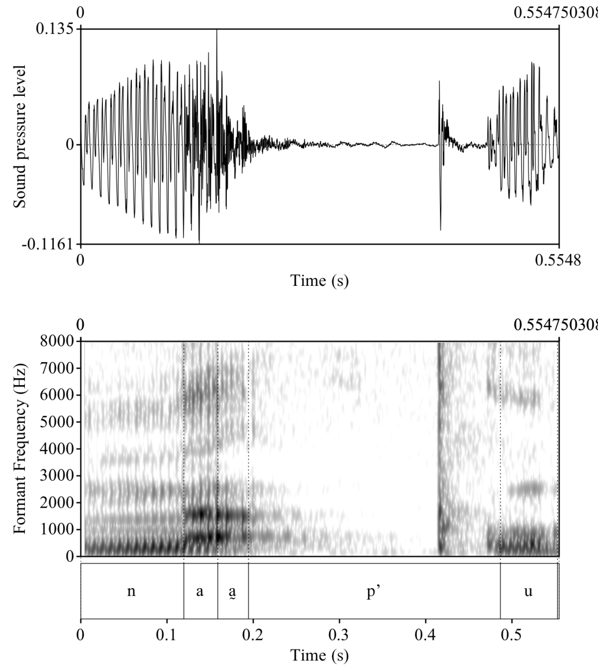

Figure 2.2 Waveform and spectrogram of [nap’ú] ‘myth’ by male speaker FR

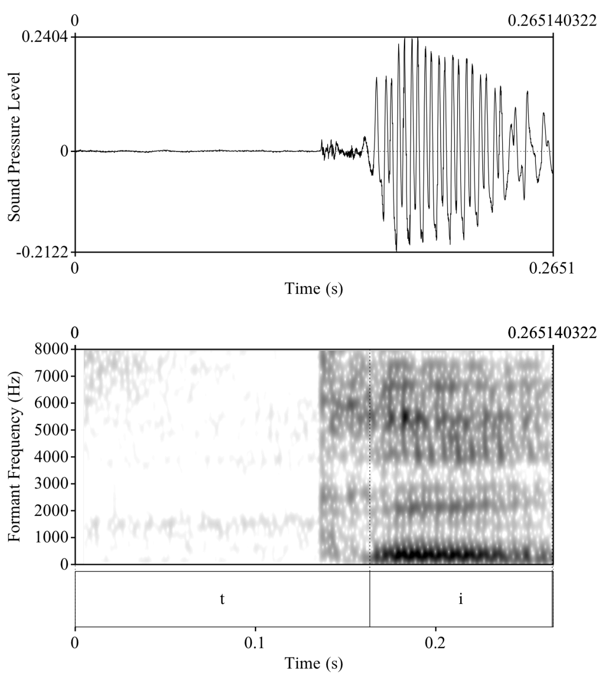

Figure 2.3 Waveform and spectrogram of [tí] ‘that’ by male speaker FR

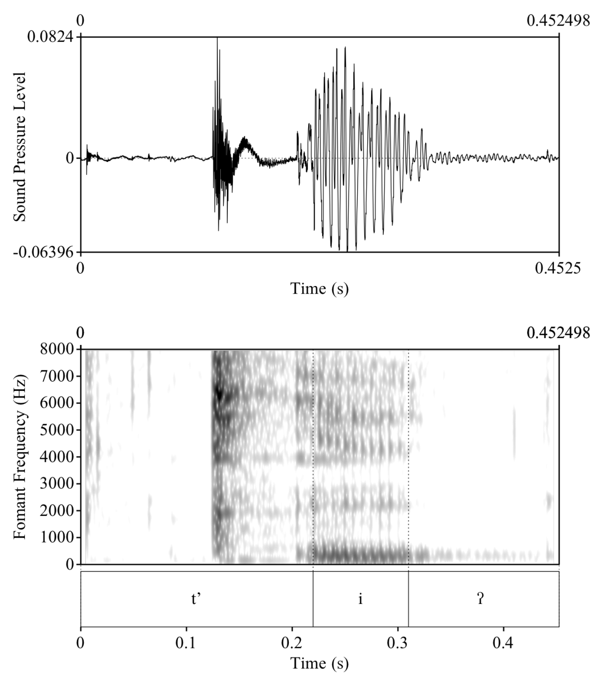

Figure 2.4 Waveform and spectrogram of [t’íʔ] ‘broth’ by male speaker FR

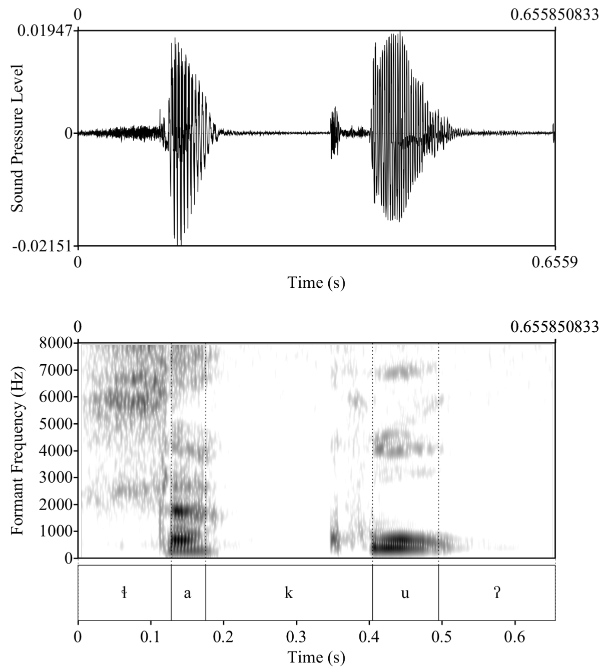

Figure 2.5 Waveform and spectrogram of [łakúʔ] ‘his cheek’ by female speaker TS

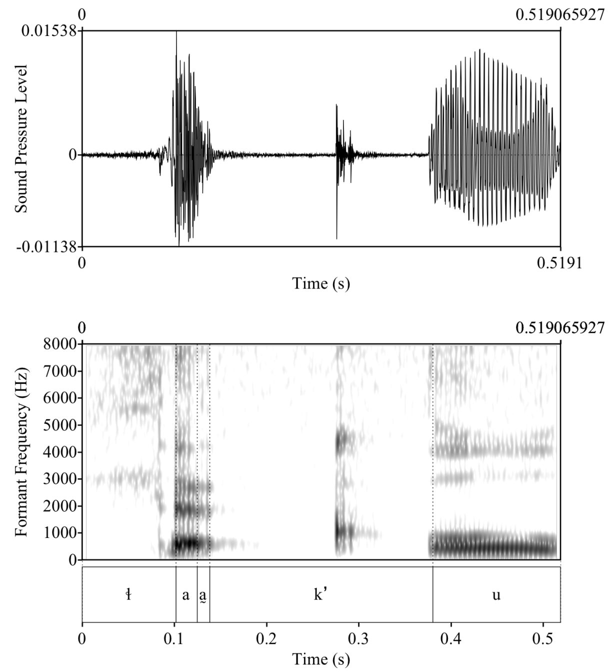

Figure 2.6 Waveform and spectrogram of [łak’ú] ‘his weapon’by female speaker TS

The morphological concatenation of glottal-initial suffixes, such as the imperfective [-ʔin] (16a) causes a preceding stop or affricate to emerge as an ejective (16b), (§3.3.2.2). A comparative acoustic study between underived (15) and derived (16) ejective stops and affricates goes beyond the scope of this dissertation yet, an initial (non-statistically validated) inspection of spectrograms reveals an inconsequential minimal difference between these two sounds.

(15) tik’ín
‘small’

(16) a. x-ɑk-ʔín
1S-go-IMPFV
‘I am leaving’
b. xɑk’ín

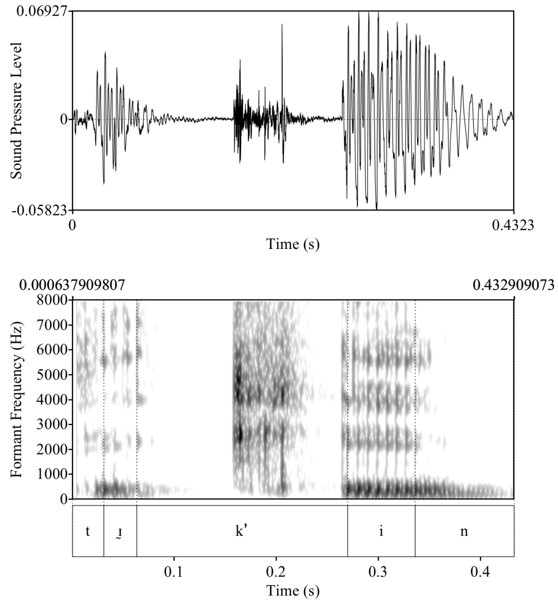

Figure 2.7 Waveform and spectrogram of [tik'ín] 'small' by male speaker FR

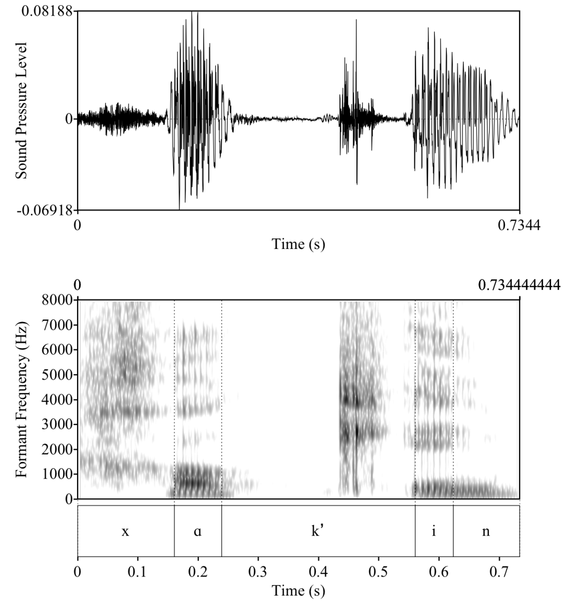

Figure 2.8 Waveform and spectrogram of /xɑkʔin/: [xɑk'ín] 'I am leaving' by male speaker FR

2.2.2 Vowels

Stell (1989:97) posits a phonemic distinction between plain vowels /i e a ɑ o u/ and "glottalized" vowels /ỉ ẻ ả ɑ̉ ỏ ủ /. Table 2 below presents the vowel inventory based on Stell's thesis. Square brackets enclose allophonic variants of the vowels. Note that [ɪ] is a variant of /i/ and /e/, and [ə] is a variant of /a/.

Table 2.2 Nivaĉle vowels (adapted from Stell 1989: 57)

	front		central		back	
	plain	glot.	plain	glot.	plain	glot.
high	i	iˀ			u	uˀ
	[ɪ]					
mid	e	eˀ			o	oˀ
			[ə]			
low			a	a'	ɑ	ɑˀ

The status of glottalized vowels will be discussed at length in Chapters 3 and 4. However, two observations should be made at this point. First, voice quality, i.e. laryngealization or creakiness is not reported as a contrastive value in the vowel systems of other Mataguayan languages. In this sense, Nivaĉle would constitute an exception or an innovation in this language family. Second, note that vowel length is not proposed to be contrastive either in Stell's analysis or in mine.[16] Importantly, even though I posit that vowel length is not contrastive synchronically in Nivaĉle, I report durational differences between modal and glottalized vowels that are statistically significant (§3.2.3). Glottalized vowels are roughly double the duration of modal vowels. In this context, non-modal phonation has been documented cross-linguistically as being associated with phonemic long vowels but not their short counterparts – e.g., in Hupa (Golla 1977, Gordon 1998:101, Gordon & Ladefoged 2001:18).

Stell (1989:84) correlates cases of phonetic vowel length on modal vowels to speech styles (careful and/or emphatic speech). Based on my fieldwork data, I am in accord with this generalization. Vowel length is, for instance, profusely used in storytelling to indicate emphasis, or in everyday conversations to express one's emotions. Recall that I represent primary stress with an acute accent and secondary stress with a grave accent (§1.5.2). Note also that the vowel /e/ usually gets realized more open, i.e., [ɛ] in closed syllables:

(17)	[pa músika	sit͡séx	ʔəpɛ́ːʔ]
	/pa=musika	sit͡séx	apéʔ/
	DET=music	loud	too
	'the music is too loud!'		

(18)	[t͡ʃáːχpi		ɬùt͡sχəjít͡ʃ	ʔɪsíːs]
	t͡ʃa	xapi	ɬut͡sxa-jit͡ʃ	is-is
	EXCL	DET-PL	young.woman-PL	pretty-PL
	'wow, the girls are (very) pretty!'			

[16] Recall, however, that Hunt (1924) posited a distinction between long and short vowels (§1.3).

Another phenomenon worth mentioning in the vowel inventory system is vowel reduction. It has been observed cross-linguistically that, for some languages, the difference in articulation of stressed vs. unstressed vowels is also reflected in the tendency of unstressed vowels to become more centralized (Gussenhoven 2004). In (18) it can be observed that a front low vowel /a/ is reduced to [ə] in an unstressed position, and that it is deleted in the determiner. In fact, in Nivaĉle, a front unstressed vowel /i/ or /e/ is often reduced to [ɪ] (19, 20b), a low central unstressed vowel /a/ (21) is often reduced to a mid vowel [ə] or [ʌ], and a high back unstressed vowel /u/ is sometimes produced as a near-close near-back vowel [ʊ] (22). As will be discussed in subsequent chapters (§3.3.4, §6.6.2), unstressed vowels can also be the target for translaryngeal vowel harmony and deletion processes:

(19) [tɪk'ín]
/tik'in/
'small'

(20) a. sisé
'cane'
b. [sisɪt͡ʃát]
/sise-t͡ʃat/
cane-COL
'cane field'

(21) [xiβéʔk͡lə]
/xiβéʔk͡la/
'moon'

(22) [-nʊt͡sa̰x]
/-nut͡sá̰x/
'angry'

The miminal pairs in (23)-(27) illustrate some of the phonemic contrasts found between the Nivaĉle vowels.

(23) a. /is/ /i/ ≠ /u/
‘nice’
b. /u-s/
big-PL

(24) a. /in/ /i/ ≠ /e/
‘paint! (IMP)’
b. /en/
‘love! (IMP)’

(25) a. [naβa] /a/ ≠ /ɑ/
/na-wa/
DET-PL
‘the’
b. [naβɑ]
/nawɑ/
‘pollen’
c. /xa-tan/
1S-unhappy
‘I am unhappy’
d. /xa-tɑn/
1S-chew
‘I chew’
e. /win.tax/
‘tree’
f. /win.tɑx/
‘brown snail’

(26) a. /wat-sɑʔ/ /o/ ≠ /ɑ/
INDEF.POSS-scabbies
‘someone’s scabbies’
b. /wat-soʔ/
INDEF.POSS-penis
‘someone’s penis’

(27) a. /kak͡lek / /e/ ≠ /o/ ≠ /ɑ
‘heavy’

b. /k'ak͡lok/
'twisted'
c. /kak͡lɑk/
'quiet'

In the following figure, the vowel plot for a male (FR) and a female speaker (TS) are presented. Each of the six Nivaĉle contrastive vowels /i e a ɑ o u/ were recorded in the context of a preceding plain alveolar stop in a stressed syllable.

(28) a. tí
'that'
b. jitéx
'carob'
c. táta
'dad'
d. itɑ́x
'fire'
e. tós
'snake'
f. túɬ
'night'

The midpoint of each vowel was measured in Praat using LPC analysis with a series of overlapping Gaussian 50 ms windows and a 25 ms step size. Formant values are given in Hertz.

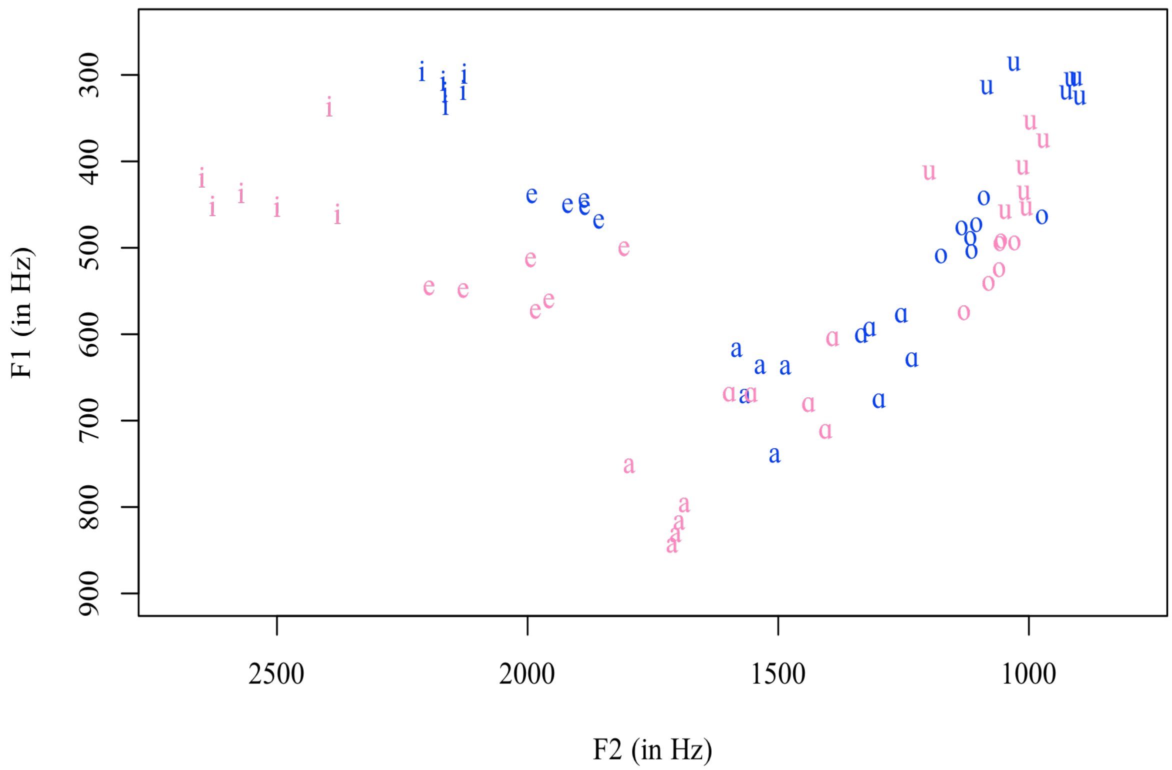

Figure 2.9   Nivaĉle vowels charted in a two-dimensional unnormalized F1-F2 space, male speaker (FR) in blue, female speaker (TS) in pink

Given the formant values in Figure 2.9, the vowel [a] can be characterized as relatively central. However, this vowel patterns with front vowels in processes of palatalization, while /ɑ/ systematically patterns with back vowels (§2.5.1).

The vowel [ɑ] is the one that displays more variability both across dialects and in its diphthongal variants. In a few examples (29-32), the vowel /ɑ/ alternates with a diphthongal variant – [ɑᵓ] or [ɒ] in fast speech. The vowel [ɑᵓ] is represented in the Nivaĉle dictionary (Seelwische 1980) as a sequence of two vowels: *aô*. What Seelwische represents as *aô* corresponds to three different realizations. First, as shown in the data of (29) below, what Seelwische represents as *aô* corresponds to the presence of a glottal in between two heterosyllabic vowels. Second, in data like (30), it just corresponds to the glottalized counterpart of /ɑ/ or /a/, analyzed in this work as the sequence /ɑʔ/ or /aʔ/ in a closed syllable:

(29) [naʔɑ́]
/naʔɑ/
na-ô (Seelwische 1990)
DET-DIST
'that'

(30) a. [jɑ̰́s]
/jɑʔs/
y-aôs (Seelwische 1990)
1POSS-son
'my son'

b. [jikɑ̰́txok]
/ji-ka-tʼxok/
yi-caôtjoc (Seelwische 1990)
1POSS-POSS.CLASS-uncle
'my brother-in-law'

One of my main consultants, FR, who collaborated in the elaboration of Seelwische's dictionary, explicitly mentioned that the vowel in 'son' does not have two different vowels; rather, it was his orthographic opinion that it should be written as *yôôs*, which correctly focuses on the salience of extended duration in the context of glottalized vowels.

Third, what Seelwische represents as *aô* represents the low back vowel /ɑ/ followed by a a glide /w/ (note that the [β] is the /w/, represented in the orthography as "v"). This can be variously realized as as [ɑɔ̯] or as a farther back low [ɒ].[17]

[17] A front vowel /a/ before /w/ does not undergo a comparable process.

(31) [tɑɔ̰βk͡l̚áx] ~ [tɒβk͡l̚áx]
taôvĉlaj
‘infant’

(32) [ʔɑɔ̰βtéχ]
aôvtej
‘(it) hurts’

The low back vowel [ɑ] is subject to regional variation. In the *yita*’ *lhavos* ‘people of the sandy spot’ variety (a.k.a. *c’utjaan lhavos* ‘people of the thorny bushes’), there is no low back-unrounded vowel [ɑ]; [a] is ubiquitously found instead. According to RF, a Nivaĉle primary school teacher in Misión Santa Teresita (*yita’ lhavos*), the vowel [ɑ] is only produced when reading texts at school or during mass, otherwise the [a] has replaced the [ɑ] in everyday life (p.c).[18]

(33)	***yita’ lhavos***	***shichaam lhavos***
	[xák]	[xɑ́k]
	j-ôc	
	1S-go	
	‘I go’	
(34)	[tajḛ́x]	[tɑjḛ́x]
	tôyeej	
	‘shaman’	
(35)	[a-ɬán]	[aɬɑ́n]
	a-lhôn	
	2IMP-light	
	‘light(IMP)!’	
(36)	[xak͡lá̰p]	[xak͡lɑ̰́p]
	ja-ĉlôôp	
	1S-to.have.on.lap	
	‘I have (sb.) on my lap’	

18 MG, another female *yita’ lhavos* speaker, also confirms this observation; she states that [ɑ] does not exist in her speech except for certain words such as [ʔɑxɑk͡lɑ] *bird* (where the dorsal consonants might be causing the [a] vowel to become [+back]).

(37)	[iná̰t] *inôôt* 'water'	[inɑ̰́t]

(38)	[towák] *tovôc* 'river'	[towɑ́k]

(39)	[ɬási] *lhôs-e* 3POSS-son-FEM 'his/her daughter'	[ɬɑ́se]

Another feature of the *yita' lhavos* variety is that in certain words, the front vowel [e] is pronounced as a high front vowel [i], as seen in (39) above and in some of the vowel correspondents in (40-42) below:[19]

(40)	***yita' lhavos***	***shichaam lhavos***
	[t͡ʃʼit͡ʃʼí] *ch'ech'e* 'parrot'	[t͡ʃʼet͡ʃʼé]
(41)	[kek͡lejt͡ʃí] *queĉlei-che* ?-FEM 'bean'	[kek͡lejt͡ʃé]
(42)	[nìkxak-é] *necjôqu-e* boy-F 'girl'	[nèkxɑké]

[19] Another case of vowel raising seems to occur with back vowels as well, though I have only documented the following example:

(i) kutsxá̰t (*yita' lhavos*) kotsxá̰t (*shichaam lhavos)*
'land'

Whereas one could hypothesize that vowel raising in some forms is due to adjacency with the preceding alveopalatal affricate, e.g. in (40) and (41), it is not very clear why [e] would raise to [i] in (39) and (42). Interestingly, Hunt (1924:2) already noted an alternation between [e] ~ [i] in the feminine marker: "it is not always easy to determine the final vowels *e* and *i*, e.g. the feminine termination as in somto-ke or somto-ki, 'white woman'". Note in that regard that the [e] ~ [i] in (39) is the feminine marker, though this same alternation is not registered in (42). It is worth mentioning that [i] can occur in final position in the *shichaam lhavos* variety, e.g. [mimi] 'mother'; [k͡limʃi] 'flour'; thus, this is not a case of absolute neutralization.

In sum, given the issues that have been discussed so far, I propose that the contrastive and non-constrastive vowel inventory for Nivaĉle could be organized as follows:

Table 2.3 Nivaĉle vowels: Synchronic Proposal

Phonemes	**yita' lhavos**	**shichaam lhavos**	**Variants**
/i/	/i/	/i/	[i] ~ [ɪ]
/e/	/e/ ~ /i/	/e/	[e] ~ [ɛ]
/a/	/a/	/a/	[a] ~ [ə] ~ [ʌ]
/ɑ/	(/ɑ/ > /a/)	/ɑ/	[ɑ] ~ [ɑɔ̰] ~ [ɒ]
/o/	/o/	/o/	[ɔ]
/u/	/u/	/u/	[ʊ]

2.3 Nivaĉle syllable structure and phonotactics

The phonotactics of a language comprise restrictions on the permissible combinations of sound elements. Specifically, phonotactic constraints define the syllable structures, consonant clusters, and vowel sequences that are allowed in a language. This section presents an overview of the syllable structure in Nivaĉle in order to serve as the background for the discussion of phonotactic constraints and morpho-phonological processes.

2.3.1 Overview of syllable structure

The core syllable structure in Nivaĉle consists of the following structures: CV, CVC, CCV and CCVC.

Table 2.4 Nivaĉle core syllable structure and the role of ʔ

Syllable	CV	CVC	CCV	CCVC
	CV	CVC	CCV	CCVC
	ʔV	CVʔ	*CʔV	*CʔVC
		ʔVʔ	*ʔCV	*ʔCVC
				CCVʔ

In the following subsections, I analyze the different constraints on syllable structure in this language.

2.3.1.1 Onsets

Contrary to Stell (1989:116, 117), I claim that there are no onsetless syllables in the language neither word-initially, nor word-medially. That is, the constraints ONSET and *VV are undominated:

(43) ONSET

*[ₒV (Syllables must have onsets) (Itô 1989, Prince & Smolensky 1993)

(44) *VV: There cannot be two adjacent vowels.

All Nivaĉle consonants may appear as singleton onsets. Complex onsets are allowed in the language but only word initially. The following examples show alienable nominal roots, that is, roots that do not require the presence of an obligatory possessive prefix (45), and predicative verbs (46):

(45) a. txóp
'temperate'
b. ʃk͡lɑkxáj ~ sk͡lɑkxáj
'wild cat'
c. ʃnawɑ́p
'spring'
d. xpɑ̰́k
'straw'
e. pxuxúk
'cactus'
f. f͡tsṵ́k
'palm tree'

(46) a. fk’a͡tsáx
‘wide’
b. kxám
‘just’

Note that examples with initial #pC, #fC, #xC are provided for completeness here, but in fact are extremely rare clusters. The pervasive generalization is that C1 of an initial CC cluster is COR, consistent with Morelli (1999, 2003).

Ejectives /p’ t’ k’ t͡s’ t͡ʃ’/ cannot occur as the first member of a complex onset, but can occur as the second member, as seen in (46a), above. Further, given that CCC clusters are not allowed, the initial onset cluster [fk’] in (46a) provides evidence against treating ejective consonants as C + ʔ sequences.[20]

Table 2.5 below shows the CC co-occurrences in word initial position. Data was taken from Seelwische’s dictionary and my own fieldwork. White cells indicate attested CC sequences; when there are fewer than 4, I indicate the number of attested examples. Grey cells indicate unattested combinations. The plus (+) sign indicates that the sequence is only attested across a morpheme boundary. It can be seen that complex onsets are quite restricted and that coronals [t] and [ɬ] are the preferred C1. The preferred C2 is [x].

[20] The following examples provide additional evidence: [tt͡ʃ’akfaj] ‘s/he is married (with children)” and [tt͡s’ak͡ɬaj] ‘s/he is poor’.

Table 2.5 Initial CC clusters [Note: the + sign indicates that the sequence is only attested across morpheme boundaries]

	C2	stops				ejectives					affricates			fricatives					nasals		glides	
C1		p	t	k	ʔ	p’	t’	k’	t͡s’	t͡ʃ’	t͡s	t͡ʃ	k͡l	ɬ	f	s	ʃ	x	m	n	j	w
stop	p																					
	t	+		+		+ 1		+	+ 1	+	+ 1	+ 2			+		3			3		
	k																					
	ʔ																					
eject.																						
aff.	k͡l																					
	t͡s																					
	t͡ʃ																					
fricatives	ɬ	+	+	+		+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+
	f							1				3						1				
	s		3	2								1	2						1	1		
	ʃ						1						1									
	x					1																
nasals																						
glides																						

Word-medial complex onsets are not allowed; inalienable CCVC nominal roots have the first consonant of the complex onset syllabified as the coda of the preceding syllable, which contains a possessive prefix:

(47) ji-f.xúx
1POSS-toe
'my toe'

(48) k'a-k.xúʔ
1A.2P-greet
'I greet you'

In Section 2.3.1.3, I will discuss the kind of consonants that can occur in coda position and CC medial clusters (cf. Table 2.6).

2.3.1.2 ʔ-epenthesis

In the previous section, I claim that ONSET (43) is an undominated constraint in the language. Consider the following data:

(49)	a.	[ʔak͡le] /ak͡le/ 'scalp'	a'.	[kat͡sakle] /kat͡si-akle/ 1POSS.PL-scalp 'our scalp'	a''. *[kat͡sʔak͡le] *[kasʔak͡le] *[kat͡si-ʔakle] (§2.4)
	b.	[ʔáʔseɬ] /ɑʔs-eɬ/ son-PR.PL 'your son'			
cf.					
	c.	[ʔàʔseʔéɬ] /ɑʔs-e-eɬ/ son-F-PR.PL 'your daughter'			

An epenthetic glottal stop is inserted in both word initial position and word medial position to ensure satisfaction of ONSET. A descriptive generalization that falls out from ONSET » DEP-IO-ʔ is that there cannot be two adjacent vowels:

(50) DEP-IO-ʔ: An output glottal stop must have an input correspondent (‘No ʔ-epenthesis’).

(51) ONSET » DEP-IO-ʔ

The epenthetic status of the glottal stop can be determined by comparing (49b) with (49c). The root in (49a) does not start with a glottal stop because the first person possessive plural form is not [kat͡sʔak͡le] or *[kasʔak͡le], but rather, [kat͡sakle] ‘our scalp’.

Interestingly, a glottal stop is not epenthesized in order to repair a vowel hiatus at the pre-root prefix domain: *[kat͡si-ʔakle]. As will be discussed in §2.4, the final vowel of a prefix consistently deletes when added to a vowel-initial root. In contrast, in a post-root suffix domain, glottal stop epenthesis is enforced in order to not violate *VV (44). The epenthetic status of the glottal stop will be discussed in §3.3.3.1.

2.3.1.3 Codas

While closed syllables are a frequently found syllable structure type, complex codas are not allowed in this language, and so *CC]$_{\sigma}$ is an undominated constraint. In contrast, NOCODA has to be low ranked:

(52) *COMPLEXCODA

*CC]$_{\sigma}$	‘Codas are simple’	(Kager 1999)

(53) NOCODA

*C]$_{\sigma}$	‘Syllables are open’	(Kager 1999)

All consonants may appear in coda position except for the ejectives /p’ t’ k’ t͡s’ t͡ʃ’/ which can neither serve as word-internal nor word-final codas. In that regard, several authors (Itô 1986, Itô & Mester 1994; Lombardi 1991, 1995) have pointed at the restriction against LARYNGEAL and PLACE jointly occurring in coda position. Similarly, in Nivaĉle, ejectives lose their laryngeal feature in coda position (see §2.5.5 and §6.5.1). Steriade's (1997) *Licensing by Cue* approach presents a perceptual motivation for this constraint: "an optimal identification of an ejective (…) will depend on the nature of the right hand context, i.e. on the presence of a vowel or a sonorant" (78). Because none of the ejective obstruents can occur as the first member of an initial consonant cluster in Nivaĉle, this fact can be interpreted as an argument for Steriade's (1997) perceptual explanation of laryngeal neutralization: glottalized obstruents neutralize in the absence of a following sonorant, regardless of whether or not they are in the 'same' syllable.

From the affricate set, /t͡s/ can only occur in onsets (54b):

(54) a. -fé.tas
'root'
b. -fe.ta.t͡s-íj
root-PL
'roots'

The affricate /t͡s/ can also occur in word-internal codas (55b), but only before [x] (cf. Table 2.6). There is only one example where /t͡s/ can also occur before /f/, as seen in (7) [kut͡sfas] 'friends':

(55) a. -ɑ.fḭ́s
'reach'
b. -ɑ.fit͡s-xan
reach-INT
'to reach' (Stell 1989:123)

(56) a. xaj-kút
1S-steal
'I steal'
b. kὺt͡s-xanáx
steal-NMLZ
'thief'

The palato-alveolar affricate [t͡ʃ] occurs in onset and word final coda position. In word medial coda position, it only occurs before [ʔ], [ʃ] and [x] initial suffixes. Recall that the morphological concatenation of glottal-initial suffixes causes a preceding stop or affricate to emerge as an ejective, as seen in (58a).

(57) xokitát͡ʃ
'*lapacho* (tree)'

(58) a. xa-wàn-t'ɑfít͡ʃ-ʔin ~ xawànt'ɑfít͡ʃ'in
1S-REF-hide-IMPFV
'I am hiding'

b. xa-wàn-t'ɑf̰ít͡ʃ-ʃi na=jitáʔ
1S-REF-hide-IMPFV-LOC DET=scrubland
'I hide (inside) the scrubland'

c. t'a-k͡l̥at͡ʃ-xop
t'a-claach-jop (Seelwische 1990)
3POSS-song-FOR
'(his/her clothing)for singing'

A rare and interesting alternation, discussed in detail in Chapter 5, pertains to the complex segment /k͡l̥/, which consistently neutralizes to [k], when it is not preceded by a vowel (§5.3), but, interestingly, it is retained before a glottal stop (§3.3.4). This special behavior of /k͡l̥/ suggests a perceptual, rather than a syllabic, explanation behind complex segment neutralization.

In sum, there are two types of complexity under consideration: one is sequential complexity (i.e. consonant clusters); the other is internal segmental complexity, e.g. affricates and glottalized consonants. As previously mentioned, whereas there are a number of complex onsets, complexity never occurs in coda position, the constraint *COMPLEXCODA is undominated.

A major set of distributional generalizations that plays an important role in my analysis is that where there is a word-internal coda, the following onset is always of equal or lesser sonority (§2.3.2 and §6.3.2); that is, obstruent(O)-resonant(R) sequences are not attested at the MStem1 domain: *O.R. I consider the Morphological Stem 1 to consist of the root and derivational suffixes (cf. Chapter 4, §4.5). In contrast, OR sequences are attested between prefixes and roots or across a word-enclitic boundary. However, there does not seem to exist an internal sonority hierarchy among the obstruents. Table 2.6 below summarizes the CC medial clusters combinations. Similarly to Table 2.5, white cells mean attested, grey cells mean unattested, “1, 2, 3” indicates the number of examples. Further, for relevant cases, I indicate the specific morpheme in contact.

Light grey cells indicate neutralization; the outcome is indicated in the relevant cell.

Table 2.6   Medial CC clusters

C2 / C1		stops				ejectives					affricates			fricatives					nasals		glides	
		p	t	k	ʔ	p’	t’	k’	t͡s’	t͡ʃ’	t͡s	t͡ʃ	k͡l	ɬ	f	s	ʃ	x	m	n	j	w
stop	p												1	3			-ʃi 1					
	t		ɬ																wat-	wat-	wat-	wat-
	k																				=	=
	ʔ																					
ejective																						
aff.	k͡l	k	k	k		k	k	k	k	k	k	k	k	k	k	k	k	k			=	=
	t͡s	[21]													1							
	t͡ʃ																-ʃi				=	=
fricatives	ɬ	1	3			2				t͡ʃ’e							1					
	f									t͡ʃ’e				1			-ʃi					
	s																		kas-	kas-	kas-	kas-
	ʃ									t͡ʃ’e				1			-ʃi				=	=
	x									t͡ʃ’e				3			-ʃi	-xi			=	=
nasals	m									t͡ʃ’e	= tsex			3			-ʃi					=
	n									t͡ʃ’e												
glides	j																					2
	w																			1		
		p	t	k	ʔ	p’	t’	k’	t͡s’	t͡ʃ’	t͡s	t͡ʃ	k͡l	ɬ	f	s	ʃ	x	m	n	j	w

[21] /t͡s/ simplifies to [s] and [t].

2.3.1.4 Nucleus

So far, I have presented an analysis of the Nivaĉle internal syllable structure that accommodates the notions of Onset and Coda not as prime constituents, but rather as prosodic domain edges. Further, I assume an internal syllable structure that has a Nucleus as a constituent (Shaw 1992, 1994), specifically, as the Prosodic Head of the syllable. The mora (Hyman 1985, McCarthy & Prince 1986, Zec 1988, Hayes 1989), which serves as the "primitive subsyllabic constituent and as a measure of syllable weight" (Zec 1995:85), gets parsed to the Nucleus of a syllable and therefore plays a crucial role in the assignment of stress (cf. Chapter 4) and in the realization of [c.g.] (cf. Chapter 3).

In this dissertation, I argue that besides vowels, glottal stop is associated with a mora (§3.3.4), and this mora is parsed to the Nucleus of the syllable (59). All other (non-moraic) segments are parsed directly to the syllable (61).

(59) Parse-μ-Nuc (Parseμ): Moras are parsed into the Nucleus of a syllable.

(60) Parse-Nuc-σ: (ParseNuc): The Nucleus is parsed into a syllable.

(61) Parse-SEG-σ: Segments are parsed into syllables (exhaustive parsing).

2.3.2 Sonority

It has been traditionally assumed that the organization of segments within the syllable is driven by the sonority hierarchy, a ranking of segments from least to most sonorous. Several proposals have been put forward to define and formalize the concept of 'sonority' (Sievers 1876/1893, Jespersen 1904, Murray & Vennemann 1983, Vennemann 1988, Keating 1988, Clements 1990, Goldsmith 1990, Clements & Hume 1995, Gouskova 2004, Parker 2002, 2008, 2012, among others).

Sonority has been defined in terms of openness or aperture of the oral articulation (Kirchner 1988, Goldsmith 1990, Howe & Pulleyblank 2001), relative loudness of speech sounds (Sievers 1876/1893), or inherent or perceived loudness (Ladefoged 1975, Clements 1990, Laver 1994), and so correlated with acoustic notions such as energy (Ladefoged 1971, Keating 1988, Goldsmith 1990, Wright 2004) and segmental intensity levels (Parker 2002, 2008). Even if the concept of sonority has been questioned as a linguistic construct per se (Parker 2008: 56) or its existence has been denied

(Ohala 1990), this concept has had a crucial impact on distinctive feature theory (Chomsky & Halle 1968, Steriade 1982; Clements 1988, 1990, Clements & Hume 1995). Further, a number of cross-linguistic tendencies in the distribution and sequencing of segments are explained with reference to sonority hierarchies – though not without some problems (see Henke, Kaisse & Wright 2012, and Parker 2012 for useful discussion of this issue). When major phonological groupings of sounds are considered the sonority hierarchy with the five classes identified in (62) is generally assumed (Bell & Hooper 1978, Harris 1983, Clements 1990, Kenstowicz 1994, de Lacy 1997), although both more and less inclusive classes have been proposed for particular languages (Jespersen 1904, Goldsmith 1990, Gouskova 1999, de Lacy 2002). Stops, fricatives, and affricates are the lowest ranked segments in regards to the sonority hierarchy whereas vowels are the most sonorous segments:

(62) Sonority Hierarchy (SH): Vowels > Glides > Liquids > Nasals > Obstruents

An intimately related concept is the Sonority Sequencing Principle, which predicts that segments comprising the onset should rise in sonority until they reach the nucleus of the syllable (e.g. vowel), and that the nucleus should be more sonorous than the onset and coda.

(63) Sonority Sequencing Principle (SSP): Sonority increases towards the syllable peak and decreases towards the syllable margins (Clements 1990).

Let us take a look at consonant clusters in Nivaĉle. As seen in §2.3.1, at most two consonants can occur in word-initial position. For instance: (a) obstruent + obstruent: [kxam] 'exact', [pxuxuk] 'type of cactus', [fk'a͡tsax] 'wide', [f͡tʃinax] 'ray', [f͡tsu̯k] 'palm tree', [sxe͡tsi͡tʃ] 'owl' (b) obstruent + sonorant: smitka 'peanut', [ʃnawap] 'spring'.

Consonant clusters can also emerge through morpheme concatenation. Certain verbs surface with a word initial complex onset when the third person subject prefix /t-/ is attached:

(64) t-ka-ʃáʔ-j-a
3S-MED-price-VBLZ-PUNC
'she/he sells'

(65) t-t͡ʃ'ak.fá-j
3S-husband-VBLZ
's/he is married'

Also, two reduplicative forms have CCVC shapes:

(66) txux-txux-ʔin
'narrow'

(67) tʃim-tʃim-t͡ʃ'e
tshimtshimch'e
'(a road) full of potholes'

In these two cases, the first member of the consonant cluster is an alveolar stop, and the second member a fricative. Interestingly, the consonant cluster in (67) is not affricate. I specifically asked the consultants about the pronunciation of this word; they confirmed that there are two consonants, and that they would write it down as *t + sh*.

Table 2.7 and 2.8 below presents co-occurrence constraints on MANNER of CC-initial clusters. This compilation of attested Nivaĉle sequences is non-exhaustive. However, it established that the Nivaĉle data show a relative freedom of co-occurrence across MANNER categories with "equal" sonority within the "Obstruent" class of the general hierarchy in (62). Only affricate-stop and affricate-affricate sequences are not attested. However, in the context of morpheme concatenation only an alveolar stop can occur before another stop or an affricate; no CC-initial root composed of a STOP-STOP or STOP-AFFRICATE is ever attested. Fricatives are the least constrained members of CC-initial clusters. Of this set, the velar fricative [x] is the most frequent. Note that the shaded cells indicate non-licit or unattested consonant clusters. Affricates cannot occur as the first member of a CC-initial cluster except for [t͡s] before [x].

Table 2.7 Co-occurrence constraints on MANNER: Onset CC Obstruents with equal sonority

C1↓ C2→	STOP	AFFRICATE	FRICATIVE
STOP	t-ka-mkɑ-j 3S-?-flour.VLBZ	t-t͡ʃ’akfa-j 3S-husband-VBLZ ‘to be married’	kxatux ‘cactus’ tʃaʔnu (cf. 67) ‘rain’ pxotʃi ‘soft’
AFFRICATE			t͡sxot’atax ‘kingfisher’
FRICATIVE	ʃtɑtax mushroom fk’a͡tsax ‘wide’	ft͡ʃinax ‘ray’ ft͡sṵk ‘palm tree’	sxe͡tsit͡ʃ ‘owl’

Also note the total and systematic absence of Sonority Reversal sequences in Onset, namely, *Nasal/Glide-Obstruent.

In turn, Table 2.8 presents the co-occurrences constraints on MANNER with CC-initial clusters that involve a rise in sonority. These clusters are very rare. Only /t/ can occur as C_1 and /n/ as C_2. The only OBSTRUENT-m cluster is [smitka], and related forms. The only OBSTRUENT-GLIDE sequence is [swuk͡lax].

Table 2.8 Co-occurrence constraints on MANNER: Onset CC with rising sonority

C1↓ C2→	NASAL	GLIDE
STOP	t-nijkɑ-j-xan 3S-thread-VBLZ-CAUS 's/he makes threads' tnɑxke 'vase'	
AFFRICATE		
FRICATIVE	ʃnɑwɑp 'spring' smitka 'peanut'	swuk͡lax 'anteater'

Finally, Table 2.9 considers co-occurrences constraints on place of initial CC clusters. Except for *LABIAL-LABIAL, and *DORSAL-CORONAL, the specific place-place categorizations establish that there seems to be significant freedom of occurrence of place in both derived and non-derived OO clusters at the left edge of the word. Once again, however, the voiceless alveolar stop /t/ is the only CORONAL consonant that can occur before a LABIAL consonant.

Table 2.9 Co-occurrence constraints on PLACE

C1↓ C2→	LAB	COR	DOR
LAB		f͡tsɑnax '*suncho* tree'	pxuxuk 'cactus' fxos 'steep'
COR	tpik͡la ~ pik͡la 'fish' t-fuj-an 3S-blow-CAUS 's/he blows'	tʃaʔnu 'rain' t-ʃajk'u-j 3S-lay.eggs-INT 'it lays eggs'	t͡sxap 's/he tackles'
DOR	xpɑ̰k 'straw'		kxatux 'type of cactus'

Let us now turn to the consideration of medial CC clusters formed by derivational suffixation on the end of a ROOT. Table 2.10, below, recapitulates the data presented in Table 2.6 and reorganizes the relevant information in terms of sonority (across MANNER). Note that “H” stands for homorganic and that exceptions to the pattern established in the relevant cell are indicated between parenthesis.

Table 2.10 Co-occurrence constraints on MANNER

C1 ↓	C2→	OBSTRUENTS							RESONANTS			
		ʔ	STOP	AFF	EJ.	FRIC	LATERALS		NASALS		GLIDES	
							k͡l	ɬ	m	n	j	w
OBSTRUENTS	ʔ											
	STOP		(*H)				(*kk͡l)					
	AFF					(t͡s.x)						
	EJEC											
	FRIC					(*H)	(*xk͡l)					
	k͡l											
	ɬ					(ɬ.x)						
NAS	m											
	n											
GLI	j											2
	w		(*wp)		(*wp’)					1		

Several patterns are worth mentioning: First, the glottal stop can occur before all consonants except before another glottal stop or an ejective. Second, with considerable less freedom of occurrence are ejectives, affricates and the complex segment /k͡l/, which are the most restricted as C1. From this set, there are two interesting cases. On the one hand, as previously mentioned (§2.3.1), the affricate [t͡s] can only occur before [x]. On the other hand, [k͡l] can also only occur as C1 before [ʔ] (§ 5.3.1), but neither [x], nor [k] can occur before [k͡l].

Third, the situation within the resonant class is different: /m/ and /w/ show the most restricted distribution, and thus appear to be the most marked segments. This is not surprising given the lack of co-occurrence between labial obstruents in both medial and initial CC clusters. Nasals do not co-ccour, and co-occurrences of glides are restricted. It is not very clear why /n/ can occur before the palatal glide but the reverse is not attested [*jn], or more specifically, when such contact happens the glide is deleted: In contrast with obstruents, though, there is a clear preference for glides to occur as C1.

In order to account for the Nivaĉle data, certain adjacent categories of the Sonority Hierarchy in (62) can be collapsed. I assume the sonority hierarchy in (68) (for further discussion see §6.3.2). Recall that there is no sonorant lateral or rhotic in Nivaĉle. Hence, the category of liquids is null, indicated informally by parentheses in the full version in (62) below:

(68) Vowels > Resonants > Obstruents

cf. (62) Sonority Hierarchy (SH): Vowels > Glides > (Liquids) > Nasals > Obstruents

As will be discussed in Chapter 6 (§6.3.2), when morpheme concatenation results in a 'bad syllable contact' – namely, when sonority rises across a syllable boundary – VC metathesis takes place. Because it is more optimal for syllable onsets to have lesser sonority, and syllable codas greater sonority; "a sonority reversal" is where a coda is less sonorous than the following onset (i.e., obstruent-resonant). When there is a sonority reversal between a coda and a following onset, metathesis functions as a repair process, reversing the sequence of the coda and the immediately preceding vowel. In other words, metathesis emerges as a repair process (69b).

(69) a. tɑjḛ́x
'shaman'
b. tɑj.xe-met͡ʃ b'. *tɑjḛxmet͡ʃ
shaman-POWER.OVER
'shaman that has power over other shamans'

What these examples show is that metathesis functions to repair the "bad syllable contact" […ex.m…] by effectively relocating the low sonority coda segment, [x], from coda position and putting it into the onset position of its host syllable, thus optimizing the syllabic parse to […xe.m…]. Note that vowel-consonant methathesis occurs with all vowels and a range of consonants. For a full account of metathesis see Chapter 6.

The notion of sonority also provides a window into the fact that different layers of affixes define different prosodic domains, these being motivated by different patterns of patterning. Whereas the data in (69), along with many more examples presented in Chapter 6, illustrate that an obstruent-resonant "sonority reversal" sequence across a syllable boundary is actively and systematically avoided within the phonology of Nivaĉle, there are other contexts where such contact persists without being subject to metathesis (or any other repair strategy).

(70) ɬ-tḛ́ʃ=ji
2S-say-1O
'you tell me'

In (70), it can be seen that the palatoalveolar fricative /ʃ/ in the coda precedes the palatal glide /j/ in the following onset (a bad syllable contact). What I hypothesize is that in cases where such "bad syllable contact" sequences persist, they are permitted to do so because there is a stronger prosodic boundary between them. Specifically, note in (70), that the first person object pronoun is a clitic, the prosodic domain difference being signified by the clitic boundary marker [=]. The generalization governing metathesis is that it operates within an inner prosodic domain, identifed as the MSt1, whereas it does not function in the outer domain of clitics embraced within the higher Prosodic Word domain.

The fact that there are a diversity of prosodically-sensitive phonological constraints – the Syllable Contact Law and metathesis (§6.3.2) – that all demonstrably apply within a well-defined morpho-prosodic domain (the Morphological Stem) that is not fully co-extensive with, but rather is internal to the Prosodic Word, constitutes a significant body of empirical evidence that the prosodic phonology needs 'inside access' to morphological domain structure in the sense of Shaw (2009).

2.4 Pronominal allomorphy

Here I will describe an interaction between the possessive personal pronouns and the syllable well-formedness constraints introduced in §2.3.1. This discussion will serve as the background for issues like stress, which will be the subject matter in Chapter 3.

In the nominal domain, the morphemes that can precede the lexical root are possessives and possessive classifiers. Like the other Mataguayan languages and several languages of the Chaco region, Nivaĉle distinguishes between inalienable (a.k.a. relational) and alienable (a.k.a. non-relational) nouns. Inalienable nouns denote entities that are inherently possessed, and thus obligatorily require the presence of possessives. In contrast, alienable nouns are not obligatorily prefixed by possessives. On the one hand, Nivaĉle inalienable nouns comprise: body parts, family relationships, clothing /accessories. On the other hand, alienable nouns comprise: objects, animals/plants, elements from nature (sun, tree, thunder, river), human beings (man, woman, girl, etc).

The possessive pronominal prefix paradigm is summarized in Table 2.11 below.[22] When applicable, the possessive plural suffixes [-ʔeɬ] ~ [-eɬ] are included.

[22] Here and in the rest of the thesis, I will be representing the indefinite possessive prefix with an intial [β] instead of [w], its 'basic' form, as /w/ consistenly surfaces as [β] in this context. Also note that there exists another set of indefinite possessive prefixes whose occurrence is very restricted: [n- ~ na- ~ tin- ~ tn-], e.g. (i). However, they also serve to derive an inalienable noun and create a related alienable noun (ii), (iii):

(i)	na-kfij	~	watá-kfij
	INDEF.POSS-shoe		INDEF.POSS-shoe
	'(someone's) shoe'		'(someone's) shoe'
(ii)	tin-βá̰k		
	INDEF.POSS-intestine		
	'reed'		
(iii)	tin-áx		
	INDEF.POSS-skin		
	'leather'		

Table 2.11 Nivaĉle pronominal possessive paradigm

PERSON	SINGULAR	PLURAL
1INC.	ji- ~ j-	ka͡tsi- ~ ka͡tsʼi-, ~ ka͡ts- ~ ka͡tsʼ-, kas-
1EXCL.	ji- ~ j- ___ -ʔeɬ ~ -eɬ	
2	ʔa- ~ ʔ-	ʔa- ___-ʔeɬ ~ -eɬ
3	ɬ- ~ ɬa- / tʼ- ~ tʼa-	ɬ- ~ ɬa- / tʼ-~ tʼa- ___ + ʦiβeʔ
INDEF.	wat- ~ watʼ-, wata- ~ watʼa, ~ wa-	wat- ~ watʼ-, wata- ~ watʼa, ~ wa-___-ʔeɬ ~ -eɬ

Some patterns of alternation can be noticed. First, there is variation in the syllable shape of the prefixes: C ~ CV, CVC ~ CVCV. These alternating forms are motivated by syllable structure constraints; namely ONSET, *VV, and and *COMPLEXONSET (cf. §2.3.1). Whereas C-final prefixes attach to V-initial roots, CV- prefixes attach to C-initial and CC-initial roots.[23] Similarly, CVCV-prefixes, i.e., [ka͡tsi] (74a,b) and [βata] (79), attach to CC-initial roots in order to not violate COMPLEXONSET. Illustrative examples are given below.

(71) **First Person Singular:** [ji-] ~ [j-]

a. ji-tʼóx
1POSS-aunt
'my aunt'

b. ji-k.fíj
1POSS-shoe
'my shoe'

c. j-ák
1POSS-food
'my food'

(72) **Second Person Singular:** [ʔa-] ~ [ʔ-]

a. ʔa-tí.niʃ
2POSS-necklace
'your necklace'

[23] The only C-prefix that attaches to a C-initial root is the third person possessive prefix [ɬ-], see example (73c) and discussion in pages 61-62.

b. ʔa-k.t̓éʔ
2POSS-grandmother
'your grandmother'

c. ʔ-éj
2POSS-name
'your name'

(73) **Third Person Singular:** [ɬa-] ~ [ɬ-]

a. ɬa-k.tḛ́t͡ʃ
3POSS-grandfather
'his/her grandfather'

b. ɬ-ɑ.s-e
3POSS-son-F
'his/her daughter'

c. ɬ-t'óx
3POSS-aunt
'his/her aunt'

(74) **First Person Inclusive Plural:** [kat͡si-] ~ [kas-] ~ [kat͡s-]

a. ka.t͡sí-f.xux
1POSS.INCL.PL-toe
'our toe'

b. ka.t͡s'í-k.teʔ
1POSS.INCL.PL-grandmother
'our grandomother'

(75)

a. kas-fín
1POSS.INCL.PL-sling
'our sling'

b. kas-ká̰t
1POSS.INCL.PL-chin
'our chin'

(76) ka.t͡s-á.k͡ɬe
1POSS.INCL.PL-sebum
'our sebum'

(77) **First Person Exclusive Plural:** [ji-] ~ [j-] NB: this prefix co-occurs with PR.PL suffix [-(ʔ)eɬ]

a. ji-kɔ̰ts.xat-[i]s-éɬ
1POSS-land-PL-PR.PL
'our (excl.) lands'

b. ji-ka.t͡ʃi.k͡lɑ-[ʔ]eɬ
1POSS-earring-PR.PL
'our (excl.) earrings' (Stell 1989:185)

c. j-ɑk-éɬ
1POSS-food-PR.PL
'our foods'

(78) **Second person plural:** [ʔeɬ] ~ [-eɬ]

a. ʔa-t͡ʃàk.fa-[ʔ]éɬ
2POSS-husband-PR.PL
'your (pl) husband'

b. ʔ-à̰p.ku.nɑ.k͡l-éɬ
2POSS-traditional.salad-PR.PL
'your traditional salad'

(79) **Indefinite Person:** [βata] ~[βat-]

a. βa.tá-f.tiɬ
INDEF.POSS-thread
'someone's thread'

b. βat-á̰j
INDEF.POSS-traditional.purse
'someone's purse'

c. βàt-ka.t-[í]s
INDEF.POSS-chin-PL
'someone's chins'

What is shown in the above data is that the final vowel of a prefix, whether that vowel is /i/ or /a/, systematically deletes when affixed to a vowel-initial root. Deletion of the initial vowel in an underlying V_1V_2 cluster (in accordance with generalizations noted by Casali 1997) functions, therefore, as a strategy to avoid *VV sequences and to optimize CV syllable structure. What is interesting to note is that although *VV is a pervasive constraint in Nivaĉle, different strategies are invoked to resolve violations of *VV in the pre-root prefix domain as opposed to the post-root suffix domain. In the pre-root domain, as we have seen here, *VV violations are resolved by deletion of V_1. In contrast, a sequence of two adjacent vowels at the root-suffix boundary does not surface due to glottal stop epenthesis, as shown in (77b) and (78a). Interestingly, a parallel set of complementary repair mechanisms occurs in Campa languages (Arawakan, Peruvian Amazon): like Nivaĉle, V_1 is deleted in prefixes, but after the root, rather than V-deletion, [t] insertion applies instead to resolve the vowel hiatus (Megan Crowhurst, p.c.).

The alternation in the first person plural (inclusive) possessive [kat͡si ~ kat͡s ~ kas] deserves some comments. First, I posit that the underlying representation must have the palato-alveolar affricate and not the alveolar fricative, that is, /kat͡si/ and not /kas/. As, described in §2.3.1, /t͡s/ simplifies to /s/ before a consonant, except before a velar fricative /x/. The vowel /i/ gets deleted before V-initial roots to avoid a violation of ONSET. Interestingly, this vowel also gets deleted before C-initial roots. While the motivation behind vowel deletion in this context is not very well understood, one of my main consultants stated that the [kat͡si] ~ [kas] is based on intergenerational variants. According to FR, the use of [kas-] before consonant-initial roots is characteristic of Nivaĉle younger generations, who in turn only use [kat͡si] with CC-roots to avoid illicit triconsonantal clusters of three consonants. In contrast, [kat͡si] is mostly used by older generations, both before C- and CC-initial roots. According to Stell's (1989:185) description, [kat͡si] is exclusively used before C-initial roots. The alternation between [kas] and [kat͡s] is definitely a reflection of a language change in progress. During my fieldwork, I found variation of these two allomorphs across speakers of different generations.

The only case in which a C-initial prefix attaches to a C-initial root is displayed by the lateral fricative [ɬ-] (73c). In (73), the third person possessive prefix [ɬa] (73a,b) alternates with [ɬ], (73c). The lateral fricative [ɬ] appears to be the only 'syllabic' consonant in the language.[24] However, given the

[24] Note that in Wichí, a related language, the cognate third person possessive prefix /la-/ gets reduced to [l] in casual speech: e.g., [l.'wu] 'his neck'. Nercesian (2011:138) treats this 'reduced' allomorphic variant as "syllabic" and states that this syllabic lateral is longer than its non-syllabic counterpart (no duration measurements are given). In contrast, I have not found any significant duration differences in Nivaĉle.

constraints postulated in §2.3.1, only moras get parsed into the Nucleus; segments get parsed into the syllable. The lateral fricative is not associated with a mora; therefore, it is parsed directly to the syllable.

It is posited that the vowel [a] in [ɬa] (73) gets deleted, in accordance with the previously discussed vowel hiatus repair mechanism. Also, it is worthy of mention that the vowel [a] also gets deleted in the following form: /ɬakomʔa/ → [ɬkomʔa] 'everybody', suggesting that vowel deletion occurs after a /ɬ/ in other domains. Moreover, during my fieldwork, I noticed another case of syllable reduction; the first person subject /xa-/ reduces to /x/ in fast speech, for instance /xa-k͡l̰ḛ́ʃ/ 'I wash'⇒ [x.k͡l̰ḛʃ] (cf. §2.5.4).

A parallel situation to the one described in the nominal domain can be found in the verbal domain: the second person subject [ɬa] alternates with [ɬ].

(80) a. ɬa-k.t͡ʃáʔ
2S-paddle
'you paddle'

b. ɬ-ám
2s-come
'you come'

c. ɬ-péʔ.ja
2S-listen
'you listen'

An alternative analysis is to propose that the lateral fricative forms a complex onset with the following syllable: e.g., [ɬná̰ʃ] 'his/her nose' [ɬpéʔja] 'you listen'. Nothing in principle would rule out this possibility, especially when considering that, if sonority were to be taken into account, no violation for sonority reversal would be incurred. Note that the possessive prefixes [kas-] and [βat-] occur before sonorant-initial roots. The Syllable Contact Law operates in the MStem domain (root + derivational suffixes), (§4.5).

Another analytical approach would be to hypothesize that the initial [ɬ-] is extrametrical, i.e., that it is outside of the metrical/syllabic parsing of the segmental string. However, I do not claim that this consonant is not parsed into the syllable. Rather, I adduce evidence in Chapter 4 to support the hypothesis that it is counted towards foot formation. Foot formation, stress assignment and the licensing of glottalized vowels provide the evidence for treating the lateral fricative as a different syllable, similarly to other CV possessive prefixes.

2.5 Phonological processes in Nivaĉle

There are several phonological processes that will be referred to in subsequent chapters; it thus will be useful to include a brief characterization of them here.

2.5.1 Palatalization

Palatalization, a cover term for a variety of processes that arise through the bidirectional interaction of a high front vowel or palatal glide with consonants, has been proposed as an areal feature of the Chaco languages (Klein 1992, Messineo 2003, González 2014). Specifically, González (in press) argues that *full palatalization,* where "a consonant shifts its primary place of articulation and often its manner of articulation while moving toward the palatal region of the vocal tract" (Bateman 2007:2), is a common feature of the Chaco languages. In the Mataguayan languages, palatalization affects dorsal consonants (González, in press). For example, in Maká there is a contrast between a uvular stop /q/ and a velar stop /k/, which gets realized as a palatal stop [k^j] before /e/ and /a/ (Gerzenstein 1994: 47). Carol (2014) claims that there is a phonemic contrast between /k/ and /k^j/. There is no palato-alveolar affricate [t͡ʃ] in the aforementioned languages. In contrast, the Bermejo variety of Wichi (Nercesian 2014a) has the affricate /t͡ʃ/ in the phonological inventory (only in onset position). Recall that in Nivaĉle there is a velar stop /k/, in alternation with a uvular stop [q], plus the presence of /t͡ʃ/ (§2.2.1). Also, Nivaĉle has dorsals [x], [χ] and the palato-alveolar /ʃ/. None of the other Mataguayan languages have [ʃ] except for Wichí; [x] palatalizes into [ʃ] when preceding [i] and [e] across morpheme boundaries (Nercesian 2011:153).

Table 2.12 Palatalization: Comparison within the Mataguayan family

	Chorote	Wichí	Maká	Nivaĉle	Gloss
k vs. t͡ʃ	ihnyeta**k**	nate**k**	xunxete**k**	xunʃata**t͡ʃ**	'tusca tree'
	-hete**k**	-ete**k**	-ete**k**	-ʃate**t͡ʃ**	'head'
	tetik			tite**t͡ʃ**	'plate'
	-**k**'inix	-**t͡ʃ**'ihnɑ	-**k**'inχaʔ	-**t͡ʃ**'inxɑ	'younger sister'
			k'e**k**'e	**t͡ʃ**'e **t͡ʃ**'e	'parrot'
			-e**k**aχ	-**t͡ʃ**a̱x	'bring'
	-**k**i	-**k**e ~ -**t͡ʃ**e	-**k**i	-**k**e ~ -**t͡ʃ**e	FEM
x. vs. ʃ	-**h**etek		**x**iɬa	-ʃatet͡ʃ	'head'
		ʔile**x** ʔileʃ-ex wash-INST		-k͡lḛʃ	'wash'
			xinawap	ʃnawɑp	'spring'
	-**h**i	-**h**i	-**x**i	-**x**i ~ -ʃi	INSIDE
			-**x**em	-**x**am ~ -ʃam	THROUGH

Besides the existence of roots with /ʃ/ and /t͡ʃ/, there exists an alternation between the Nivaĉle palatal – [t͡ʃ], [ʃ] – and velar-initial suffixes /k/, /x/ – for example: [ʃam] ~ [xam] 'LOC (on (top of)/up/through)'; [ʃane] ~ [xane] 'LOC (down)'; [t͡ʃiʃam] ~ [kiʃam] 'on'; [ʃi] ~ [xi] 'RES', 'LOC'; [t͡ʃ'e] ~ [k'e] 'LOC (interior) /intensive').[25] The velar vs. palatal realization of the consonant-initial suffix is motivated by the vowel quality of the rightmost vowel of the preceding root. If there is a front vowel, the palatal variant is used. As noted previously in the discussion of the vowel inventory (§2.2.2), these data show that whereas [a] patterns with front vowels, [ɑ] patterns with back vowels. Interestingly, note that the trigger (vowel) and the target (consonant) are not necessarily adjacent: there can be labials, (83a), coronals (82a), (84a), dorsals (82), (84b) and a glottal stop (81b), (83b), before the palato-alveolar affricate and fricative.

[25] Until I find more conclusive evidence, I will refer to these morphemes as suffixes. However, there could some arguments for treating these morphemes as clitics. First, they have freedom of host selection; they can attach to both nominal and verbal stems. Second, these morphemes behave differently from derivational suffixes in terms of stress assignment, i.e. they do not necessarily "shift" stress to the last syllable (see §3.3.2, §4.5.3).

(81) a. ɬ-nḛ́t-ʃam
2s-get-LOC(up)
'you get up'
b. jitáʔ-ʃam
scrub-LOC(up)
'very thick scrubland'

(82) xaxṵ́x-xam ɬa = t'ún
1S-bite-LOC(on) F.DET = *galleta*(type of bread)
'I bit the cracker'

(83) a. k͡ɬím-ʃi
white-RES
'flour'
b. t͡ʃi-jáʔ-xi
INDEF.S-drink-RES
'it is drunk'

(84) a. is-t͡ʃ'é
nice-INTENS
'beautiful'
b. ux-k'é na = nik͡ɬá̰tsit͡ʃ
big-INTENS DET = corn
'the corn is very big/thick'

(85) a. ɬ-ɑ̰́w-xané
2s-be-LOC(down)
'you sit down'
b. ɬ-ɑ.β-ḛ́ɬ-ʃané
2-be-PR.PL-LOC(down)
'you sit down'
c. j-íʔ-ʃané
3-be-LOC(down)
's/he sits down'

Stell (1989:301) documented *ɬ-aw-xané-ʔeɬ* for the second person plural rather than the form in (85b). Whereas I am not sure about the reason behind the different placement of the pronominal plural

[ʔeɬ], it is interesting to note –consistent with the Palatalization analysis documented here – that in the (85b) form where [-ʔeɬ] precedes the locative (LOC), the front vowel in [-ʔeɬ] triggers the use of the ‘palatalized’ alternant [-ʃane].

The collective and feminine suffixes in the following examples also show the velar and palato-alveolar alternation:

(86) a. smìt.ka-t͡ʃát
peanut.tree-COL
‘stand of peanut trees’
b. tìs.xu-kát
quebracho-COL
‘stand of quebracho trees’

(87) a. niβak-t͡ʃé
man-F
‘woman’
b. samto-ké
white.man.F
‘white woman’

Despite broad-based empirical support for interpreting these alternations in terms of an active synchronic palatalization process governed by the front vs. back vowel quality of the preceding root there are some forms in my database that do not conform to the expected palatalization generalizations:

(88)	a. -tá̰ɬ-ʃam	‘to come from’	cf. (82) -xam
	b. jikxṵ́s-ʃam	‘on my knee’	cf. (82) -xam
	c. t͡siká̰t-ʃane	‘I fell down’	cf. (85) -ʃane
	d. t͡sànku-t͡ʃát	‘stand of duraznillo trees’	cf. (86a) -t͡ʃat

What is unexpected in each of these cases is that the palatalized alternants, [ʃ] and [t͡ʃ], occur after a back vowel, rather than a front vowel. In the first three cases above, one might hypothesize that the intervening coronal consonant (ɬ, s, t) might be exerting a local assimilatory influence on the realization of the following segment, e.g. as perseverating the coronal articulation. This would not, however, explain the form in (88d). The analysis of non-adjacent palatalization patterns in Nivaĉle go beyond the scope of this dissertation but open an interesting venue of research.

2.5.2 Epenthesis

Some phonotactic constraints in Nivaĉle reflect the prohibition against onsetless syllables complex codas and the syllable contact law (SCL) (§2.3.2, §6.3.2). In terms of strategies to repair violations of syllable structure, it is notable that underlying segments are hardly ever deleted. Rather, ʔ-epenthesis and V-epenthesis work as syllable repair strategies. This leads, therefore, to an over-arching observation that MAX-IO faithfulness constraints are higher ranked than DEP-IO constraints in Nivaĉle.

As is discussed in greater detail in Chapter 3, the default epenthetic onset is the glottal stop.

Glottal stop epenthesis

(89) a. tsi-kú = [ʔ]a pa = *cocido*
1S-like-3O DET = *cocido*
'I would like to have a *cocido* (mate tea)'

b. k'-uʔ-é.ʃ = a pa = fitsɑk'ɑjit͡ʃ
1S-believe-INST = 3O DET = God
'I believe in God'

(90) a. xà-t-pe.k͡ɬ-éj
1S-DIR-go-DIR
'I return'

b. xa-pèʔ.je-[ʔ]éj
1S-hear-DIR
'I hear (from the distance)'

As illustrated in these examples, ʔ-epenthesis functions as a pervasive strategy to provide otherwise onsetless syllables with a consonantal onset. Explicit argumentation is adduced in Chapter 3 for the featural representation of /ʔ/. Its place-less specification allows it to function as the optimal epenthetic consonant to effect non-violation of the syllable structure markedness constraints ONSET.

Vowel epenthesis

As will be developed in subsequent chapters, vowel epenthesis is enforced in order not to violate higher-ranked markedness constraints, e.g.*COMPLEXCODA and the SCL (§6.3.2). As is illustrated by a broad diversity of suffixes below, the default epenthetic vowel is [i].

(91)	a. woxó ‘pecari’	+ -k PL	woxók ‘pecaris’	
	b. kasús ‘pumpkin’		kasus[í]k ‘pumpkins’	*kasusk
(92)	a. aɬú ‘lizard’	+ -s PL	aɬús ‘lizards’	
	b. βat-mát͡ʃ INDEF.POSS-meal		βàtmat͡ʃ[í]s ‘meals’	*βatmat͡ʃs
	c. oβáj ‘guavirami (fruit)’		oβaj[í]s ‘fruits’	*toss
(93)	a. wɑkɑ́ ‘cow’	+ -tax AUG	wɑkɑtáx ‘zebu’	
	b. wosók ‘butterfly’		wosòk͡l[i]táx ‘big butterfly’	*wosoktax
(94)	a. ɬaβɑ́ ‘flower’	+ -t͡ʃat COL	ɬaβɑt͡ʃát ‘garden’	
	b. ɬú̯p ‘nest’		ɬup[i]t͡ʃát ‘group of nests’	*ɬu̯pt͡ʃat
(95)	a. tɑwɑ́ ‘Maká people’	+ ɬaj GROUP	tɑwɑɬáj ‘group of Maká people’	
	b. k’afok ‘crow’		k’afòk[i]ɬáj ‘Argentine militaries’	*k’afokɬaj

(96)	a. wot͡só ‘*lechiguana*’	+ -met͡ʃ SHAMAN	wot͡so-mét͡ʃ ‘shaman of the *lechiguana*’	
	b. saxét͡ʃ ‘fish’		saxèt͡ʃ[i]mét͡ʃ ‘shaman of the fish’	*saxet͡ʃmet͡ʃ
(97)	a. kumok͡lú chañar(tree)’	+ -nɑk RES	kumòk͡lunɑ́k ‘chañar wine’	
	b. ɬaft͡sṵ́k ‘palm tree’		ɬaft͡sùk[i]nɑ́k ‘palm tree wine’	*ɬaft͡sṵ́knɑk
(98)	a. isí ‘clean’	+ -nat CAUS	isinát ‘to make s.t. clean’	
	b. sás ‘dirty’		sas[i]nát ‘to make s.t. dirty’	*sasnat
(99)	a. k͡lesá ‘knife’	+ -niɬ MAT	k͡lesaníɬ ‘made of iron’	
	b. kot͡sxá̰t ‘soil/ground/land’		kot͡sxàt[i]níɬ ‘made of soil’	*kot͡sxá̰tniɬ
(100)	a. naɬú ‘day’	+ -jan CAUS	xanàɬuján ‘I light’	
	b. k͡lap’á̰f ‘bold’		xak͡làp’af[i]ján ‘I shave’	*xak͡lap’á̰fjan
(101)	a. ji-pást͡ʃe 1POSS-finger ‘my finger’	+ -waʃ MARK	jipàst͡ʃewáʃ ‘my fingerprint’	
	b. p’ók ‘arrow’		p’ok[i]wáʃ ‘mark of an arrow’	*p’okβaʃ

2.5.3 Vowel harmony

In Nivaĉle, spreading of vocalic features can be observed across epenthetic and non-epenthetic glottal stops at morpheme boundaries. When two vowels are adjacent in the input due to morpheme concatenation, a glottal stop is inserted and there is regressive or progressive vowel harmony. The examples in (102-103) show regressive assimilation, where a stressed vowel [e] is the trigger for vowel harmony and low vowels /ɑ a/ are the target. I have also found one example with the vowel /u/ as the target (103c).

(102) [meʔéɬ]
/mɑ-eɬ/
go-PR.PL
'go (pl)!'

(103) a. [xapèʔjeʔéj]
/xapeʔj-a-ej/ pa=tʼɑ̰́j
1S-hear-PUNC-LOC DET=noise
'I heard noise (from the distance)'

b. [ʔaβà̰t͡ʃeʔéɬ]
/a-βaʔt͡ʃa-eɬ/
2POSS-property-PR.PL
'your(pl) property/you (pl)

c. [xanùkeʔéɬ]
/xa-nuku-eɬ/
1S-drop-PR.PL
'We (excl.) drop'

The data in (102) and (103a,b) show unstressed [ɑ] and [a] undergoing total vowel assimilation to [e]. In (103c) we can also see a high back vowel undergoing assimilation of /e/. In contrast, example (104) shows progressive vowel harmony across an underlying glottal stop.

(104) a. [xap’ò?e?én]
/xa-p’o?-e-?in/
1S-close-LOC-IPFV
‘I am closing’
b. *[xa-p’ò-?i-?ín]
c. *[xa-p’o-?e-?ín]

The examples just presented will be discussed in Chapter 3, §3.3.3.

Notably, vowel harmony can also be marginally found in epenthetic vowels across coronal and dorsal consonants (§2.6.2, cf. Chapter 6):[26]

(105) a. -sɑ̰́t
‘vein’
b. -sɑ.t-[ɑ́]j
vein-PL
‘veins’

(106) a. ji-pɑ́?.kɑt
1POSS-hand
‘my hand’
b. ji-pɑ̀?.kɑt-[ɑ́]j
1POSS-hand-PL
‘my hands’

(107) a. βat-sá̰ʃ
INDEF.POSS-hair
‘someone’s hair’
b. βàt-sa.ʃ-[á]j
INDEF.POSS-hair-PL
‘someone’s hairs’

(108) a. ?an.kó̰k
‘s/he has a limp’

[26] Note, as will be explained in Chapter 4, that the glottalized vowels deglottalize when not receiving stress (105b, 107b, and 108b).

b. kas-ʔàn.ko.x-[ó]j
1POSS.PL-limp-PL
'we have a limp'

(109) a. ji-βóʔ.mat
1POSS-wound
'my wound'

b. ji-βòʔ.mat-[á]s
1POSS-wound-PL
'my wounds'

(110) a. ji-kạ́-t.xok
1POSS-POSS.CLASS-uncle
'my brother-in-law'

b. ji-kạ̀-t.xo.k-[o]-βót
1POSS-POSS.CLASS-uncle-FAM.PL
'my brothers-in-law'

Vowel harmony in epenthetic vowels, though, is restricted to a small number of examples. Further, I have documented fluctuations in the vowel quality of the epenthetic vowel. I posit that these alternations might be due to a change in progress; because determiners inflect for number, the plural marker of the noun can be dropped. As a consequence, plurality on the nouns is not consistently marked and thus hesitations arise.

(111)	a.	ji-pɑ̀ʔ.kɑ.t-[ɑ́]j	~ ji-pɑ̀ʔ.kɑ.t-[í]j	~	na-wá=ji-pɑ́ʔ.kɑt
		1POSS-hand-PL	1POSS-hand-PL		DET-PL=1POSS-hand-PL
		'my hands'	'my hands'		

2.5.4 Metathesis and deletion

When morpheme concatenation would result in an illicit syllable structure or a bad syllable contact (§2.3.2), vowel-consonant metathesis may come into play as a repair strategy (cf. Chapter 6).

(112) a. ɑ.tɑ́x
'cranium'

b. ɑt.xɑ́-s b'. * ɑtɑxs
cranium-PL
'crania'

(113) a. ji.jɑ̰́x
'puma'
b. jij.xɑ́-s b'. jijɑ̰xs
puma-PL
'pumas'
c. jìj.xɑ-métʃ c'. jijɑ̰xmetʃ
puma-SHAMAN
'shaman that has power over the pumas'

Unstressed vowels also tend to delete (or reduce, cf. Chapter 4) in fast speech or storytelling (§2.3.1); specifically, they occur in open pretonic syllables:

(114) a. [ɬ.kómʔa]
/ɬakomʔa/
'everybody'
b. [ɬ.péʃ]
/ɬapeʃ/
'a long time ago.'

(115) a. [xtɑ́ʔɬej]
/xa-tɑʔɬ-ej/
1S-come-DIR
'I come from'
b. [x-k͡lḛ́ʃ]
/xa-k͡leʔʃ/
1S-wash
'I wash'

2.5.5 Deglottalization of glottalized consonants and vowels

A pervasive and complex set of phenomena in Nivaĉle involves the "deglottalization" of both consonants and vowels under what initially appears to be a diversity of circumstances. A major goal of the present research is to show that the realization of the distinctive feature of [constricted glottis] is fully systematic, and that its surface alternations are governed by the interaction of constraints on both segmental and prosodic structure in Nivaĉle.

As will be explained in detail in Chapters 3 and 6, the realization of the [constricted glottis] feature in consonants is perceptually motivated: ejectives can only occur before vowels, as this context allows for the optimal identification of the glottalized release. In turn, the realization of the [constricted glottis] feature with vowels is tied to prosodic prominence: *rearticulated/creaky* vowels or the alternant [Vʔ] realization can only occur in a stressed syllable. Where the requisite conditions for the realization of [c.g.] are not met, the segment will "deglottalize". For example, forms like the following (repeated from (107) above) illustrate deglottalization of the vowel [á̰] in the root for 'hair' if it does not surface in a stressed syllable.

(116) a. βat-sá̰ʃ
INDEF.POSS-hair
'someone's hair'
b. βàt-saʃ[á]-j
INDEF.POSS-hair-PL
'someone's hairs'

The deglottalization processes will be discussed at length in Chapters 3, 4 and 6.

Chapter 3: The phonetics and phonology of Nivaĉle laryngeals

3.1 The problem

Issues related to the distribution and phonemic status of the glottal stop, its surface realizations, and glottalization on vowels, have challenged the phonological analyses of languages of the Americas such as Mayan (England 1983, Frazier 2009, Avelino 2011), Mazatec (Silverman et al. 1995, Silverman 1997, Blankenship 2002), Mixtecan (Hollenbach 1984, Macaulay & Salmons 1995, Gerfen 1999, Gerfen & Baker 2005, DiCanio 2008, Herrera Zendejas 2009), Tukanoan (Miller 1999, Stenzel 2004, 2007, Silva 2012) and Zapotec (Munro & Lopez 1999, Avelino 2004, Arellanes 2009, Chávez-Peón 2010), among many others.

Most of the challenges posed by the glottal stop arise from its ambiguous patterning. On the one hand, the glottal stop can pattern with either stops or sonorants. On the other hand, it can get realized as a full segment or as glottalization in the same language (Zoll 1998 [1996]). In that regard, what is commonly referred to in phonological inventories as 'glottal stop' has been variously analyzed as: i) a full independent segment (e.g., Yalálag Zapotec, cf. Avelino 2004; Desano, cf. Miller 1999; Wanano, cf. Waltz & Waltz 2000, and Stenzel 2004; Chalcatongo Mixtec, cf. Macaulay 1987), ii) a constricted glottis ([c.g.]) feature on vowels (e.g. Desano, cf. Kaye 1970; Mixtec, cf. Bradley 1970, Hinton et. al 1992, Gerfen 1999), iii) a floating constricted glottis feature (e.g., Yawelmani, cf. Archangeli & Pulleyblank 1994; Mixtec, cf. Macaulay & Salmons 1995; Blackfoot, cf. Peterson 2004), and as a floating tone (e.g., Southern Min dialects, cf. Chung 1996 as cited in Kavitskaya 2002; Tukano, cf. Ramírez 1997 as cited in Stenzel 2007).

Further, unlike other features, which are posited to have a unique structural dominance affiliation within a given feature hierarchy model, the [c.g.] feature has been variously analyzed as directly dominated by a mora in Mixtec (Macaulay & Salmons 1995) and Wanano (Stenzel 2007), exclusively by a non-nuclear mora in Blackfoot (Peterson 2004), by a root node (Zoll 1996), or a laryngeal ([LAR]) node (Clements 1985, Clements & Hume 1995, Picanço 2005).

The relationship between the glottal stop and vowels in the Mataguayan languages has not been thoroughly studied. What seems to be consistent in the previous literature, though, is its treatment as a consonant rather than as a vocalic feature. Gerzenstein (1983, 1994) includes the glottal stop in the consonantal phonemic inventory of Chorote and Maká. The author states that this consonant can occur in word initial, medial (between homorganic vowels) and final position. However, neither the featural representation of the glottal stop nor the nature of the relationship with the homorganic vowels that are being interrupted is addressed. In turn, Nercesian (2011:92) specifies the syllabic affiliation of the glottal stop in Wichí by claiming that it can serve as an onset in word initial and medial position, and as a word medial and final coda. She further notes that glottal stop onsets cause laryngealization – and elongation – of the following vowel. In summary, then, glottal articulation has been analyzed as a consonant in other Mataguayan languages.

Recall, however, from §2.2.2 that Stell (1989) posits that there is a distinction in Nivaĉle between plain and glottalized vowels. Given that glottalization or creakiness in vowels has not been reported as a contrastive value in any of the other Mataguayan languages, it is illuminating to compare the representation of cognates across the different languages. Note in the following cognate forms that what Stell represents as a contrastively glottalized vowel corresponds to what is represented as two homorganic vowels interrupted or followed by a glottal closure in Chorote and Wichí:

Table 3.1 Cognates of Nivaĉle "glottalized vowels"

Languages	Transcription	Gloss	Source
Nivaĉle	/fảj/ [fa̰j] ~ [faʔᵃ̰j]	‘*algarroba* pods’	(Stell 1989: 192) (my fieldwork notes)
Chorote	fʷaaˀ waˀaj	‘*algarroba* pods’	(Gerzenstein 1983:128) (Campbell and Grondona 2007:19)
Wichí	fʷaʔaj	‘*algarroba* pods’	(Nercesian 2011:92)

Nivaĉle	jikféʔ	‘my ear’	(my fieldwork notes)
Maká	jikfiʔ	‘my ear’	(Gerzenstein 1994:71)

Nivaĉle	ɬawoʔ xawoʔ	‘worm’ ‘I fish’	 (my fieldwork notes)
Chorote	awoʔ ʔa-woʔo	‘worm’ ‘I fish’	(Gerzenstein 1983:50) (Carol 2014:78)

Within the literature on the Nivaĉle language there is no consensus – either explicit or tacit – about the distinction and relationship between glottal stops and glottalized vowels. In his Nivaĉle-Spanish dictionary, Seelwische (1990) represents glottalized vowels in closed syllables as double vowels, e.g. *c’utsaaj,* cf. ‘old person’ [k’ut͡sá̰x] (my transcription); and elsewhere, i.e. in word-medial and final position, as a vowel followed by an apostrophe, e.g. *yo’nis* ‘fox’, cf. [joʔnis] (my transcription), and *nu’* ‘bone’, cf. [núʔ] (my transcription). With respect to Seelwische’s double vowel representation, the reader will recall (§2.2.2) that there is no vowel length distinction in Nivaĉle independently of a modal/glottalized distinction. Even though there is phonetic validity to there being greater vowel length in glottalized vowels (§3.2.1), Seelwische’s double-vowel representation gives no overt acknowledgment of laryngeal articulation in these vowels.[27] The glottal stop – represented with an apostrophe [’] – does not head an entry anywhere in the dictionary. In other words, Seelwische does not

[27] Nivaĉle teachers have also represented the Nivaĉle glottalized vowels as two vowels separated by an apostrophe: e.g. *c’utsa**’a**j*. The representation of glottalized vowels has thus been object of debate within the Nivaĉle educational community. The Linguistic Committee of the Nivaĉle People (CLPN) has decided to continue using Seelwische’s representation: *c’uts**aa**j*.

give independent recognition to [’] as a distinctive segment in the language, aside from its post-vocalic realization. Even though suffixes are listed and certain suffixes like the imperfective [ʔin] would need to be analyzed as glottal-initial since glottal realization here is distinctive, not predictable, Seelwische lists this suffix as *-in.* [28]

In turn, Stell (1989: 92) posits the existence of a phonemic contrast between plain vowels /i e a ɑ o u/ and their glottalized /ỉ ẻ ả ɑ̉ ỏ ủ/ counterparts. As well, she treats the glottal stop as an independent consonantal phoneme in the language, /ʔ/.

Stell represents glottalized vowels with a hook on top of the vowels. I will adopt a similar transcription only in this section to illustrate the different ways glottalized vowels are represented in the Nivaĉle literature. Elsewhere I represent what Stell characterizes as “glottalized vowels” as [V̰] ~ [Vʔᵛ] in closed syllables and as [Vʔ] in open syllables (see discussion below), and as /Vʔ/ in input representation:

(117)	a. is ‘nice’	b. ỉs ‘write (IMP)’
(118)	a. jitex ‘carob’	b. jitẻx ‘grass’
(119)	a. -saʃ ‘mucus’	b. -sảʃ ‘wool’
(120)	a. k͡lɑp ‘fast’	b. -k͡lɑ̉p ‘to be seated on the lap’
(121)	a. k͡lop ‘white/larva.’	b. k͡lỏp ‘winter’
(122)	a. ji-f.xux 1POSS-toe ‘my toe’	b. ji-f.xủx 1POSS-stick ‘my stick’

[28] The CLPN has undertaken a revision of Seelwische’s dictionary: this suffix is listed as *’in* but under the entry for the vowel *i.*

From the data set in (117)-(122), we can observe that all of the listed minimal pairs involve closed syllables. However, Stell notes that all glottalized vowels can also occur in final position (123)-(125). She provides the following auditory characterization (1989:61): "glottalized vowels are clearly perceived as two identical vowels separated by a glottal closure [ʔ]. The second vowel is shorter in initial and interconsonantal position. In absolute final position, the second vowel is voiceless" [my translation from Spanish/AG].

Importantly, Stell (1989:62) also notes that the glottalized vowel "may lose its second voiceless vowel when the following word starts with a vowel [(123)], a consonant [(124)], or when suffixation occurs [(125)]. In the last case, it also loses its glottalized property" [my translation from Spanish/AG]:

(123) /ɬ-kå/ / ɬ-kå/
a. ɬa ɬ-kå
DET 3POSS-fruit
'his/her fruit'
b. ɬa ɬ-kaʔ ux
DET 3POSS-fruit big
'his/her fruit is big'

(124) /ji-kfẻ/ /ji-kfẻ/
a. ji-kfẻ
1POSS-ear
'my ear'
b. ji-kfeʔ tik'in
1POSS-ear small
'my ear is small'

(125) /tisůx/ /tisůx/
a. tisůx
'quebracho'
b. tisxu-j
'quebracho (pl)'

Stell (1989:62)[29]

I have not encountered the phenomenon described in (123) and (124): all those forms are realized in my data as a vowel-glottal sequence regardless of the following context. The deglottalization phenomenon exemplified in (125) is an interesting and pervasive process that I will discuss in §6.5.[30]

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[29] For clarity, I have added the UR of the glottalized vowels, in accordance with Stell's analysis.
[30] Given Stell's general characterization of the glottalized vowels, it is worth pointing out the presence of some transcription inconsistencies in her grammar. Sometimes glottalized vowels in word final position are transcribed as

In contrast, in their article on internal reconstruction in Nivaĉle, Campbell and Grondona (2007:5) present only six vowels /i e a ɑ o u/ as well as the glottal stop in the Nivaĉle phonological inventory. Recall from Chapter 1 that both Stell (1989) and Campbell and Grondona (2007) worked with the same group – the *chishamnee lhavos* 'highlanders' (Upriver dialect) group, though with a difference of 30 years. In addition, Stell (1989) worked with some *shichaam lhavos* 'lowlanders' (Downriver dialect) consultants. Recall, in that regard, that I worked with both *shichaam lhavos* and *yita' lhavos* speakers ('people of the scrub').

While Campbell & Grondona do not explicitly discuss the status and representation of glottalized vowels, it can be observed by comparing their transcription with Stell's in (126) and (127) that Stell's 'glottalized vowel' [å] gets variantly transcribed by Campbell & Grondona as Vˀ (126b) and as VˀV (127b):

(126) a. k'u͡tsåx 'old man' (Stell 1989:141)
b. k'u͡tsaˀx 'old man' (Campbell & Grondona 2007:6)

(127) a. fåjuk '*algarrobo* tree' (Stell 1989:192)
b. ɸaˀayuk '*algarrobo* tree' (Campbell & Grondona 2007:6)

Given the representational divergences in the cited literature (Seelwische 1980, Stell 1989, and Campbell & Grondona 2007), one crucial topic to be analyzed is the phonetic realization and

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"glottalized", with a hook on the vowel: (ia) - (iiia), and sometimes as a sequence of a vowel and a glottal stop: (ib) - (iib) or a vʔv sequence (iiib). It is not clear whether these are typos or whether this reflects some sort of variation in the actual realization of the glottalized vowels being documented.

(i) a. ɬků (Stell 1989:149) 'load' b. ɬkuʔ (Stell 1989:65) 'load'

(ii) a. konxå (Stell 1989:78) 'smooth-billed ani' b. konxaʔ (Stell 1989:133) 'smooth-billed ani'

(iii) a. nů (Stell 1989:116) 'dog' b. nuʔu (Stell 1989:103) 'dog' phonological status of Nivaĉle glottalized vowels and the glottal stop. The goal of this chapter is to address the featural and prosodic representation of the alleged phonemic glottalized vowels (Stell 1989) and the glottal stop.

Section 3.2 presents an overview of phonation types in the languages of the world, with focus on creaky and glottal phonation and its variable manifestation in Nivaĉle vowels. Two basic categories of realization of Nivaĉle 'glottalized' vowels are proposed: the first, I call a *rearticulated/creaky* vowel, represented variably as [Vʔ$^{\text{v}}$] (careful speech) ~ [V̰] (fast speech), and, the second, I call a *vowel-glottal coda*, represented as [Vʔ]. Further, based on data collected in the field, it is shown that duration is a statistically significant variable that distinguishes modal from *rearticulated/creaky* vowels. Section 3.3 advances a proposal in which the glottal stop is specified for [c.g.], but not for place. First, a glottal stop can occur, as an independent segment, in syllable onset position. Second, if a vowel + glottal stop sequence occurs in a syllable closed by another consonant, the glottal stop, here analyzed as underlyingly moraic (see §3.4 and §4.3), can be parsed to the vocalic nucleus of the syllable and hence form part of a complex nucleus – phonetically realized as a *rearticulated/creaky* vowel. In turn, if there is no other consonant in coda position, the [c.g.] feature will be realized post-vocalically as a glottal stop (*vowel-glottal coda*). It is argued here that these diverse glottal realizations are rooted in a set of prosodic constraints. *Rearticulated/creaky* vowel and *vowel-glottal* coda, thus, are variants that occur in complementary distribution due to the different parsing of the [c.g.] feature. In Section 3.4, it is shown that Nivaĉle glottalized vowels must occupy a prominent position, that is, they occur only in a stressed syllable, i.e. the head of a foot (cf. Chapter 4, §4.3). Section 3.5 concludes with the main findings of this chapter.

3.2 Overview of phonation types

Phonation types – or voice quality – refer to the manner in which the vocal folds vibrate. Several proposals have been advanced in order to explain the different ways in which the vocal folds are configured in the production of speech (Catford 1964, 1977, Ladefoged 1971, 1973, Laver 1980, Ladefoged & Maddieson 1996, Gordon & Ladefoged 2001). Based on glottal constriction, that is, the degree of aperture between the arytenoid cartilages, Ladefoged (1971:17) proposes a continuum of phonation types.[31] This continuum ranges from voiceless (arytenoid cartilages furthest apart, no vibration of the vocal folds) going through breathy voiced, to regular modal voicing, then to creaky voice, and finally to glottal closure (arytenoid cartilages closest together, no vibration of the vocal folds). Airflow rate is inversely related to the degree of glottal constriction (Ladefoged & Maddieson 1996:48).

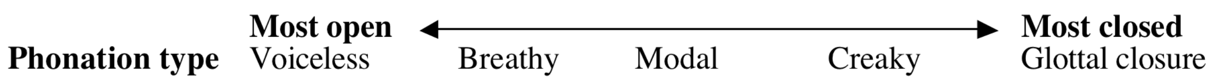


Figure 3.1 Continuum of glottal constrictions (after Ladefoged 1971), reproduced from Gordon & Ladefoged (2001).

Phonation contrasts in vowels can be found in several languages, ranging from two-way to four-way contrasts. For instance, in terms of two-way contrasts, Gujarati (Fischer-Jørgensen 1967) and Kedang (Samely 1991) distinguish between modal and breathy vowels, whereas Mundurukú (Picanço 2005) contrasts modal and creaky voice on vowels. Three-way contrasts across the categories of breathy, modal, and creaky can be mostly found in Otomanguean languages (Kirk et al. 1993, Silverman 1995, 1997, Blankenship 2002, Esposito 2010, among others). Four-way contrasts – modal, breathy, creaky and interrupted – can be found in San Lucas Quiaviní Zapotec (Munro & López 1999, Chávez Peón 2010).[32]

The phonetic correlate of 'glottalized' or 'laryngeal' vowels has been described in the literature as creaky or laryngealized voice. This type of non-modal phonation is "typically associated with vocal folds that are tightly adducted but open enough along a portion of their length [the anterior portion] to

[31] Note that Ladefoged's (1971) original proposal consisted of nine phonation types or states: voiceless, breathy voice, murmur, lax voice, voice, tense voice, creaky voice, creak, and glottal stop.

[32] Interrupted vowels are defined as modal voice followed by a glottal closure. Interrupted is also defined by Chávez-Peón (2010:12) as "glottalized voice".

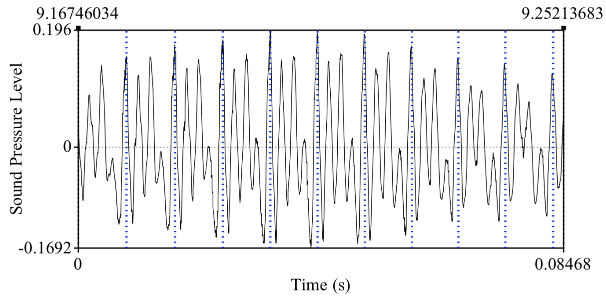
allow for voicing" (Gordon & Ladefoged 2001:386), which [often, but not always] results in a typical low fundamental frequency (Ladefoged 1971, Laver 1980).

In turn, other proposals move beyond the glottal states and make reference to supra-glottal mechanisms involving "a number of valves that represent a synergistic and hierarchical system of laryngeal articulations" (Edmondson & Esling 2006:157) that may create distinctive phonation types (see also Moisik & Esling 2011; Moisik, Czaykowska-Higgins & Esling 2012). For instance, based on contrastive phonological behaviour in Dinak, Bai, and !Xóõ, Edmondson and Esling (2006) add 'faucalised', 'harsh' and 'strident' voice to the range of phonation types.

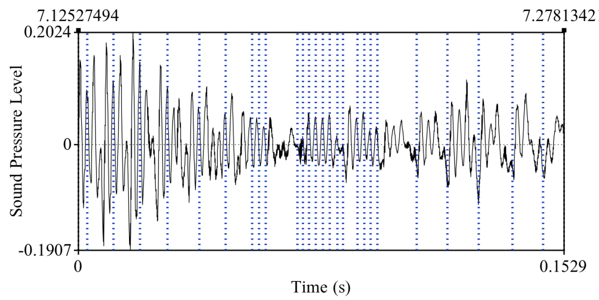
3.2.1 On glottal stop and creaky voice in Nivaĉle

Aperiodicity (Gordon & Ladefoged 2001) in the signal is one of the traditional acoustic characteristics of creaky voice. Figure 3.2 presents waveforms of the Nivaĉle modal vowel [e], in [ɬk͡lés] 'her children', the glottalized vowel [ḛ], in [ɬk͡lḛ́ʃ] 'she washes', and the modal vowel followed by a glottal stop [eʔ], in [jikféʔ] 'my ear', all pronounced by FR. Periodicity differences between these three phonation types can be observed. While the pitch cycles for the modal vowels are quite regularly spaced (a), the waveform for the glottalized vowel displays irregularly spaced pulses (b). In contrast, no vibration and no pulses are present in the waveform of a glottal stop (c).

a. MODAL



b. CREAKY



c. GLOTTAL

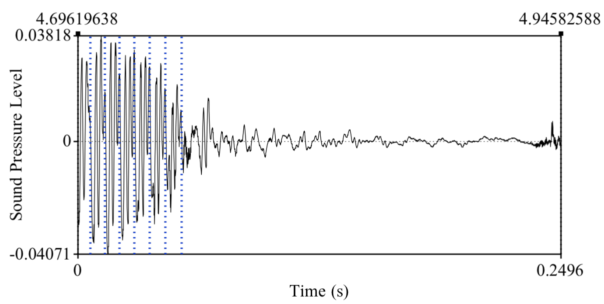


Figure 3.2 Waveform of Nivaĉle voice qualities: modal [e], creaky [ḛ], and [eʔ], from male speaker FR.

Periodicity can be calculated as the relative absence of jitter, the latter referring to the presence of irregularly spaced vocal pulses, or the variation in the duration of successive f0 cycles, which translates into the characteristic auditory impression of creak (Laver 1980:124) as "a rapid series of taps, like a stick being run along a railing" Catford (1964:32).[33] Jitter, also known as pitch perturbation, has been used as a parameter to establish differences in phonation types (Gordon & Ladefoged 2001). The increased length of the pitch cycles is indicative of a lowered fundamental frequency (the acoustic

[33] Laver (1980:127) refers to jitter as 'aperiodicity of the fundamental frequency', Ní Chasaide and Gobl (1997:41) as 'random variation in F0'.

correlate of the perceptual property of pitch) for creaky voice relative to modal voice (Gordon 2001). In the following section, I discuss the manifestation of these parameters in the Nivaĉle glottalized vowels.

3.2.2 The variable realization of Nivaĉle glottalized vowels

On the basis of my fieldwork, I observed two basic categories of realization of Nivaĉle 'glottalized' vowels: the first, I call a *rearticulated/creaky* vowel, represented variably as [Vʔ$^{\text{V̰}}$] (careful speech) ~ [V̰] (fast speech), and, the second I will refer to as a *vowel-glottal coda*, represented as [Vʔ].

It has been noted that the implementation of 'glottalized' vowels is subject to variation within and between speakers across languages (Gordon & Ladefoged 2001, Avelino 2004, Peterson 2004, Gerfen & Baker 2005, Picanço 2005, Munro, Lillehaugen & Lopez 2008).[34] The Nivaĉle glottalized vowels follow this pattern. What I refer to as rearticulated/creaky vowels tend to consist of a modal vowel portion followed by either: (i) a glottal closure released into a short voiceless or creaky vowel [Vʔ$^{\text{V̥}}$] ~ [Vʔ$^{\text{V̰}}$] or (ii) a period of glottalization/laryngealization or creak [VV̰], respectively. Given the latter description, it is worth mentioning that cross-linguistically 'glottalized/laryngealized' and 'creaky' vowels are not necessarily interchangeable tems. For instance, Blankenship (2002) makes a distinction between vowel laryngealization and creaky phonation. She points out that Mazatec contrastively laryngealized vowels do not consistently have an audible creak or display irregular glottal pulses on a spectrogram (Blankenship 2002:164). As will be later shown, this is also the case for some realizations of Nivaĉle glottalized vowels: aperiodicity is not always present in the signal (cf. Figure 3.16). However, while aperiodicity is normally present, a consistent acoustic difference between modal and glottalized vowels is one of duration.[35] One further point is that the description in (i), i.e. "a full short glottal closure released into a short voiceless or creaky vowel [Vʔ$^{\text{V̥}}$] ~ [Vʔ$^{\text{V̰}}$]" is similar to what are

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[34] For instance, gender has been noted as a factor in the realization of phonation types. Gordon and Ladefoged (2001:10), and Munro, Lillehaugen and López (2008:35) report that creaky vowels produced by Quiaviní Zapotec men sound creakier than those produced by women. Speech rate has also been correlated to variation in the implementation of phonation types (Esposito 2003, Picanço 2005:37).

[35] This consistent durational realization lays a strong foundation for positing that the glottal stop is associated with a mora (cf. Chapter 4, §4.3).

sometimes referred to as echo vowels. An echo vowel has the same vowel quality as the vowel preceding the glottal stop (Gerfen & Baker 2005:312) but its formants are weaker.

The alternation between (i) [Vʔᵛ̥] ~ [Vʔᵛ̰] and (ii) [V̰], is, according to my fieldwork research, mostly due to speech style factors. The words containing glottalized vowels were recorded in a different set of contexts: in isolation (the word was repeated five times), in sentences, and in conversations/narratives. Whereas the rearticulated variant [Vʔᵛ̰] ~ [Vʔᵛ̥] tokens typically occurred in careful speech, the creaky variants, [V̰], were typically found in fast or casual speech tokens. Yet overall, despite the variability in the production of Nivaĉle glottalized vowels, these vowels involve a sequencing of modal phonation and laryngealization, similar to Coatzospan Mixtec laryngealized vowels (Gerfen & Baker 2005).

There are two important observations about the distribution of the Nivaĉle glottalized vowels. First, they never occur in an unstressed context. Secondly, in the case of rearticulated vowels, stress is consistently realized on the first, not the second (or "rearticulated") portion of these sequences. Based on this observation, I claim that the "rearticulated" portion does not constitute a second, separate syllable. Rather, these "rearticulated" vowels constitute a single complex bimoraic syllable nucleus (§3.4). The diverse realizations of the rearticulated vowels are generally represented in the data presentation throughout this thesis as [V̰], unless the more specific phonetic realization is particularly relevant to the discussion at hand.

Figures 3.3 and 3.4 illustrate the alternative realization of rearticulated and creaky vowels, respectively. Note that both the rearticulated [Vʔᵛ̰] and the creaky variant [V̰] have approximately identical duration: 200 ms.

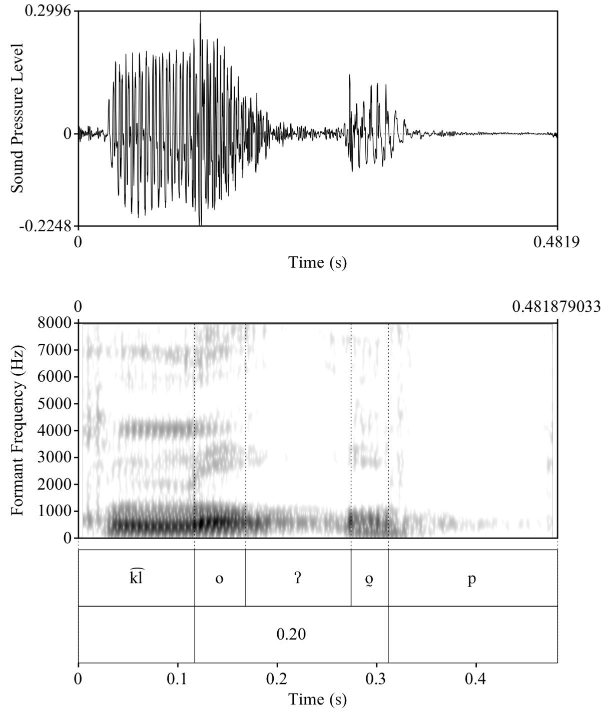


Figure 3.3 Waveform and spectrogram of [k͡lóʔ$^{o̰}$p] ‘winter’ by male speaker MV.

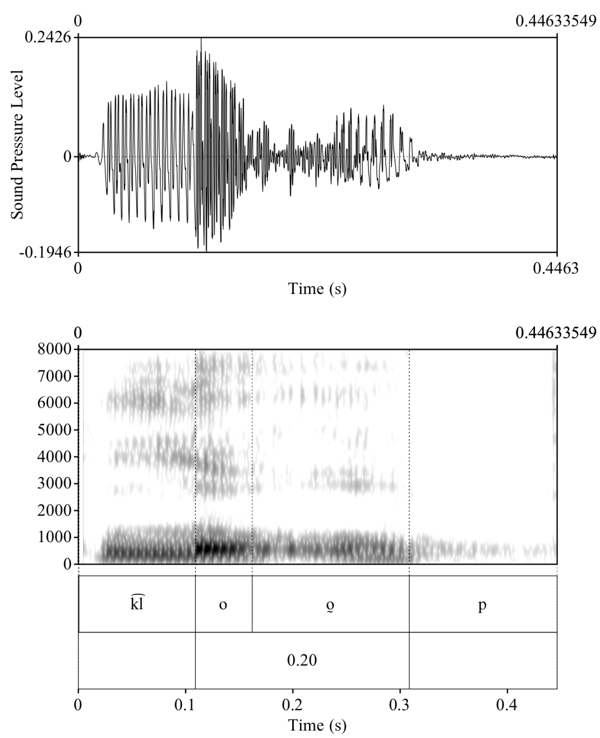


Figure 3.4 Waveform and spectrogram of [k͡ló̰p] ‘winter’ by male speaker MV.

In Figure 3.3, three different phases can be clearly observed: modal phonation followed by a glottal closure, followed by aperiodicity in the glottal pulses, which translates into a creaky and (and lower amplitude) vowel. Figure 3.4 shows an initial period of modal phonation followed by aperiodicity.

Let us turn to an acoustic consideration of what are referred to as the Nivaĉle "vowel-glottal coda" cases. Recall that these are represented as [Vʔ], and occur when there is no (other) coda consonant in the syllable.

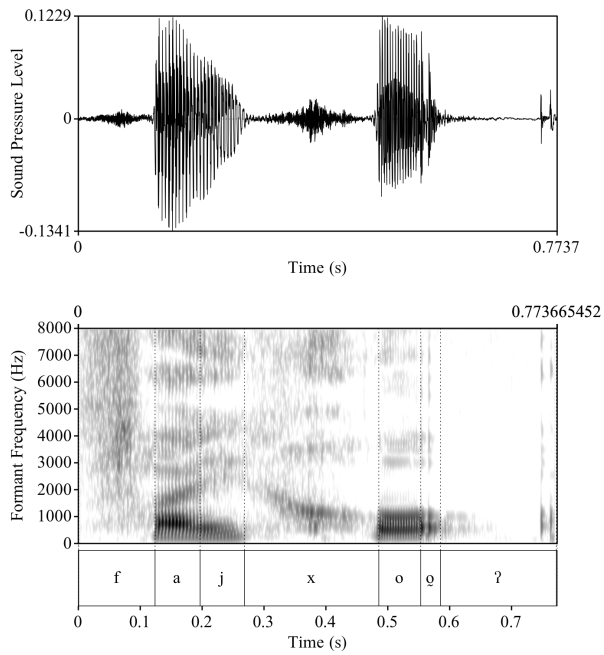


Figure 3.5 Waveform and spectrogram of [fajxóʔ] 'charcoal' by female speaker CS.

As seen in Figure 3.5, a vowel-glottal coda consists of a modal vowel portion followed by a full glottal closure. The last part of the vowel can be creaky due to the adjacency with the glottal stop.

Besides aperiodicity, Gordon and Ladefoged (2001) propose a number of acoustic properties that distinguish between modal and non-modal phonation types, specifically: acoustic intensity, spectral tilt, fundamental frequency, formant frequencies, duration, and airflow. From the analyses of the Nivaĉle data I collected in the field, duration is a relevant acoustic property that merits discussion, which I turn to in the following section.

3.2.3 On the relationship between [c.g.] and the acoustic parameter of duration

At the interface of phonology and phonetics lie issues of contrastiveness and discreteness, and articulatory complexity, gestural overlap, and variability. In other words, the complex interplay between distinctive features and their physical manifestation in speech have posed long standing questions at the intersection of these fields (Pierrehumbert 1990, Ladd 2014).

A major endeavor in phonological theory has been the postulation of distinctive features as primitive components of segments and phonological patterns in sound systems (Trubetzkoy 1939, Jakobson, Fant & Halle 1951, Chomsky & Halle 1968, Schane 1973, Kenstowicz & Kisseberth 1979, Clements 1985, Clements & Hume 1995, among others).

According to a universalist approach (Chomsky & Halle 1968, Clements 1985), all phonological contrasts and sound patterns are described by a set of universal features that are provided by Universal Grammar. By contrast, an emergent feature approach (Mielke 2008 [2004], 2005) posits that features are abstract categories based on generalizations that emerge from phonological patterns. In other words, different phonetic properties can be relevant for defining sound patterns, and as such, some degree of cross-linguistic variation, or subtle phonetic differences between languages, is expected. In actuality, these are some of the challenges posed for the universalist approach: "Ladefoged (1984) observed that many facts of language-specific phonetics are consistent within a given speech community, but are not explainable from universal principles of phonology or phonetics" (Hume & Mielke 2006: 729). The example under discussion in Hume & Mielke (*loc. cit.*) pertains to vowel systems of Italian and Yoruba. Even though these languages have the 'same' seven vowels /i e ɛ a o ɔ u/, the Yoruba vowels are not as evenly distributed as in Italian. Ladefoged (1984: 85-86) attributed this variability to different lip shapes and mouth opening between the two groups, what Ladd et al. (2008) refer to as *individual biases*.[36] It can be understood by these observations, that the correspondence between phonological and phonetic

[36] By *individual biases* Ladd et al. (2008:118) mean "anything in a given individual's genetic makeup that somehow inclines the individual to acquire, perceive and/or produce a given linguistic phenomenon in preference to some alternative. Such biases could include a range of cognitive/perceptual and anatomical/physiological factors".

descriptions are not necessarily based on a one-to-one correspondence in terms of a postulated set of universal features.

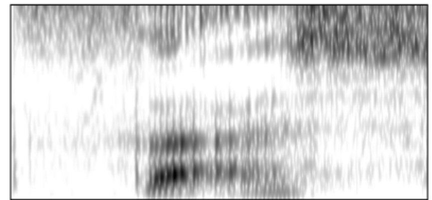
The problem laid out by Ladefoged can be also related to the one pointed out by Ladd (2014: 30-31): that phonological theory has been grounded on a specific theory of phonetics, namely, 'systematic phonetics'. Ladd states that systematic phonetics – "embodied in the principles of the International Phonetic Association" – is based on two premises: "the segmental idealization and the universal categorization assumption" (31). The goal of systematic phonetics is to provide a "universally valid taxonomy of speech sounds" (Ladd 2014:41). Such a goal is challenged when considering, for instance, the case of Kera (Ladd 2014:42-43). This Chadic language has been described as having a voicing distinction in stops, three distinctive tones, and a number of co-occurrence restrictions between laryngeal features of stop consonants and pitch properties of the tonal distinctions. For example, voiced stops predominantly occur before low tone. However, it has been shown "that VOT is extremely variable in all stops, and co-varies with pitch" (43). In sum, even though VOT is not distinctive in Kera, VOT is, in fact, one of the phonetic cues to the phonological category of tone.

A similar situation can be observed in Nivaĉle. One of the major proposals in this chapter is that a Nivaĉle glottalized vowel consists phonemically of a vowel plus glottal sequence, where the glottal is lexically specified for [c.g.]. As mentioned in §3.2.1, the post-vocalic [c.g.] feature is manifested as aperiodicity in the signal or as a full glottal closure. In addition, a consistent acoustic difference between modal and glottalized vowels is one of duration. Even though duration is not lexically distinctive in the Nivaĉle vowel inventory, it can be posited that duration is one of the phonetic cues to glottalization in as much as VOT is one of the phonetic cues to tone in Kera. In this vein, even though I am proposing that the glottal stop can be phonologically understood in terms of the [c.g.] feature and the association with a mora (cf. Chapter 4), the phonetic manifestation is not a one-to-one correspondence between phonemic (128a) and featural (128b) representations, and phonetic reality (128c).

(128) a. /Vʔ/ c.

b.

μ μ
| |
/˙\ /˙
[+son] [-cons] LAR
|
[c.g.]



/CVʔC/

With these observations in mind, let us turn to a consideration of the phonetic manifestation of duration as non-modal phonation types have been commonly associated with longer duration relative to modal phonation types (Gordon & Ladefoged 2001:18, Blankenship 2002:185,189). For instance, contrastive creaky vowels in Jalapa Mazatec (Kirk et al. 1984, Kirk et al. 1993, Silverman et al. 1995, Silverman 1997) and glottalized vowels in Chuxnabán Mixe (Jany 2007) are longer than corresponding modal vowels. However, laryngealized vowels in Coatzospan Mixtec are reported to be shorter than their modal counterparts (Gerfen & Baker 2005: 321). Any claim about durational differences should take into consideration both vowel quality and the phonological status of the vowels under study. In this sense, Gerfen & Baker (2005:329) conclude that, cross-linguistically, laryngealized vowels can be longer, shorter, or equal in duration to their modal counterparts. In Nivaĉle, although glottalized vowels are consistently and significantly longer than their modal counterparts, vowel duration before a glottal coda is variable.

Similarly, non-modal phonation has been documented as being associated with phonemic long vowels but not their short counterparts, e.g., in Hupa (Golla 1977, Gordon 1998:101, Gordon & Ladefoged 2001:18). Romero-Méndez (2008:49) states that length and laryngeal features are intertwined in Ayutla Mixe. There are two types of glottalized vowels in Ayutla Mixe: [Vˀ] is a short modal vowel followed by a glottal constriction and [VˀV] is a long vowel with medial constriction (141).

It has also been observed that creaky phonation is usually confined to a portion of the vowel (Silverman 1997, Gordon 1998, Gordon & Ladefoged 2001) due to perceptual reasons; non-modal vowels are less perceptually salient than modal vowels.[37] The presence of a modal voiced portion serves to enhance the salience of a non-modal vowel (Gordon 1998) and/or to manifest tonal contrasts (Silverman 1997).

Interestingly, it has been noted that non-modal phonation may be associated with prosodic properties, and, more specifically, with stress. Gerfen (1996:130) posits a strong correlation between vowel glottalization in Coatzospan Mixtec and stress, more specifically, he claims that glottalized vowels are licensed by stress.[38]

One of the central claims in this chapter is that there is a relationship between stress, duration and the optimal acoustic context for the realization and perception of glottalization in Nivaĉle vowels [Vʔ$^{\text{V̰}}$]. In order to test this hypothesis, five repetitions of each of the following words were recorded with six Nivaĉle speakers.

(129)	a.	[ʔ]ís 'nice'	b.	ʔḭ́s 'write!'
(130)	a.	jitéx 'carob'	b.	jitḛ́x 'grass'
(131)	a.	ɬ-sáʃ 'mucus'	b.	ɬ-sá̰ʃ 'his wool'
(132)	a.	k͡lɑ́p 'fast'	b.	k͡lɑ̰́p 'to be seated on the lap'
(133)	a.	k͡lóp 'white/larva'	b.	k͡ló̰p 'winter'
(134)	a.	ji-f.xúx 1POSS-stick 'my toe'	b.	ji-f.xṵ́x 1POSS-stick 'my stick'

[37] To the best of my knowledge, modal voice always precedes creaky voice.
[38] In contrast, Macaulay & Salmons (1995:54) do not associate glottalization in Mixtec with stress.

The words were recorded in isolation and measurements were done in Praat for Mac (version 5.3.08; Boersma & Weenink 2014). Results were compiled and statistics were run in R for Mac (R Core Team 2013). Figure 3.6 presents the durational differences for the modal and rearticulated/creaky vowels as produced by male speakers FR, FAR, GR, and females speakers CS, TS, and RF.

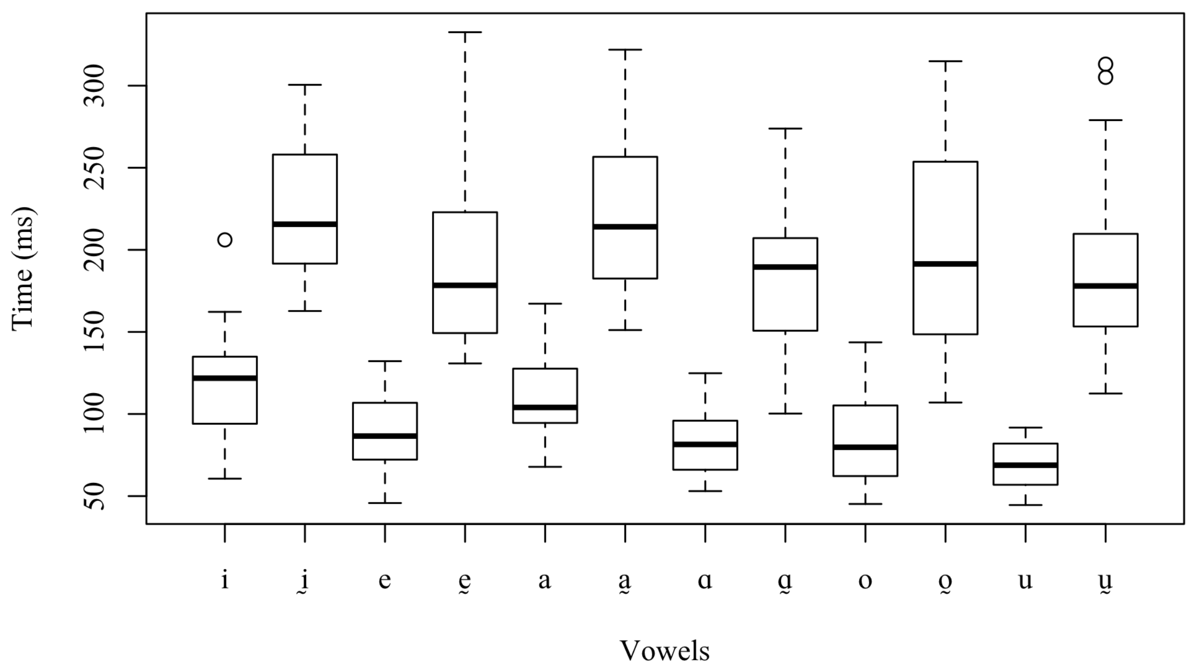


Figure 3.6 Duration results for creaky vs. modal vowel pairs across six Nivaĉle speakers: FAR, FR, GR (male) and CS, RF, TS (female)

A repeated measures ANOVA was conducted with duration as the dependent variable and vowel quality as within-speaker variable with six levels /i e a ɑ o u/ and glottalization as another within-speaker variable with two levels (plain vs. glottalized). The analysis yields significant main effects of vowel quality ($F(5, 25) = 7.99$, $p < 0.001$) and glottalization ($F(1, 5) = 119.5$, $p < 0.001$). The analysis did not show a significant interaction of vowel quality and glottalization ($F(5,25) = 0.552$, $p = 0.73$).

In summary, this study shows that duration is a statistically significant acoustic property that differentiates modal vs. glottalized contrast within the Nivaĉle vowel system; creaky vowels are roughly twice as long as their modal counterparts.

The duration of a vowel before a glottal stop, that is, what I call vowel-glottal coda (cf. Figure 3.5) has not yet been systematically studied in a comparable way; word shape and size of forms containing Vʔ (vowel + glottal stop) and VT (vowel + oral stop) are factors that could not be rigorously controlled during fieldwork and certainly merits future investigation. From an impressionistic point of view, the duration of a vowel in a [Vʔ] context is not as long as the duration of a creaky/rearticulated vowel, but appears to be slightly longer than a vowel before a stop [VT]. Let us examine some data:

Table 3.2 Comparative duration of Vʔ and VT

Speaker	Token	Vowel	Mean (ms)	SD
TS	ji-β.ɬíʔ ‘my rib’ (n = 6)	i	76.35	20
	xa-f.ɬít ‘I blow’ (n = 6)		58.50	4
FR	ji-k͡lɑ́ʔ ‘my toy’ (n = 6)	ɑ	80.15	14
	xa-k͡lɑ́t ‘I escape’ (n = 6)		69	10
	ɬaβóʔ ‘resident’ (n = 6)	o	93	25
	toβók ‘river’ (n = 6)		67	3.6

If we compare the durational differences between [Vʔ] and [VT] presented in Table 3.2, a trend can be noticed at this point: a vowel in a vowel-glottal sequence appears to be longer than a vowel followed by an oral stop.

3.3 Feature specification of Nivaĉle laryngeals

In this section I present several arguments linking the phonetic attributes and phonological behaviour of these glottal/glottalized realizations to the underlying presence of a glottal stop /ʔ/ which, I propose, is featuraly specified as [c.g.]. A further claim (anticipating the detailed discussion in §3.4) is that /ʔ/ is consistently moraic in post-vocalic tauto-syllabic position.

3.3.1 On the ambiguous behavior of glottal stop

Cross-linguistically, glottal stops often pattern differently from supralaryngeal consonants. This asymmetry has been mostly characterized in terms of different featural configurations, namely, that glottals are placeless or do not have an oral articulator (Steriade 1987, Cohn 1990, Bessell & Czaykowska-Higgins 1992, Buckley 1994, Rose 1996, Ola Orie & Bricker 2000, Broselow 2001). Some phonological patterns particular to the glottal stop are laryngeal transparency to the spreading of vocalic place features (135a) or nasalization (135b); debuccalization of final stops and fricatives (136); and epenthesis/hiatus-resolution processes (137, see also Shaw (1991) and Borroff (2007).

(135) Arbore (Cushitic)

a. /gereʔa/	[gereʔe]	'it is a belly'	(Steriade 1987)

Sundanese (Austronesian)

b. /niʔis/	[ñĩʔis]	'relax in a cool place'	(Cohn 1993)

(136) Kelantan (Austronesian)

a. /ʔasap/	[ʔasaʔ]	'smoke'	(Trigo 1991:124)
b. /kilat/	[kilaʔ]	'lightening'	
c. /balas/	[balah]	'finish'	

(137) Malay (Austronesian)

a. /di-daki/	[didaki]	'to climb [PASS]'	(Lombardi 2002: 228)
b. /di-ukir/	[diʔuke]	'to carve [PASS]'	

In some cases, glottal stops have been treated as a type of pharyngeal (McCarthy 1991). Following McCarthy (1994), Lombardi (2002:221) adopts the hypothesis that glottal stops have pharyngeal place and extends the Place Markedness hierarchy (Prince & Smolensky 1993) by adding PHARYNGEAL as the least marked place: *DOR, *LAB » *COR » *PHAR. This representation would then, according to Lombardi, account for the unmarked status of the glottal stop and its role in the aforementioned phenomena of transparency, neutralization and epenthesis.

According to Rose (1996) the characterization of laryngeals as bearing pharyngeal place, though, depends on the presence of guttural consonants (i.e. pharyngeals and uvulars) in the phonemic inventory of the language in question. Note, however, that a non-guttural system like Yucatec Maya has placeless laryngeals /h ʔ/, but also another laryngeal "h2" specified for dorsal place that is the product of historical change: *x > h2 (Ola Orie and Bricker 2000). These authors find that, on the one hand, Yucatec Maya laryngeals /h ʔ/, unlike other consonants in the language, can take part in processes of transparency, deletion, debuccalization and epenthesis. They thus behave like placeless consonants. On the other hand, Yucatec Maya "h2" can resist deletion (140), and thus behaves like consonants specified for PLACE (140). Whereas in (138), deletion targets the [j] consonant of the affix /uj-/, in (139) deletion targets the initial [ʔ] or [h] consonant of the root: the hypothesis is that these /ʔ/ and /h/ laryngeals are not specified for PLACE. In contrast with the examples in (139), note in (140) that even though the first consonant of the root is a laryngeal [h], deletion targets the consonant of the prefix rather than this [h]. Because this surface [h], called "h2" to differentiate it, behaves like a consonant with a PLACE node (cf. the consonant-initial roots in the data of (138)).

	Input	**Output**	**Gloss**
(138)	uj-sàak'	u-sàak'	'the itchy one'
	uj-kìik	u-kìik	'his older sister'
(139)	uj-ʔal	uj-al	'the heavy one'
	uj-heʔel k'uʔ	uj-eʔel k'uʔ	'the nest's egg'
(140)	uj-hàah	u-hàah	'the true one'

The dual behavior of /h/ found in Yucatec Maya gives further support to the proposal first made by Shaw (1991): a laryngeal consonant may have two different representations in the same language.

Another facet of the complex status of glottal stops is that they have been analyzed variously as (i) segmental or (ii) suprasegmental phenomena. When considered full segments, glottals have been treated as obstruents (Ladefoged 1971, Hyman 1975, Bessell 1992) or sonorants (Chomsky & Halle 1968) and so patterning with glides (Kenstowicz & Kisseberth 1979, Kavitskaya 2002). In addition, there has been debate as to whether glottal stops are [+consonantal] (Hyman 1985) or not (Hume & Odden 1996).

Two other kinds of patterns have led to the analysis of glottals as suprasegmentals: specifically, glottal stops may be implemented as creaky phonation overlaid on the realization of other segments, and underlying creaky phonation may be realized as glottal stop (Avelino 2004:181). For instance, whereas the glottal stop of Yatzachi Zapotec is sometimes realized as creakiness on the surface (as a prosodically conditioned variant realization), other related languages – Jalapa Mazatec, Comaltepec, Chinantec and Copala Trique – simply have phonemic creakiness with no surface glottal stop realization (Borroff 2007:39). To recapitulate the discussion in §3.2.3, there is not a necessary one-to-one correspondence between phonemic representations and phonetic reality.

3.3.2 Phonological patterning of [ʔ]

Let us turn, then, to an investigation of the phonemic status and feature specification of glottal stop in Nivaĉle. In terms of morphological and prosodic distribution, [ʔ] patterns with plain stops in that both occur in onsets and codas throughout the word domain.

In contrast, the series of ejective obstruents /p’ t’ k’ t͡s’ t͡ʃ’/ can only occur in onset position. They are never attested in coda position. Interestingly, if an independently motivated morphophonemic process in the language (i.e., vowel-consonant metathesis, cf. Chapter 6) results in an underlying ejective obstruent being parsed into coda position (141a), it systematically neutralizes to its plain counterpart (141b):

(141) a. a.p’ax
'yarara'

b. ap.xa-s b’. *ap’.xa-s
yarara-PL
'yararas'

The conclusion then (which will be discussed further in §3.3.3.3), is that glottal stop and ejective obstruents do not pattern together in coda position. Specifically, ejective stops and affricates are not allowed in coda position (§6.5.1).

However, in onset position, glottal stop patterns with ejectives. Not only do both freely occur as onsets (as previously shown in §2.3), but also there exists a non-adjacent glottal dissimilatory process whereby any rearticulated/creaky vowel surfaces as deglottalized when the onset of the immediately following syllable consists of either an ejective or a glottal stop.

Glottal dissimilation

(142) a. [k͡la͡ts’ṵ́s]
/k͡la͡ts’uʔs na = ko͡tsxaʔt/
slippery DET = ground
'the ground is slippery'

b. [k͡la͡ts’úsʔe]
/k͡la͡ts’uʔs-ʔe na = ji-xpɑji͡tʃ /
slippery-LOC(ON) DET = 1POSS-house
'it is slippery on the house '

c. [k͡la͡ts’úst͡ʃ’ə]
/k͡la͡ts’uʔs-t͡ʃ’e na = nɑjiʃ/
slippery-LOC(AROUND) DET = road
'it is slippery around the road'

cf.

	d.	[k͡la͡tsʼṵ́sʃi]	
		/k͡la͡tsʼuʔs-ʃi	ɬa = wiʃini/
		slippery-LOC(INSIDE)	F.DET = lagoon
		‘it is slippery inside the lagoon’	
(143)	a.	[βà̰ɬjɪt͡ʃʼé]	
		/∅-βɑʔɬ-ji-t͡ʃʼe	ɬ-pa = siwɑk͡lɑk/
		3S-walk-1O-LOC(AROUND)	F-DET = spider
		‘a spider is walking on/around’	
cf.			
	b.	[t͡siβáɬt͡ʃʼə]	
		/t͡si-βɑʔɬ-t͡ʃʼe	ɬ-a = siwɑk͡lɑk/
		3A.1P-walk-LOC(AROUND)	F-DET = spider
		‘a spider is walking on/around (me)’	
(144)	a.	[k͡lapʼá̰f]	
		/∅-k͡lapʼaʔf/	
		3S-bald	
		‘he is bald’	
	b.	[k͡lapʼáfʔe]	
		/∅-k͡lapʼaʔf-ʔe	na = ɬ-tako/
		3S-bald-LOC	DET = 3POSS-face
		‘his face is bald’	
(145)	a.	[xak͡lḛ́ʃ]	
		/xak͡leʔʃ	na = tite͡tʃ/
		1S-clean	DET = plate
		‘I clean the plate’	
	b.	[xak͡léʃt͡ʃʼə]	
		/xak͡leʔʃ-t͡ʃʼe	na = ji-jeʔs/
		1S-clean-LOC(AROUND)	DET = 1POSS-hair
		‘I wash my hair’	

(146) a. [xajβṵ́j]
/xaj-βuʔj/
1S-cover
'I cover myself'

b. [xajβújʔin]
/xaj-βuʔj-ʔin/
1S-cover-IPFV
'I cover myself repeatedly'

(147) a. [ɬant͡ʃá̰xjij]
/ɬa-n-t͡ʃaʔx = ji-j na = jukuβe/
2S-CISL-take = 1O-DIST DET = bread
'you bring me bread'

b. [xant͡ʃáxʔaj]
/xa-n-t͡ʃaʔx = ʔa-j na = jukuβe/
1S-CISL-take = 2O-DIST DET = bread
'I bring you bread'

(148) a. [xaβkúʔxi]
xa-wkuʔ-xi na = *hamaca*
1S-swing-LOC(INSIDE) DET = hammock
'I swing/swang in the hammock'

cf.

b. [xaβkúʔin]
/xa-wkuʔ-ʔin/
1S-swing-IPFV
'I am swinging'

Unlike other deglottalization patterns explained in Nivaĉle that systematically occur when a syllable containing a glottalized vowel or a vowel-glottal coda is *unstressed* (see §2.6.5, §4.5); the above data above show that this Glottal Dissimilation process regularly occurs even in *stressed* syllables. The trigger in this case is an ejective or glottal stop onset in the following syllable. Compare the different effect on a non-ejective onset in (142d, 147a, 148a).

A further interesting property of this Glottal Dissimilation process, as illustrated in the data above, is that the trigger is not necessarily directly adjacent to the target, for another consonant can intervene between them. For example, in /k͡lat͡s'uʔs-ʔe/, the /uʔ/ target is separated from the following onset /ʔ/ trigger by an intervening (coda) /s/, and yet the deglottalization takes place nonetheless, resulting in the output [k͡la.t͡s'ús.ʔe] (where [.] marks syllable boundaries). From the available data {f, t, s, ɬ, ʃ, j, x} are attested as possible intervening consonants, that is, labial, coronal and dorsal consonants. Of great significance is the directionality of this Glottal Dissimilation process, in that there can be an ejective in the onset immediately preceding a glottalized vowel, as in (142d) [k͡lat͡s'ṵ́s-ʃi], and it does not trigger deglottalization.

The generalization that arises from this puzzling phenomenon is (i) a post-vocalic glottal stop is the target and (ii) either another glottal stop or an ejective in the following onset is the trigger. This can be interpreted as a type of Obligatory Contour Principle (OCP) effect (Odden 1986) whereby there cannot be two adjacent [c.g.] feature specifications (cf. (148b) or two [c.g.] feature specifications across a segment specified for [+cons]:

```
(149)        .                  ( . [+cons] )              .
            /                     |                        |
          LAR                   PLACE                     LAR
           |                                               |
         [c.g.]                                          [c.g.]
```

In contrast, there can be two [c.g.] feature specifications across a segment that is not specified for [+cons], that is, in cases where there is an intervening vowel, as the following examples illustrate:

(150) a. t͡ʃ'et͡ʃ'e — T'VT'
'parrot'

b. xa-p'ó-ʔej na=ɬaʃí — T'Vʔ
1S-close-DIR DET=door
'I close the door'

c. j-i-ʔéʔ na=ɬa-x.pá.jit͡ʃ ʔVʔ
3S-be-LOC
's/he is at home'

To summarize the generalizations that have been established in this section about how ejectives and glottal stop pattern phonologically, it has been shown that glottal stop patterns with all consonants in its distributional freedom of occurrence in (simplex) onset and coda positions.[39] In onset position, glottal stop patterns with ejectives as a trigger for Glottal Dissimilation. In coda position, glottal stop does not pattern with ejectives: like plain stops, a glottal stop can occur in a coda, but an ejective cannot.

3.3.3 Glottal stops and syllable structure

In the literature on glottalized vowels in other languages, most of the arguments against treating the glottal stop as a phonemic segment rely on its defective distribution, e.g., the glottal stop may be the only coda in a language, e.g. in Mixe (Macaulay & Salmons 1995), and/or the glottal stop may not occur or be contrastive in initial position (e.g. in Quiaviní Zapotec; Chávez-Peón 2010). As will be shown in the following sections, the Nivaĉle glottal does not fit this picture; [ʔ] is contrastive in onset position and I will argue that, importantly, it can be parsed to coda position.

3.3.3.1 Glottal stop as an epenthetic onset

An initial question related to the interplay of syllable structure constraints and the role of epenthetic glottal stop is whether onsetless syllables ever occur in Nivaĉle. Stell (1989:116-117) claims that V syllables are licit syllable structures in Nivaĉle; she illustrates her point through the following examples:

(151) o-sej-k͡ɬa
'prickly pear'

(152) ɬa-n-ku-**a**
3S-DIR-desire-3O
'he desires (s.t.)'

Stell (1989:116-117)

[39] It will be recalled from Chapter 2, Table 2.4, that neither glottal stop nor ejectives have freedom of occurrence in word-initial onset clusters. Neither can occur as C1 in such clusters. With respect to C2, there are no occurrences of glottal stop and only three attested examples with an ejective.

Based on the data gathered in the context of my own fieldwork, I will argue that onsetless syllables are neither allowed at the beginning (151), nor inside of the word (152); the constraint ONSET is undominated (§2.3.1). An epenthetic glottal stop is inserted to ensure satisfaction of this constraint, thus violating DEP-IO-ʔ:

(153) [ʔ]osejk͡ɬá
'prickly pear'

(154) ɬan-kú = [ʔ]a
3S-desire = 3O
'he desires (s.t.)'

(155) ONSET » DEP-IO-ʔ

(156)

/osejk͡ɬa/	ONSET	DEP-IO-ʔ
a. osejk͡ɬa	*!	
b. ☞ ʔosejk͡ɬa		*

The allomorphic alternation between [kas-] and [kats-] also provides an argument for treating the glottal stop in data such as (157a) as epenthetic. In her grammar, Stell (1989) presents three allomorphs for the first person possessive prefix; these are claimed to be phonologically conditioned (§2.5):

Table 3.3 First person plural inclusive possessive prefixes

kas-	before CV-initial roots
kat͡s-	before V-initial roots
kat͡si-	before CC-initial roots

Because [kat͡s-] – not [kas-] – is prefixed to the root in cases like (157b), it must be inferred that there is no underlying glottal stop in root initial position:

(157) a. [ʔ]a.si.nɑ́
speech-BEN
‘word/speech’

b. ka.t͡s-àsi.nɑ́
1POSS-speech
‘our speech’

c. *kas-ʔasi.nɑ
1POSS-speech
‘our speech’

Further, Stell notes a series of allomorphic alternations involving glottal stops. There exist a number of suffixes that alternate between being vowel-initial and [ʔ]-initial, as seen in the (d)-(e) and (f)-(g) pairs in (158), as well as parallel alternations between the vowel-final and [ʔ]-final prefixes, as in the (a)-(b) pairs. Rather than treating such cases as *allomorphic* alternations, I treat them as *phonologically*-governed alternations. For example, if the root for ‘love’ is posited to be V-initial, /en/, rather than glottal-initial, then the surface occurrence of [ʔ], and the /x-/ form of the first person subject follow as *phonological* generalizations.

(158) **Morpheme boundary epenthetic onset**

a. ni-n-fós NEG-3S-bury ‘s/he does not not bury’	b. ni[ʔ]-én NEG-love ‘you do not love’	cf. c. x-én 1S-love ‘I love’
d. ni-j-én-eɬ NEG-1S-love-PR.PL ‘we do not love’	e. x-ɑ.t͡sí-[ʔ]eɬ 1S-pour-PR.PL ‘we pour’	Stell (1989:258)
f. xà-t-pek͡l-éj 1S-DIR-return-DIR ‘I return’	g. xa-pèʔ-ja-[ʔ]éj 1S-hear-PUNCT-DIR ‘I hear (from the distance)’	

What is seen here is that vowel sequences that arise through morpheme concatenation are systematically avoided by epenthesis of a glottal stop. From the perspective of syllabification of the segmental sequence, this [ʔ] functions to provide an onset for the otherwise onsetless vowel-initial syllable. To illustrate this, consider the syllabification of the form for ‘you do not love’ in (158b) with – as opposed to without – the epenthetic [ʔ]:

(159)

What has been argued in this section is that there are a diversity of morphophonemic alternations in Nivaĉle which receive a more systematic interpretation within an analysis that recognizes a role for epenthetic glottal stop. There are two basic contexts in which [ʔ] can be epenthesized to repair ill-formed surface sequences. One is to provide an ONSET to all otherwise V-initial words (§2.3.1). The other is to avoid a word-internal sequence of two vowels in a row, *VV, as in (159).

The further question then is what kind of evidence can be adduced for whether a surface [ʔ] in either of these contexts is underlying. This is addressed in the next section.

3.3.3.2 Non-epenthetic glottal stop onset

Non-epenthetic glottal stop can occur clitic/suffix-initially (160a), (161), and (162). A crucial piece of evidence for the phonemic status of glottal stop in onset position is the contrast between the second person object /ʔa/ (160a) and the third person object /a/ (160b):

(160) a. k’-uʔ-éʃ = ʔa
1S-believe-INST = 2O
‘I believe in you’

b. k’-uʔ-éʃ = a pa = fi͡tsɑk’ɑji͡tʃ
1S-believe-INST = 3O DET = God
‘I believe in God’

Other grammatical suffixes such as the locative [-ʔe] and the iterative/imperfective [-ʔin] consist of a lexically specified glottal stop before the vowel. In contrast with the directional /-ej/ in (158d, f), when these suffixes get attached to a consonant-final root, the glottal stop of the locative [-ʔe] and the iterative/imperfective [-ʔin] is parsed into onset position. Also note that, similarly to the examples in (142)-(148) there is glottal dissimilation in examples (161) and (162).

(161) [t’a-kúm-ʔɪn] a’. *t’a.ku.min
/t’a-kuʔm-ʔin/
3S-work-IPFV
‘He is working’.

(162) a. kla.t͡s’ús-ʔe a’. *kla.t͡s’u.s-e
slippery-LOC
b. nɑke x-an-ʔé naβa=ji-tɑ̀s.xe-ʃi.j-[í]s b’. *xane
here 1S-put-LOC DET.PL=1POSS-eye-REC-PL
‘I put the glasses here’

cf. (158d,f) repeated here for convenience:

(163) a. ni-j-én-eɬ
NEG-1S-love-PR.PL
‘we do not love’ (Stell 1989:258)
b. xà-t-pek͡ɬ-éj na=Filadelfia
1S-CISL-return-DIR DET=Filadelfia
‘I return to Filadelfia’

As seen in Figure 3.7 below, the presence of the suffix-initial [ʔ] from the example in (161) shows clearly in the waveform as aperiodicity and low amplitude in the signal.

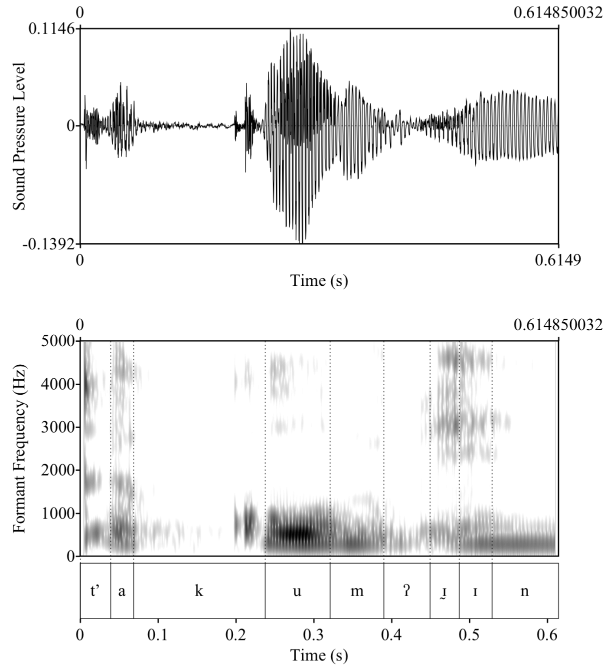


Figure 3.7 Waveform and spectrogram [t’akúmʔin] ‘s/he works’ by female speaker TS.

During fast speech, the ʔ-initial suffix overlaps with the articulation of a preceding non-continuant obstruent, e.g., a root-final stop, such that an ejective stop results:

(164)	ji-ʔé	na = ko͡ts.xát-ʔe ~ ko͡ts.xá.t’e
	be-LOC	DET = land-LOC
	‘It is on the land’	

Below, Figures 3.8 and 3.9 show the alternation between the forms in (164). Note the long glottal stop closure in Figure 3.8; this is characteristically found in a very emphasized stop-glottal sequence in a citation context.

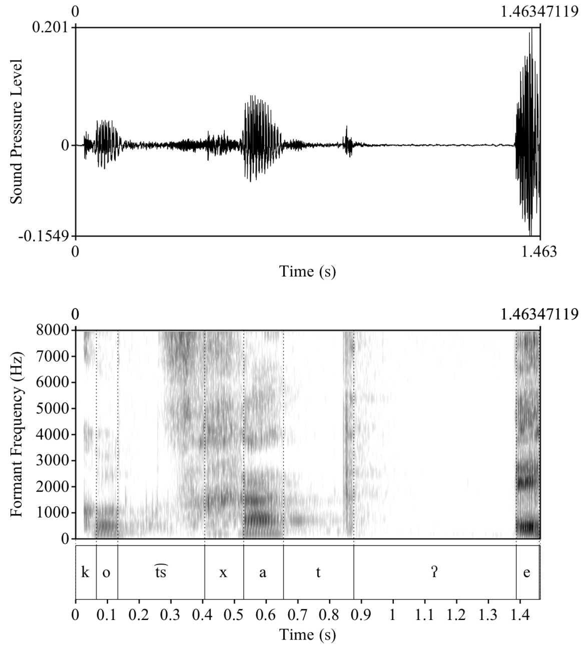


Figure 3.8 Waveform and spectrogram [kot͡sxátʔe] ‘on the land’ by male speaker FR.

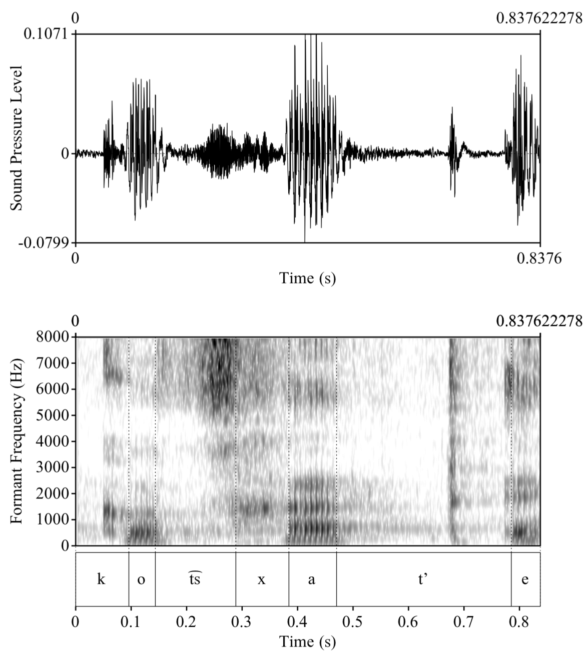


Figure 3.9 Waveform and spectrogram [kot͡sxát’e] ‘on the land’ by male speaker FR.

In the first version (Figure 3.8), FR emphasized the presence of a glottal stop in a very careful pronounciation of ‘on the land’. The second version (Figure 3.9) is characteristic of casual speech. The important point here is that the glottalization that is realized as either [tʔ] or [t’] can only result from there being a phonemic /ʔ/ in the input; [ko͡ts.xa.te] is not attested as a possible output. The alternative hypothesis that the root-final consonant is an ejective stop /ko͡tsxaʔt'/ is not plausible as it would not account for the […tʔ…] realization. Nor would it account for the fact that in other contexts when an epenthetic vowel is inserted, as shown in (165), there is no ejective in the output.

(165) a. ko͡tsxat-[í]s
land-PL
'lands'
b. *ko͡tsxat'-[i]s

Besides serving as suffix-initial onsets, the following examples show that glottal stop can also serve as a lexically-specified (i.e. non-epenthetic) root-internal onset.

(166) a. kan.ʔút
'yesterday'
b. nu.ʔú
'dog'
c. ʃniɬ.ʔá
'small lizard'
d. mis.ʔá
'scarlet-headed blackbird'
e. ɬùm.ʔa.ʃí
'tomorrow'
f. kum.ʔá
'crowned eagle'
cf. f'. kum.xá
'*aloja* (alcoholic drink)'
g. am.ʔá
'rat'
cf. g'. am.pá
'nothing'
j. ka.jin.ʔá
'hummingbird'
k. k͡ɬi.sa.ʔá
'blue-black grassquit'

(167) a. fak͡ɬ.ʔú
'brother-in-law'

b. fak͡l.ʔá
'nephew'
c. fak͡l.ʔís
'bat'
d. uk͡l.ʔá
'type of dove'

Albeit not exhaustive, this is a representative list of cases in which the glottal stop surfaces as a root-internal onset. A closer look reveals that these might not all be considered mono-morphemic roots; the [ʔ] might in fact be morpheme-initial, especially when considering the similarity between the kinship terms and that many forms are names of animals. Nevertheless, whether the above examples involve instances of glottal stop behaving as root-internal onset or not, these data clearly support the claim that glottal stops can behave as contrastive onsets in Nivaĉle. Recall, in this regard, the minimal pairs listed in (160a-b) and (166f-f'), (166g-g').

It is worth commenting on examples (167) where the complex segment [k͡l] is parsed as a coda before a glottal stop onset. As seen in Chapter 2 and as will be discussed in Chapter 5, it is normally the case that the complex segment [k͡l] consistently neutralizes to [k] in coda position. However, the only context in which [k͡l] does not undergo this neutralization to [k] is before a tautomorphemic glottal stop (§5.3.1). This 'exceptional' syllabic behavior of [k͡l] will become relevant in the discussion of the feature specification of glottal stop (Section 3.3.4).

3.3.3.3 Glottal stop as coda

Let us turn now to a consideration of contexts where glottal stop can be interpreted as serving as a word-medial (168) or word-final coda (169). These are the contexts where the theoretical assumptions behind the featural representation of both glottalized vowels – more precisely, what I have previously referred to as *vowel-glottal coda* – and glottal stops *per se* will be motivated in detail.

In Chapter 2, I showed that CVC is an attested (and frequent) syllable type in the language, and, in Chaper 4, I claim that the minimal foot in Nivaĉle is CVC (§4.2). Let us investigate now the distribution of the glottal stop with respect to the final coda C in these CVC syllables. Examples in

(168) show that a coda containing a glottal stop can precede both obstruents and sonorants. However, it cannot precede another glottal stop or an ejective (see also §2.3.1.3, Table 2.9).

(168) **Word-internal coda**

a. ji-pɑ́ʔ.kɑt ‘my hand’
b. xi.βéʔ.k͡la ‘moon’
c. βéʔ.ɬa ‘one’
d. tɑ́ʔ.ɬɑs ‘vase’
e. nɑ́ʔ.ni ‘girl’
f. xa-péʔ.j-a ‘I hear’

In addition, examples of word-final glottal stops are presented in (169); they occur after all vowel qualities.

(169) **Word-final coda**

a. t͡ʃíʔ ‘and’
b. t’íʔ ‘broth’
c. méʔ ‘otter’
d. ji-k.t’éʔ ‘my grandmother’
d. ji.táʔ ‘scrubland’
e. kas-k͡lɑ́ʔ ‘our toy’
f. ji-mɑ́ʔ ‘s/he sleeps’
g. faj.xóʔ ‘charcoal’
h. t͡ʃa.ɬúʔ ‘short’
i. xa-β.kúʔ ‘I swing’
j. k’ak,xúʔ ‘ I greet you’

In sum, it has been shown that Nivaĉle glottal stop can occur in both onset and coda position; Table 3.4 summarizes the possible syllable parsings of the glottal stop.

Table 3.4 Syllable types and glottal stop

Syllable types			
CV	**CVC**	**CCV**	**CCVC**
ʔV	CVʔ	*CʔV	*CʔVC
	ʔVC	*ʔCV	*ʔCVC
	ʔVʔ		CCVʔ

This broad base of distribution, parallel to other major classes of consonants, motivates the representation of /ʔ/ as having an independent root node. This allows it to be parsed into what have to this point been informally referred to as "onset" and "coda" position.

Although issues of prosodic structure will be discussed in greater detail in Chapter 4, it is useful at this point to briefly clarify the conception of syllable structure being adopted here. Of particular relevance, "onset" and "coda" are not prime concepts, but rather represent segments identifiable in relation to the left or right edge, respectively, of the prosodic domain of a syllable. The prime prosodic constituents within the syllable (abbreviated σ) are the Nucleus (abbreviated N), which functions as the Head of a syllable, and the mora (abbreviated μ), "a unit which functions variously as the prosodic host for segments with significant sonority, weight, duration, and/or tone" (Shaw, p.c.). Because Nivaĉle vowels all have weight, they are moraic, and because they have greater sonority than all other classes of segments (see §2.3.2) in the language, they are parsed to the Nucleus. Major questions to be addressed in the rest of this chapter and in Chapter 4 relate to how the various realizations of "glottal stop" are prosodically parsed.

3.3.4 Feature specification of Nivaĉle glottal stop

In light of the evidence related to the phonotactic patterning of the glottal stop, I will discuss feature representation for this segment. The first hypothesis advanced here is that the glottal stop is unspecified for the place features. Three supporting arguments will be discussed:

(i) laryngeal transparency (vowel harmony across a glottal stop)

(ii) parsing of the glottal stop in coda position (as opposed to ejectives, which are specified for place features),

(iii) lack of delateralization of [k͡l] before a glottal stop onset (cf. (167) above; Chapter 5)

Laryngeal transparency has been advanced as an argument for the lack of internal place of articulation structure of laryngeals in comparison to other consonants; that is, for glottal stops being placeless in non-guttural systems. In autosegmental phonology terms: due to laryngeal transparency, vocalic features can spread across a glottal stop because no crossing of an intervening consonantal place specification is involved (Goldsmith 1976, Sagey 1988).

In Nivaĉle, spreading of vocalic features can be observed across non-epenthetic (170-172) and epenthetic glottal stops (174-175) at morpheme boundaries (§2.5.3). Specifically, progressive vowel harmony has been attested with the imperfective /-ʔin/ and the locative /-ʔe/ suffixes; as discussed in §3.3.3.2 these glottal initial morphemes are not epenthetic.

(170) /…e-ʔin/
[…e-ʔen]
a. [nixak͡lèʃt͡ʃ’əʔén]
/ni = xa-k͡leʔʃ-t͡ʃ’e-ʔin/
NEG = 1S-wash-LOC-IPFV
‘I do not (regularly) do the cleaning’

b. [xaj-kùm-ʔe-ʔén]
/xaj-kuʔm-ʔe-ʔin/
1S-work-LOC-IPFV
‘I am/was working’

(171) /…a-ʔin/
[…a-ʔan]
[ɬpèʔjaʔán]
/ɬ-peʔja-ʔin/
2S-hear-IPFV
‘you are hearing’

(172) /…ɑ-ʔin/
[…ɑ-ʔɑn]
[jifɑ̀ʔjɑʔɑ́n]
/ji-fɑʔjɑ-ʔin/
3S-fly-IPFV
‘s/he is/was flying’

In (170)-(172) the high front vowel /i/ is realized harmonically as a front or back non-high non-rounded vowel across an underlying glottal stop. I have not found examples of non-low back rounded vowels triggering harmony: *[oʔon], *[uʔun]:

(173) [xaβkúʔin] *[xaβkúʔun]
/xa-βkuʔ-ʔin/
1S-swing-IMPFV
'I am swinging'

Vowel harmony is also attested across epenthetic glottal stops. When two vowels are adjacent in the input due to morpheme concatenation, a glottal stop is inserted (§2.3.1.2) and there is regressive vowel harmony: the vowel following the glottal stop spreads its place features to the preceding vowel. This vowel harmony process occurs when the trigger is a [-back, -low] vowel and the target is a [+low] vowel. Examples (174)-(175) illustrate this phenomenon:

(174) a. [meʔéɬ]
/mɑ-eɬ/
IMP.go-PR.PL
'Go you all!'

b. [meʔéj]
/mɑ-ej/
IMP.go-DIR
'Go (you singular) there!'

(175) a. [xapέʔj-a]
/xapeʔj-a/ pa=ɬaβḭ́m
1S-hear-PUNC DET=wind
'I heard the wind'

b. [xapɛ̀ʔjeʔéj]
/xa-peʔj-a-ej/ pa = t’á̰j
1S-hear-PUNC-DIR DET = noise
‘I heard noise (from the distance)’

The /VʔV/ sequence presented in (175b) differs from creaky/rearticulated vowels in that the stress system (see Chapter 4) counts it as two syllables instead of one. Further, and concomitantly, the second vowel here is somewhat longer than the first one, contrary to the case of glottalized vowels:

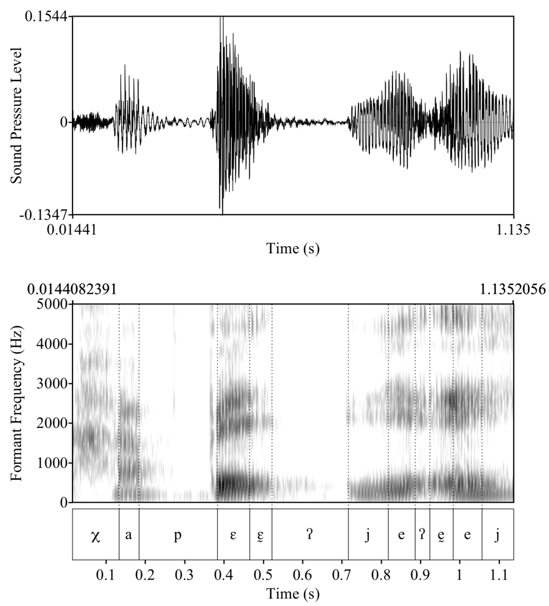


Figure 3.10 Waveform and spectrogram of [xapɛ̀ʔjeʔéj] ‘I heard’ by male speaker FR

Interestingly, the two attested types of vowel harmony processes can be shown with the predicative verb ‘to be nearby’. On the one hand, we see progressive spreading of vowel features across an underlying glottal stop (176). On the other hand, we see regressive vowel harmony across an epenthetic glottal stop (177):

(176) **Progressive Vowel harmony**

		[ʃàʔ**ɬaʔá**]
na = niβak͡lé	ɬa-β͡tsa̰t	/∅-ʃaʔ**ɬa**-ʔ**e**/
DET = nivaĉle	3POSS-village	3-close-LOC

'the Nivaĉle community is nearby'

(177) **Regressive vowel harmony**

[ʔaʃàʔ**ɬeʔé**ɬ]
/a-ʃaʔ**ɬa**-**e**ɬ/
2S-close-PR.PL
'you (pl.) are nearby'

Vowel harmony occurs across a glottal stop, as seen in (177) but not across a consonant specified for PLACE, as the examples below illustrate:

(178) a. ∅-ʃàʔɬa-xúɬ
3S-close-VEN
's/he is getting close (to the deictic centre)'

b. ∅-ʃàʔɬa-t͡ʃʼe
3S-close-IT
's/he is still close (but s/he is moving away from the deictic centre '

(adapted from Seelwische 1990:169)

In summary, the attested cases of laryngeal transparency to vowel harmony processes thus provide support for the analysis of the glottal stop as placeless. The different patterns (progressive vs regressive) vowel harmony associated to underlying vs. epenthetic glottals merits further investigation.

Let us turn to a second argument for PLACE feature(s) not being part of the lexical representation of glottal stop. It has been observed that both PLACE and LARYNGEAL features are often restricted in coda position (Itô 1986, Mester & Itô 1989, Itô & Mester 1994; Lombardi 1991, 1995). The lack of specification for PLACE, then, might therefore explain the asymmetric behaviour between glottal stop and ejectives in coda position. Recall from Chapter 2 that ejectives are banned from occurring in coda position. In descriptive terms, the generalization appears to be that when [c.g.] is functioning as a "secondary" feature (i.e. on ejective obstruents) in Nivaĉle, it is not tolerated in coda position. A plain glottal stop, however, can – and quite pervasively does – occur as a coda. I propose a structural account for this: whereas both ejectives and glottal stop in Nivaĉle are specified with a [c.g.] feature, only ejectives are specified for place – LABIAL, CORONAL, and DORSAL. Glottal stop is not: it is literally place-less. In order to capture this different patterning, the following coda constraints can be locally conjoined:[40]

(179) *PLACE]$_\sigma$: A segment in the coda of a syllable cannot be marked for [PLACE]

(180) *[c.g.]]$_\sigma$: A segment in the coda of a syllable cannot be marked for [c.g.]

(181) [*PLACE & [c.g.]]$_\sigma$: A segment in the coda of a syllable cannot be marked for both PLACE and [c.g.]

According to Smolensky (1993) a locally-conjoined constraint is violated if both of its conjuncts C_1 and C_2 are violated in a local domain D (181). [41]

Whereas ejective stops and affricates (T') in coda position would violate the two coda constraints in (179) and (180), and also the locally-conjoined constraint in (181) – see candidate (a) in (182) – the glottal stop would only violate (180) and not (181) because /ʔ/ is not specified for PLACE in Nivaĉle (see (183a)).

(182)

/T'.CV/	[*PLACE & *[c.g.]]$_\sigma$	*PLACE]$_\sigma$	*[c.g.]]$_\sigma$
a. T'.CV	*!	*	*
b. T.CV		*	

(183)

/ʔ.CV/	[*PLACE & *[c.g.]]$_\sigma$	*PLACE]$_\sigma$	*[c.g.]]$_\sigma$
a. ʔ.CV			*
b. T.CV		*	

[40] I am grateful to Megan Crowhurst for this suggestion.
[41] In this vein, a locally-conjoined constraint can be formally defined as follows (Lubowicz 2005:254):
(i) C=[C1&C2]D is violated iff both C1 and C2 are violated in a local domain D

Similarly, a plain stop or affricate (T) would only violate one constraint (179), and not (181) – see candidates (182b) and (183b).

It has been established, then, that the glottal stop can be parsed as a coda, in contrast with ejectives. One supporting argument for the glottal stop being parsed to coda position is word minimality. As will be advanced in Chapter 4 (§4.2), the minimal monosyllabic word in Nivaĉle is CVC. Open syllable CV or CCV words are not attested: a well-formed Minimal Foot needs to be closed by a coda consonant.[42] Given that CVC constitutes a Minimal Word in Nivaĉle (see data in (184a,b) below) and given that CVʔ words are well-formed (see data in (184c,d) below), it follows that the glottal stop is functioning as a coda consonant.

(184) a. tós
'snake'
b. ∅-tú̯x
3S-eat
's/he eats'
c. méʔ
'otter'
d. ɬ-áʔ
3POSS-fruit
'fruit (of the tree)'

Finally, the third argument favouring the lack of oral place of articulation of the glottal stop comes from the phonotactic behaviour of /k͡l/. This complex segment only occurs before vowels and it pervasively neutralizes to [k] in final coda position (185) or word internal coda position (186), before another consonant (cf. Table 2.6, §5.3.1).

[42] One might question whether CVC could be considered bimoraic, and hence satisfy FTBIN-μ. Although it is argued in §3.4 that /ʔ/ is moraic and therefore a CVʔ word would indeed meet a FTBIN-μ condition, there is no evidence that any other consonants in Nivaĉle are moraic. Consequently, in the absence of independent evidence for any consonant other than [ʔ] bearing weight, the appropriate generalization for the CVC MinWord in Nivaĉle is that it must be closed by a C. In Optimality Theory, this conforms to the constraint FINAL-C (McCarthy 1991:203, 1993:176).

(185) a. wo.sók
'butterfly'
b. wo.so.k͡l-ís
butterfly-PL
'butterflies'

(186) a. xa-t'ù?.k͡l[i].ján
1S-obstruct-CAUS
'I obstruct'
b. ∅-t'ṵ́k-ʃi
3S-obstruct-LOC(inside)
'it is obstructed'

Nevertheless, there is one particular context in which [k͡l] is preserved in coda position, namely before glottal stops root internally. Compare, in this regard, (187a) with (187b), where the glottal stop onset is not part of the root (§3.3.2 ; §3.3.3.2)

(187) a. uk͡l.ʔá
'turtle dove'
cf.
b. [xatpék'in]
xa-t-pek͡l-ʔin
1S-CISL-return-IPFV
'I return (more than once)'

Here I argue that the fact that [k͡l] can only occur as a coda before [ʔ] highlights the place-less specification of glottal stop. The fact that [k͡l] does not occur before consonants but pervasively before vowels – and before tautomorphemic glottal stop – suggests a relationship between glottal stop and vowel-like properties. This special behaviour of [k͡l] favours a *Licensing by cue* approach (Steriade 1997) (cf. Chapter 5.3).

The generalizations arrived at in this section form the basis for the following feature specification of the glottal stop and ejectives. Note that I am assuming unary features.

Table 3.5 Feature specification of glottal stop and ejectives

	ʔ	T'
PLACE		LAB/COR/DOR
CONSTRICTED GLOTTIS	✓	✓

Briefly, the data and phenomena analyzed so far are predicted by the ∅ place specification hypothesis for /ʔ/. The phonologically active distinctive features below the root node that function to define a glottal stop in Nivaĉle is [c.g]. In the following section, arguments will be presented that, at the prosodic level, /ʔ/ is moraic.

3.4 Prosodic representation of Nivaĉle glottalized vowels

Let us now turn to a consideration of the representation of the Nivaĉle glottalized vowels, which are variantly realized as (i) [Vʔ^{v}] ~ [V̰] and (ii) [Vʔ] (§3.2.1).

The major argument advanced in this chapter is that a Nivaĉle 'glottalized' vowel consists of a vowel plus glottal sequence – where the glottal is lexically specified for [c.g.]. As a consequence, I differ from Stell (1989) in that I do not consider the [c.g.] to be a contrastive feature within the vowel inventory. Instead, I analyze the [c.g.] to be a distinctive component of an independent /ʔ/ segment that occurs postvocalically (§3.3.4). This is, I claim, the same lexically distinctive /ʔ/ segment that can occur in Onset position. Its particular phonetic realization is dependent on how it is parsed into prosodic structure. In other words, the implication of this proposal is that, contrary to Stell, I do not postulate the existence of twelve vowels in Nivaĉle. Rather, I hypothesize that the alleged phonemic contrast between modal and glottalized vowels (Stell 1989) is actually a contrast between a modal vowel /V/ and a sequence of a vowel and a glottal stop: /Vʔ/.

What is interesting is that the prosodic constraints of the language allow the glottal stop to have variable syllabic parsing and thus different realizations emerge: (i) [Vʔ^{v}] ~ [V̰], and (ii) [Vʔ]. Specifically, I posit that the variable parsing of the [c.g.] feature is tied to prosodic context. First, given that there is a consistent correlation between glottalized vowels and the locus of stress, I propose that the glottal stop is, like vowels, underlyingly moraic (cf. Chapter 4, §4.3). The WEIGHT-TO-STRESS

PRINCIPLE (Prince & Smolensky 1993) states that heavy (bimoraic) syllables are required to be stressed. Second, if the glottal segment is aligned with the right edge of the syllable domain, the glottal stop will be parsed directly to the syllable node, as a coda, and the mora will be parsed to the Nucleus (cf. Figure 3.11a). Alternatively, if there is another consonant intervening between the glottal stop segment and the right edge of the syllable, then the mora (and its associated /ʔ/ features) will be parsed directly into the Nucleus of the syllable (cf. Figure 3.11b). In other words, only if the coda position is already filled by another consonant will the glottal stop be parsed into the Nucleus; a complex nucleus emerges at the expense of not creating a complex coda.

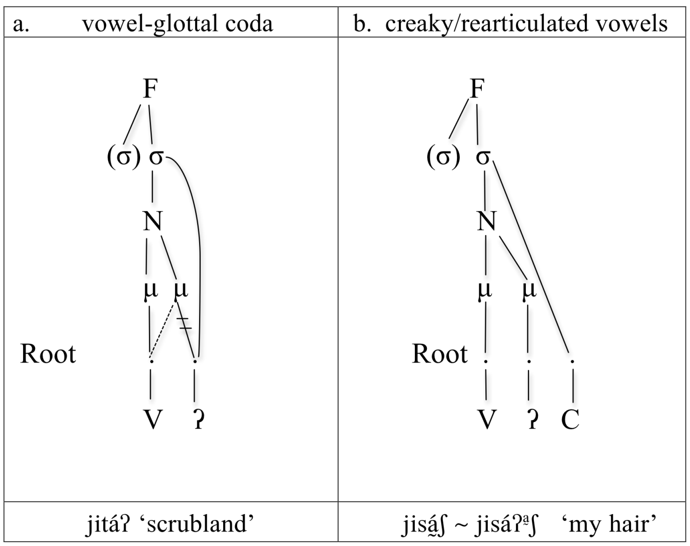


Figure 3.11 Prosodic representation of /Vʔ/

It is proposed, then, that the various prosodic roles the glottal stop has can be captured by interplay between prosodic markedness constraints and faithfulness constraints outlined in (188)-(194). A more detailed explanation will be given in §4.3.2.

(188) ONSET:

$*[_{\sigma}V$ (Syllables must have onsets). (Itô 1989, Prince & Smolensky 1993)

(189) DEP-IO-ʔ: An output glottal stop must have an input correspondents ('No ʔ-epenthesis').

(190) NOCODA: Syllables are open. (Kager 1999)

$*C]_{\sigma}$

(191) *COMPLEXCODA (Kager 1999)

* $CC]_\sigma$ ‘Codas are simple’.

(192) *COMPLEXNUC: No more than one segment may associate to the nucleus

(Prince & Smolensky 1993)

(193) MAX-IO-ʔ: A glottal stop in the input is present in the output.

(194) MAX-IO-μ: A mora in the input is present in the output.

First, as already discussed in §3.3.3.1 (see also §2.3.1.1) there are no onsetless syllables in Nivaĉle: ONSET is higher ranked than DEP-IO-ʔ. An epenthetic glottal stop is inserted to avoid onsetless syllables or vowel-vowel sequences: ONSET » DEP-IO-ʔ.

Second, *COMPLEXNUC is higher ranked than NOCODA. This ranking explains why the glottal stop is parsed into coda position, if possible (i.e. if there is not another consonant in the coda). Recall that, because the glottal stop is not specified for place features (§3.3), it can be realized in coda position, in contrast with ejectives, which are specified for both [c.g.] and PLACE.

(195) *COMPLEXNUC » *NOCODA

(196)

/ fajxoʔ /	*COMPLEXNUC	*NOCODA
a. faj.xo̰	*!	
b. ☞ fajxoʔ		*

Candidate (b) wins over candidate (a) because it is more preferable to have a coda than a complex nucleus.

The tableau in (198) illustrates the parsing of [c.g.] into the Nucleus of the syllable (Figure 3.11b), which results in a complex bimoraic glottalized vowel. Because of the presence of an adjacent consonant to the right, the glottal stop is parsed into the Nucleus in order to not violate $*CC]_\sigma$, an undominated constraint in the language (§2.3.1.3, §6.3.1).

(197) $*CC]_\sigma$, MAX-IO [ʔ],MAX-IO-μ: » *COMPLEXNUC

(198)

/k͡loʔp /	*CC]$_\sigma$	MAX-IO [ʔ]	MAX-IO [μ]	*COMPLEXNUC
a. k͡loʔp	*!			
b. k͡lop		*!	*	
c. ☞ k͡lo̰p				*

The winning candidate (c) violates *COMPLEXNUC, at the expense of not violating higher ranked *CC]$_\sigma$ or the constraints MAX-IO-[ʔ] and MAX-IO-[μ] (see further discussion of these two constraints on §4.5.2). As a result, a more marked syllable nucleus emerges by parsing the [c.g.] feature into the nucleus of the syllable. The tableaux in (196) and (198) will be expanded and further discussed in §4.3.2.

As previously mentioned, the complementary distribution of a glottalized vowel and a vowel-glottal sequence is based on the interaction of COMPLEXCODA, COMPLEXNUC, and NOCODA. The different parsing of the glottal stop, which is argued to be dependent on prosodic context, can be illustrated through the following pairs of related forms:

(199) a. ɬa-k.féʔ
3POSS-ear
'his/her ear'

b. ta-k.fḛ́-j
3S-ear-VBLZ(to.have)
'it has ear' (lit. meaning) /'mug'

(200) a. ɬa-ʃáʔ
3POSS-salary
'his/her salary'

b. xaj-ʃá̰-j
1S-salary-VBLZ(to.have)
'I have salary'

(201) a. ɬ-áʔ
3POSS-fruit
'its fruit'

b. t-á̰-j
3S-fruit-VBLZ(to.have)
'it has fruit'

(202) a. ji-núʔ
3POSS-bone
'my bone'

b. ta-nṵ́-j
3S-bone-VBLZ(to.have)
'it is bony'

In (199-202) a stative verb 'to have X/X's property' is created by suffixation of the verbalizer /-j/ to a ʔ-final nominal root; 'ear', 'salary', 'fruit' and 'bone', respectively. In all these cases, the glottal stop is parsed into the complex nucleus of the syllable and the verbalizer is parsed into the coda. Similarly, the following data show variable parsing of /ʔ/:

(203)	a.	xa-wɑ̰́m	xa = ji-k͡lú.t͡seʃ	[ʔ]ɑ.xɑ̀.k͡lɑ-βó
		1S-lose	DET = 1POSS-shotgun	bird-ART
		'I lost my shotgun'		
	b.	xa-wɑ́ʔ.m = eʃ	xa = wɑ.kɑ	ɬ-t͡s'ó̰s
		1S-lose = 3O	DET = cow	3POSS-milk
		'I discarded the cow's milk'		

(204) a. k'ut.xá̰n
'thorn'

b. k'ut.xáʔ.n = a
thorn = NEG
'there is no thorn'

(205) a. [ʔ]a-βṵ́n
2POSS-roasted.meat
'your roasted meat'

b. [ʔ]a-βúʔ.n = a
2POSS-roasted.meat = NEG
'there is no (your) roasted meat'

Whereas the (a) examples in (203)-(205) show contexts where the glottal stop is parsed to the Nucleus of the syllable, the (b) examples show comparable contexts where the glottal stop is parsed to coda position, and the final consonant of the root is parsed into the onset of the subsequent syllable. The negative clitic does not impact stress assignment and so the postvocalic glottal stop can get realized (§4.3.2). The following spectrograms illustrate this variable realization of the glottal stop.

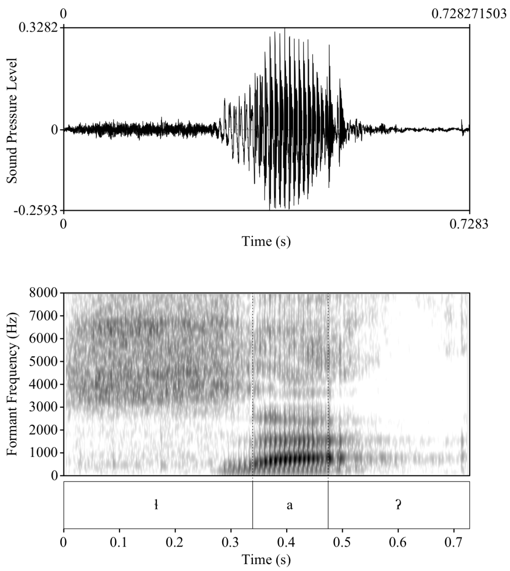


Figure 3.12 Waveform and spectrogram of [ɬáʔ] ‘its fruit’ by male speaker FR

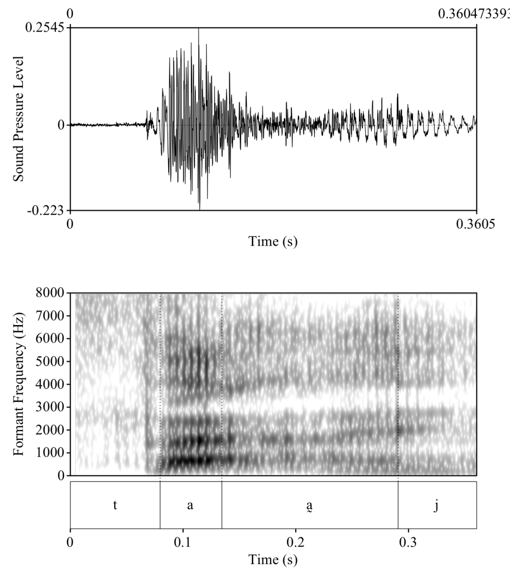
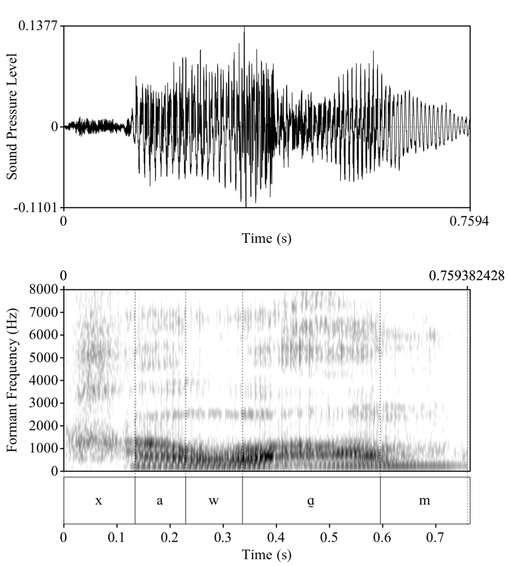


Figure 3.13 Waveform and spectrogram of [tá̰j] ‘it has fruit’ by male speaker FR

Figures 3.12 and 3.13 present the spectrograms for the pair in (201). Under the analysis proposed here, the glottal stop of the vowel-glottal coda in Figure 3.12 is realized as nuclear creakiness in Figure 3.13 when the verbalizer [-j] is parsed into coda position. A mirror example is demonstrated in the following figures:



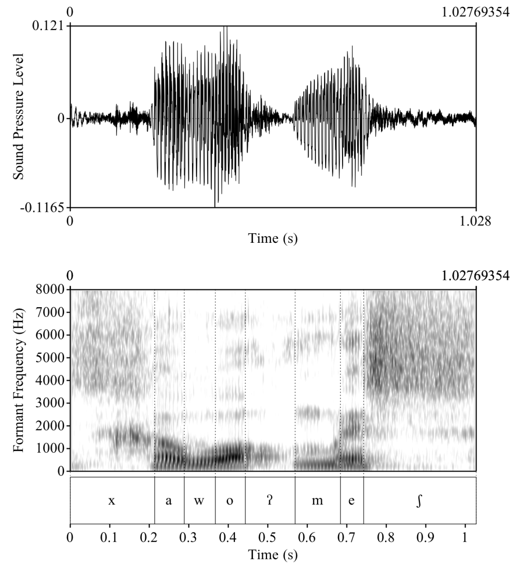
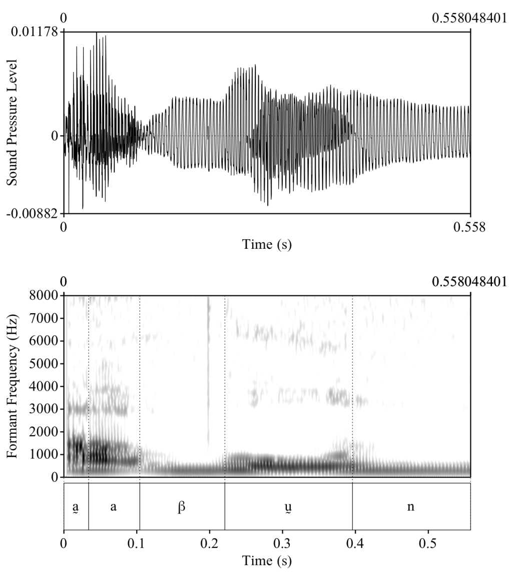


Figure 3.14 Waveform and spectrogram of [xawɑ̰́m] by male speaker FR

Figure 3.15 Waveform and spectrogram of [xawáʔmeʃ] by male speaker FR



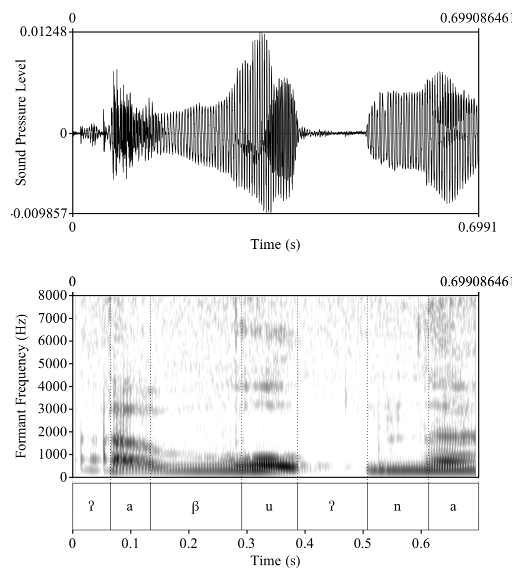


Figure 3.16 Waveform and spectrogram of [ʔaβṵ́n] 'your roasted meat' by female speaker TS

Figure 3.17 Waveform and spectrogram of [ʔaβúʔna] 'there is no (your) roasted meat' by female speaker TS.

Figures 3.14 and 3.16 show a form where, in the analysis proposed here, the glottal stop is parsed to the Nucleus of the syllable; as a result, a Complex Nucleus arises. In contrast, the Figures 3.15

and 3.17 show forms where the glottal stop being parsed to Coda position since the final consonant of the root is parsed into the Onset of the following syllable; these are examples of what I have called vowel-glotal coda.

Note that the glottalized vowel produced by TS (Figure 3.16) does not display irregular glottal pulses on the spectrogram. As briefly mentioned in §3.2.1, for some speakers, glottalized vowels are not constantly produced with creak. The production of glottalized vowels by TS sometimes involves long vowels rather than rearticulated or creaky vowels. This phenomenon raises the question, again, about the absence of a one-to-one correlation between phonology and phonetics.

Recapitulating, the fundamental claim being advanced is that the underlying sequence of a /V/ followed by a glottal stop /ʔ/ is realized either (i) as a [V] plus glottal stop coda, or, (ii) as a 'creaky/rearticulated' vowel, if the syllable is closed by another consonant.

3.5 Conclusions

Relating the syllable and phonotactic restrictions laid out in Chapter 2, this chapter has established the featural and prosodic representations of the glottal stop and the so-called 'glottalized' vowels in Nivaĉle (Stell 1989). It has been proposed that the glottal stop is unspecified for place features, but specified for [c.g.]. Glottalized vowels are underlying vowel-glottal sequences: /Vʔ/. As such, they consist of a vowel followed by glottal stop, which is itself defined as a moraic root node specified for [c.g.]. This moraic root node can attach to (i) the nucleus of the syllable and form part of a complex nucleus – phonetically realized as a 'rearticulated/creaky' vowel – or (ii) the syllable node as coda and thus get realized as a glottal stop. Phonetic evidence for the alternation and relationship between rearticulated and vowel-glottal coda has been provided in the effect of affixation processes on syllabic parsing.

In addition, a crucial argument has been proposed: glottalized vowels are bimoraic. In Chapter 4, I will develop this proposal by showing that glottalized vowels occupy a prominent position, that is, the head of a foot, and thus bear stress.

Chapter 4: Prosodic structure of Nivaĉle

4.1 Introduction

Prosodic structure refers to the organization of segments in terms of universal prosodic units: mora, syllable, foot, prosodic word. The goal of a theory of prosodic structure is to capture linguistically significant generalizations about "suprasegmental" phonological properties such as weight, duration, stress, tone, and intonation, among others.

An essential claim in metrical stress theory is that prosodic units are organized in a hierarchical relation; the Prosodic Hierarchy (Selkirk 1980, 1984, 1986, McCarthy & Prince 1986, Nespor & Vogel 1986/2007) serves as the basis for the analysis of prominence or stress assignment in a language. The Strict Layering Hypothesis (Selkirk 1984) states that all prosodic constituents at a particular level consist exclusively of constituents from the level below (prosodic levels cannot be skipped or repeated). The Headedness Principle requires that each prosodic unit dominates a head at the next lower level of the Prosodic Hierarchy: that is, every prosodic word (PrWd) is headed by a foot (Ft), every foot is headed by a syllable (σ), and every syllable is headed by a mora (μ). Shaw (1992) argues for an intermediate level between the syllable and the mora: a Nucleus constituent, in order to account for the two distinct types of bimoraic syllables (CVμCμ and CVμVμ) in templatic morphology. Given this distinction, Shaw proposes a contrast between nuclear moras and non-nuclear moras. As discussed in Chapter 3 of this thesis, I adopt the notion of the Nucleus as head of the syllable: in Nivaĉle, the Nucleus functions as the prosodic unit that hosts all and only the moraic units of the language. Specifically, I propose that:

(i) Both /V/ and /ʔ/ are moraic in Nivaĉle.

(ii) A mora is always parsed into the Nucleus in Nivaĉle.

(iii) Pre-nuclear ("Onset") segments are not moraic.

(iv) Because there is no phonemic contrast in vowel length in Nivaĉle, the phonetic realization of length in a Nucleus derives from the mora from a glottal stop /ʔ/ being parsed into the Nucleus.

(v) If the full segmental content of the /ʔ/ is also parsed into the Nucleus, then the surface realization is of a creaky/rearticulated vowel.

(vi) If the segmental content of the /ʔ/ is disassociated/delinked from its mora so that the /ʔ/ can be realized as a coda, then (in accordance with (ii) above) the mora remains in the Nucleus.

(vii) The bimoraic status of the Nucleus in the context of glottalized [Vʔ$^{\tilde{\text{v}}}$] ~ [VV̰] and vowel-glottal [Vʔ] coda accounts for the ubiquitous association of these syllables with stress through the direct correlation of the Weight-to-Stress Principle (Prince & Smolensky 1993).

To clarify then, I am adopting a prosodic hierarchy model structured as follows:

(206) **Prosodic hierarchy** (adapted from Selkirk 1980, Itô 1986, McCarthy & Prince 1986, Shaw 1992).

PrWd	Prosodic Word
|	
Ft	Foot
|	
σ	Syllable
|	
N	Nucleus
|	
μ	Mora

The mora (Hyman 1985, McCarthy & Prince 1986/1996, 1990, Zec 1988, Hayes 1989) serves as a "primitive subsyllabic constituent and as a measure of syllable weight" (Zec 1995: 85). Crosslinguistically, syllables commonly subclassify into (a) light monomoraic, and (b) heavy bimoraic.[43] Stress assignment (along with tone assignment, compensatory lengthening, and reduplication, among other phonological phenomena) has been proposed as a diagnostic for syllable weight (Prince 1980, McCarthy & Prince 1986/1996, Zec 1988, Hayes 1989, Gordon 2006).

The moraic status of coda consonants is subject to cross-linguistic variation. There is no evidence suggesting that coda consonants are moraic in Nivaĉle. It has been hypothesized that the

[43] Less commonly attested are trimoraic syllables (e.g. German (Féry 1997), Hindi (Broselow et al 1997) etc.) and non-moraic or weightless syllables (e.g. hən̓q̓əmin̓əm̓ Salish (Shaw et al. 1999); Mohawk (Piggott 1995), etc.).

weight of coda consonants is parameterized on a language-specific basis (Hyman 1985, Zec 1988, Hayes 1989, Zec 1995). In this way, a typology for moraic consonants can be found:

(i) Languages where CVC syllables pattern with CVV syllables and are thus heavier than CV light syllables; e.g. Finnish (Sadeniemi 1949), Hindi (Ohala 1986), Latin (Allen 1973), Yana (Sapir & Swadesh 1960).

(ii) Languages where CVC syllables pattern with CV syllables as against CVV syllables; e.g. Araucanian (Echeverría & Contreras 1965), Khalkha Mongolian (Walker 1997), Malayalam (Broselow et al. 1997).

Besides vowel quantity and moraic codas, prominence (Hayes 1995) has been proposed for distinguishing light from heavy syllables. For instance, "rhymes with full vowels, high tone, lower (and thus more sonorous) vowels, <u>or rhymes with a complex vowel involving glottalization</u> count as "more prominent" than their respective counterparts" (van der Hulst 1999:10 [my underline/AG]). Furthering the line of research into the relative prominence of different vowels within a given phonological system, Kenstowicz (1997) examines languages where prominence is determined by the quality of the syllabic nucleus:[44] what he advances is phonological evidence that "lower vowels are more prominent than higher vowels and peripheral vowels are more prominent than central vowels" (157).

In their analysis of the complex stress system of Nanti (Kampa, Arawakan), Crowhurst and Michael (2005) show that, besides being sensitive to rhythmic factors, syllable quantity, and vowel quality, stress is, interestingly, sensitive to whether a syllable is open or closed (§4.2). Similarly, Munshi and Crowhurst (2012) show that in Koshur (Kashmiri) closed syllables "are preferred as stress peaks over [open] syllables with vowels of the same length" (427). The central point to be drawn from the Nanti and Kashur (Kashmiri) analyses is that a coda consonant that is arguably *not* moraic can nonetheless contribute to a closed CVC syllable having greater prosodic prominence than an otherwise comparable open CV syllable. Here it is argued that CVC syllables in Nivaĉle, despite being

[44] The languages under study are: Kobon (Davies 1981), Chuckchee (Skorik 1961), Aljutor (Kodzasov & Muravjova 1980), Mari (Gruzov 1960), and Mordwin (Tsigankin & Debaev 1975).

monomoraic and monosyllabic, play an active role in the stress system, particularly as a locus of secondary stress in polysyllabic words.

Post-vocalic glottal stop, however, has a unique role in terms of prominence. Based on the observation that glottalized vowels are consistently stressed in Nivaĉle, one of the central claims advanced in this thesis is that the glottal stop is moraic (§4.3); this mora attaches to the nucleus of the syllable. That is, both creaky/rearticulated vowels and a Vʔ] rhyme are prominent. As expected from the cross-linguistic generalization that Onsets do not standardly contribute prosodic weight, a glottal stop onset in Nivaĉle is not moraic; only postvocalic glottal stop functions to contribute weight to a syllable. This follows from two claims in the present analysis. First, /ʔ/ is underlyingly moraic.[45] Secondly, a mora in Nivaĉle can only be parsed into the Nucleus. Nivaĉle then behaves like a Type (ii) language in the bipartite moraic languages typology discussed above, where CVC syllables pattern with CV syllables: coda consonants do not bear weight. Notably, in distinction from /ʔ/, ejective obstruents do not bear weight. The only weight-bearing, i.e. moraic, segments are vowels and glottal stop. Moreover, only the Nucleus can host weight.

The brief characterization of Nivaĉle stress that is found in Stell (1989: 81-83) will be discussed in Section 4.4.1. No details of the Nivaĉle prosodic system, such as the moraicity of its segments, the minimal word, foot types, and phonological domains are addressed in Stell's grammar nor have there been any other studies which have offered a detailed, prosodically motivated analysis of the stress system of Nivaĉle.

The goal of this chapter is to account for the internal structure of the Prosodic Word and of stress assignment in Nivaĉle, focusing on the nominal and verbal domains. Section 4.2 analyzes the smallest prosodic domain, that is, monosyllabic words, and proposes that the Minimal Word is a closed monosyllable: CVC. Section 4.3 analyzes the case of glottalized vowels, provides empirical

[45] This is intended to function as a simplifying assumption, rather than as a crucial tenet of the analysis. An alternative hypothesis is that vowels and /ʔ/ (but no other segments) acquire moraic status through the relative ranking of parsing constraints such as PARSE-ʔ-to-μ and PARSE-V-to-μ. Under either analysis, the pervasive generalization is that (unless deleted or parsed into an onset) a /ʔ/ consistently contributes weight to a syllable.

argumentation in support of the present claim that they bear weight and illustrates their consistent conformity to the WEIGHT-TO-STRESS Principle (Prince & Smolensky 1993).

In section 4.4, the stress patterns in Nivaĉle are discussed. I propose that Nivaĉle has a quantity sensitive stress system, and that the rhythmic type is iambic. The following foot types are thus attested: Heavy (H), Light-Light (LL), and Light-Heavy (LH). In addition, it is advanced that stress assignment is edge-based, aligned with the edges of hierarchically nested morphological categories (MCat), specifically: Root (Rt), Morphological Stem 1 and 2 (MSt1, MSt2), and Morphological Word (MWd). In Section 4.5, the internal morphological structure of nominal and verbal forms are presented; the role of prefixes and suffixes with regards to stress placement is discussed, as there are Left-edge and Right-edge stress generalizations that apply. A major generalization at the uppermost prosodic level is that primary stress falls on the rightmost foot of the PrWd.

4.2 Minimality: Nivaĉle CVC monosyllables

In many languages, there is a restriction on the minimum prosodic size of a word (McCarthy & Prince 1986). Further, the minimal content word of a language has been equated with the minimal foot allowed in that language (Prince 1980, McCarthy & Prince 1986).[46] In that vein, certain languages require that every content word either contain at least two moras or two syllables. This minimality requirement corresponds to the claim that feet must be binary under moraic or syllabic analysis (McCarthy & Prince 1993:90):

(207) FT-BIN-μ: Feet are binary at the moraic level. (Kager 1999)

(208) FT-BIN-σ: Feet are binary at the syllabic level. (Kager 1999)

Nivaĉle presents an interesting case study in this regard. Specifically, in Nivaĉle, what is found is that a CVC syllable can stand alone as a word. However, because in the present analysis it is argued

[46] Nevertheless, several studies have shown that there is not necessarily a one-to-one correlation between minimal word requirements in a language and the minimal stress foot (Hayes 1999, Garrett 1999, Gordon 1999).

that there is no independent prosodic evidence for coda consonants (other than [ʔ]) being moraic, a Nivaĉle CVC word does not meet the bimoraic constraint (207). Nor, clearly, does a CVC word meet the bisyllabic constraint (208).

Thus the smallest word in Nivaĉle does not conform transparently to the Binarity generalization of the prosodically-defined notion of a “Minimal Word”. It is proposed nonetheless that CVC in Nivaĉle, despite being monomoraic and monosyllabic, constitutes a Minimal Word and functions also as a minimal well-formed foot.

Crucially, a CV syllable never stands alone as a word. Nor does a CV syllable function as a foot in the stress system, whereas a CVC syllable can do so. The conclusion therefore is that Nivaĉle provides evidence that a monomoraic CVC syllable plays a fundamental prosodic role, both as a Minimal Word and as a stress foot.

There are two types of arguments in favor of claiming that the Minimal Word in Nivaĉle consists of a CVC syllable.

First, as illustrated in (209), (210), and (211), both CVC nominal and verbal roots can occur as independent words. Indeed, the majority of the Nivaĉle nominal and verbal roots consist of CVC monosyllables. Moreover, because all lexical items bear stress, these forms illustrate a minimal stress foot as well.[47] Recall that primary stress is marked as an acute accent on the stressed syllable.

(209) a. p’ók
‘arrow’
b. t͡sók
‘plastic’
c. ɬéɬ
‘snail’
d. tós
‘snake’

[47] Examples of a (CVC) foot occurring in longer polysyllabic words are presented later, in §4.5.6.

e. t’ún
‘hard/*galleta* (type of bread)’

Alienable nominal roots can occur independently as a monosyllabic CVC foot as in (209a-e) above. Inalienable roots require the presence of a possessive prefix, as seen in (210). What these V-initial roots prefixed by a single-C possessive pronoun further establish is that a polymorphemic word can also be realized simply as CVC.

(210) a. ɬ-ɑ́k
3POSS-food
‘his/her food’

b. j-ɑ́x
1POSS-skin
‘my skin’

c. j-éj
1POSS-name
‘my name’

The verb forms below show a fully parallel pattern; CVC is also well-formed foot and Minimal Word. In the forms in (211), ∅ is represented to indicate the non-surface realization of a third person subject.

(211) a. ∅-k͡ɬóp
3S-white
‘s/he is white’

b. ∅-sás
3S-bad/ugly
‘s/he is bad/ugly’

c. ∅-βáf
3S-pass.away
‘s/he passed away’

d. ∅-túx
3S-eat
‘s/he eats’

Similarly to (211), the following data show verbal roots that require the presence of a person prefix: single consonant prefixes attach to vowel-initial roots (212) and CV prefixes attach to C-initial roots (213):

(212) a. x-én pa = *Jesus*
1S-love DET = Jesus
'I love Jesus'

b. ɬ-ám
2S-arrive
'You arrive'

c. j-ít͡ʃ ka = tós
3S-go DET = serpent
'a serpent passed by'

(213) a. ji-t͡ʃét
3S-upset.stomach
's/he has an upset stomach'

b. ji-mɑ́ʔ
3S-sleep
's/he sleeps'

c. xa-t'ó.wɑs = ʔakfí ɬa = [ʔ]a̰k.xi.júk
1S-cut = LOC(inside) F.DET = tree
'I cut down the tree'

What is particularly significant across both the nominal and verbal contexts is the fundamental generalization that Nivaĉle lacks CV words. Whereas polysyllabic words can be V-final, e.g., bisyllabic CV.CV (214a), or CVC.CV (214b), monosyllabic words cannot: *CV.

(214) a. wa.wó
'maned wolf'

b. k'ak.xó
'armadillo'

c. ju.ku.βé
'bread'

d. ni = ji-ká.ku pa = *Jesus*
neg = 1S-distrust DET-*Jesus*
'I believe in Jesus'

e. xa-fù.ju-k'é na = ji-k͡lá.nat͡ʃ
1S-play(an instrument)-LOC DET = 1POSS-DRUM
'I play the drum'

Given that CVC – and not CV – is the minimal word in Nivaĉle and, as will be further argued later, coda consonants are not moraic, an interesting implication for the prosodic analysis of glottals emerges: as seen in (215), glottals can occupy coda position and fulfill the CVC MinWord condition.

(215) a. ɬ-áʔ
3POSS-fruit
'fruit (of the tree)'

b. ɬ-úʔ ɬa = *pelota*
2S-throw DET = ball
'you throw the ball'

c. méʔ
'otter'

d. βíʔ
'caterpillar'

e. máʔ
'frog'

There is no phonological evidence that a glottal stop is ever inserted to satisfy MinWord requirements. For instance, recall from Chapter 3 (§3.4) that a glottal final root like the one in (215) can be parsed to the Nucleus when a suffix is added; a rearticulated/creaky vowel arises: tá̰j 'it has fruit' (cf. (201b).

Two further empirical issues arise. First, while all the examples above illustrate CVC words with modal vowels, the following data establish that the nucleus of a CVC word may alternatively be a glottalized vowel, i.e. CV̰C:

(216) a. k͡ló̰p
'winter'
b. wá̰s
'sky'

Secondly, it is well established that onset complexity does not normally play a prosodic role in MinWd or Foot-form constraints, and it is not surprising therefore that some monosyllabic words have a complex onset:

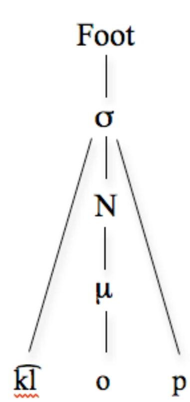
(217) a. xpá̰k
'straw'
b. kxát
'fruit of the cactus'

But, what is significant in showing that onset complexity does not entail weight is that, like *CV, *CCV is not a possible MinWd. The important criterion for a monosyllabic MinWd is that it be a closed CVC – or, as in (217) above, CCVC – syllable.

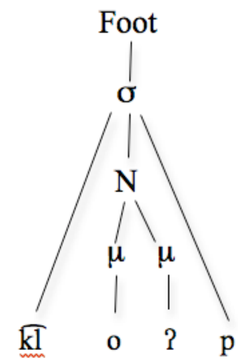
Also note that there are no free-standing VC words; the constraint ONSET is undominated, enforced by [ʔ] epenthesis (§2.3.1).

Some illustrative examples from (211a), (216a) and (215a) are presented in (218) with their moraic analysis.

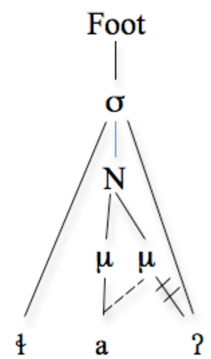
(218) a. Monomoraic CVC foot: [k͡lóp]



b. Bimoraic foot: heavy bimoraic nucleus: [k͡ló̰p]

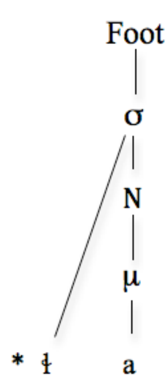


c. Bimoraic foot: heavy bimoraic nucleus with [ʔ] coda



In contrast, a CV or CCV (d) is not a well-formed attested foot type.

d. *(C)CV foot



The details of the featural and prosodic representation of glottalized vowels (218b) and the glottal stop (218c) have been discussed in §3.4 and are recapitulated in §4.3.1.

In sum, CVC functions as a well-formed MinWd in this language, regardless of moraic content. Interestingly, therefore, in the case of CVC the criterial restriction is on syllable shape rather than weight. If a lexical unit does not meet either the Ft-Bin-μ (207) or Ft-Bin-σ (208) constraints, then it can nonetheless qualify for MinWd status if it is a single closed syllable, i.e. if there is a "coda" consonant. This restriction on the syllable shape of the Minimal Word can be interpreted in three ways.

First, one could hypothesize that there is a constraint that requires a Prosodic Word to end in a consonant:

(219) FINAL-C: A Prosodic Word (PrWd) cannot end in a vowel (McCarthy 1993)
$*V]_{PrWd}$

However, it is clear that Final-C is not an undominated constraint, as polysyllabic words can be V-final (220), or C-final (221):

(220) a. k͡le.sá
'knife'
b. wa.wó
'maned wolf'
c. t͡ʃa.xa.ní
'rodent'

(221) a. ma.kók
'frog'
b. ma.ko.k-[í]s
frog-PL
'frogs'

What we can conclude is that the requirement to be C-final functions as a well-formedness MinWd constraint on monosyllabic words (where possible, the optimal Head foot of the PrWd will conform to Ft-Bin-σ (208)). In this vein, the following well-formedness constraint can be proposed:

(222) MINFT=CVC: The Minimal Foot is a CVC syllable. [violated by *(CV́) *(CV̀)]

This constraint would connect the observation that the minimal word in Nivaĉle is a foot that can be as small as (CVC). In addition, note that in polysyllabic words, an initial CVC foot receives secondary stress as shown in (223a-c) whereas otherwise comparable forms with an initial CV syllable (223d-e) do not have secondary stress, as an open CV syllable does nto satisfy the MinFt constraint in (222):

(223) a. ([ʔ]ὰk).(xek͡lá) (CVC)
'woman'
b. (pùʔ).(xaná) (CVʔ)
'three'
c. (fà̰j)(ku-kát) (CV̰C)
carob-TREE.CLASS-COL
'a stand of algarrobo trees'
d. si(βok͡lók)
'spider'
e. ni(βak͡lé)
'man'

The discussion of CVC functioning as a foot will be shown in §4.5.6.

The fact that Nivaĉle minimal word is not sensitive to weight but to whether a syllable is closed or not could be captured by two alternative analyses.

First, one could posit that CVC minimal words acquire a mora in order to satisfy foot binarity. This would constitute a case of variable closed-syllable weight, namely, light syllables become contextually heavy to satisfy a higher ranked constraint (Rosenthall & van der Hulst 1999, Morén 1999). For instance, CVC syllables do not count as heavy for stress assignment unless a satisfaction of word minimality or the avoidance of some critical constraints violation is at issue. In this case, a mora would be inserted – in violation of low ranked DEP-μ – in order to satisfy FT-BIN-μ.

(224) DEP-μ: A mora in the output has a correspondent in the input.

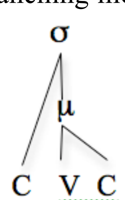
(225) FT-BIN-μ: Feet are binary at the moraic level.

(226) FT-BIN-μ » DEP-μ

Given that there is no independent motivation for coda consonants having weight, this 'variable closed syllable weight' analysis would be entirely *ad hoc*, serving only to satisfy a FT-BIN-μ constraint. What I have posited so far is that the special ranking of FT-BIN-σ, FINAL-C and MINFT＝CVC constitute relevant constraints to account for foot construction and stress assignment.

Second, an alternative analysis, in line with Crowhurst & Michael (2005) and Munshi & Crowhurst (2012), would posit that syllable codas play a role in stress assignment independently of moraic weight (contra Rosenthall & van der Hulst (1999) and Morén's (1999) above mentioned accounts). Under this approach, it is argued that the prosodic role of codas in contributing to CVC syllables being preferentially stressed over CV syllables can be attributed to mora branchingness (Munshi & Crowhurst 2012: 430). These authors claim that "branching is another property of the mora with metrical significance in some languages":

(227) Branching mora



Nevertheless, this branching mora approach cannot account for the Nivaĉle data because under the syllable representation in (227), a glottal stop coda and any other coda would be expected to pattern together. However, only the glottal stop is associated with a mora. The present analysis proposes that this mora is parsed to the Nucleus of the syllable (recall from §4.1 that only the Nucleus can host weight). In contrast, there is no phonological evidence of other coda consonants contributing to weight, or to stress prominence in any way. In sum, it is argued that a syllable representation that includes the Nucleus as the prosodic head of the syllable has greater explanatory value as it captures the different patterning of glottals and other coda consonants.

In this chapter, I will posit that: (i) CVC syllables are not heavy, that is, there is no Weight-by-Position, neither consistent nor variable WBP, (ii) CVC syllables satisfy word minimality, and (iii) CVC can function as a foot in the stress system of Nivaĉle. However, what will be argued in §4.5.6 is that a CVC foot is not an optimal foot. In a polysyllabic word, a foot that satisfies the FT-BIN-σ constraint receives primary stress, while a CVC foot receives secondary stress. Consequently, I propose that the Head of the PrWd is optimally binary at the syllabic level.

4.3 Prosodic properties of /ʔ/

It has been posited that languages differ in the parameter used to set the boundary along the sonority hierarchy between moraic vs. non-moraic coda consonants (Zec 1988, 1995). Specifically, the analysis of glottals as being moraic displays some variability. This is not an unexpected phenomenon; much of the ambiguity of glottals as bearing vs. not bearing a mora comes from its variable featural and prosodic representation across languages. For example, it has been argued that the special status of glottals derives from a structural difference between glottals and other segments, such as the absence of a supralaryngeal node (Cohn 1993). Glottals can pattern with either obstruents (Ladefoged 1971, Hyman 1975, Lass 1976, Bessell 1992) or sonorants (Chomsky & Halle 1968, Kenstowicz & Kisseberth 1979, Kavitskaya 2002). Moreover, whereas in some languages glottals have been argued to bear place features (McCarthy 1991, 1994, Ola Orie & Bricker 2000, Lombardi 2002), in others they do not (Steriade 1987, Cohn 1990, Bessell & Czaykowska-Higgins 1992). See §3.3.4 for a more detailed discussion of the featural specification of glottal stops.

Alongside of these featural differences, various proposals have been advanced with respect to the moraic status of glottal stops. Just to cite some examples, the glottal stop has been analyzed as moraic in Blackfoot (Peterson 2004, Elfner 2006), but as the only non-moraic consonant (along with /h/)

in Tehrani Farsi (Darzi 1991), and the only weightless consonant in Bella Coola/Nuxalk (Bagemihl 1991, 1998).

Kavitskaya (2002) argues that in languages where the loss of glottals results in compensatory lengthening alternations, these glottals need to be analyzed as phonological approximants and as moraic. She thus predicts the existence of two types of glottals based on their relationship with compensatory lengthening. If deletion of a glottal does not trigger compensatory lengthening, this glottal is predicted to be weightless and to pattern with (non-moraic) stops. In contrast, glottal approximants are predicted to have weight, and their deletion results in compensatory lengthening.

There is another variable that one should consider in the relationship between glottals and moras. The particular surface realization of the glottal stop – as an independent segment vs. glottalized realization concomitant with a vowel – can be conditioned by foot type and foot size (Elías-Ulloa 2006).

Elías-Ulloa (2006) analyzes a special case of contextual syllable weight in closed syllables. In Shipibo and Capanahua (Panoan), the weight of closed syllables changes according to the position in which they occur within the prosodic structure. For instance, "closed syllables are light in Capanahua when they occur unfooted or as the initial syllable of a disyllabic foot; elsewhere closed syllables are heavy" (2006:19).

Interestingly, variable closed syllable weight and prosodic structure in Capanahua is related to the occurrence of the glottal as a full segment, or as creakiness in the preceding vowel. Coda glottal stops can only surface in head syllables because this privileged or prominent prosodic position inhibits glottal coalescence into a preceding vowel nucleus. In contrast, in non-head positions, coda glottal stops fuse with the preceding vowels and are thus realized as glottalized/creaky vowels. In other words, Capanahua's glottal coalescence is analyzed as a strategy to adjust the weight of its syllables to the metrical context in which they occur while respecting the disyllabic size of their feet (Elías-Ulloa 2006:9).

In this thesis, I propose that the occurrence of glottalized vowels in Nivaĉle is also correlated with the prosodic structure. On the one hand, creaky/rearticulated vowels and coda glottal stops surface only under stress, i.e. in prosodic head position: thus, it is posited that there is a direct correlation between these syllables being bimoraic and their being stressed. On the other hand, in non-head position, both the moraic value and the [c.g.] of an underlying glottal stop (whether in coda position or incorporated into a glottalized vowel) are lost: the pervasive generalization is that coda glottal stops and glottalized vowels are not realized except under stress.

To recapitulate the Nivaĉle analysis, the glottal stop in Nivaĉle displays some interesting phonological behaviour. On the one hand, it is argued that it can be realized as a glottal stop in post-vocalic "coda" position. On the other hand, it can form part of the syllabic nucleus. It, thus, displays a dual patterning:

(i) like vowels it can be part of the nucleus.

(ii) like consonants it can be realized as a full glottal stop and be parsed into coda position (§3.3.3.3).

4.3.1 Syllabic status of /ʔ/ vs Glides

The glottal has a dual patterning in terms of syllabic parsing that is not shared with other segments. For example, whereas glides can occupy onset or coda position, an analysis of tautosyllabic vowel-glide sequences establishes that they do not ever form part of a complex nucleus.

Given this asymmetric pattern, let us examine what featural representations can appropriately capture the natural class behaviours of the vowels, glides, the glottal stop, and glottalized vowels. Following Levi (2008, 2011), I hypothesize that glides are [+consonantal]. There are three arguments in favor of the claim that glides /w/ and /j/ in Nivaĉle are [+consonantal].

First, as mentioned in §2.2.1, in terms of distribution, glides can occur in onset and coda position, before and after all vowel environments, and thus are not restricted to co-occurrence with a small number of vowels.

Second, there are no tautosyllabic vowel-glide-consonant (VGC) sequences in Nivaĉle. Because it has been established that complex codas are not allowed in Nivaĉle (§3.3.1.3), the only potential parsing of a tautosyllabic VGC string would therefore be if [VG] were a possible complex nucleus, i.e. a diphthong. Given that [...VGC]$_\sigma$ strings are unattested, whereas [...VG]$_\sigma$ strings are attested, it follows that the glides (G) pattern with other consonants in being parsed into the syllable coda, and not into a complex nucleus.

Thirdly, in addition to these distributional constraints, active phonological evidence that glides are parsed into the coda comes from the fact that glide-final roots behave like other consonant-final roots in terms of triggering vowel epenthesis when suffixed by a single –C plural marker. That is, as the following examples of plural suffixation show, when a consonant-initial suffix is added to either a glide-final (228-229) or consonant-final stem (230-231), there is vowel epenthesis in order not to incur violations of *COMPLEXCODA:

(228) a. ʃk͡lɑk.xɑ́j
'partridge'
b. ʃk͡lɑ̀k.xɑj-[í]s b'. *ʃk͡lɑkxɑjs
partridge-PL
'partridges'

(229) a. [ʔ]o.βáj
'guavirami (fruit)'
b. [ʔ]o.βa.j-[í]s b'. *[ʔ]oβajs
guavirami (fruit)-PL
'guavirami fruits'

(230) a. βa.tʼ-ɑ́x
INDEF.POSS-skin
'skin'
b. βa.tʼ-ɑ.x-[í]s b'. *βaťoxs
INDEF.POSS-skin-PL
'skins'

(231) a. k'ut.xá̰n
'thorn'
b. k'ùt.xa.n-[í]s b'. *k'utxa̰ns
thorn-PL
'thorns'

cf.

(232) a. [ʔ]a.ɬú
'lizard'
b. [ʔ]a.ɬú-s
lizard-PL
'lizards'

Consequently, the generalization is that glides pattern with consonants and not with vowels (232).

4.3.2 Syllable structure parsing constraints for /ʔ/

Let us turn now to a consideration of the patterning of the glottal stop and the vowels. It is proposed here that there is a direct and consistent correlation between the presence of [c.g.] in a syllable nucleus or as a coda [ʔ], and the locus of stress.

The prosodic representation of two words, one with a tautosyllabic vowel-glottal sequence, the other with a creaky/rearticulated vowel, is schematized in Figure 4.1 below (see also Chapter 3, §3.4)

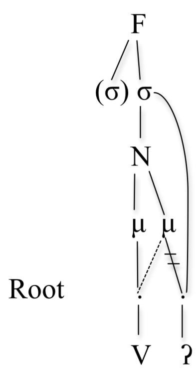
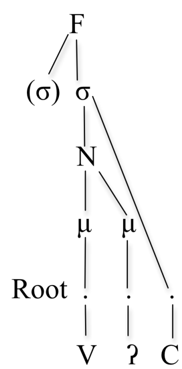
a. vowel-glottal coda	b. creaky/rearticulated vowels
	
jitáʔ ‘scrubland’	jisá̰ʃ ~ jisáʔ^{a}ʃ ‘my hair’

Figure 4.1 Prosodic representation of /Vʔ/

To summarize, it is proposed that the Nivaĉle glottal stop patterns (i) with vowels in being moraic and parsed to the Nucleus node, and (ii) with consonants in potentially functioning as a coda and being parsed directly to the syllable node. First, /ʔ/ consistently contributes weight to a Nucleus and attracts stress: therefore it is claimed to be a mora-bearing unit. Under the hypothesis that Nivaĉle is a language (like the other Type (ii) languages referred to in §4.1) where only the Nucleus of a syllable can license weight, the Parsing constraint in (233), in conformity with the Strict Layering Hypothesis of the Prosodic Hierarchy, will effectively select only vowels and /ʔ/ to parse into a Nucleus.

(233) PARSE-μ-TO-NUC (PARSEμ): Moras must be parsed into the Nucleus of a syllable.

Secondly, the complementary patterning of /ʔ/ with segments other than vowels follows from the general, highly ranked parsing constraint:

(234) PARSE-SEG-TO-σ (PARSE-SEG): Segments must be parsed into syllable structure.

(cf. Prince & Smolensky 1993)

The constraint in (234) functions to ensure exhaustive parsing to the syllable level of all segments in a string. Depending on its relative position in a phonological string, a glottal stop can thus be parsed into the Nucleus or be parsed as an independent segment to either edge of a syllable, i.e. to either an "onset" or a "coda" position,[48] e.g. as in (232a) [ʔałú] 'lizard' or (215e) [máʔ] 'frog', respectively.[49]

The most fundamental analytical question with respect to a post-vocalic /ʔ/ is what constraints govern whether it is parsed into a Nucleus or a Coda. The most basic generalization to be captured is that /ʔ/ is parsed into the coda if and only if there is no other consonant parsed into coda position, i.e. in post-Nuclear position at the right edge of the syllable. Otherwise, the /ʔ/ will be parsed into the Nucleus.[50] What this generalization reflects is the fundamental role of the FINAL-C constraint (see (219) in §4.2) in Nivaĉle. Its crucial ranking above NOCODA, normally a high-ranking markedness constraint, is shown first in the tableau in (235a):

(235) a. βíʔ 'caterpillar'

/ β i ʔ /	FINAL-C	NOCODA
a. (βḭ́)	*!	
b. ☞ (βíʔ)		*

b. βeʔła 'one'

/ βeʔła /	FINAL-C	NOCODA
a. (βḛ)ła	*!	
b. ☞ (βéʔ)ła		*

[48] To reiterate, the terms "onset" and "coda" are used here, as elsewhere, not as primitive prosodic units but rather simply as informal terms of reference to designate segments at the left or right periphery of a syllable domain. The sole syllabic units that are formally posited to be prosodic primes in the framework assumed here are syllable (σ), Nucleus (N), and mora (μ).

[49] Under the assumption that /ʔ/ is underlying moraic, it is further assumed that if /ʔ/ is parsed into an onset position, the universal markedness constraint (unviolated in Nivaĉle) reflecting the cross-linguistic generalization that onsets are not moraic (*ONSET-μ) will effectively result in the deletion of the mora. This would entail a concomitant violation of MAX-μ. As the focus of the present analysis is on the manifest weight properties of /ʔ/ in non-onset position, a more detailed formal treatment of this issue is not directly relevant and hence is not pursued further.

[50] Recall that a glottalized vowel or a tautosyllabic [Vʔ] sequence is only realized in a stressed syllable. In the tableaux here, this condition is met and therefore the constraint implications of WEIGHT-TO-STRESS, MAX-μ, MAX-[ʔ] are not shown.

With respect to the tableau in (235b), recall from §4.2 that a CVC syllable functions not only as a MinWd, but also – under the generalization MinWd = PrWd – as a minimal stress domain. As is argued in the subsequent sections of this chapter, the Nivaĉle stress system is based on FT-FORM = IAMBIC, but feet may be parsed from the left edge or the right edge of a word, depending on a well-defined hierarchy of morphologically-defined domains. What is relevant to the present discussion is that there can therefore be word-internal syllables with a final [ʔ] coda: the prediction of the present analysis is that such non-word-final [CVʔ] syllables will only be found under conditions of stress prominence. The tableau in (235b) illustrates this with the word [βéʔɬa] 'one', where the initial syllable (βéʔ) functions as a left-aligned CVC foot, and the final syllable [ɬa] is stray, i.e. unparsed to the foot level. What is important to note is that in the initial syllable, which is functioning as a stress domain, it is optimal for the /ʔ/ to be parsed as a coda, thus satisfying the higher-ranked FINAL-C constraint, as opposed to its being parsed into the Nucleus, which would satisfy the lower-ranked NOCODA constraint.

As both the tableaux above apply to monosyllabic feet with a final /Vʔ/, let us consider what the role of these postulated constraints is in the case of a bisyllabic iambic foot without /Vʔ/ in the head syllable of the foot. In the form for 'armadillo' (237), both candidates satisfy FT-FORM = IAMBIC and FT-BIN-σ, so these are not included in the tableau here. Of present relevance is that both FINAL-C and NO-CODA are seen to be violated in the winning candidate. What is more important for well-formedness here is that no segments are deleted, in violation of MAX-SEG.

(236) MAX-SEG: Every segment in the input must have a correspondent in the output.

(237) k'akxó
'armadillo'

(238)

/ k'akxo /	MAX-SEG	FINAL-C	NOCODA
a. ☞ (k'ak.x ó)		*	*
b. (k'a.x ó)	*!	*	

Given 'armadillo' as a basis of comparison, let us turn to examine a word with a final /ʔ/ that is parsed not to a monosyllabic foot as in (239), but rather into a bisyllabic iambic foot:

(239) jijéʔ
'*caraguata*'

(240)

/ jijeʔ /	MAX-SEG	FINAL-C	NOCODA
a. ☞ (ji.jéʔ)			*
b. (ji.jḛ́)		*!	
c. (ji.jé)	*!		

Importantly, what these tableaux in (238) and (240) establish is that even though satisfaction of the FINAL-C constraint is not "necessary" to create a well-formed bisyllabic iambic foot (238), it is better (240) for the glottal component to be parsed as a coda consonant (despite violating NOCODA) than it is for it to be parsed into the Nucleus, which results in violating the higher ranked FINAL-C constraint.

Having examined a diversity of contexts where /ʔ/ is parsed into the coda of a syllable, consider now the complementary set of cases where a /ʔ/ is parsed into the Nucleus. These are cases like /wɑʔs/ [wɑ̰́s] 'sky' where another C follows the /ʔ/ in the input string and is parsed to the coda position.

(241) a. wɑ̰́s 'sky' (216b)

(242)

/wɑʔs /	$*CC]_\sigma$	MAX-SEG	FINAL-C	*COMPLEXNUC	NOCODA
a. wɑ́ʔs	*!				*
b. wɑ́ʔ		*!			*
c. wɑ̰́		*!	*	*	
d. ☞wɑ̰́s				*	*

The crucial constraints are:

(243) FINAL-C » NOCODA

(244) *COMPLEXCODA ($*CC]_\sigma$), MAX-SEG » *COMPLEXNUC

(245) MAX-SEG » NOCODA (see tableaux for 'armadillo' (238) and '*caraguata*' (240))

As was established in Chapter 2, Nivaĉle does not tolerate complex codas. As seen in (242), the ranking of both *COMPLEXCODA (*CC]$_{\sigma}$) and FINAL-C above NOCODA accommodates this. What a comparison of candidates (a) and (d) in the tableau in (242) also shows is that Nivaĉle tolerates a *COMPLEXNUC violation over a *COMPLEXCODA violation. A comparison of candidates (b) and (d) further illustrates that incorporating the glottal into the nucleus avoids deletion of the underlying consonant /s/ (which would entail a MAX-SEG violation). In addition to incurring this same MAX-SEG violation, what a comparison of candidate (c) with the winning candidate (d) further establishes is that enforcing NOCODA, through either deletion or nuclear parsing of /ʔ/, is not optimal. The ranking relations that have been established thus far are summarized in (243)-(245).

What remains to be clarified is the moraic status of the glottal affiliation within the syllable. The generalizations that have been discussed here present an interesting paradox. To recapitulate, it has been shown that there is a consistent correlation between [Vʔ] (whether realized as a glottalized vowel or as a vowel plus [ʔ] coda) and stress. On the one hand, a syllable with nuclear or coda glottal realization is always stressed, regardless of its position in a word:

(246)	a. ɬpèʔ.ja.ʔán	‘you are hearing’
	b. t’ṵ́k.ʃi	‘obstructed’
	c. kṵ̀k.ti.nís	‘thunder (PL)’
	d. xi.βéʔ.k͡la	‘moon’
	e. ji.fɑ̀ʔ.jɑ.ʔɑ́n	‘s/he is/was flying’
	f. faj.xóʔ	‘charcoal’
	g. jik.t͡sṵ́k	‘silk floss tree’
	h. kàs.fe.tá̰s	‘our root/medicine’

On the other hand, all cases where an underlying /Vʔ/ sequence is 'deglottalized' (under any of the various circumstances discussed in §2.5.5, §4.5, §6.5, etc.), occur in unstressed syllables. In conformity with cross-linguistic generalizations, it is hypothesized in the present analysis, first, that /ʔ/ is a weight-bearing, i.e. moraic, segment, and secondly, that Nivaĉle stress is a weight-sensitive system. The bimoraic status of a tautosyllabic vowel plus glottal sequence accounts for the ubiquituous association of these syllables with stress, in conformity with the WEIGHT-TO-STRESS constraint (to be discussed further in §4.5.2.1):

(247) WEIGHT-TO-STRESS PRINCIPLE (WSP): Heavy (i.e. bimoraic) syllables are stressed.

(Prince & Smolensky 1993)

Concomitantly, the fact that deglottalization phenomena in Nivaĉle are consistently correlated with a lack of stress entails deletion of the entire lexical representation for /ʔ/: both its featural and its moraic specification delete.

Here is the paradox. On the one hand, it has been argued in terms of Word Minimality constraints (§4.2) that [ʔ] can and will function as a coda if there is no other consonant parsed into that position. On the other hand, however, no other coda consonant in Nivaĉle contributes to syllable weight. Aside from [ʔ], Nivaĉle can be categorized cross-linguistically as a Type (ii) language (as discussed in §4.1 above) where coda consonants are systematically non-moraic. Because /ʔ/ is consistently weight-bearing, the claim here is that, like vowels, a /ʔ/ in Nivaĉle is underlyingly moraic, like vowels: thus, its moraic status is part of its lexical representation, as opposed to being contextually determined through the postulated WEIGHT-BY-POSITION constraint, which claims that "Coda consonants are moraic" (Hayes 1989, Sherer 1994, Kager 1999:147). No coda consonants in Nivaĉle satisfy WEIGHT-BY-POSITION.

The representational question, however, is this: when a glottal is parsed into a coda position (evidence for which is the fact that such cases satisfy the FINAL-C constraint: i.e. a [CVʔ] word satisfies

MinWd, and a [CVʔ] syllable can bear secondary stress), what happens to its affiliation with its underlying mora? While acknowledging that there are various possible interpretations of this, the present analysis seeks to foreground the following broad-based generalizations in Nivaĉle (see §4.1) by adopting the hypothesis that the mora needs to be parsed into the Nucleus:

1. Coda consonants do not bear weight.

2. The only moraic segments are vowels and glottal stop.

3. Only the Nucleus can host weight.

4. Stress prominence is sensitive to Nuclear weight.

5. MinWd is sensitive to closed syllable status (FINAL-C) independent of syllable weight.

Let us turn now to a detailed examination of how these factors interact with other properties of the Nivaĉle stress system.

4.4 Stress patterns in Nivaĉle

Stress in Nivaĉle is associated with the following phonological and phonetic properties. First, all lexical words have primary stress (the 'obligatoriness' parameter; Hyman 2006:231) with one syllable bearing the highest degree of prominence (the 'culminativity' parameter; Hyman 2006:231). Second, on the basis of samplings included in this dissertation, Nivaĉle stressed vowels are slightly but consistently longer than unstressed vowels; increased duration is correlated with stressed vowels. Another acoustic correlate of stress is higher pitch. Further, because glottalized vowels are bimoraic, they are always stressed (in accordance to the WEIGHT-TO-STRESS Principle (247)) and are characteristically double the duration of modal vowels (§3.2.3). Third, unstressed vowels may be reduced or deleted. As the conditions (e.g. fast speech) governing the reduction/elision behaviour of prosodically weak vowels are not investigated in detail in this work, the discussion presented here (unless otherwise noted) focusses on the level of analysis that entails full specification of these vowels and, as such, faithfully represents the attested speech of my consultants (in a range of speech styles ranging from 'careful' to 'relatively informal', but not focussing on 'fast' or 'very informal'). Fourth, unstressed vowels undergo translaryngeal vowel harmony (§2.6.3, §3.3.4).

Metrical theory (Hayes 1985, 1987, 1995; McCarthy & Prince 1986, Prince 1990, Kager 1999) assumes a small universal inventory of foot types: the quantity-insensitive syllabic trochee and the quantity-sensitive "moraic trochee" (head-initial or left foot prominence), and the quantity-sensitive iamb (head-final or right foot prominence).

(248) Inventory of foot types:

a. Syllabic trochee (quantity-insensitive): (**σ**σ)
b. Moraic trochee (quantity-sensitive): (**L**L) (**H**)
c. Iamb (quantity-sensitive): (L**L**) (**H**) (L**H**)

In this section, I consider the different word-stress patterns in Nivaĉle and propose that (i) the foot type is iambic, and (ii) the Nivaĉle language has a quantity-sensitive stress system, where the moraic weight of /ʔ/ is consistently correlated with stress prominence, and (iii) a CVC syllable in word initial position – and only in this position of convergent morphological and prosodic prominence – is stressed, this correlating with the monosyllabic CVC foot that was argued in Section 4.2 to constitute the MinWd in Nivaĉle.[51] As argued in Section 4.3, glottalized vowels and glottal codas contribute additional weight; the glottal stop /ʔ/ is underlyingly moraic. This mora is parsed to the Nucleus of the syllable.

In addition, I advance the hypothesis that stress assignment in the nominal and verbal domains varies according to whether prefixes or suffixes are attached. The prosodic system that emerges is analyzed in terms of systematic constraints on foot construction from both the left and right edges of words where the prosodic domains are defined by hierarchical morpho-syntactic processes of prefixation and suffixation.

[51] An initial CVC syllable is optionally stressed as secondary stress assignment can be overridden by other factors.

4.4.1 Previous accounts

The only previous analysis of the Nivaĉle stress system can be found in Stell (1989:81-83). The author provides a brief characterization of the stress patterns in the language. Below, I present her main arguments and discuss the examples she provides.

First, Stell (1989:81) characterizes the locus of primary stress as follows:

> Primary stress falls on the root and in several inflectional and derivational affixes. In disyllabic or trisyllabic roots, primary stress mainly falls on the last syllable [249b; 250a]. In morphological constructions constituted by mono- and disyllabic roots, certain inflectional and derivational suffixes shift primary stress to the last syllable [249a,b; 250a,b]. In morphological constructions of four or more syllables, primary stress mainly stays on the root and on certain inflectional and derivational suffixes [my translation from Spanish/AG].

Some illustrative examples follow that description. In the left hand column, I include a faithful copy of Stell's examples, on the right side my interpretation/analysis of her representations (including the morphemic breakdown). Note that Stell uses the standard IPA conventions for the representation of primary and secondary stress, while I use an acute and grave accent respectively.

	Stell	AG
(249)	a. ˈis 'good'	a'. ∅-[ʔ]ís 3S-good 's/he/it is good'
	b. isˈis 'good (pl)'	b'. ∅-[ʔ]is-[í]s 3S-good-PL 'they are good(pl)'
(250)	a. kaˈsus 'pumpkin'	a'. kasús 'pumpkin'
	b. kasuˈsik 'pumpkins'	b'. kasus-[í]k pumpkin-PL 'pumpkins'

(251)	a. xaˈnỉs ‘I tattoo’	a’	xa-n-ḭ́s 1S-REF-write/mark ‘I tattoo myself’
	b. xanisˈʔin ‘I am tattooing’	b’.	xàʔ-n-is-ʔín 1S-REF-write/mark-IPFV ‘I am tattooing myself’ [52]
(252)	a. ˈweʔɬa ‘one’	a’.	[βέʔɬə] ‘one’

The data in my corpus agree with Stell’s documentation of primary stress as presented in (249)-(252). Interestingly, Stell shows an example, viz. (252), that does not follow the word final stress pattern that she claims is ‘mainly’ found in disyllabic and trisyllabic roots. I propose that primary stress falls on the penultimate syllable in this and other similar cases (see §4.5.2) because glottals are moraic and thus attract stress. While example (252) could in principle be an exception to the main stress pattern for disyllabic words, no reference to the special status of the glottal stop is ever mentioned or discussed by Stell.

Second, Stell (1989:83) claims that “secondary stress falls on the second and fourth syllable of morphological constructions of four or more syllables, as long as it does not coincide with primary stress (…) and in certain inflectional and derivational affixes (prefixes and suffixes)”. According to the author, the distribution of primary and secondary stress accounts for the fact that Nivaĉle does not allow sequences of more than two unstressed syllables (see below).

Stell (1989:83) illustrates this brief characterization of secondary stress with the following examples (my morphemic breakdown/AG; note that in my transliteration of her data, secondary stress is marked as a grave accent and primary stress as an acute accent):

[52] It is not very clear to me why there is a vowel-glottal coda in the first syllable of ‘I am tattooing’. However, I present this data as faithful to my field records.

(253) a. wà.t-a.si.nɑ́
INDEF.POSS-word
'someone's word'
b. wà.t-a si.nɑ-n.-jáʃ
INDEF.POSS-speak-?-NLMLZ
'someone's way of speaking'

(254) a. wat'-éj.xa͡ts.xan.xát
INDEF.POSS-teaching
'someone's teaching/education'
b. wat'-éj-xa͡ts.xàn.xat-és
INDEF.POSS-word-teaching-PL
'someone's educations'

(255) a. -tɑ.xɑ́x
'to grind'
b. ji-tɑ́.xɑx.-ke-nɑ́.k'-èɬ
1POSS-grind-LOC-RES-EXCL.PL
'our pastas'

I am not in accord with Stell's documentation of these primary and secondary stress examples, nor with certain aspects of her discussion.

First, my data differ in that secondary stress falls on the second, and not the first syllable of (253a) 'someone's word'; in my analysis, an iambic foot is formed with reference to the left-edge of the possessive prefix; the final foot bears primary stress. Even though I posit that the possessive prefixes [kas] and [βat] can bear stress (§4.5.4), it is only before consonant-initial roots (among other conditions). Before vowel-initial roots as in (253), the last consonant of [βat] gets parsed as the onset of the following root [βa.t-à.sinɑ́]. In addition, I am not in agreement with where she has marked stress in (253b); I documented [βa.tà.si.nɑ-n.jáʃ]. Further, Stell's example in (253b) shows a sequence of three unstressed syllables, which actually contradicts her aforementioned observation that there cannot be more than two unstressed syllables in a row in this language. Note that the stress pattern that I documented is in accord with the generalization that there are no sequences of three or more unstressed syllables.

Second, given the data in (254b), it is not clear why 'teaching' has two primary stresses at both the left and right edge and secondary stress at the middle of the word (on the fourth syllable). According to my documentation, there is only one primary stress (the rightmost one here), and the other prominent syllables receive secondary stress.

Third, even though I have not documented the form in (255), this example presents some unresolved issues: (i) secondary stress is found in this form in final position (without any explanation), and (ii) there is adjacent stress (treated as "stress clash" in the present analysis) in the last two syllables. In the following sections, I present evidence that stress clash is not allowed in Nivaĉle: e.g. some final syllables are left unparsed in order to not violate *CLASH.

Yet, from Stell's brief description and puzzling presentation of secondary stress, it can be interpreted that stress is related to morphological constructions. The following section explores this issue.

4.5 Stress and affixation processes

It is proposed in the present analysis that in Nivaĉle, there are four basic domains for stress assignment. The Root (Rt), the Morphological Stem 1 (MSt1), the Morphological Stem 2 (MSt2), and the Morphological Word (MWd). The root plus an "inner" level of suffixes defines the MSt1. Prefixation onto MSt1 defines the next higher domain: MSt2. An outer layer of suffixation to the MSt2 defines the MWd.

The basic claim advanced here is that each of these morphological categories (MCat) defines a prosodic domain that is relevant to identifying the locus of stress. Stress in Nivaĉle is edge-based and quantity-sensitive, building feet consistent with FOOTFORM = IAMBIC: a series of ranked alignment constraints and the WEIGHT-TO-STRESS Principle are the main constraints responsible for stress assignment.

It is important to highlight that the MCats are hierarchically layered. Even if a domain that is an MSt1 does not undergo any further prefixation or suffixation, it is nonetheless parsed and labelled within the nested structure as an MSt2 and as an MWd. Whether affixation does or does not occur is relevant to whether the output form meets a characterization of morphologically derived or non-derived (§4.5.3, §4.5.7), and, concomitantly, whether that output form is subject to the particular alignment constraint associated with the domain in question.

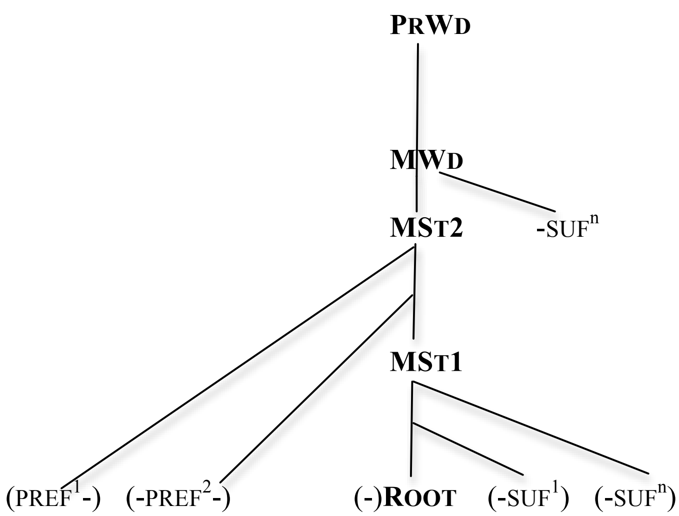


Figure 4.2 Word-internal morphological relationships

4.5.1 Nominal domain

Nivaĉle nouns can be modified by a number of affixes that express inflectional and derivational categories. A template of the linear sequence of morpheme categories that comprise a noun is given in Figure 4.3. Note that plural number can modify the noun and/or the pronominal possessive independently (see §2.4):

(256) [ʔ]a-tìnʃi-s-éɬ
2POSS.necklace-PL-PR.PL
'your (pl) necklaces'

POSS - POSS.CLASS – **ROOT** - DERIV$^{(n)}$ - NOM.PLURAL - PRON.PLURAL -(LOC-NEG)[53]

Figure 4.3 Morphological structure of the noun

What a strictly linear template fails to reveal, however, is that there is an internal, hierarchically organized layering of affixation, as diagramed in Figure 4.2. The labelled brackets in Figure 4.4 illustrate how the linear categories of Figure 4.3 correspond to the hierarchical domains of Figure 4.2.

[[POSS - POSS.CLASS - [[**ROOT**]$_{Rt}$ - DERIV^{n}]$_{MSt1}$] $_{MSt2}$ - PLURAL]$_{MWd}$

Figure 4.4 Domains for stress assignment in a noun

Now turning to a characterization of each of these domains, first we find the Root. Evidence will be presented in §4.5.2 below to show that the right edge of the Root defines an alignment domain for iambic foot construction that functions independently of the progressively more inclusive right alignment domains that incorporate successive layers of suffixes. The principal generalization that emerges here is that input-output Faithfulness to glottal/moraic representation within the Root is ranked more highly than the prosodic R-edge alignment for stress at this level, whereas the constraints governing glottal/moraic Faithfulness are more lowly ranked (and hence violated) at the MSt1 or MWd level, and prefixation at the MSt2 level.

The root plus an “inner” level of suffixes defines the Morphological Stem 1 (henceforth MSt1). Examples of the derivational suffixes that appear within this domain include: nominalizer, augmentative, agentive, resultative, plants/fruits classifier.

If the root is possessed, then a pronominal possessive (and possessive classifier, if applicable) is prefixed to the MSt1 and marks the left-edge of the MSt2. The left edge of the MSt2 domain defines the alignment edge for an independent constraint on iambic foot construction.

A major hypothesis advanced here then is that stress assignment is sensitive to both the left and right edges of a word. Foot parsing proceeds from the right edge of the Root, the MSt1 and the MWd

[53] These outermost suffixes will not enter into the analysis of stress in this chapter.

and from the left edge of MSt2. What is particularly interesting is how the exigencies of each domain interact, given the considerable morphological complexity of word formation in Nivaĉle. Main stress falls on the rightmost foot of the Prosodic Word.

4.5.2 The Root

In this section, I will be examining the smallest domain for stress assignment, the root. As mentioned in §4.2 the Minimal Word in Nivaĉle consists of a CVC syllable; monosyllabic alienable nominal roots can stand on their own and be stressed:

(257) tós
‘snake’

Such monosyllabic, monomoraic words establish that both FT-BIN-σ and FT-BIN-μ are violable, but only if the word is consonant-final, i.e. a closed syllable, in conformity with the Minimal Word generalization established in §4.2. This minimal FootForm will be referred to here as a Minimal Foot (MINFT), defining a constraint MINFT = CVC (see (258) below). What is crucial to note is that not only does a simple open CV syllable not satisfy the MinWd = CVC requirement in Nivaĉle, but also a CV syllable never functions as a foot, even in a longer word with multiple feet. In the present analysis, this is accounted for by the fact that a “CV foot” would not satisfy any of the FootForm well-formedness constraints: it violates the bisyllabicity constraint, it violates the bimoraicity constraint, and it violates the C-final MinFt = CVC constraint.

Recall also from §4.3 that stressed monosyllables can be bimoraic, if they have a glottalized vowel or a glottal coda. In terms of foot wellformedness, observe that even though FT-BIN-σ is systematically violated by the foot parsing of these words, both FT-BIN-μ and MinFt = CVC are satisfied.

(258) a. méʔ
‘otter’
b. fá̰j
‘carob bean’

c. k͡ɬóp
‘winter’

This investigation of stressed monosyllabic words reveals a systematic gap: just as a single open syllable cannot stand as a Minimal Word (§4.2), it never occurs as a stress foot, i.e. *(CV́). The Minimal Foot is a closed syllable: (CV́C) or, as will be seen below in polysyllabic words, (CV̀C) with secondary stress.

Turning our attention to disyllabic roots, the basic generalization is that stress is final, motivating the claim that the stress system of Nivaĉle is right-headed, or iambic. CV.CV is the least frequent pattern but several examples are given below. Stems with a CV.CVC and CVC.CVC shape constitute the most frequent/typical pattern in the Nivaĉle lexicon (CVCV: 115; CVC.CVC: 217, CV.CVC: 391; out of 723 disyllabic stems in Seelwische’s 1980 dictionary).[54]

(259) **CV.CV**

a. ja.ká
‘blue’

b. si.sé
‘*tacuara* (type of bamboo)’

c. t͡ʃ’a.ť’á
‘turtle from the scrubland’

d. sɑ.ť’á
‘fruit of the tuna’

e. pe.k͡ɬó
‘Wichí person’

f. wa.wó
‘maned wolf’

(260) **CV.CVC**

a. sa.múk
‘excrement’

[54] It is possible that some of the forms in (259)-(261) are actually bi-morphemic; however, the root is not transparently separable from the suffixes, and so these forms are treated here as monomorphemic.

b. [ʔ]i.tɑ́x
'fire'

c. ta.núk
'cat'

d. sa.xét͡ʃ
'shad'

e. ni.wáj
'lemon'

(261) **CVC.CV**

a. [ʔ]am.ʔɑ́
'rat'

b. k'ak.xó
'armadillo'

Note that the initial (C)VC syllables are treated as light in (261); otherwise the stress pattern would be: *(ám)ʔɑ and *(k'ák).xo, respectively. In the additional data below, note that a vowel-glottal coda or a creaky/rearticulated vowel can be found in the second (heavy) syllable:

(262) **CVC.CVC** where σ_2 is heavy:

a. ʃin.βóʔ
'honey'

b. k'ut.xɑ̰́n
'thorn'

(263) **CVC.CVC** where both σ_1 and σ_2 are light

a. nuk.sít͡ʃ
'cassava'

b. k'us.táx
'*calandria* (South American mockingbird)'

Consistent with the hypothesis that Nivaĉle is a quantity-sensitive language, the following is a summary of the iambic foot types attested in the range of data considered thus far:

```
                                              F                    F
                                              |                    /\
                                              σ                   σ  σ
                                              /\                  |   /\
(264)  a. Iambic Quantity-Sensitive Foot:    μ μ  Heavy (H)       μ μμ   Light-Heavy (LH)

                                              F
                                              /\
                                             σ  σ
                                             |  |
       b. Iambic Quantity-Insensitive Foot:  μ  μ  Light-Light (LL)
```

Among the core constraints characterizing the Nivaĉle stress system are the following: (Note: (266, 267) and (268) were introduced in §4.2 but are repeated here for ease of reference.)

(265) RHTYPE = I (a.k.a. FTFORM = IAMBIC) (Kager 1999)

(266) FT-BIN-μ: Feet are binary at the moraic level. (Kager 1999)

(267) FT-BIN-σ : Feet are binary at the syllabic level. (Kager 1999)

In addition, because it has been shown in data like (258) above that a monosyllabic CVC word (i.e. the minimal word in Nivaĉle; cf. §4.2) functions without augmentation as a primary stress foot, it is proposed that the FootForm inventory for Nivaĉle includes a MinFt constraint, formalized in (268) below:

(268) MINFT = CVC The Minimal Foot is a CVC syllable. [violated by *(CV́) *(CV̀)]

Importantly, it will be seen below that (CVC) systematically functions as a well-formed monosyllabic MinFt in polysyllabic words as well.

Whereas the forms in (258), i.e. [méʔ] 'otter', and (262), i.e. [k'utxán] 'thorn', conform to **H** and L**H** feet, respectively, the forms in (259-261) display L**L** feet (see (271). What these examples have in common, though, is an alignment of the right edge of the root with the right edge of a foot:[55]

(269) ALIGN-R (Root, Foot) Align the right edge of the Root with the right edge of a Foot.

(270) a. (mé$_\mu$ʔ$_\mu$) H
b. (k'u$_\mu$t.xá$_{\mu\mu}$n) LH
c. (pe$_\mu$k͡ló$_\mu$) LL

What establishes even more definitively that foot alignment is to the right edge of the Root is that trisyllabic roots also show main stress falling on the last syllable, as in (271) and (273).

(271)
a. t͡ʃa.(xa.ní) 'wild boar' — a'. *(t͡ʃa.xá).ni
b. ni.(βa.k͡lé) 'man/person' — b'. *(ni.βá).k͡le
c. ju.(ku.βé) 'bread' — c'. *(jukú)βe
d. [ʔ]ɑ.(xɑ.k͡lɑ́) 'bird' — d'. *([ʔ]ɑ.xɑ́).k͡lɑ
e. [ʔ]a.(k͡la.βó) '*caracolero* (bird)' — e'. *([ʔ]a.k͡lá.)βo

(272)
a. si.(βo.k͡lók) 'spider/bicycle' — a'. *(si.βó)k͡lok
b. ta.(βa.ʃáj) 'countryside' — b'. *(ta.βá).ʃáj
c. ɑ.(jin.t͡ʃé) 'pepper' — c'. *(ɑ.jín).t͡ʃe

[55] Even though the forms in (271)-(273) might be historically polymorphemic, a morphemic breakdown is not straightforward and hence they are here considered "roots".

What the unattested (*) forms on the right side of each data set show is that even though the first two syllables could be parsed together into a well-formed foot, this is not what happens. Rather, a bi-syllabic foot is right-aligned with the Root edge. In all of the above tri-syllabic forms, the initial syllable that remains unparsed is consistently a light open syllable. In contrast, what is seen in (273) is that if an initial syllable (in an otherwise comparable trisyllabic form) is closed, then it also will be parsed, resulting in an output with two feet: an initial as a CVC MinFt followed by a regular bisyllabic iambic foot:

(273) a. (pùʔ)(xa.ná)
‘three’
b. ([ʔ]àk).(xe.k͡lá)
‘woman’

The rightmost foot receives primary stress (a pervasive generalization in Nivaĉle) accounted for by non-violation of the constraint RIGHTMOST (R-MOST), and the initial CVC foot receives secondary stress (§4.5.6). A second important generalization governing foot construction is that stressed syllables (a.k.a. the foot heads) are never directly adjacent in the output: consequently, the *CLASH constraint, which mitigates against adjacent stressed syllables, is defined below, and will be shown to be unviolated in the tableaux throughout this chapter.

(274) RIGHTMOST: The head foot is final in PrWd.

(275) *CLASH: No stressed syllables are adjacent.

The following tableau for (273b) ‘woman’ illustrates the interplay of a number of the constraints that have been discussed to this point, and establishes the crucial ranking of PARSE-σ » FT-BIN-σ. Other evidence for relative constraint rankings will be presented throughout the sections to follow. Note that ONSET consistently forces a DEP-IO-ʔ violation in word-initial position (§2.3.1.2 and §3.4) and for ease of exposition is not included in the tableau in (277).

(276) [ʔàk.xe.k͡lá] ‘woman’

Crucial ranking: PARSE-σ » FT-BIN-σ

(277)

/ ɑkxek͡lɑ /	R-MOST	*CLASH	MINFT = CVC	ALIGN-R(Rt, Ft)	PARSE-σ	FT-BIN-σ
a. ([ʔ]ák)(xek͡là)	*!					*
b. ([ʔ]ɑk.xé) k͡lɑ				*!	*	
c. ([ʔ]ɑk.xè)(k͡lá)		*!	*			*
d. [ʔ]ɑk.(xe.k͡lá)					*!	
e.☞([ʔ]àk)(xe.k͡lá)						*

Comparison of the above tableau with one for a trisyllabic word with an initial light/open syllable, such as ‘spider/bicycle’, reveals the requisite rankings of both *CLASH and MINFT = CVC above PARSE-σ :

(278) [si.βo.k͡lók] ‘spider/bicycle’

Crucial rankings: *CLASH, MINFT = CVC » PARSE-σ

Summary: *CLASH, MINFT = CVC » PARSE-σ » FT-BIN-σ

(279)

/ siβok͡lok /	*CLASH	MINFT = CVC	ALIGN-R(Rt, Ft)	PARSE-σ	FT-BIN-σ
a. (si.βó).k͡lok			*!	*	
b. (si.βò)(k͡lók)	*!				*
c.☞ si.(βo.k͡lók)				*	
d. (sì)(βo.k͡lók)		*!			*

Given that the initial CVC syllable of [ʔàk.xe.k͡lá] ‘woman’ is stressed as its own foot as seen in (277) above, how do the postulated constraints not apply to stress the initial CVC syllable of a bisyllabic root like [k’akxó] ‘armadillo’? As shown in the tableau below, the constraints *CLASH and

ALIGN-R(Rt, Ft), along with the other motivated constraints, conspire to ensure an optimal binary iambic foot:

(280) k'ak.xó 'armadillo'

(281)

/ k'akxo /	*CLASH	MINFT = CVC	ALIGN-R(Rt, Ft)	PARSE-σ	FT-BIN-σ
a. (k'ák).xo			*!	*	*
b. k'ak.(xó)		*!		*	*
c. (k'àk)(xó)	*!	*			**
d. ☞ (k'ak.xó)					

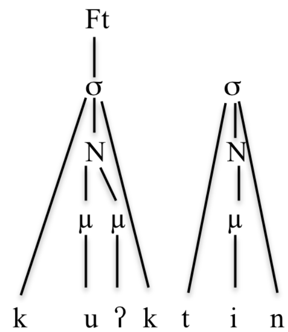
However, a consideration of other bisyllabic root forms reveals that it is not always the case that stress is aligned with the right edge:

(282) a. [kṵ́k.tɪn]
/kuʔktin/
'thunder'
b. [tɑ̰́ʔ.ɬəs]
/tɑʔɬɑs/
'pot'
c. [jóʔ.nɪs]
/joʔnis/
'fox'
d. [βéʔ.ɬə]
/weʔɬa/
'one'

What characterizes all these forms is the presence of a creaky/rearticulated vowel or a vowel-glottal coda in the first syllable. Stress falls on that syllable, and the unstressed vowel is reduced.

Under the hypothesis advanced in §4.3 that glottal stop is associated with a mora, and the further hypothesis that no other segments (other than vowels, of course) in Nivaĉle are weight-bearing, these forms are analyzed as having an initial heavy syllable. As illustrated in (283), this is parsed into a monosyllabic bimoraic ‘heavy’ foot (H). The syllable that follows is, under the constraints of the present analysis, predicted to be unstressed because it is unparsed.

(283)



Data such as (282) show that there is a conflict between WEIGHT-TO-STRESS (247), the ALIGN-R(Rt, Ft) alignment constraint, introduced in (269), and repeated here for convenience (284), (285), respectively, and Parse-σ (286). Also, because the glottal associated with the second mora of the first syllable does not get deleted in order to favour final stress, the faithfulness constraints in (287) and (288) must be more highly ranked than ALIGN-R(Rt, Ft):

(284) WEIGHT-TO-STRESS PRINCIPLE (WSP): Heavy (i.e. bimoraic) syllables are stressed.

(285) ALIGN-R (Root, Foot): Align the right edge of the Root with the right edge of a Foot.

(286) PARSE-σ: A syllable must be parsed into a foot.

(287) MAX-IO-[μ]: Input moras must have output correspondents.

(288) MAX-ʔ: Every /ʔ/ in the input must have a correspondent in the output.

Because in the data to be considered in this chapter, the glottal segment /ʔ/ and its associated μ remain affiliated with each other (i.e. where there is deletion, they both delete), the two faithfulness constraints will for presentational purposes be abbreviated as Max-IO-ʔ/μ in the tableaux to follow.

Consider how these constraints apply to the various candidates in (282). Again, in all the tableaux to be presented, all candidates obey R-MOST.

(289) [kʊ̰́ktin] 'thunder'

Crucial rankings: *CLASH, WSP » AL-R(Rt, Ft), PARSE-σ

MaxIO-ʔ/μ » AL-R(Rt, Ft), PARSE-σ

(290)

/kuʔktin/	*CLASH	WSP	MAXIO-ʔ/μ	ALIGN-R (Rt, Ft)	PARSE-σ	FT-BIN-σ
a. ☞ (kʊ̰́k).tin				*	*	*
b. kʊ̰k.(tı́n)		*!			*	*
c. (kʊ̰k.tı́n)		*!				
d. (kʊ̰̀k).(tı́n)	*!					**
e. (kuk.tı́n)			*!			

What is seen is that all of the candidates (b-e) that respect AL-R(Rt, Ft) violate some other more highly ranked constraint. In neither candidate (b) nor (c) is the glottalized vowel (a heavy Nucleus) in the initial syllable stressed, thereby violating the WEIGHT-TO-STRESS PRINCIPLE (WSP). In candidate (d), this syllable is footed as a well-formed CVC MinFt (which receives secondary stress: see §4.5.6) so it obeys WSP, but the resultant two adjacent monosyllabic feet violate *CLASH. As none of the forms in my Nivaĉle database ever violate WSP or *CLASH, these constraints stand at the extreme left of the constraint rankings. There are, however, various contexts in Nivaĉle where deglottalization occurs (see especially §2.5.5 and §6.5), which means in the theoretical framework adopted here that the faithfulness constraint Max-IO-ʔ/μ is violable. Nonetheless, candidate (e), where deglottalization has occurred in the initial syllable, is not the winning candidate: this is not a context for deglottalization. The fact that candidate (a) is the attested output establishes that MaxIO-ʔ/μ crucially outranks ALIGN-R(Rt, Ft).

The tableau in (284) establishes that bisyllabic roots with an initial [Vʔ] syllable behave the same way.

(291) [jóʔnɪs] 'fox'

(292)

/ joʔnis /	*CLASH	WSP	MaxIO-ʔ/μ	AL-R (Rt, Ft)	PARSE-σ	FT-BIN-σ
a. ☞ (jóʔ).nɪs				*	*	*
b. joʔ.(nîs)		*!			*	*
c. (joʔ.nîs)		*!				
d. (jòʔ).(nîs)	*!					**
e. (jo.nîs)			*!			

In summary, the data discussed so far shows that the right edge of the Root is aligned with the right edge of a Foot unless the penultimate syllable has a glottalized vowel. Under the hypothesis that /ʔ/ is moraic, such syllables are heavy; the fact that these heavy syllables are consistently correlated with stress in Nivaĉle is accounted for in the present analysis by positing that *CLASH, WSP, and Max-IO-ʔ/μ are all crucially ranked above ALIGN-R(Rt, Ft) and PARSE-σ.

4.5.2.1 Loanword Phonology

Loanword phonology can also provide arguments in favor of Nivaĉle Righmost prominence and iambic foot type. Loanword phonology involves the interplay of competing constraints between two grammars; when adapting a non-native word, speakers may remain faithful to certain properties of the language source while obeying the target/borrowing language's phonotactic and prosodic constraints (Kenstowicz 2005). Similarly to other Chaco languages (Vidal & Nercesian 2009:7), the contact between Nivaĉle and Spanish developed fairly late. Whereas other South American languages, for instance Imbabura Quechua, came into contact with Spanish in the 14th century (Gómez Rendon & Adelaar 2009), the contact between the Chaco languages and Spanish took place at the end of the 19th century and beginning of the 20th century.[56] Very few words that are borrowed from Spanish and adapted to the Nivaĉle phonology can be found in the Nivaĉle lexicon. It is worth noting that none of these loanwords seem to have been introduced through other Mataguayan languages. Only (293a) [waka] (without indication of stress) is found for Maká (Gerzenstein 1994: 545).

[56] Recall from Chapter 1 that, even though the Anglicans made contact with the Nivaĉle people at the end of the 19th century and tried to settle down and establish missions, it was not until 1925 with the arrival of the Missionary Oblates of Mary Immaculate that the first stable mission (San José de Esteros) was created (Fritz 1995).

(293)

Gloss	Spanish	Nivaĉle		
a. *cow*	[bá.ka]	[wɑ.qɑ́]	~	[βɑ.qɑ́]
(*cows*	[bá.kas]	[wɑ.qɑ́s]	~	[βɑ.qɑ́s])
b. *soap*	[xa.βón]	[fa.wóm]	~	[fa.βóm]
c. *horse*	[ka.βá.ʝo]	[ku.wɑ.jú]	~	[ku.βɑ.jú]
(*horses*	[ka.βá.ʝos]	[ku.wɑ.jús]	~	[ku.βɑ.jús])
d. *watermelon*	[san.dí.a]	[sa.ni.jɑ́]		
e. *cigar*	[si.ɣá.ro]	[si.ja.ló]		
f. *majordomo*	[ma.joɾ.ðó.mo]	[màj.lo.má]		

Note first that no loanword from the Spanish lexicon belongs to the inalienable class of nouns. Interestingly, though, disyllabic, trisyllabic, and quadrisyllabic words display (primary) final stress even though primary stress usually falls on the penultimate syllable of the Spanish words (the only exception is (293b) [xaβón]).[57] The pattern observed in the loanwords (293) provides additional support to the proposal that primary stress is rightmost. Interestingly, the Nivaĉle adaptation of 'majordomo' (293f) shows an initial CVC syllable with secondary stress, a topic that will be further discussed in §4.5.6.[58]

4.5.3 MSt1: Derivational suffixes

Let us now turn to the interplay between roots, derivational suffixes, and stress assignment. Of particular significance is the observation that derivational suffixes 'shift' stress to the right, that is, stress falls on the rightmost syllable of the MSt1, rather than on the rightmost syllable of the internal root.[59]

The following pairs of related forms provide evidence for the iambic foot being aligned with the right edge of the MSt1. The data in (294d) and (295b) provide additional examples of an initial CVC foot which receives secondary stress. (See §4.5.6 for detailed discussion).

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[57] Interestingly, the [x] from Spanish gets incorporated into Nivaĉle as [f]. While, it is not clear the date when this word was introduced in the lexicon, I have noticed an alternation between [f] and [x] in native Nivaĉle words even within speakers: e.g. [ʔakfi] ~ [ʔakxi] 'inside of'.

[58] Concomitantly, note that (293f) is providing a further argument for the glide [j] being parsed into coda position.

[59] As will be also shown in the following sections, Nivaĉle stress system is edge oriented and so it does not resemble the case of dominant/recessive languages (Hill &Hill 1968, Crowhurst 1994, Alderete 2001).

(294) a. (xa-fín)
1S-suck/kiss
'I suck/kiss'

b. (fi.n-ɑ́k) b'. *(fí.nɑk)
suck-NOM/RES
'tobacco'

c. (fìn)-(kɑ-náx)
suck-RES-AG
'smoker'

d. (fìn)-(kɑ-xíj)
suck-NOM/RES-CON
'pipe'

(295) a. (sa.múk)
'excrement'

b. (sàm)-(ku-xíj)
excrement-CON
'latrine'

(296) a. (jik͡lɑ́ʔ)
'wood'

b. ji(k͡lɑ-níɬ)
wood-MAT
'(it is) made of wood'

(297) a. (si.sé)
'cane'

b. si.(sɪ-t͡ʃát)
cane-COL
'cane field'

c. *(si.sé)t͡ʃat

d. *(si.sè)(t͡ʃát)

Thus far, the appropriate generalization about primary stress assignment is made with respect to the right edge of the MSt1. In each pair of morphologically related words (294)-(297), stress consistently falls on the last syllable. Suffixation to unprefixed roots remains consistent with rightmost stress. To put it differently, iambic feet are formed from the rightmost edge of the MSt1.

In addition, two other observations can be made with regards to these data. First, one of the phonetic concomitants of stress 'shift' from the second to the third syllable in examples (286)-(289) above, like [(si.sé)] 'cane' and [si.(sɪ-t͡ʃát)] 'cane field', is allophonic variation in vowel quality: for example, in (289a) the stressed vowel [e] gets reduced to [ɪ] (289b) when it surfaces in an unstressed position. These low-level realizations are entirely predictable and hence are not focussed on in the present analysis. A second and more major phonological process – metathesis – is evidenced in alternations like (294b) [fi.n-ɑ́k] 'tobacco' and (294c) [fìn-kɑ-náx] 'smoker'. The conditions governing metathesis are discussed in detail in Chapter 6. The effects of metathesis do not, however, impact on the surface regularity of the stress patterning of these forms, and therefore they are included in the data considered here.

To account for the locus of stress in these data, the only new constraint that is needed is one that invokes alignment to the right edge of the derived MStem1, rather than the right edge of the Root. Clearly, the observed patterns of stress 'shift' show that this Align-R(MSt1, Foot) outranks Align-R(Rt, Foot). The relevant constraints required to account for these MSt1 suffixed data are repeated below, for convenience. Note that henceforth, for economy of space, the ALIGN-R constraints will be abbreviated in the tableaux as AL-R/MSt1 and AL-R/Rt, and MINFT = CVC will simply be MINFT.

(298) RIGHTMOST: The head foot is final in PrWd. (cf. (274))

(299) *CLASH: No stressed syllables are adjacent. (cf. (275))

(300) MINFT = CVC: The Minimal Foot is a CVC syllable. (cf. (268))

(301) ALIGN-R (Rt, Ft): Align the right edge of the Root with the right edge of a Ft. (cf. (285))

(302) ALIGN-R (MSt1, Ft): Align the right edge of the MSt1 with the right edge of a Foot.

(303) PARSE-σ: Feet are parsed by syllable. (cf. (286))

(304) FT-BIN-σ: Feet are binary at the syllabic level. (cf. (267))

The following tableau for (297b) adds the relative ranking of AL-R/MSt1 » AL-R/Rt into the ranked relationships already established:

(305) [si.(sɪ-t͡ʃát)] 'cane field'

New crucial ranking: AL-R/MSt1 » AL-R/Rt

sise]$_{Rt}$ -t͡ʃat]$_{MSt1}$	*CLASH	MINFT	AL-R/MSt1	AL-R/Rt	PARSE-σ	FT-BIN-σ
a. (si.sé)-t͡ʃat			*!		*	
b. (si.sè)(t͡ʃát)	*!					*
c.☞ si.(se-t͡ʃát)				*	*	
d. (sì)(se.t͡ʃát)		*!				*

Compare now the case of a monosyllabic root [fin] with two MStem1 suffixes, in order to verify the established rankings. Note that I removed MINFT from the tableau because all feet satisfy it, and I have added RIGHTMOST in order to show that candidate (c) is not optimal.

(306) [fìn-kɑ-náx] 'smoker'

fin]$_{Rt}$-kɑ-nax]$_{MSt1}$	R-MOST	*CLASH	AL-R/MSt1	AL-R/Rt	PARSE-σ	FT-BIN-σ
a. (fin-kɑ́)-nax			*!	*	*	
b. (fin-kɑ̀)(-náx)		*!		*		*
c. (fín).(-kɑ.-nàx)	*!					*
d. fin (-kɑ.-náx)				*!	*	
e.☞ (fìn).(-kɑ.-náx)						*

It is data such as the following that clearly establish the necessity of differentiating alignment to the Root edge compared to the MStem1 edge:

(307) a. (ta.k͡ló̰k)
'weed'

b. ta(k͡lok-t͡ʃát)
weed-COL
'scrub'

c. *(tak͡lǫ́k).t͡ʃat

d. *(ta.k͡lòk)-(t͡ʃát)

(308) a. (ji.jéʔ)

‘*caraguata*’

b. ji(je-t͡ʃát)

caraguata-COL

‘a place where the caraguata plant lives’

c. *(jijéʔ)-t͡ʃat

d. *(jijèʔ)-(t͡ʃát)

What is unexpected in these data sets is the ill-formedness of the forms in (c). For example, note that the glottal stop in the second syllable of [jijéʔ] ‘*caraguata*’, does *not* get realized in the suffixed form, [jije-t͡ʃát] ‘a place where the *caraguata* plant lives’. As will be recalled from §4.5.2, this is directly opposite to what happens within a root like [jóʔnɪs] ‘fox’, where foot alignment to the edge of the Root was violated, in order to maintain faithfulness to the underlying glottal segment and its associated mora.

The different behaviour of these two sets of data focusses on a very interesting question. Whereas (i) R-edge alignment applies to both the Root and the MStem1 domains to effect the basic generalization that stress is word-final; and (ii) the R-edge of the MStem1 domain will subsume and override the effects of alignment to the R-edge of the Root, e.g. (297b) si(sɪ-t͡ʃát) ‘cane field’, one might therefore ask whether there is any need for reference to the R-edge of the Root, independently of the R-edge of the MSt1. It is the violation of R-edge alignment in words like [jóʔnɪs] ‘fox’ which establish that there is.

Recall the constraints governing weight-sensitivity and Faithfulness to underlying glottal identity (amalgamated in the tableaux as MAX-IO-ʔ/μ):

(309) WEIGHT-TO-STRESS PRINCIPLE (WSP): Heavy (i.e. bimoraic) syllables are stressed. (cf. (284))

(310) MAX-IO-[μ]: A mora in the input has a correspondent in the output. (cf. (287))

(311) MAX-IO-ʔ: Every ʔ in the input must have a correspondent in the output. (cf. (288))

Recall also that a comparison of candidates (a) and (e) from the tableau in (292), repeated here below, motivate a crucial ranking of MAX-IO-ʔ/μ » AL-R/Rt:

(312) [jóʔnɪs] 'fox'

MAX-IO-ʔ/μ » AL-R/Rt

/ joʔnis /	*CLASH	WSP	MAX-IO-ʔ/μ	AL-R/Rt	PARSE-σ
a. ☞ (jóʔ).nɪs				*	*
e. (jo.nís)			*!		

In turn, candidates (a) and (c) in the tableau from (305) above for [si.(sɪ-t͡ʃát)] 'cane field' establish that AL-R/MSt1 » AL-R/Rt:

(313) [si.(sɪ-t͡ʃát)] 'cane field'

Crucial ranking: AL-R/MSt1 » AL-R/Rt

sise]$_{Rt}$ -t͡ʃat]$_{MSt1}$	*CLASH	MINFT	AL-R/MSt1	AL-R/Rt	PARSE-σ
a. (si.sé)-t͡ʃat			*!		*
c.☞ si.(se-t͡ʃát)				*	*

Now, consider how the constraints that have been independently motivated in the preceding analysis would handle the diversity of candidates related to the form from (308) [jijet͡ʃát] 'place where the caraguata plant lives'. As before, note that all the candidates obey RIGHMOST (hence it is not included in the tableau):

(314) [jijet͡ʃát] 'place where the caraguata plant lives' (cf. (308))

Crucial ranking: AL-R/MSt1 » MAX-IO-ʔ/μ

(315)

jijeʔ]$_{Rt}$ -t͡ʃat]$_{MSt1}$	*CLASH	WSP	MINFT	AL-R/MSt1	MAX-IO-ʔ/μ	AL-R/Rt
a. (ji.jèʔ)(t͡ʃát)	*!					
b. ji.(jeʔ.t͡ʃát)		*!				*
c. (jì)(je.t͡ʃát)			*!		*	*
d. (ji.jéʔ).t͡ʃat				*!		
e. ☞ ji.(je.t͡ʃát)					*	*

Even though candidate (a) in the tableau in (315) satisfies both alignment constraints, i.e. ALIGN-R(MSt1,Ft) and ALIGN-R(Rt,Ft), as well as the MAX-IO-ʔ/μ faithfulness constraints, it violates the highly ranked *CLASH constraint. What candidate (b) confirms is that WSP is inviolable in Nivaĉle; in comparison with the winning candidate (e), the crucial ranking of WSP above MAXIO-ʔ/μ is clearly evident. Candidate (c) avoids a violation of high-ranking WSP through deletion of the /ʔ/ and its associated mora [μ]: the primary stress foot aligns with the R-edge of the derived MStem1, but the parsing of the initial sub-minimal CV syllable into an ill-formed foot fatally violates the MINFT = CVC constraint. Of particular interest is a comparison of candidates (d) and (e), as they provide evidence for the crucial ranking of AL-R/MSt1 » MAXIO-ʔ/μ.

In summary then, the following ranking relations have been established in these last three tableaux:

(316)	MaxIO-ʔ/μ » AL-R/Rt	(312)	a. (jóʔ)nis	vs.	e. (jonís)
(317)	AL-R/MSt1 » AL-R/Rt	(313)	a. (si.sé)-t͡ʃat	vs.	b. si.(se-t͡ʃát)
(318)	AL-R/MSt1 » MAX-IO-ʔ/μ	(315)	d. (ji.jéʔ).t͡ʃat	vs.	e. ji.(je.t͡ʃát)

The crucial ranking of the MAX-IO-ʔ/μ constraint in between AL-R/MSt1 and AL-R/Rt shows that the two R-edge alignment constraints are indeed functioning as independent constraints in Nivaĉle, and importantly shows that R-edge alignment to the internal Root constituent is not totally obliterated by the more highly ranked R-edge alignment to the derived MStem1.

These Nivaĉle stress facts provide further empirical evidence for the claim in Shaw (2009; also Kiparsky 2000; Hyman & Katamba 1999; among others) that "constraints on prosody may access internally embedded morphological constituency" (2009: 241). As is argued by Shaw for the Salish hən̓q̓əmin̓əm̓ language, this hypothesis is crucial to an analysis in Nivaĉle of data that would otherwise be opaque (or would be interpreted as "exceptional", with a loss of insight into the systematic nature of the phenomena involved). The hypothesis that I argue for in Nivaĉle is that three major word-internal domains – the Root, MStem1, and MStem2 – are "visible" in the parsed string that is available in the

Output for constraint evaluation. What has been argued for in this section is that the right edge of the Root defines a prosodically significant domain for stress, and must be identifiable in the Output string.

However, a further interesting question now arises regarding the identification of the relevant domain of edge alignment for a *non-derived* form, for example, for a Root without any MStem1 suffixes. Under the standard assumption that the nested constituents in the hierarchically organized MCat tree presented in Figure 4.2 are defined by the succesive layered dominance relations within the "morphological word" (MWd) category, then a Root *is an* MStem1 which *is an* MStem2 which *is an* MWord. Given (i) that a Root without any affixes is also an MStem1, and given (ii) the established ranking of AL-R/MSt1 » MaxIO-ʔ/μ » AL-R/Rt (see (316)-(318)), then a reconsideration of the previous analysis for [jóʔnis] 'fox' (see the tableau in (320)) reveals that the attested candidate [jóʔnis] is no longer evaluated as the optimal candidate, once the higher-ranked AL-R/MSt1 is added in to the constraint sequence. Note that an X marks the problematic constraint evaluation for what "should" be the optimal candidate (a), and an X also marks candidate (e) that is "wrongly" evaluated as optimal.

(319) *CLASH, WSP » AL-R/MSt1 » MAXIO-ʔ/μ » AL-R/Rt, PARSE-σ

(320)

joʔnis]Rt]MSt1	*CLASH	WSP	AL-R/MSt1	MaxIO-ʔ/μ	AL-R/Rt	PARSE-σ
a. ☞ (jóʔ).nɪs			X*		*	*
b. joʔ.(nîs)		*!				*
c. (joʔ.nîs)		*!				
d. (jòʔ).(nîs)	*!					
e. X (jo.nîs)				*!		

A comparison of this tableau, which gives the "wrong" result for words like [jóʔnis] 'fox', with the tableau in (315), which – with the very same constraint ranking - gives the "right" result for words like [jijet͡ʃát] 'place where the caraguata plant lives', leads to the hypothesis that the principal issue relates not to the proposed constraint ranking, nor to the postulated relevance of the specific MCat domains, but rather to the formal distinction as classically discussed in Kiparsky (1993) between "derived" and "non-derived" forms.[60] Consider how the morphological structure of these two words differs.

Table 4.1 Morphologically derived vs non-derived and relevant domains

	Morphologically derived status	**Domain of constraint evaluation**
joʔnis]Rt]MSt1	non-derived	internal]Rt domain edge
jijeʔ]Rt -t͡ʃat]MSt1	derived	outer]MSt1 domain edge

What is proposed therefore is that the **MCat domain of relevance** for the evaluation of prosodic alignment constraints for stress in Nivaĉle is the MCat domain that is defined by the outermost layer of overt affixation. If there has not been any explicit affixation between a major Morphological Category and the next hierarchically dominant Morphological Category, then the former domain – the "non-derived" domain - remains the MCat domain of relevance. If, as is proposed here, the major MCat domains (Root, MStem1, MStem2, and MWord) are labelled in the Input/Output candidates under evaluation, then the requisite information to assess whether a candidate is morphologically derived or non-derived is transparently accessible. How this will be implemented in the context of constraint evaluation in the present analysis is to adapt Kiparsky's (1993) proposed Non-Derived Environment Blocking (NDEB) condition: specifically, an alignment constraint can be satisfied by a candidate (no violation); be violated by a candidate (marked by *), or blocked from applying to a candidate (marked NDEB). The major tenets of this proposal are summarized below:

(321) a. **MCat domain of relevance:**

The MCat domain of relevance for the evaluation of prosodic alignment constraints is the MCat domain defined by the outermost layer of affixation.

[60] Note that here I am referring to blocking in morphologically (and not phonologically) non-derived forms.

b. **Morphological Categories** of relevance in Nivaĉle:

MWord > MStem2 > MStem2 > Root

c. **Non-Derived Environment Blocking Condition: (NDEB)** (cf. Kiparsky 1993)

A constraint may be blocked from applying to a non-derived form.

d. **Constraint Evaluation**: A constraint can be:

- satisfied by a candidate (no violation);
- violated by a candidate (marked by *); or
- blocked from applying to a candidate (marked NDEB).

Although non-derived environment effects are recognized and discussed in the literature, there is no consensus as to how they might be most effectively handled within an Optimality Theoretic model. Of particular interest is that among the various cases and proposed analyses,[61] I am not aware of another case like Nivaĉle where the non-derived blocking effects apply within a prosodic domain: to clarify, the constraints that are subject to the NDEB in Nivaĉle are prosodic edge-alignment constraints. In the interests of transparency and in the hopes that the Nivaĉle case can contribute an additional body of empirical data to the literature and hence deepen insights into the range of systematic non-derived environment behaviours, the proposed analysis here simply labels as “NDEB” (Non-Dervied Environment Blocking) the contexts where the relevant edge-alignment constraint is “blocked” because no additional morphological content has been added to create a morphologically-derived environment. The intent therefore is that the “NDEB” label capture the generalizations of the Nivaĉle data, and thereby identify a significant, systematic phenomenon that merits further investigation. The potential extent to which other types of constraints may manifest similar behaviours cross-linguistically is an open issue for future research.

[61] See McCarthy (2003) for a comparative markedness approach to derived environment effects, and Wolf (2008) for a review of non-derived environment blocking.

In order to see how the NDEB hypothesis applies in Nivaĉle, let us revisit the tableau in (320) for the morphologically non-derived root:[62] joʔnis]$_{Rt}$]$_{MSt1}$

(322) *CLASH, WSP » AL-R/MSt1 » MAXIO-ʔ/μ » AL-R/Rt » PARSE-σ

(323)

joʔnis]$_{Rt}$]$_{MSt1}$	*CLASH	WSP	AL-R/MSt1	MaxIO-ʔ/μ	AL-R/Rt	PARSE-σ
a. ☞ (jóʔ).nɪs			NDEB		*	*
b. joʔ.(nîs)		*!				*
c. (joʔ.nîs)		*!				
d. (jòʔ).(nîs)	*!					
e. (jo.nîs)				*!		

The fact that candidate (a) is a bare root, with no MSt1 suffixes attached, means that when it is evaluated by the AL-R/MSt1 Alignment constraint, the constraint is "blocked" from applying because the candidate has no morphological content in the targeted MSt1 domain that is not fully co-extensive with the Root domain.

Other examples of non-derived forms being subject to this NDEB blocking condition will be seen in the next section.

4.5.4 The MSt2 domain: Possessive prefixation

In this subsection, the next higher domain for stress assignment, namely the MSt2, will be analyzed. As discussed in Section 4.4, inalienable roots obligatorily require the presence of a possessive prefix; alienable roots can be optionally possessed. What is shown here is that possessive prefixes mark the leftmost edge of the MSt2. Further, since there are no other layers of prefixes, this coincides with the left edge of the Prosodic Word for nouns.

As previously mentioned, the prefixes that can stand on the left edge of roots are possessive pronouns, which can concatenate with possessive classifiers and "temporary possessor" markers (cf. Table 4.2).

[62] Looking ahead, this root form for 'fox' is not only a "non-derived" MSt1, but also a "non-derived" MSt2, and a "non-derived" MWord.

Table 4.2 Nivaĉle pronominal possessive paradigm (cf. Table 2.11)

PERSON	POSS.SING	PLURAL
1	ji- ~ j-	
1 Inclusive		kas- ~ kat͡s- ~ kat͡s'- ~ kat͡si- ~ kat͡s'i-
1 Exclusive	ji- ~ j- +	ʔeɬ ~ eɬ
2	ʔa ~ ʔ	-ʔeɬ ~ -eɬ
3	ɬa- ~ ɬ- t'a- ~ t'-	
INDEFINITE	wa- ~ wat- ~ wat'- wata- ~ wat'a- n- ~ na-	

The allomorphic variation found in the possessive paradigm is to a large extent phonologically conditioned. However, there are certain alternations that are not well understood: for instance, the conditions behind the ejective vs. plain forms alternants in the first person plural inclusive [kat͡si- ~ kat͡s'i-] and the indefinite possessive [βata- ~ βat'a-].

Regarding the phonologically conditioned alternations, a major phonotactic constraint active in the language is ONSET (§2.3.1). Essentially, whereas V-final prefixes attach to (C)C-initial roots, C-prefixes attach to vowel initial roots. Interestingly, during my fieldwork research, I found that 1POSS.PL [kas-] and [kat͡si-] are used almost interchangeably before consonant-initial roots. Stell's (1989:183) analysis of this alternation holds that [kas-] only occurs before C-initial roots and [kat͡si-] before CC-initial roots. During my fieldwork, I found variation of these two allomorphs across (and even within) speakers of different generations. Regardless, the important point raised by the [kas-] and [kat͡si-] alternation is the consequence for syllable parsing into a foot and hence for stress assignment. As will be seen in data like (337e, 337f) [kas-náʃ̰] ~ [kat͡sí-naʃ] 'our nose', there is a difference in stress placement and concomitantly in the realization or not of the glottal stop.

Alienable roots can be either directly possessed, that is, without any additional morphological marking other than the possessives listed in Table 4.2 or they can be possessed through the addition of a prefix that makes that alienable root inalienable [β-] ~ [ˀβ-] ~ [βi-], which can be analyzed as 'able to be possessed'; abbreviated as AB.POSS (Fabre 2014).[63]

With respect to stress, what the following data based on bare (unprefixed) vs possessed (prefixed) alienable roots show is that primary stress is aligned with the *left* edge of these derived MSt2 forms. The edge alignment of disyllabic forms is ambiguous, as either R-edge alignment (with Root/MSt1) or L-edge alignment with the MSt2 edge is consistent with the output. However, trisyllabic forms present crucial evidence for L-edge alignment:

(324) a. (sa.múk)
'excrement'
b. (ji-sá).muk
1POSS-excrement
'my excrement'
c. *ji(sa.múk)

(325) a. (k͡le.sá)
'knife'
b. (ji-k͡lé).sa
1POSS-knife
'my knife'
c. *ji(k͡le.sá)

(326) a. ([ʔ]i.tɑ́x)
'fire'
b. ([ʔ]a-β-í.)tɑx
2POSS-AB.POSS-fire
'your fire'

[63] Interestingly, the [ˀβ-] alternant is the only occurrence of a preglottalized consonant that I have found in the language. This prefix is mostly used with alienable nouns that express elements from nature, e.g, 'water', 'fire', 'tree', 'stone'. Interestingly, this prefix is not being regularly used by younger generations (FR, p.c.). For instance, a glottal stop (instead of [β]) can be found in (316b): [t'aʔísi] 'his/her beauty'.

c. *ʔa(βi.tɑ́x)

(327) a. (∅-[ʔ]ís)
3s-nice
'
s/he/it is nice'

b. (t'a-β-í).s-i
3POSS-AB.POSS-nice-NMLZ
'his/her beauty'

c. *t'a(βisí)

The preceding examples provide evidence for stress assignment being made with reference to the left edge of the MSt2, the morphological domain marked by the possessive prefixes. Monosyllabic possessive prefixation to disyllabic stems, then, 'shifts' stress from the last syllable (a) to the penultimate (b). If foot parsing proceeded from the right edge of the MSt2, as it does for MSt1, the forms in (324c, 325c, 326c, 327c) would be expected. The hypothesis advanced here, then, is that the alignment constraint in (328) is higher ranked than both ALIGN-R(Rt, Foot) and ALIGN-R(MSt1, Foot).

(328) ALIGN-L (MSt2, Foot): Align the left edge of MSt2 with the left edge of a Foot.

(329) *CLASH, WSP, MINFT, AL-L/MSt2 » AL-R/MSt1 » MaxIO-ʔ/μ » AL-R/Rt, PARSE-σ

The crucial constraint ranking is:

(330) AL-L (MSt2, Ft) » AL-R(MSt1, Ft)

The following tableau is for (326b) [ʔaβítɑx] 'your fire' [2POSS-AB.POSS-[fire]]. Note that all candidates obey R-MOST and violate DEP-IO[ʔ] in order to satisfy ONSET (and so these constraints are not included in the tableau).

(331)

$_{MSt2}$[a-β-[itɑx]$_{MSt1}$]	*CLASH	MINFT	AL-L/MST2	AL-R/ MST1	PARSE-σ
a. ʔa-(β-i.tɑ́x)			*!		*
b. (ʔà-)(β-i.tɑ́x)		*!			
c. (ʔa-βì-)(tɑ́x)	*!				
d.☞ (ʔa-β-í.)tɑx				*	*

The stress alternations found in the related sets of data in (332)-(333) show another effect of foot formation from the left edge of the MSt2: the glottal in (332) and the glottalized vowels in (333) lose their laryngeal feature because they occur in a syllable that remains unparsed.

(332) a. (ʃin.βóʔ)
‘honey’
b. (ji-ʃín)βo
1POSS-honey
‘my honey’
c. *ji-(ʃin.βóʔ)
d. *(ji-ʃìn)(βóʔ)

(333) a. (jik.t͡sṵ́k)
‘silk floss tree’
b. (ʔa-β-ík.)t͡suk
2POSS-AB.POSS-canoe.made.of.silk.floss.tree
‘your canoe (made of the wood of a silk floss tree)’
c. *ʔa(βikt͡sṵ́k)
d. *(ʔaβìk)(t͡sṵ́k)

To recapitulate, the pair of forms in (332)-(333) shows stress “shifting” from the final to the penultimate syllable; the presence of the possessive prefix impacts on stress assignment. The generalization is that stress consistently falls on the second syllable from the left edge of the MSt2. The (d) examples provide further evidence for *CLASH being an undominated constraint in the language. Under an OT analysis, this apparent “shift” falls out of the ranking of constraints already motivated, as shown in tableau (331). Again, notice that all candidates satisfy RIGHTMOST and so this undominated constraint is not represented in the tableau.

(334) CLASH, WSP, MINFT, AL-L/MSt2 » AL-R/MSt1 » MAX-IO-ʔ/μ, AL-R/Rt

(335) Crucial ranking: MINFT = CVC, AL-L/MSt2 » MAX-IO-ʔ/μ

MSt2[ji-ʃinwoʔ]Rt	*CLASH	WSP	MINFT	AL-L/MSt2	MAX-IO-ʔ/μ	AL-R(Rt, Ft)
a. ji-(ʃin.βóʔ)				*!		
b. (jì)(ʃin.βóʔ)			*!			
c. (ji.ʃín).βoʔ		*!				*
d. (ji.ʃin)(βóʔ)	*!					
e.☞ (ji.ʃín).βo					*	*

Given the interaction between the output candidates in (335), it can be seen that Align-L(MSt2, Ft) has to be crucially higher ranked than MAX-IO-ʔ/μ, so that candidate (e) wins over candidate (a). In addition, WSP has to be higher ranked than MAXIO-ʔ/μ so that (e) wins over (c). Further, *CLASH and MINFT = CVC have to be higher ranked than MAXIO-ʔ/μ so that candidate (e) wins over candidates (d), and (e), respectively.

Compare, in that regard the following form, where an initial CVC syllable qualifies for being parsed into a foot (§4.5.6).

(336) (kàs)-(fetá̰s) 1POSS.PL- root/medicine 'our medicine'

MSt2[kas-[fetaʔs]Rt]	*CLASH	WSP	AL-L/MSt2	MAXIO-ʔ/μ	AL-R(Rt, Ft)	PARSE-σ	FT-BIN-σ
a. kas-(fe.tá̰s)			*!			*	
b. (kas-fé). tas				*!	*	*	
c. (kas-fé). ta̰s		*!			*	*	
d. (kas-fè)(tá̰s)	*!						*
e.☞ (kàs)-(fe.tá̰s)							*

Let us turn to a consideration of monosyllabic inalienable roots; it can be observed that stress also falls on the second syllable from the left edge of the possessive prefix. The full possessive singular paradigm is illustrated in (337). Of particular relevance is the alternation found in first person possessive plural forms (337e, f):

(337) **Inalienable monosyllabic roots**

a. ji-ná̰ʃ
1POSS-nose
'my nose'

b. ʔa-ná̰ʃ
2POSS-nose
'your nose'

c. ɬ-ná̰ʃ
3POSS-nose
'his/her nose'

d. βat-ná̰ʃ
INDEF.POSS-nose
'someone's nose'

e. kas-ná̰ʃ ~ f. kat͡sí-naʃ
1POSS.PL-nose
'our nose'

g. *kat͡siná̰ʃ

Examples (337e,f) provide another piece of evidence for supporting the claim that iambs are formed from the left edge of MSt2. The alternation between the first person plural possessive prefixes [kas-] and [kat͡sí] shows that an iambic foot is left aligned with the left edge of the MStem2. Even though, as mentioned earlier, the use of [kat͡sí-] has been extended to C-initial roots (i.e. in current usage as compared with the usage described by Stell 1989:183), the use of one or the other carries consequences for stress assignment. With [kas-], stress falls on the root, with [kat͡sí-], the root is left unparsed (due to *CLASH) and thus does not receive stress.

In contrast, the example in (338) below show an obligatory use of [kat͡sí-] and [βatá-]; the use of [kas] would result in an illicit triconsonantal cluster *[kas-β.ɬíʔ]. Again, the same effect is found: the monosyllabic root is not parsed into a syllable and it does not bear stress:

(338) a. (ji-β.ɬíʔ)
1POSS-rib
'my rib'

b. (ka.tsí-β).ɬi
1POSS.PL-rib
'our rib'
c. (βatá-β).ɬi
INDEF.POSS-rib
'someone's rib'

Similarly to example (337f), [ka.tsí-] bears primary stress and the root-final glottal stop does not get realized in (338b) or (338c) because under the left-edge alignment of the MSt domain, the root syllable does not get parsed into a foot. As proposed earlier, the head of a foot licenses glottalized vowels.

(339)

MSt2[wata-w-ɬiʔ/Rt	*CLASH	WSP	MINFT=CVC	AL-L/MSt2	MAXIO-ʔ/μ	AL-R(Rt, Ft)
a. βa(ta-βɬíʔ)				*!		
b. (βà)(taβɬíʔ)			*!			
c. (βatá-β).ɬiʔ		*!				*
d. (βatà-β)(ɬíʔ)	*!					
e.☞ (βatá-β).ɬi					*	*

Disyllabic inalienable roots display a similar behaviour to monosyllabic roots; stress falls on the second syllable from the left edge of the MSt2, the last syllable is left unparsed.

(340) a. ([ʔ]a-tí).niʃ
3POSS-necklace
'his/her necklace'
b. (ji-ká)t͡ʃa
1POSS-weapon
'my weapon'
c. ([ʔ]a-t͡ʃák).fa
2POSS-husband
'your husband'
d. (ji-k'út).xan
1POSS-thorn
'my needle'

Besides the [β]~[βi] prefix that makes alienable roots inalienable, there exists another morpheme that can stand between the possessives and the root: [ka] ~ [k'a]~ [k] ~ [k']. This prefix can attach to both alienable and inalienable roots. In the former case it functions as a possessive classifier since it can turn an alienable noun into an inalienable one. The possessive classifier indicates an indirect type of possession or a "transitory possession" (Stell 1989:187), meaning 'something that can be used/has been temporarily acquired by the possessor'. It so changes the connotation of the noun; e.g., [ɨ-áf] '(the bird's) feather', [ji-k-áf] 'my feather (the one I found/got)'.

When the possessive classifier occurs between the nominal root and a monosyllabic possessive prefix, stress is realized on this prefix, as in (341), consistent with the generalization that iambic feet are constructed with reference to the leftmost edge of the MSt2.

As previously mentioned, there are two basic functions the possessive classifier has. First, it makes alienable nouns possessable or usable by humans:

(341) a. (xṵ́k)
'firewood'
b. (ji-ká)-xuk
1POSS-POSS.CLASS-firewood
'my firewood'

Similarly, this possessive classifier can make nouns that are marked for third person possessive (e.g. 'feather of a bird', 'fruit of a tree') possessable. For instance, if the speaker wants to make reference to 'your fruit', [k-] has to be used:

(342) a. (ɨ-áʔ)
3POSS-fruit
'fruit (of a tree)'
b. (ʔa-k-áʔ)
2POSS-POSS.CLASS- fruit
'your fruit (the one you harvested)'

Second, this prefix introduces a new type of possessive relation between the possessed (if it is an inalienable noun) and the possessor. For instance, the Nivaĉle possessive system can encode a difference between the milk from a woman that is breastfeeding and the milk the speaker got from an animal. The prefix [ka-] creates another layer of distance between the possessor and the thing being possessed.

(343) a. (ji-t͡sǿ̰s)
1POSS-milk
'my milk (only of a woman that is breastfeeding)'
b. (ji-ká)-t͡sos
1POSS-POSS.CLASS-milk
'my milk (the one I got/bought)'

Note the deglottalization of root vowel in (b) since that syllable is left unparsed.

The possessive classifier [ka-] can also be found in kinship terms. The forms in (344)-(346) show that [ka-] classifies the noun by the type of relation between the possessor and the possessed (noun), namely, an extended layer of family relationship: in-law family members that are one generation younger than the ones in (a):

(344) a. (ji-t.xǿ̰k)
1POSS-uncle
'my uncle'
b. (ji-ká̰-t).xok
1POSS-POSS.CLASS-uncle
'my brother-in-law'

(345) a. (ji-k.t'ḛ́t͡ʃ)
1POSS-grandfather
'my grandfather'
b. (ji-ká-k).t'et͡ʃ
1POSS-CLASS-grandfather
'my father-in-law'

(346) a. (ji-k.t'éʔ)
1POSS-grandmother
'my grandmother'
b. (ji-ká-k)t'e
1POSS-POSS.CLASS-grandmother
'my mother-in-law'

In the above data set, the presence of [ka] introduces a number of changes; some of them have been already introduced. First, the glottalized vowel in (344a) and (345a) gets deglottalized in (344b) and (345b). In each case, the syllable that this moraic [c.g.] feature occurs in is not parsed into a foot. As has been argued, there is a pervasive generalization that [V̰] or [Vʔ] surface in Nivaĉle only in a stressed syllable. On the one hand, the constraint WSP plays an important role in creating an optimal prosodic context for the realization of [V̰] and [Vʔ]. However, if the other competing constraints on stress placement inhibit the realization of the glottal stop by a prosodic foot head, then it will not surface, resulting in a MAX-[μ] and a MAX-ʔ violation (recall that I have conflated these two constraints in the previous tableaux).

There is a puzzling aspect of some of the examples just presented in (344): why is it that the [c.g] feature seems to have moved from the nucleus of the root [jitxo̰k] to the preceding (prominent) syllable in (344b), [jiká̰txok]? If that is the case, then, why are not [jiká̰kt'et͡ʃ] and [jiká̰kt'e] optimal outputs for (345b) and (346b) respectively?

I propose the "new" [c.g.] feature that surfaces in the stressed syllable in (344b), i.e. the [c.g.] in [ji-ká̰-txok] 'my brother-in-law' does not come from the [c.g.] feature present in the postvocalic glottal stop /t'xoʔk/ in 'uncle', but rather from an underlying covert [c.g.] feature associated with the onset in the input, i.e. /t'/ as in /t'xoʔk/. Specifically, note that the related form 'my aunt' is [ji-t'óx], where the root has an ejective. I thus hypothesize that the input form for 'my uncle' is /ji-t'xoʔk/. Because ejectives can only occur before vowels (§2.5.5), the [c.g.] feature of the /t'/ is deleted in 'uncle'. The form is [jitxó̰k]; *[jit'xó̰k] is not a possible grammatical output, nor is it *[jḭt.xók] comparable to the [c.g.] "movement" in the (b) form, but here that syllable lacks stress. Further, there cannot be two adjacent glottalized vowels due to the undominated *CLASH AND WSP.

Further evidence for the [c.g.] being parsed into the Nucleus is shown in the following example:

		/ji-tʼxoʔk/
(347)	a.	(ji-t.xó̰k)
		1POSS-uncle
		'my uncle'
		/kat͡si-tʼxoʔk/
	b.	(kat͡sʼḭ́-t).xok
		1POSS.PL-uncle
		'our uncle'

In addition, parsing of [c.g.] from an onset into a preceding stressed nucleus can be found in other forms without underlying glottalized vowels. In (348b), there is no evidence that would motivate a hypothesis that the [c.g.] found in the first person plural possessive prefix comes from the following syllable.

		/ji-k'fij/
(348)	a.	(ji-k.fíj)
		1POSS-shoe
		'my shoe'
		/kat͡si-k'fij/
	b.	(kat͡s'ḭ́-k)fij
		1POSS-shoe
		'our shoe'

If we hypothesize that the first consonant of the root is underlyingly specified for [c.g.], namely /k'fij/, then the [c.g.] feature can be realized in the preceding adjacent syllable nucleus, and explain the emergence of a rearticulated vowel. Because this phenomenon is not found with all CC-initial roots, it would not be plausible to hypothesize that /kat͡siʔ/ is the underlying representation of the first person plural possessive prefix. For instance, glottalization in the possessive prefix is not found in the form for 'our thread':

(349) /kat͡si-ftiʔɬ/ 'our thread'
a. [(kat͡síf)tiɬ]
b. *[(kat͡sḭ́f)tiɬ]

The contrast between (348) and (349) carries an interesting implication. The variable parsing of [c.g.] can only occur across adjacent segments in the same syllable. Both the sponsor segment (the ejective) and the docking-site (the stressed vowel) need to occur in the same syllable for the [c.g.] to surface. For example, the first vowel /i/ is not immediately adjacent to the glottal stop in /kat͡siftiʔɬ/, as there are two intervening consonants. In contrast, the vowel /i/ is immediately adjacent to ejective /k'/ in /kat͡si-k'fij/. As a result, there is a complex nucleus with longer duration and primary stress is enhanced [kat͡sḭ́k'fij. The prediction of this analysis is that the only roots that can trigger glottalization in a prefix are CC-initial ones, where C1 is an ejective stop or affricate. While I do not offer a formal analysis for this [c.g.] movement at this point, it is important to note this interesting connection between the Nivaĉle glottal stop, weight, and their parsing to the Nucleus of the syllable.

In sum, the main argument of this section is that an iambic foot is constructed from the left edge of possessed nouns. It has been shown that alienable nouns that are possessed show stress being assigned with reference to the left edge of the MSt2.

4.5.5 The MWd domain: The plural suffix

Let us now consider the interplay between the inner suffixes that define MStem1 and the outermost suffix, namely the plural suffix. When the plural [-s] [-j] [-k] is added to a disyllabic or trisyllabic MSt1 respectively, stress consistently falls on the last syllable.

(350) a. (t͡ʃ'atʼá)
'turtle'
b. (t͡ʃ'atʼá-k) ~ (t͡ʃ'atʼá-s)
turtle-PL
'turtles'

(351) a. t͡ʃa.(xa.ní)
'wild boar'
b. t͡ʃa.(xa.ní-s)
wild boar-NOM.PL
'wild boars'

(352) a. (ta.núk)
'cat'
b. ta.(nu.k-[í]s)
cat-PL
'cats'

(353) a. (k'ut.xá̰n)
'thorn'
b. (k'ùt).(xan-[í]s)
thorn-PL
'thorns'

(354) a. (fâ̰j)-(ku-kát)
carob.fruit-PLANT.CLASS-COL
'stand of carob trees'
b. (fâ̰j)-ku-(kát-[í]s)
carob.fruit-PLANT.CLASS-COL-PL
'stands of carob trees'

(355) a. (ji-fé)tas
1POSS-root/medicine
'my root/medicine'
b. (ji-fè)(tat͡s[í]j)
1POSS-root/medicine-PL
'my root/medicine'

Note that an epenthetic vowel [i] is inserted to break up a potentially ill-formed syllable structure, i.e. a complex coda (356); DEP-IO-V is at play here:

(356) DEP-IO-V: An output vowel must have an input correspondent ('No V-epenthesis')

In addition, the other relevant alignment constraints is:

(357) *COMPLEXCODA
* CC]$_{\sigma}$ 'Codas are simple'. (cf. (191)).

(358) ALIGN-R(MWd, Foot): Align the right edge of the MWd with the right edge of a Foot.

(359)

[[tanuk]$_{Rt}$-s]$_{MWd}$	*CC]$_{\sigma}$	*CLASH	MINFT	AL-R/MWd	AL-R(Rt, Ft)	PARSE-σ	DEP-IO-V
a (tanúks)	*!				*		
b. (ta.nú)kis]				*!	*	*	*
c. (tà)(nu.kís)			*!		*		*
d. (ta.nù)(kís)		*!			*		*
e. ☞ ta(nukís)					*	*	*

As we have seen in previous tableaux, *CLASH, and MINFT = CVC are undominated constraints; candidates (c) and (d) are therefore not viable. Also, as introduced in §2.3, complex codas are not permitted in Nivaĉle; *CC]$_{\sigma}$ is an undominated constraint and so candidate (a) is not viable either. ALIGN-R(MWd, Ft) has to be higher ranked than ALIGN-R(Rt, Ft), PARSE-σ, and DEP-IO-V so that (e) wins over (b).

Examples (353b), (354) and (355b) illustrate cases of secondary stress. Examples (354b) and (355b) will be discussed in §4.5.6 and §4.5.7, respectively. In the following section, I analyze the assignment of secondary stress and the relationship between the morpho-phonological domains introduced so far.

4.5.6 Secondary stress & domain interaction

In example (308) – repeated here for convenience as (360) – a derivational suffix [-t͡ʃat] marks the right edge of the MSt1, gets primary stress, and the glottalized vowel in the preceding syllable is deglottalized.

(360) a. jijéʔ
'*caraguata*'

b. jije-t͡ʃát
caraguata-COL
'a place where the caraguata plant live'

c. *jijéʔ-t͡ʃat
d. *jijèʔ-t͡ʃát

A different situation is depicted by examples (361)-(363), in which a glottalized vowel or a vowel-glottal sequence still gets realized.

(361) a. (kṵ́k).tɪn
'thunder'
b. (kṵ̀k)(tɪ.n-ís)
thunder-PL

(362) a. (tɑ́ʔ).ɬɑs
'pot'
b. (tɑ̀ʔ)(ɬɑ.s-ík)
pot-PL
'pots'

(363) a. (jóʔ).nis
'fox'
b. (jòʔ)(ni.s-ík)
fox-PL
'foxes'

Recall that the last syllable of the (361a)-(363a) examples were unparsed (§4.5.2); here we can see that the root-final unparsed syllables in the (a) forms are counted towards foot formation in the (b) forms with plural affixation. There seems to be phonological conspiracy here in that MAX-IO-ʔ/μ and WSP conspire with PARSE-σ so that a syllable containing a glottal stop gets realized, is parsed into a foot, and gets stress. Crucially, the syllable containing the glottalized vowel and the one carrying the plural suffix are not adjacent; *CLASH is not compromised.

By contrast, the form in (360d) – [*jijèʔʃát] – is not an optimal candidate because it would involve two adjacent stressed syllables, thus in violation with *CLASH. As discussed in §4.2, feet have to be minimally CVC – a requirement fulfilled by the syllables bearing secondary stress in (361) – (363). The first syllable in (360), though, is open and it thus does not conform to foot minimality.

Let us consider the form in (361b): (kṵ̀k)(tɪ.n-ís) thunder-PL. The tableau in (364) shows secondary stress emerging as a way of preserving the underlying [c.g.] feature, WSP, and PARSE-σ. To put it differently, if CVC is footed, the [c.g.] feature in that syllable is preserved, and PARSE-σ is satisfied as well since the foot conforms to MINFOOT. Note that all the candidates violate DEP-IO-V and that all candidates satisfy RIGHTMOST; these constraints are not included for ease of exposition.

(364)

[kuʔktin]$_{Rt}$-s]$_{MWd}$	WSP	*CLASH	MINFT	AL-R/MWd	MAXIO-ʔ/μ	AL-R/Rt, Ft)	PARSE-σ	FT-BIN-σ
a. (kṵk.tí).nis	*!			*		*	*	
b. (kṵk.tì)(nís)	*!	*				*		*
c. kṵk.(ti.nís)	*!					*	*	
d. kuk(ti.nís)					*!	*	*	
e.☞ (kṵ̀k)(ti.nís)						*		*

If we consider example (354b) (fà̰j)-ku-(kát-[í]s) 'stands of carob trees', WSP and MAX-IO-ʔ/μ have a crucial role in the footing of the initial syllable. Note that all candidates violate DEP-IO-V and AL-R(MSt1, Ft); for presentational purposes they are not included in the tableau.

(365)

[fà̰j]$_{Rt}$-ku-kat]$_{MSt1}$-s]$_{MWd}$	*CLASH	WSP	AL-R/MWd	MAX-IO-ʔ/μ	AL-R/Rt, Ft	PARSE-σ	FT-BIN-σ
a. (fa̰j.kù)(ka.tís)		*!			*		
b. (faj.kù)(ka.tîs)				*!	*		
c. (fà̰j).(ku.ká)tis			*!			*	*
d. (fà̰j).(ku.kà)(tîs)	*!						*
e.☞ (fà̰j).ku.(ka.tîs)						*	*
f. faj.ku.(ka.tîs)				*!	*	**	

The optimal candidate (e) only violates low ranked PARSE-σ and FT-BIN-σ.

Another argument for the secondary stress data comes from the discussion of the MSt2 domain (§4.5.4). Example (355), repeated in (366) below, showed that the root's glottalized vowel gets deglottalized because it is not parsed into a foot:

(366) (ji-fé)tas
1POSS-root/medicine
'my root/medicine'

However, in both the first person plural possessive and the indefinite possessive forms, the glottalized vowel is realized:

(367) a. (kàs)-(fetá̰s) (cf. tableau in (336))
1POSS.PL- root/medicine
'our root/medicine'
b. (βàt)-(fe.tá̰s)
INDEF.POSS- root/medicine
'someone's root/medicine'

The fact that there is an alternation between a modal and a glottalized vowel in (366) as opposed to (367) indicates an interesting interplay between CV- vs. CVC- prefixes, stress assignment, and surface realization of glottalization.

A similar pattern can be found in the following pairs of morphologically related forms. All the forms in (368b,c), (369b,c), and (370-372) have the shape CVC-CV.CVC. Recall the earlier discussion of the MinWd in Nivaĉle (cf. §4.2); it was proposed that the Minimal Word in Nivaĉle has a CVC shape. As a consequence, [kas] and [βat] qualify for being parsed as a foot. An initial CVC gets footed in all the domains: Root, MSt1, MSt2, and MWd.

(368) a. ([ʔ]a-ʃá)tet͡ʃ
2POSS-head
'your head'

b. (kàs)-(ʃa.tḛ́t͡ʃ)
1POSS.PL-head
'our head.'
c. (βàt)-(ʃa.tḛ́t͡ʃ)
INDEF.POSS-head
'someone's head.'

(369) a. ([ʔ]a-tí).niʃ
2POSS-necklace
'your necklace'
b. (kàs)-(tinḭ́ʃ)
1POSS.PL-necklace
'our necklace'
c. (βàt)-(tinḭ́ʃ)
INDEF.POSS-necklace
'someone's necklace'

(370) ([ʔ]ɑ̀k)(xek͡lɑ́)
'female'

(371) (k'ùt)(xan-ís)
thorn-PL
'thorns'

(372) (fìn)(kɑ-náx)
suck-RES-AG
'smoker'

In contrast, as has been shown in previous sections, initial CV syllables never get parsed as a monosyllabic open syllable foot. Following, I reintroduce some illustrative examples:

(373) a. t͡ʃa.(xa.ní)
'wild boar'
b. si(βo.k͡lók)
'spider/bicycle'

c. ta(nu.kí-s)
cat-NOM.PL
'cats'

(374) a. (ji-ʃín)βo a'.*(jì)-(ʃinβóʔ)
1POSS-honey
'my honey'

Example (374) shows that the initial CV syllable cannot get parsed into a foot, as a consequence, the [c.g.] feature cannot be preserved in the last (unstressed) syllable.

4.5.7 Prefixation and suffixation

As introduced in §4.5, MSt1, MSt2, and MWd are considered to be layered domains. Every word is an MWd, every word contains within it an MSt2, which in turns contains an MSt1 and a Root. It has been proposed that each of these morphological categories (MCat) defines a prosodic domain that is relevant to defining the locus of stress. In this vein, it has been shown that there are specific alignment constraints that are sensitive to the domain edges created by the the presence of prefixes and suffixes associated with MSt1, MSt2, and MWd, respectively. Nevertheless, these MCat categories may not be morphologically derived, that is, there may not be any overt morphology – such as an affix of the relevant kind – present in the relevant domain. This situation carries consequences for the expected locus of stress in forms where there is an alignment conflict; e.g. between MSt2 and MWd. If an MSt2 is by extension an MWd, then given the constraint in (358) – ALIGN-R(MWd, Ft): Align the right edge of the MWd with the right edge of a Foot – we would expect the MWd in (375) to be aligned with the right edge of a foot. However that is not the case.

(375) a. $[[[(\text{ji-}[\text{fé})\text{tas}]_{Rt}]_{MSt1}]_{MSt2}]_{MWd}$
1POSS-root
'my root'

b. *$[[[\text{ji}([\text{fetá̰s})]_{Rt}]_{MSt1}]_{MSt2}]_{MWd}$

In contrast, the possessed and pluralized form in (376) displays right-alignment:

(376) a. *[[[(ji-[t’í)k͡l]$_{Rt}$]$_{MSt1}$] $_{MSt2}$ -ej]$_{MWd}$
1POSS-tear-NOM.PL
‘my tears’

b. [[[ji-[(t’ik͡l]$_{Rt}$]$_{MSt1}$] $_{MSt2}$ -éj)]$_{MWd}$

Let us then consider the tableaux for the forms in (375) and (376). Of special importance is whether a form is morphologically derived or not.

(377) cf. (366, 367) [(ji-[fé)tas]$_{Rt}$ ‘my root/medicine’ vs. (378) [ji-[(t’ik͡l]$_{Rt}$ -éj] $_{MWd}$

$_{MSt2}$[ji-[feta̯s]$_{Rt}$]$_{MWd}$	*CLASH	WSP	MINFT	AL-R/MWd	AL-L/MSt2	AL-R/MST1	MAX-IO-ʔ/μ	AL-R/Rt	PARSE-σ	FT-BIN-σ
a. ji-(fe.tá̯s)				NDEB	*!	NDEB			*	
b. (jì)(fe.tá̯s)			*!	NDEB		NDEB				*
c. (ji.fè).(tá̯s)	*!			NDEB		NDEB				*
d. (ji.fé).ta̯s		*!		NDEB		NDEB		*	*	
e.☞ (ji.fé).tas				NDEB		NDEB	*	*	*	

In (377) the right alignment constraint is blocked because there is no overt morphology associated with that domain (MWd). As a consequence, candidate (e) wins over (a). Similarly, note that the alignment constraint for MSt1 is not active since there are no derivational suffixes. Different is the situation in (378):

(378) [ji-[(t’ik͡l]$_{Rt}$ -éj] $_{MWd}$ ‘my tears’

$_{MSt2}$[ji-[t’ik͡l]$_{Rt}$-ej]$_{Wd}$	*CLASH	MINFT	AL-R/MWd	AL-L/MSt2	AL-R(Rt, Ft)	PARSE-σ	FT-BIN-σ
a.☞ ji-(t’i.k͡léj)				*	*	*	
b. (ji.t’í). k͡lej			*!		*	*	
c. (jì)(t’i.k͡léj)		*!			*		*
d. (ji.t’ì).(k͡léj)	*!				*		*

The tableau in (378) shows that in forms where there is a "derived" prefix and word-suffix content, the crucial ranking is AL-R/MWd » AL-L/MSt2. Further, if we consider the pluralized form of (375), right-alignment of the MWd and the foot that carries primary stress can be observed:

(379) a. [[(ji-fȅ)(ta͡ts] $_{\text{MSt2}}$-ʃj)] $_{\text{MWd}}$
1POSS-root/medicine-NOM.PL
'my roots/medicines'

Crucially, what (375) shows, in comparison with (376) and (379), is that an unsuffixed trisyllabic MSt2 will not show rightmost alignment because it is not a morphologically derived MWd. Said differently, if a word does not have a derivational or a plural suffix added to it, like the forms in (376) and (379), the Align-R(MWd, Ft) alignment constraint will be "blocked" under the terms of the Non-Derived Environment Blocking (NDEB) condition (see §4.5.3).

Stress assignment in Nivaĉle is determined by morphological structure; the locus of stress is dependent on the existence of edges that are morphologically defined. Under the NDEB, if the conditions for the application of a rule (e.g. morpheme concatenation) are not met, the application of the rule (in this case a constraint) is blocked.

Below, (377) is reconsidered in a simplified tableau:

(380)

/ji-fetaʔs/	Align-R (MWd, Ft)	Align-L (MSt2, Ft)
a.☞ [(ji-fé)tas] $_{\text{MSt2}}\varnothing]_{\text{MWd}}$	blocked (NDEB)	
b. [ji-(fetá̰s)] $_{\text{MSt2}}\varnothing]_{\text{MWd}}$	blocked (NDEB)	*!

In (380), candidate (a) wins over (b). The MWd right-alignment constraint is equally blocked for both candidates; there is ∅ morphological material associated with the MWd domain. So, the relevant constraint at issue is ALIGN-L (MSt2, Ft), which is violated by candidate (b). Different is the situation in tableaux (381) and (382), where the conditions for the application of the alignment constraints are met:

(381)	/ji-t’ik͡l-j	Align-R (MWd, Ft)	Align-L (MSt2, Ft)
	a.☞ [ji-(t’ik͡l]$_{\text{MSt2}}$ éj)]$_{\text{MWd}}$		*
	b. [(ji-t’ík͡l)]$_{\text{MSt2}}$ej]$_{\text{MWd}}$	*!	

(382)	/ji-fetaʔt͡s-j/	Align-R (MWd, Ft)	Align-L (MSt2, Ft)
	a.☞ [(ji-fè)(ta t͡s]$_{\text{MSt2}}$íj)]$_{\text{MWd}}$		
	b. [ji-(feta)t͡s]$_{\text{MSt2}}$ij]$_{\text{MWd}}$	*!	*
	c. [(ji-fé)tat͡s]$_{\text{MSt2}}$ij]$_{\text{MWd}}$	*!	
	d. [ji-fe(tat͡s]$_{\text{MSt2}}$íj)]$_{\text{MWd}}$		*!

Similarly, in (383)-(386) below, the forms in (a) contain possessed singular inalienable nouns, and the forms in (b) contain possessed plural inalienable nouns. The right edge of the MWd is aligned with the right edge of a foot in (383b, 384b, 385b, and 386b).

(383) a. (ɬ-ɑ́k)
3POSS-food
‘his/her food’

b. (ɬ-ɑk-[ɑ́]-s)
3POSS-food-3PL
‘his/her foods’

(384) a. (ji-tá̰t)
1POSS-thorn
‘my thorn’

b. ji-(ta.t[í]s)
1POSS-thorn-PL
‘my thorns’

(385) a. (ji-k͡l̰íʃ)
1POSS-word
‘my word’

b. ji.(k͡liʃ-[á]j)
1POSS-word- PL
‘my words’

(386) a. (ji-β-tsá̰t)
1POSS-AB.POSS-village
'my village'
b. (jì-β)-(tsa.t-[é]s) ~ (jì-β)-(tsa.t-[í]s) ~ (jì-β)-(tsa.t-[é]j)
1POSS-AB.POSS-village-PL
'my villages'

Recall that the plural suffix (386b) can be subject to intra- and inter-speaker variation (cf. Chapter 2). Further, based on the hypothesis that glottalized vowels are only realized when parsed into the head of a foot, deglottalization in (384b-386b) indicates that these vowels are parsed as (weak) non-foot heads.

In summary, the data so far have shown that the –([V])C plural suffix surfaces with primary stress at the right edge of the MWd. In addition, when plural suffixation is added on to prefixed CV(C).CVC disyllabic roots/stems, and adds sufficient segmental content such that a new syllable will be parsed, then two prominent syllables can be found. Primary stress is RIGHTMOST (274).

(387) a. (ji.fé).tas
1POSS-medicine
'my medicines'
b. (ji-fè)(ta.t͡s-[í]j)
1POSS-medicine-NOM.PL
'my medicines'

(388) a. (ji-kó̰t͡s).xat
1POSS-land
'my land'
b. (ji-kò̰t͡s)(xa.t-[í]s)
1POSS-land-NOM.PL
'my lands'
c. (ji-kò̰t͡s).xa.(t[i]-jíʃ)
1POSS-land-AREA
'the area of my land'

(389) a. (ji-pá̆ʔ)kɑt
1POSS-hand
'my hand'
b. (ji-pà̆ʔ)(kɑt-[á̆]j)
1POSS-hand-NOM.PL
'my hands'

The argumentation and exemplification in this last section has focused on plural suffixes, which mark the rightmost edge of the MWd. It has been shown that primary stress fall on the rightmost syllable of the MWd. The ranking of constraints discussed so far can be presented in the form of a Hasse diagram

(390) R-MOST, FTFORM = IAMBIC, *CLASH, WSP, MINFT = CVC , ALIGN-R (MWd, FOOT) » ALIGN-L (MSt2, FT) » ALIGN-R (MSt1, FT) » MAXIO-[μ], MAXIO-ʔ » ALIGN-R (Rt, Ft), PARSE-σ » FT-BIN-σ

4.5.8 Verbal domain

The stress assignment generalizations discussed in the previous sections are also applicable to the verbal domain. Even though stress assignment in verbs will not be as thoroughly analyzed as it has been the case with nouns, the similarities between both domains are worthy of consideration. Specifically, the focus is on the presence vs. absence of prefixes; like in nouns, morphological structure impacts on the locus of stress assignment.

The Nivaĉle verbal system is very rich and its full description and analysis goes beyond the scope of this chapter. The Nivaĉle verb is morphologically complex; it can encode a wide variety number of grammatical categories. A non-exhaustive list includes: negation, subject, object, number (of both the subject and the object), causation, voice, location and aspect, among others.

Figure 4.5 summarizes the linear organization of verbal morphological affixes within the MWd domain, relevant for the discussion of stress assignment.

NEG = S - DERIV/REF/INTR – ROOT - DERIV/CAUS - PL - LOC = OBJ = ASP

Figure 4.5. Morphological structure of the verb

Most of the Nivaĉle verbal roots are monosyllabic. Single-consonant prefixes can attach to vowel-initial roots and be realized as a CVC inflected verb stem (§4.2), conforming to the Minimal Word requirement in Nivaĉle (391), (392a). Verbs require the presence of a subject person prefix. The third person subject of some conjugations (392b), though, has a zero morpheme marking:

(391) (x-én) pa = Jesús
1S-love DET = Jesus
'I love Jesus'

(392) a. (xa-túx) ka = fináx
1S-eat DET = crab
'I ate the crab'

b. (∅-túx) ka = fináx
3S-eat DET = crab
'she/he ate the crab'

Disyllabic verbal forms have final stress consistent with an iambic analysis. Compare (391) and (393), in which the addition of a derivational suffix affects stress placement.

(393) (x-en-táx) ka xa-βán ɬ.pa = t͡ʃitáʔ
1S-love-IRR SUB 1S-see/find FEM.DET = sister
'I would love to find my sister (the one I've never met)'

Similarly to the possessive prefixes in the nominal domain, the subject verbal prefixes mark the left edge of the Prosodic Word, against which iambic foot is aligned.

(394) (xa-ká)ku xa = samtó
1S-distrust DET = white.man
'I distrust the white man'

Also, according to the template in Figure 4.5, reflexives, directionals, and intransitivizers can stand between the root and the subject person prefixes. Another similar phenomenon to the one noted for inalienable nouns can be seen in that these other prefixes ‘attract’ stress; compare (395a) with (395b):[64]

(395) a. (xa-n.fák)
1S-tell
‘I tell (a story)’
b. (xa-tát)-fak
1S-REFL-tell
‘I confess’
c. (xa-tàt)-(fak-’ín)
1S-REF-tell-IMPFV
‘I am confessing’

(396) a. (k’a-k.xúʔ) xa = *Andrés*
1A.3P-greet DET = *Andrés*
‘I greet(ed) *Andrés*’
b. (ɬ-nḭ-k).(xu-ʔéɬ) xa = ji-βéɬ
2S-RECIP-greet-COORD.PL DET = 1POSS-relative
‘you and my relative greet each other’

Whereas primary stress falls on the root in (395a), it falls on the reflexive prefix in (395b). In (396b) we can see that secondary stress falls on the reciprocal prefix and primary stress falls on the coordinative plural suffix. Interestingly, there is a glottalized vowel in the reciprocal prefix; as has been proposed in §4.5.4, an underlying [c.g.] feature associated with an underlying ejective consonant /k’xuʔ/ is parsed into a preceding vowel. Due to the pervasive constraint in the grammar that ejectives must be prevocalic, the [c.g.] feature never surfaces on the consonant itself. There is no direct evidence for the existence of glottalization. It we consider the morphologically related forms in (397)-(398), it can be seen that glottalization also surfaces in the (stressed) preceding vowel nucleus:

[64] It is not very clear the reason why the /n/ disappears in (395b).

(397) (∅-βan.k'ḁ́-k)xu
3S-ANTIPASS-greet
'''s/he greets'

(398) (xaj̰i-k).(xu.xun)
1S-invite/greet
'I invite/greet'

(Seelwische 1990:200)

Now, let us consider the root 'to wash' /k͡le?ʃ/. Recall, once again, the proposal that glottalized vowels are licensed by the head of a foot.

Table 4.3 Verbal paradigm of *to wash*

	SINGULAR		PLURAL	
	Affirmative	Negative	Affirmative	Negative
1	xa-k͡lḛ́ʃ	ni = xa-k͡lḛ́ʃ	ʃta-k͡lḛ́ʃ	ni = ʃ.ta-k͡lḛ́ʃ
1.Excl			xa-k͡lé?.ʃ-eɬ	
2	ɬ-k͡lḛ́ʃ	ni = ?a-k͡lḛ́ʃ	ɬ-k͡lé?.ʃ-eɬ	ni = ?a-k͡lé?.ʃ-eɬ
3	ji-k͡lḛ́ʃ	ni = n-k͡lḛ́ʃ	ji-k͡lḛ́ʃ	ni = n-k͡lḛ́ʃ

Throughout the paradigm, canonical disyllabic iambic LH feet can be found. It is proposed that the left edge of the foot is aligned with the left edge of the MStem2. In the trisyllabic affirmative forms, i.e. with the first person and second person subject, the exclusive plural suffix is not parsed into a foot.[65] The initial lateral fricative is parsed into the syllable (cf. Chapter 5).

The negation morpheme [ni] does not introduce any change in stress assignment (see Table 4.3), that is, it is placed at the leftmost edge of the PrWd but falls outside of the stress domain. For the third person, this morpheme is realized as [nin] instead of [ni]. The additional segment [n] must be part of a defective third person subject prefix that does not surface in the affirmative form. For instance, the negative form of (384) [túx] 'she/he eats' is [nintúx].

[65] A similar pattern is found in nouns:
(i) ?a-ná?.ʃ-eɬ
2POSS-nose-EXCL.PL
'your (pl) nose'

Similarly to inalienable nominal roots, stress assignment is sensitive to additional prefixation. Table 4.4 illustrate how prefixation of the reflexive [βa̰t] affects both stress placement and realization of the [c.g.], respectively.

Table 4.4 Verbal paradigm of *to wash oneself*

	SINGULAR		PLURAL	
	Affirmative	Negative	Affirmative	Negative
1 Inc.	xa-βá̰t-k͡leʃ	ni = βat-k͡lḛ́ʃ	ʃta-βá̰t-k͡leʃ	ni = ʃ.ta-βá̰t.k͡leʃ
1 Exc.			xa-βà̰t̩-k͡leʃ-éɬ	ni = xa-βà̰t.k͡le.ʃ-éɬ
2	ɬa-βá̰t-k͡leʃ	ni = ʔa-βá̰t-k͡leʃ	ɬa-βà̰t-k͡le.ʃ-éɬ	ni = ʔa-βà̰t.k͡leʃ-éɬ
3	∅-βat-k͡lḛ́ʃ	ni = n-βá̰t.k͡leʃ	∅-βat-k͡lḛ́ʃ	ni = n-βá̰t.k͡leʃ

The consistent pattern is that in trisyllabic forms stress falls two syllables from the left edge of the MStem. Interestingly, if we compare the 3.SING in the affirmative and negative forms, the [c.g.] feature is realized in different syllables due to different stress placement. The crucial difference is the presence of the /n-/ in the negative form, where the observed stress pattern suggests that it has to be parsed to a syllable, and the syllable that it is parsed to counts for foot formation and stress assignment, i.e. [ni = βat.k͡lḛ́ʃ] vs. [(ni = n.βá̰t).k͡leʃ].[66]

The stress alternation pattern found between, on the one hand, the first and second person, and, on the other hand, the third person is consistent across other CV̰C-roots within the reflexive and intransitive paradigm as example (399) shows:

(399) a. (xa-fḭ͡tʃ) na = jukuβé
1S-hide DET = bread
'I hide the bread'

b. (xa-βá̰t)-fi͡tʃ
/xa-βaʔt-fiʔ͡tʃ/
1S-REF-hide
'I hide myself'

[66] This would be a case of a non-crisp edge alignment. CRISPEDGE was first proposed by Ito and Mester (1994, 1999) to rule out linkings between prosodic categories.

c. ∅-(βat-fḭt͡ʃ)
/βaʔt-fiʔt͡ʃ/
3S-REF-hide
'she/he hides herself/himself'

The presence vs. absence of (subject) prefixes thus conditions stress assignment. Also consider the following pairs of related forms:

(400) a. [(xa-tí.ɬ.ox]
/xa-ti-ɬoʔx/
1S-carry.on.shoulders
'I carry (s.t) on my shoulders'

b. ∅-(ti.ɬó̰x)
3S- carry.on.shoulders
'she/he carries (s.t.)'

(401) a. [(xa-βá.)k͡let͡ʃ]
/xa-βa.k͡leʔt͡ʃ/
1S-walk
'I walk'

b. ∅-(βa.k͡lḛ́t͡ʃ)
3S-walk
'she/he walks'

(402) a. (ɬ-t'ɑ́).taj
2S-hunt
'you hunt'

b. (∅-t'ɑ.tá̰j)
3S-hunt
'she/he hunts'

c. (ʃ-t'ɑ.tá̰j)
1PL.hunt
'we hunt'

Note, again, that the lateral fricative in (402a) is parsed into a syllable node and therefore contributes to the well-formedness constrain FT-BIN-σ. Examples such as (402a) provide evidence for /ɬ/ being parsed to a syllable and thus counting for stress assignment.

(403) a. (xa-tà)-(nek.fát)
/xa-ta-neʔk-fat/
1S-DIR-pull
'I sit on my calves'
b. ∅-(ta-nḛ́k)fat
3S-DIR-pull
'she sits on her calves'

(404) a. [(xa-βɑ̰́m)qɑ]
/xa-βɑʔmqɑʔ/
1S-wash
'I wash'
b. [∅-(βɑmqɑ́ʔ)]
/∅-βɑʔmqɑ́ʔ/
3S-wash
's/he washes'

The stress alternation pattern presented so far is consistent with the hypothesis that iambic feet are aligned with the left edge of the prefix domain. Similarly to nouns, when a word is sufficiently long to be able to meet both L- and R-edge foot alignment constraints, secondary stress appears in initial CVC or disyllabic feet aligned with the left edge, and primary stress falls on the rightmost (R-edge aligned) foot.

4.6 Conclusions

In this chapter, the internal structure of the Nivaĉle Prosodic Word and stress assignment patterns in both the nominal and verbal domain have been analyzed. It has been proposed that the smallest prosodic foot and MinWd constituent is a closed monosyllable CVC. Interestingly, the Nivaĉle Minimal Word does not conform transparently to the binarity generalizations of the standard prosodically-defined notion of a "Minimal Word": a CVC Nivaĉle word is neither bisyllabic nor (necessarily) bimoraic. However, only in the case of a monosyllabic word does a CVC foot receive primary stress. In a polysyllabic word, a foot that satisfies the Ft-Bin-σ constraint receives primary stress, while a CVC foot only ever receives secondary stress. Consequently, it has been proposed that the Head of the PrWd is, optimally, disyllabic. Further, a major generalization at the uppermost prosodic level is that primary stress falls on the rightmost foot of the PrWd.

In addition, three main proposals have been advanced with regards to Nivaĉle stress assignment patterns. First, Nivaĉle stress is quantity-sensitive: glottalized vowels bear weight and their behaviour conforms to the WEIGHT-TO-STRESS Principle. Only when parsed to the head of a foot do glottalized vowels get realized. In contrast, coda consonants are not moraic. Second, the rhythm type is iambic. Third, Nivaĉle stress is edge-based and it is related to the presence of morphological categories (MCat). The role of prefixes and suffixes with regards to stress placement has been discussed, as there are Left-edge and Right-edge stress generalizations at issue. Specifically, it has been shown that there are specific alignment constraints that are sensitive to the domain edges created by the the presence of *prefixes* and *suffixes* associated with MSt1, MSt2, and MWd, respectively. Importantly, however, these MCat categories may not be *morphologically derived*, that is, there may not be any overt morphology – such as an affix of the relevant kind – present in the relevant domain. Crucially, this situation carries consequences for the expected locus of stress in forms where there is an alignment conflict. If there has not been any explicit affixation between a major Morphological Category and the next hierarchically dominant Morphological Category, then the former domain – the "non-derived" domain - remains the MCat domain of relevance. If, as is proposed here, the major MCat domains (Root, MStem1, MStem2, and MWord) are labelled in the Input/Output candidates under evaluation, then the requisite information to assess whether a candidate is morphologically derived or non-derived is transparently accessible.

Chapter 5: Nivaĉle laterals: Implications for typology and feature specification

5.1 Introduction

One of the marked characteristics of the Nivaĉle phonological inventory is the absence of a sonorant lateral /l/.[67] According to the *World Atlas of Linguistic Structure Online* (Dryer & Haspelmath 2011) only 1.4 % of the 567 surveyed languages have no /l/, but have lateral obstruents instead. Nivaĉle shares this marked phonological property with genetically unrelated (and areally remote) languages like Ahtna (Athabascan: Kari 1990), Kootenay/Ktunaxa (isolate: Garvin 1948, Morgan 1991), Nuu-chah-nulth (Wakashan: Stonham 1999, Carlson et al. 2001), Tlingit (Na-Dene: Maddieson et al. 2001), Kiowa (Kiowa Tanoan: Sivertsen 1956, Watkins 1984), Chukchi (Chukotko-Kamchatkan: Krause 1980), Kabardian (Northwest Caucasian: Kuipers 1960), and Tigak (Austronesian: Beaumont 1979).

As presented in Chapter 2, (§2.2.1), the Nivaĉle lateral system is composed of two lateral obstruents: the lateral fricative /ɬ/ and the complex segment /k͡l/. These sounds are very interesting from both typological and theoretical perspectives in that:

(i) To the best of my knowledge, /k͡l/ is neither attested in any of the genetically related languages nor in other indigenous languages of the area. Comparative data show that Nivaĉle /k͡l/ corresponds to /l/ in other Mataguayan (Chorote, Maká, and Wichí) languages (§5.6).

(ii) On the one hand, /k͡l/ has been described as a non-homorganic affricate that involves the "simultaneous articulation and release of a velar stop and a dento-alveolar lateral" (Stell 1989:58, [my translation from Spanish/AG]). On the other hand, /ɬ/ has been described by Stell (1989:58) as "a voiceless dento-velar fricative".

(iii) As originally pointed out by Maddieson (1984:77) "velar laterals are extremely rare (…) the three complex lateral segments reported to have both velar and dental/alveolar articulations are all somewhat obscurely described. All three are voiceless and fricative or affricate, being interpreted as /xɬ/, /kɬ/ (Ashuslay [Nivaĉle], 814) and /kɬ'/ (Zulu, 126)."

[67] A sonorant lateral [l] occurs in a few loanwords; these data will play an important role in my analysis.

There are three major aspects that need to be addressed in order to contribute to the phonological understanding of this complex segment.

First, syllable structure and phonotactic constraints need to be analyzed and compared with the ones governing the lateral fricative and the affricates in order to put forward a featural specification of /k͡l/ and /ɬ/.

Second, if one assumes Stell's characterization of /k͡l/ as a non-homorganic affricate, we are in the presence of a non-canonical affricate. On the one hand, there disagreement in place of articulation – which is also the case in, for instance, Blackfoot /ks/ (Frantz 1991, Elfner 2006, Chávez-Peón 2006, Derrick 2006) and Nanti [k͡s k͡ʃ] (allophones of /k/) and [g͡z g͡ʃ] (allophones of /g/) (Michael 2008:221). On the other hand, most importantly, in Nivaĉle /k͡l/ there is disagreement in voice, and the lateral release is not fricated. Lateral affricates are defined as stops in which a "/t/ or /d/-like closure is released into a **lateral fricative** by lowering one side of the tongue" (Maddieson 2013, my emphasis). Acoustic analyses of *k͡l* will serve, then, to elucidate these two aspects.

Third, based on the comparative evidence from the other Mataguayan languages [k͡l] historically corresponds to a lateral approximant /l/. In this regard two questions need to be addressed:

(i) what is the explanation behind this sound change?

(ii) why did not *l develop into [t͡l] instead of [k͡l]?

In this chapter, I argue that /k͡l/ is a complex segment that is the diachronic result of lateral hardening (Lavoie 2001, Keating 2006). Complex segments have been defined as a single root node with two different oral articulators (Clements & Hume 1995:253) or manner features. They are potentially ambivalent as to which phase determines their phonemic status (François 2010); the phase that is phonemically definitional is not necessarily the one that is phonetically prominent. Based on the phonological patterning of /k͡l/, I argue that DORSAL is the major articulator phase with a [lateral] release. I further argue that this segment is also specified for [-continuant]. In contrast, /ɬ/ is only marked for CORONAL. One of the outcomes of this chapter is that the Nivaĉle 'laterals' /k͡l/ and /ɬ/ do not form a natural class. Only /k͡l/ is specified for [lateral].

This chapter is organized as follows. Section 5.2 presents an overview of the cross-linguistic literature on lateral obstruents with special reference to the theoretical questions raised by Nivaĉle /k͡l/ and /ɬ/. Having established the relevant issues and implications to be addressed, Section 5.3 draws on Nivaĉle syllable structure constraints and perceptual cues in order to show the patterning of /k͡l/ with complex segments, such as affricates and ejective stops, and its inadequate characterization as a consonant cluster. Section 5.4 presents the acoustic correlates of /k͡l/ in comparison with /l/, which occurs in few loanwords in Nivaĉle. In addition, the acoustic properties of /ɬ/ are analyzed with reference to the fricative set in the full Nivaĉle inventory.

Based on the aforementioned phonotactic patterning of the Nivaĉle laterals, Section 5.5 presents and discusses the featural representation of /k͡l/ and /ɬ/. Finally, Section 5.6 draws on comparative data from other Mataguayan languages and Section 5.7 explores the hypothesis of lateral hardening while discussing the articulatory and perceptual factors that might have influenced the development of Proto-Mataguayan *l into Nivaĉle /k͡l/.

5.2 Laterals: resonants and lateral obstruents

In this section I present an overview of the cross-linguistic tendencies of lateral obstruents with special reference to the theoretical questions raised by Nivaĉle *k͡l* and *ɬ*.

5.2.1 Cross-linguistic typology of laterals

There have been two influential definitions of lateral sounds. In the *Sound Patterns of English* (Chomsky & Halle 1968:317), English laterals were defined as sounds “produced by lowering the mid section of the tongue at both sides or at only one side, thereby allowing the air to flow out of the mouth in the vicinity of the molar teeth”. In turn, Ladefoged and Maddieson’s (1996:182) definition of laterals concentrates on the tongue’s narrowing gesture: “the tongue is contracted in such a way as to narrow its profile from side to side so that a greater volume of air flows around one or both sides than over the center of the tongue (…) our definition does not require the presence of a central occlusion, and will allow for some central airflow”. The reason why Ladefoged and Maddieson (1996) focus more on the articulatory dimension of the lateral sounds is that whereas airflow patterns have been found to be quite variable across languages and speakers, the "narrowing gesture of the tongue" seems to be a constant property during the articulation of a lateral consonant (Walsh-Dickey 1997:49).

In addition, Walsh-Dickey (1997:49) points out that Ladefoged and Maddieson's definition implies that "both the tongue body and the tongue blade are involved in the articulation of laterals: the tongue blade cannot be narrowed without the tongue body also being narrowed, and *vice versa*". In this vein, and relevant for the discussion of Nivaĉle /k͡l/, articulatory phonetic studies have shown that English lateral segments involve two distinct gestures: an apical extension and a dorsal retraction/lowering component (Sproat & Fujimura 1993:304; cf. also Fujimura & Lovins 1978, Browman & Goldstein 1989). For example, Gick et al. (2006:69) showed that "postvocalic liquids always have a measurable dorsal constriction" across six languages.[68] These findings open the debate on the relationship between physical events, their phonological status and cross-linguistic generalizations; e.g. is the presence of a dorsal gesture in laterals part of a language-specific phonological specification or part of universal phonetic principles? This issue will be raised again in Section 5.5.

From a phonological perspective, Blevins (1988, 1994) and Walsh-Dickey (1997) explore the connection between coronality and dorsality in laterals. Blevins (1994) shows that velar laterals are treated as coronals; for instance, in Kanite and Movie Yagaria, the velar lateral [ʟ] has an alveolar stop allophone [t]. On her part, Walsh-Dickey (1997) takes a further step and argues that all laterals are complex segments characterized by both coronal and dorsal places of articulation; the feature [lateral] is not necessary.

With these claims in mind, let us consider the broader typological picture of lateral sounds. The focus will be on lateral obstruents, namely lateral affricates and lateral fricatives.

The majority, specifically 68.6%, of the world languages surveyed in *WALS* (2013) lack obstruent laterals, and most of the lateral sounds are produced with the tip or blade of the tongue, that

[68] The languages included in the study were Western Canadian English, Quebec French, Serbo Croatian, Korean, Beijing Mandarin and Squamish Salish.

is, with an occlusion in the dental/alveolar region (Maddieson 1984). In this vein, according to the UPSID (1992) database, the majority of laterals (99.2%) are coronal voiced and approximant (Ladefoged & Maddieson 1996:197); the remaining 0.8% involves velar and alveolar-velar complex laterals. Velar laterals can be found in Archi, Ekari, Hiw, Kanite, Kuman, Ku-Waru, Yagaria, Mid-Waghi, Melpa, Nii (Ladefoged, Cochran & Disner 1979, Blevins 1994, Ladefoged & Maddieson 1996:206, François 2010), and Abaza (Colarusso 1988).

Laterals can be produced with different phonation (voiced, voiceless, breathy voiced, laryngealized) and stricture types. Lateral obstruents include lateral affricates and lateral fricatives; both are more commonly voiceless than voiced (Ladefoged & Maddieson 1996: 202). Lateral affricates, though, are less common cross-linguistically than lateral fricatives.

In a lateral affricate "a stop closure is released (…) by lowering some portion of the sides of the tongue, rather than the center (…) into a homorganic lateral fricative" (Ladefoged & Maddieson 1996: 202). The most common type of lateral affricates involve homorganic articulators: e.g. [tɬ] and [tɬʼ] as in Nuuchanulth (Carlson, Esling & Fraser 2001) and Tlingit (Maddieson, Smith & Bessell 2001). Further, and interestingly, lateral affricates are mostly produced with an ejective airstream mechanism (Maddieson 2013). In the WALS sample, there are only 25 languages (4.4%) with at least one lateral affricate; 20 out of 25 surveyed languages have only a lateral ejective affricate: [tɬʼ] (e.g. Montana Salish (Flemming, Ladefoged & Thomason 2008).

Aside from coronal affricates, velar affricates have been reported in very few languages; specifically a plain and ejective pre-velar affricate in Archi (Kodzasov 1977, Ladefoged & Maddieson 1996: 206), an ejective velar affricate in Zulu (Docke 1926, Ladefoged & Maddieson 1996: 204), and a non-ejective lateral velar affricate in Nivaĉle (Stell 1972, 1989), the topic of discussion here.

In turn, lateral fricatives are sounds where "the channel through which the air flows is narrowed to the point that the flow of air becomes turbulent and noisy" (Maddieson 2013). As previously mentioned, lateral fricatives are mostly voiceless. Maddieson and Emmorey (1984) argue for a distinction between voiceless lateral approximants [l̥] and voiceless lateral fricatives [ɬ] based on three parameters: duration, amplitude, and the spectral characteristics of the noise portion. Their results indicate that "fricatives tend to have later onset of voicing, relatively greater noise amplitude – relative to the amplitude of a following vowel – and greater energy at high frequency than the approximants" (81). Consequently, Maddieson and Emmorey (1984:82) establish three systematic differences between [l̥] and [ɬ], following a report on 60 surveyed languages: (i) Voiceless lateral approximants are restricted to syllable initial position; fricatives are not; (ii) Voiceless lateral fricatives may have affricate allophones; approximants do not; (iii) Voiceless lateral approximants always occur together with a voiced lateral approximant in the inventory; voiceless lateral fricatives may occur without a voiced lateral.

In both her 1972 phonological sketch and her 1989 doctoral thesis on Nivaĉle, Stell reports the presence of a voiceless lateral approximant and a voiceless lateral fricative; [l̥] and [ɬ] are said to be in complementary distribution. Whereas [l̥] occurs before consonants (405a, b) and word-finally (405c), [ɬ] occurs elsewhere.

(405)	a.	l̥ka	'the'	
	b.	nal̥t͡ʃe	'recently'	
	c.	xa-tḭl̥	'I twist'	(Stell 1989:72)

During my fieldwork, I did not find any occurrence of a voiceless lateral approximant in the Nivaĉle inventory. Rather, I attested the presence of the voiceless lateral fricative sound occurring in all syllabic positions, in line with the first and third above-mentioned phonological generalizations. In §5.4 the acoustic characteristics of the voiceless lateral fricative are presented.

At this point, it may be of interest to see how Nivaĉle fits the picture of cross-linguistic generalizations about lateral segments (Maddieson 1984, Ladefoged & Maddieson 1996, Maddieson 2011), which will be followed by the analyses in subsequent subsections.

First, it has been claimed that the presence of a lateral affricate in a consonant inventory "generally entails the presence of a lateral fricative" (Maddieson 2011). In that regard, note that 88% of the surveyed languages in *WALS* having lateral affricates also have lateral fricatives. If we considered /k͡l/ to be a (non-canonical) affricate, Nivaĉle would fall under this generalization. Second, one could think that a language with two or more liquids is expected to have a contrast between a lateral and a non-lateral (Palosaari & Campbell 2011). However, in Nivaĉle there are no non-lateral liquids.

Third, a language with two or more laterals contrasts them either in place or in manner and voicing, but not both (Maddieson 1984:88). The two Nivaĉle laterals – /ɬ/ and /k͡l/ –though, contrast both in place (CORONAL vs. DORSAL, respectively) and manner of articulation [continuant]. The acoustic properties and feature specification of these two laterals will be discussed in §5.4 and §5.5, respectively.

5.2.2 Lateral affricates and complex segments

The focus of this subsection is to determine the descriptive and explanatory adequacy of treating *k͡l* as an affricate. Affricates have been traditionally defined as a special type of obstruent consisting of both stop and fricative components. The most accepted assumption is that they are phonologically stops (Jakobson, Fant & Halle 1952, Steriade 1989, 1993, Shaw 1991, LaCharité 1993, Rice 1994, Rubach 1994, Kim 1997, Clements 1999, Kehrein 2002), tracing back to Jakobson, Fant & Halle's (1952) seminal definition of affricates as strident stops [- continuant, + strident]. Due to the existence of non-strident affricates – e.g. Talhtan [tθ] (Shaw 1991) – place and manner features have been invoked – e.g. [+distributed] or [lateral].

As previously mentioned, lateral affricates are those sounds in which a stop closure is released into a lateral fricative by lowering some portion of the sides of the tongue. The presence of lateral affricates can be mostly found in the inventories of indigenous language families of the Northwest Coast of North America like Athabascan, Penutian, Salish, and Wakashan. These attested lateral affricates, albeit varying in phonation types (voiceless, voiced, ejective) – t͡ɬ, d͡ɮ, t͡ɬ' – all involve coronal articulators, that is, they are produced at the alveolar ridge.

As mentioned in §5.2.1, a velar-lateral ejective affricate [kʟ̥'] occurs in Zulu. Ladefoged and

Maddieson (1996:206) maintain that both components of this affricate are velar, and that there is a "fricative component auditorily reminiscent of the velar fricative x but is lateral". It is worth mentioning three aspects of this description. First, the two phases of the affricate are dorsal, that is, they are homorganic consonants. Second, and importantly, the voiceless velar stop is released into a voiceless fricative; there is agreement in voice. In this regard, note that (i) the stop release in Nivaĉle *k͡l* is an approximant, that is, there is no frication (§5.4), and (ii) the two phases disagree in voice (cf. §5.4). Because of these two characteristics, I have decided not to call *k͡l* 'affricate'; I thus use the term complex segment.

Kehrein (2002: 4) mentions that nasal and lateral affricates have also received different names in the literature. Specifically, lateral affricates have been defined as "laterally released stops" [t^{ɬ}] (Laver 1994) or "pre-stopped laterals" [^{t}l] (Ladefoged & Maddieson 1996). Because as yet no attested language makes a phonological distinction between laterally released stops and pre-stopped laterals, Kehrein uses the term 'affricate' for both types of sound.

Different is the approach of François (2010) to the case of the velar lateral [g͡ʟ̠] in Hiw (Austronesian). In New Guinea languages, this complex phoneme has been variously analyzed as (i) a lateral affricate [g͡ʟ̠], (ii) a laterally released stop [g^{L}], and (iii) a pre-stopped lateral approximant [^{g}ʟ]. What is more, variant analyses can be even found in the same language. For instance, Francois (2010:402) points out that the velar lateral in Kuman has been analyzed as a laterally released affricate (Piau 1985), as an approximant (Ladefoged & Maddieson 1996), and as a fricative (Steed & Hardie 2004). Given the lack of consensus about the categorical status in terms of what manner of articulation it should be classified as, a central endeavor endeavor for the Nivaĉle complex segment /k͡l/ is to elucidate which of the two phases is the one that is phonemically definitional. Under the claim that phonological affricates are not phonologically contrastive with stops (LaCharite 1993, Kehrein 2002) and that rather, they should be treated as stops, the affricate vs. stop alternations loses theoretical relevance. However, whether the complex segment patterns with sonorants or obstruents clearly carries implications in the establishment of phonological constraints (e.g., sonority constraints). In the following section, I turn to the discussion of these issues.

5.3 Phonological behavior of k͡ɬ

5.3.1 Phonotactic patterning of affricates, laterals and ejectives

In the generative phonological literature, it has been extensively observed that certain marked structures are banned in coda position; for example Itô's (1986, 1989) Coda Condition bans the occurrence of place features in the syllable coda:

(406) **Coda Condition** (Itô 1989:224)

$$\begin{array}{l} *\ C]_{\sigma} \\ \quad | \\ \text{PLACE} \end{array}$$

In Optimality Theory, the Coda Condition has been interpreted either in terms of a positional markedness constraint, e.g. the conjunction of two markedness constraints: NOCODA and *PLACE, or as a positional faithfulness constraint (Beckman 1997, 1999, Walker 1997, Lombardi 1999, 2001), where prominent domains, such as onsets, are more prone to preserve underlying information. In other words: "onsets are perceptually privileged by virtue of their release features" (Beckman 2004:107). In contrast, release bursts are usually absent in coda position and so fewer phonological contrasts can be made in that position.

In this regard, as initially presented in Chapter 2 (§2.3), whereas sequential segmental complexity may appear in the onset, it is more restricted in coda position. Tables 5.1 and 5.2 show the syllabic patterning of [ɬ], the affricates, [k͡ɬ] and the ejectives (T') under consideration. Recall that white cells mean attested, grey cells mean unattested and " + " means morphological boundary.

Table 5.1 Affricates, laterals and ejectives

	Onset	Word-medial coda	Word-final coda
ɬ (and other fricatives)			
t͡ʃ		only before [ʃ]	
t͡s		only before [x]	
k͡l		only before [ʔ]	
T'			

Table 5.2 Initial CC clusters: Affricates, laterals and ejectives

C2 / C1	STOPS	AFFRICATES	EJECTIVES	FRICATIVES	LATERALS	
					k͡l	ɬ
STOPS						
t	+	+	+	+	+	+
AFFRICATES				(ts.x)		
EJECTIVES						
FRICATIVES					(*xk͡l)	
k͡l						
ɬ	+	+	+	+	+	+

Nivaĉle affricates and laterals show an asymmetric pattern with regards to coda permissibility. On the one hand, the alveopalatal affricate [t͡ʃ] (407) and the alveolar lateral fricative [ɬ] (408) have freedom of syllabic distribution:

(407) [t͡ʃ]

a. xa-t͡ʃà.ma-n-xát
1S-circular-VLBZ-CAUS
'I encircle (s.t.)'

b. ∅-βàn-t'ɑ-fḭ́t͡ʃ-ʃi xa=jitáʔ
3S-DIR-?-HIDE-LOC(INSIDE) DET=scrubland
'he hides in the scrubland'

c. t’a-k͡lá̰t͡ʃ
3POSS-song
‘his song’

(408) **[ɬ]**

a. ɬapéʃ
‘a long time ago’

b. xa-kàɬ.tan = á na = jukuβé
1POSS-try = 3O DET = bread
‘I try the bread’

c. túɬ
‘night’

On the other hand, the alveolar [t͡s] can only occur in onset (409) but it cannot occur before any consonant except for [x] (410b);[69] in word-final position it either simplifies to [s] (410a) or to [t] (411). For instance, the alternation between [t͡s] and [s] can be found in the pronominal domain. Recall that there are three basic, phonologically conditioned, variants for the first person plural pronominal forms [kat͡s-] ~ [kat͡sí-] (and [kat͡s’í-]) ~ [kas-], as shown in (412):

(409) a. t͡sók
‘rubber’

b. kot͡s.xá̰t
‘land’

(410) a. k’-ɑfḭ́s a’. *k’-ɑfḭ́t͡s
1S.2P-reach
‘I reach (you)’

b. ɬt’-à.fit͡s-xán
2-reach-CAUS
‘you reach ’

[69] I have only found /t͡s/ before /f/ in one word: k’ut͡sfa ‘friend’.

(411) a. xaj-kút a'. *xajkút͡s
1S-steal
'I steal'
b. ji-kùt͡s-xajáʃ
1POSS-steal-NMLZ
'my robbery'

(412) a. ka.t͡s-ák͡le
1.POSS.PL-scalp
'our scalp'
b. ka.t͡sí-β.k'ɑ
1.POSS.PL-Adam's.apple
'our Adam's apple'
c. kas-k-áʔ c'. *kat͡s-káʔ
1POSS.PL-POSS.CL-fruit
'our fruit'

In (410b), the root-final [t͡s] simplifies to [s] in word final position (410a). Note also the deglottalization of the root vowel in a non-prominent position (410b).

In turn, /k͡l/ displays a more restricted syllabic distribution than /t͡ʃ/, /ɬ/, and even /t͡s/ (cf. Table 5.2): it can only occur before a vowel (413a)-(418a). When /k͡l/ is parsed to coda position, be it word-finally, or word-medially, it simplifies to [k] (413b)-(418b):

(413) a. xà-t-pek͡l-éj na=Filadelfia
1S-DIR-go-DIR DET=Filadelfia
'I return to Filadelfia'
b. xa-t.-pék
1s-DIR-return
'I return'

(414) a. ɬà-x.pe.k͡l-[í]s
3POSS-shade-PL
'his/her shades'

b. ɬa-x.pék
3POSS-shade
'his/her shade'

(415) a. xa-t'ùʔ.k͡l-[i]ján
1S-obstruct-CAUS
'I obstruct'

b. t'ṵ́k-ʃi
obstruct-LOC(inside)
'obstructed'

(416) a. ∅-βa.k͡lḛ́t͡ʃ
3S-walk
'S/he walks'

b. ∅-βàk.t͡ʃe-mát
3S-walk-MALEF
'S/he limps'

(417) a. [βat-sɑ̀ʔ.qɑ.k͡lít]
/wat-sɑʔkɑk͡lit/
INDEF.POSS-soul
'someone's soul'

b. βat-sɑ̀ʔ.kɑk.t-[í]s
INDEF.POSS-soul-PL
'someone's souls'

(418) a. ni.βa.k͡lé
'man'

b. ni.βak.-t͡ʃé
man-F
'woman'

The delateralization of the complex segment /k͡l/ in coda position resembles the neutralization of ejectives in coda position (see §6.4). The Nivaĉle series of ejective obstruents /p' t' k' t͡s' t͡ʃ'/ can neither serve as word-internal nor word-final codas. In examples (419a)-(421a), we can observe that ejectives neutralize to their plain counterparts in coda position (419b)-(420b):

(419) a. a.p’áx
'yarara'

b. ap.xá-s b'. *ap’xas
yarara-PL

(420) a. [qɑ.t͡s’éx]
'diarrhea'

b. [qɑ̰̀t͡s.xe-náx] b'. *[qɑt͡s’xenax]
diarrhea-NMLZ(AG)
'person that has diarrhea'

Interestingly, in (420), the [c.g] feature of the ejective (420a) gets realized in the Nucleus of the first syllable in (420b) and a glottalized vowel emerges. However, this phenomenon does not occur in (419). The result (*a̰pxas) does not conform to the stress patterns explained in Chapter 4: the Nivaĉle rhythmic type is iambic and the Head of the Prosodic Word has to be disyllabic. Also, recall that the realization of an ejective's [c.g] feature in the Nucleus of a previous syllable was also discussed in §4.5.4.

In sum, similarly to (419)-(420), examples (413)-(418) show positional neutralization of /k͡l/. Nevertheless, there is a particular context in which /k͡l/ can be preserved in coda position, namely before a glottal stop:

(421) a. [ʔ]uk͡l.ʔɑ́
'turtle dove'

b. ji-fak͡l.ʔu
1POSS-brother.in.law
'my brother in law'

c. ji-fak͡l.ʔa
1POSS-nephew
'my nephew'

Given the form in (421a), one could hypothesize that /k͡l/ is parsed as a complex onset [u.k͡lʔɑ], or that the lateral phase is syllabic: [u.k͡l̩.ʔɑ], so that there are three syllables instead of two. When I asked the members of the CLPN how they would syllabify the word in (421a), they agreed that it would be [uk͡ɬ.ʔá], that is, with two syllables. Interestingly, the forms in (421) serve to indicate a differentiation between the *shichaam lhavos* and the *yita' lhavos* varieties (cf. Chapter 1). The *yita' lhavos* speakers pronounce the words in (421) with an ejective [k'] instead of a [k͡ɬʔ] sequence, as follows.

(422) a. u.k'ɑ
'dove turtle'
b. -fak'u
'brother-in-law'
c. -fak'a
'nephew'

Even though root-internal /k͡ɬ ʔ/ sequences have not merged into an ejective in the *shichaam lhavos* variety, stop plus /ʔ/ sequences have merged in both the *shichaam* and the *yit'a lhavos* varieties (see §2.2.1.1, (16); §3.3.3.2 (164)). In Chapter 3, §3.3.2, I argue that the fact that /k͡ɬ/ can only occur before vowels and before [ʔ] confirms the lack of oral place of articulation of the glottal stop. Concomitantly, I hypothesize that the distributional patterns of /k͡ɬ/ are in favour of a perceptually motivated constraint (Steriade 1993, 1997) rather a syllabically motivated constraint (Lombardi 2002). That is, it is not the case that /k͡ɬ/ cannot be realized in coda position, but rather that a consonant specified for PLACE cannot follow the complex segment /k͡ɬ/. Further, /k͡ɬ/ is never attested as the first member of complex onsets, thus confirming the presence of a perceptually motivated constraint, which I formulate, for now as follows:

(423) *k͡ɬ [+cons, PLACE]: The complex segment k͡ɬ cannot occur before a consonant specified for PLACE.

At this point, then, it is important to reconsider the occurrence of affricates, laterals, and ejectives in complex onsets. None of these segments can occur as the first members of word-initial CC clusters, except for the affricate [t͡s], which only occurs before the fricative [x], e.g. *t͡sxotatax* ‘kingfisher’. However, all of them, except for [ɬ], can occur as second members of initial CC clusters. In fact, reference to Table 5.2 reveals that the lateral fricative /ɬ/ stands as a very distinct sound: it can occur before a consonant but only across morphemic boundaries; there is no instance of a CC-initial root where either the first or the second member has a lateral fricative.

5.3.2 Phonological status of k͡l

At this point, there are two aspects of the phonological status of [k͡l] that merit reconsideration.

First, we have observed that Nivaĉle laterals [ɬ] and [k͡l] display an asymmetric pattern of distribution. On the one hand, the fact that the complex segment [k͡l] is realized in a more restricted environment than [ɬ] might call into its phonemic status. Yet, the two laterals contrast in onset position, as the minimal pair in (424) shows:

(424) a. xa-k͡lán
1S-kill
‘I kill’
b. xa-ɬán
light.up
‘I light up (a fire)’

On the other hand, the fact that [k͡l] neutralizes to [k], while [k] from /k/ can occur in a much broader set of contexts, might raise questions about the relationship between these two sounds. In (425) we can observe that [k͡l] also contrasts with [k] in onset position.

(425) a. t-kam-k͡láj
3S-?-suffer
‘s/he is brutal’

b. t-ka-mká-j
3S-?-carob.tree.flour-VBLZ
‘s/he makes flour’

Given the minimal pairs in (424) and (425), it has been shown that [k͡l] is not in complementary distribution with either /ɬ/ or /k/, and that it holds phonemic status in the language.

Second, there are a number of arguments that argue against the hypothesis that Nivaĉle /k͡l/ is a consonant cluster composed of two individual segments /k-l/. The first is native speakers' judgments. During fieldwork and workshops on the Nivaĉle language, my consultants indicated the importance of differentiating Nivaĉle *k͡l* from Spanish consonant clusters [kl] or [gl], which also only occur in onset position.[70]

My consultants also claimed that the two components cannot be separated by an excrescent vowel, as may be the case of Spanish obstruent plus liquid consonant clusters (Colantoni & Steele 2005). On the one hand, these native intuitions about the nature of /k͡l/ resemble Clements' (1999: 272) *inseparability* property of affricates: "the stop + fricative sequence cannot be broken up by epenthesis, reduplication, and so forth". Crucially, this 'inseparability' property is intertwined with the 'noncompositionality' property of affricates (Clements 1999: 271). There is no independent lateral approximant segment in Nivaĉle and speakers do not identify [l] as a native sound in their language (though they acknowledge that there are few words with [l]); this sound is present in certain loanwords such as [ele] "missionary" and [palaβaj] "Paraguay" (§5.4.1.1). As will be argued in §5.6 and §5.7, Nivaclé [k͡l] evolved from a lateral approximant that is still part of the phonemic inventory of the other Mataguayan languages.

The second type of argument for not treating /k͡l/ as a consonant cluster comes from the phonotactics of Nivaĉle; at most two consonants can occur in onset position, as the allomorphic alternation between /ɬ-/ and /ɬa-/ – '3POSS' – show (cf. Chapter 2, § 2.3.1). Whereas /ɬ-/ occurs before vowel and singleton consonant-initial roots across morpheme boundaries (426a,b), /ɬa-/ is attached to CC-initial roots (426c).

[70] In that regard, recall that one of the recent revisions of the Nivaĉle orthography, carried out by the CLPN actually involves the representation of /k͡l/ (§ 1.5.1), This complex segment used to be represented with the grapheme *cl* but now has been replaced by *ĉl*. The goal of this modification is to highlight the phonetic difference with the Spanish consonant cluster [kl], which is written as *cl*.

(426) a. ɬ-tʼóx
3POSS-uncle
‘his/her uncle’

b. ɬ-k͡lḭ́ʃ
3POSS-word
‘his/her word’

c. ɬa-f.xúx
3POSS-toe
‘his/her toe’

If it were assumed that /k͡l/ constitutes a consonant cluster, then examples in (427) would be the only CCC clusters permitted in the language.

(427) a. t-k͡laxáj a’. *tklaxáj
3S-lean
‘S/he leans.’

b. sk͡lɑkxáj ~ ʃk͡lɑkxáj b’. *sklɑkxáj
‘wildcat’

To summarize, /k͡l/ does behave as a segment. Similarly to other complex segments, such as ejectives, it undergoes neutralization when the perceptual cue for its identification is obscured, that is, before a consonantal segment specified for place. As has been shown, /k͡l/ simplifies to [k] before a consonant or in word-final position, but interestingly, not before a glottal stop (421). One corollary of this perceptual constraint is that glides do not pattern with vowels in this language; no instance of ejectives or /k͡l/ occurs before a glide /w/ or /j/. However, it is also true that the contact between /k͡l/ and the glides should be ruled out by the Syllable Contact Law (§ 2.3.2, § 6.2.2).

5.4 Acoustic properties of Nivaĉle laterals

The goal of this section is to provide a phonetic description of Nivaĉle laterals /k͡l/ and /ɬ/.[71] As the reader will recall from §5.1, these two Nivaĉle segments were reported to have both velar and dental/alveolar articulations (Stell 1989:58), and have been "somewhat obscurely described" Maddieson (1984:77). In this section, it will be shown that the lateral release of [k͡l] is not fricated (unlike the case of lateral affricates from other languages cited in the literature; §5.2.1), and that there is no phonetic evidence for [ɬ] having a dorsal component comparable to that of the velar fricative [x].

5.4.1 On Nivaĉle k͡l

Based on the speakers' comments on their own production process, and the way they taught me how to produce this sound, the articulation of [k͡l] can be described as follows. The dorsum of the tongue is bunched and raised towards the velum where an obstruction is made, and the tongue tip touches the area behind the incisors. When the occlusion made at the velum is released, the dorsum is lowered and air flows out freely over one or both sides of the tongue. Importantly, the release does not involve audible noise or frication; the lateral realization itself is voiced.

Acoustic analysis shows that this segment /k͡l/ is acoustically complex as well, and consists of two distinct phases. The consonant's onset phase corresponds to a voiceless stop, generally realized as velar [k], thought it fluctuates with a uvular [q], mostly in the context of back vowels. This occlusive onset is released into a lateral approximant that is velarized (~ uvularized) due to coarticulation with the dorsal (~ uvular) stop. Note that this secondary co-articulation is referred to as a "dark l", represented as [ɫ], in the discussion to follow, in contradistinction to [ɬ] which represents a voiceless lateral fricative. Generally, however, to avoid potential confusion between these two graphs, this complex segment will be represented with the broader phonetic transcription as [k͡l]. Let us turn now to a consideration of the spectrogram of the complex segment /k͡l/ in Figure 5.1.

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[71] For the sake of simplicity and historical consistency, I continue to refer to these two sounds as 'laterals'; in §5.5, I will discuss their featural specification.

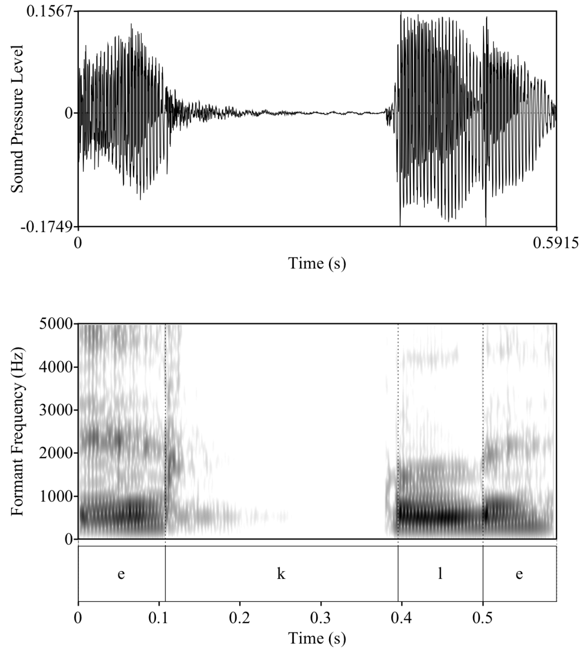


Figure 5.1 Waveform and spectrogram of [ek͡ɬe] ‘parrot’ by female speaker TS

Specifically, as can be observed from the spectrogram in Figure 5.1, after the closure period, the lateral release is voiced (see voice bar along bottom of spectrogram). Further, there is no fricative energy. Instead, a high intensity formant structure can be found in the lateral release.

5.4.1.1 [k͡ɬ] and [l]

As previously mentioned (§2.2), a sonorant lateral /l/ is absent from the Nivaĉle phonological inventory. However, a dento-alveolar lateral can be found in few loanwords. One of the loanwords is [ele] ‘(German Catholic) missionary’, which comes from Maká (Stell 1989: 60). This word thus provides a good source of comparison with [ek͡ɬe] ‘parrot’ in Figure 5.1 above.

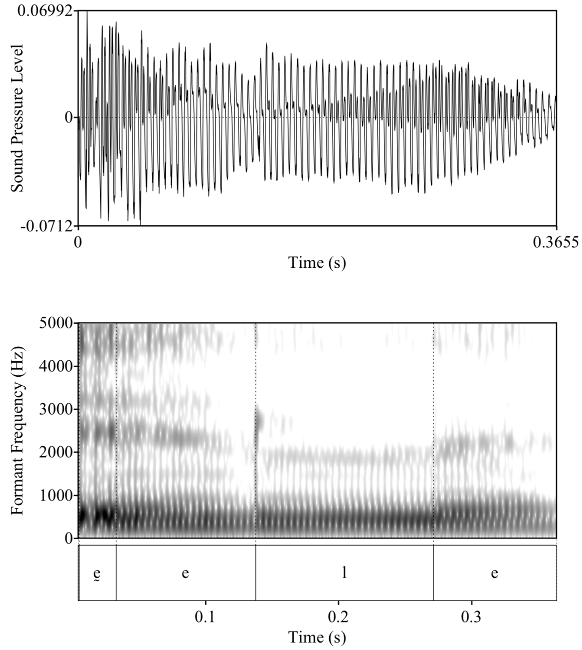
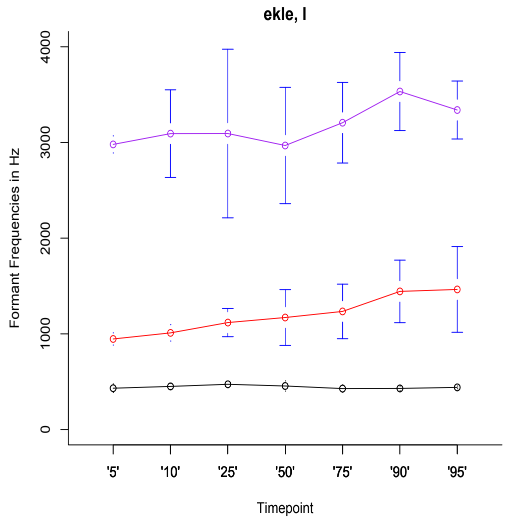


Figure 5.2 Waveform and spectrogram of [ʔele] ‘missionary’ by female speaker TS.

The analysis of the formant transitions in the lateral release of [k͡ɬ] compared to the lateral portion of [l] can inform us about the tongue body configuration in the articulation of these sounds. An initial inspection of the spectrogram shows that F2 is lower in the lateral portion of [k͡ɬ] (Figure 5.1) than in that of [l] (Figure 5.2).

Articulatory studies have shown that “there is a greater retraction in the anterior tongue body in the English dark /l/ when compared to the light variety” (Narayanan et al. 1997: 1064). Acoustically, “dark *l* [what is represented here as [ɫ]/AG] always has a very low F2 and this seems to be related to the uvular or pharyngeal constriction which it shares with back vowels” (Bladon 1979: 502). Velarized laterals are reported to have very low F2 values; for example, Russian and Portuguese velarized laterals have mean F2 values of around 1000 Hz (Recasens & Spinosa, 2005). Following this, I expect to see lower F2 values for the lateral portion of /k͡l/ compared to the dental-alveolar /l/. In order to compare the formant transitions of these two sounds, the F1, F2, and F3 values at 7 timepoints across five tokens were calculated using a Praat script (Boersma & Weenink 2014). Figures 5.3 and 5.4 show the results.



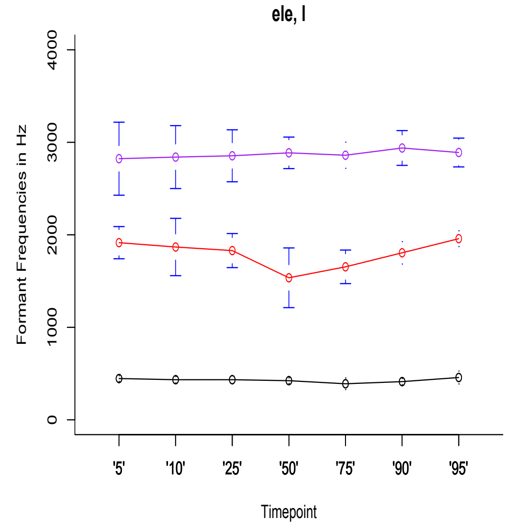


Figure 5.3 Mean average of F1, F2, and F3 at 7 timepoints of [ɫ] in [ek͡ɫe] across 5 tokens.

Figure 5.4 Mean average of F1, F2, and F3 at 7 timepoints of [l] in [ele] across 5 tokens.

As can be observed in Figures 5.3 and 5.4, the F2 in the lateral release of the complex segment is much lower than in the lateral approximant. This situation suggests that the lateral release is velarized; resembling the results for "dark l". The formant values from 5% into the vowel were used in a paired t-test. The F2 values of the lateral release of [k͡ɫ] at 5% ($M = 946.6$, $SD = 51.4$) was significantly lower than that of [l] [$M = 1990.6$, $SD = 222.7$; $t(4.42) = 10.21$, $p < 0.001$].

5.4.1.2 [k͡ɫ] and [k]

As mentioned in §5.3, the lateral phase of the complex segment does not get realized in coda position. Figures 5.5 and 5.6 show the alternation between [k͡ɫ] and [k], respectively.

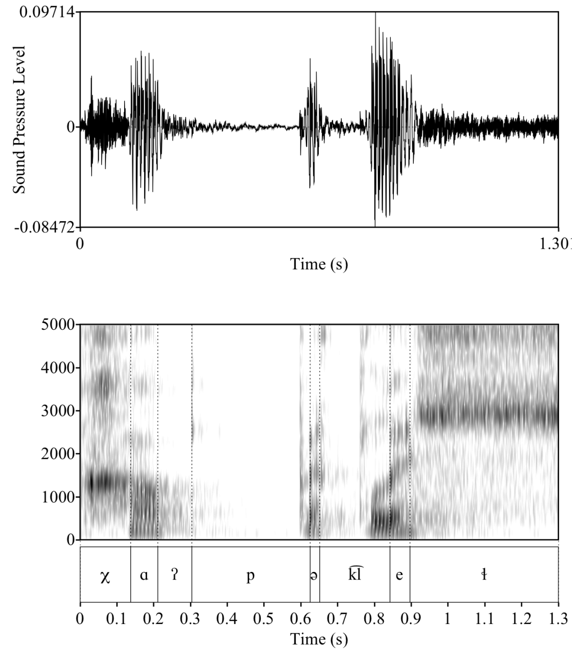


Figure 5.5 Waveform and spectrogram of [xàʔpək͡léɬ] 'we return' by male speaker FR

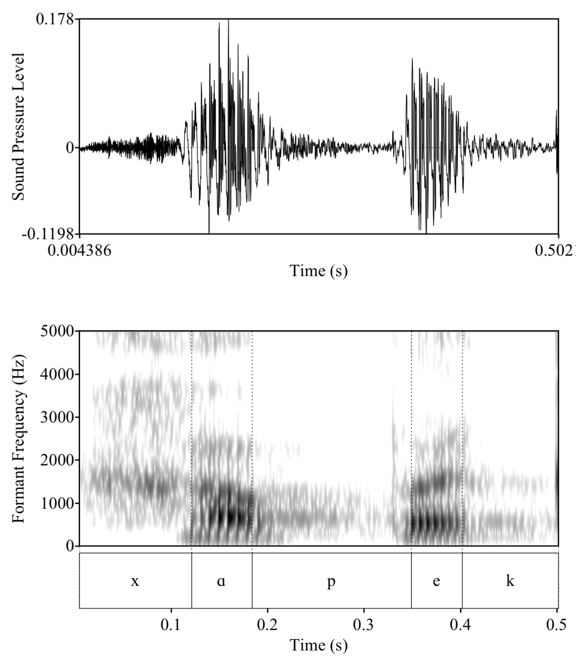


Figure 5.6 Waveform and spectrogram of [xɑpék] 'I return' by male speaker FR

In Figure 5.6, it can be seen that no trace of the lateral realization is present; the complex segment delateralizes to [k] and not to [l] in coda position (note that there is echo of the preceding vowel in the signal of the [k]; there is no voicing). Recall, however, that /k͡l/ gets realized before a root internal glottal (421). See for example Figure 5.7.

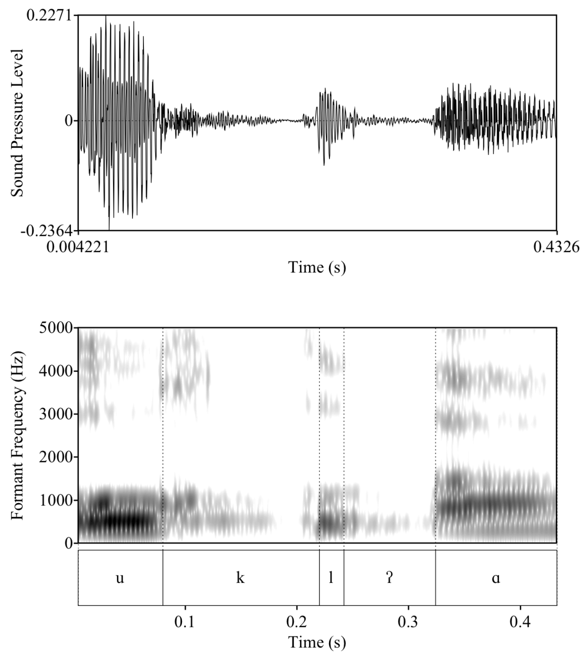


Figure 5.7 Waveform and spectrogram of [uk͡lʔɑ́]
'turtle dove' by *tovoc lhavos* female speaker TS

In Figure 5.7, a very brief lateral release (22 ms) can still be observed before the glottal stop. In contrast, Figure 5.8 shows the pronunciation of this same word by a female *yita' lhavos* speaker. The lateral phase is not present and the (neutralized) velar plus glottal stop sequence gets realized as an ejective stop [k'].[72] This is one of the phonological dialectal differences between the *tovoc lhavos* speakers, who live along the Pilcomayo river, and the *yita'* and *jotoy lhavos*, who live in the inland area (Boquerón Department, Paraguay).

[72] Recall that stem final plosives become glottalized in the context of glottal-initial suffixes across all varieties (cf. Chapter 3).

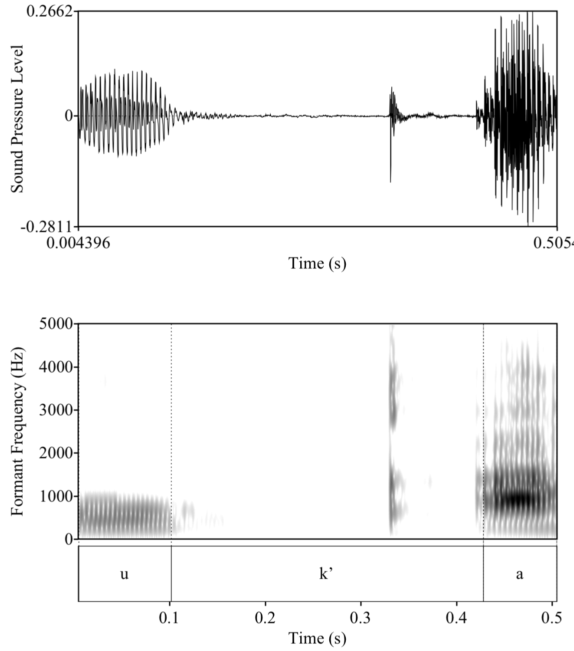


Figure 5.8 Waveform and spectrogram of [uk’á]
‘turtle dove’ by *yita’ lhavos* female speaker RF

Also note the different vowel quality at the end of the word: [a] instead of [ɑ]. As mentioned in Chapter 2, another characteristic of the *yita’ lhavos* variety is that there is no low back vowel [ɑ]; the only low vowel is [a].

I now turn to the discussion of the articulatory and acoustic properties of the lateral fricative /ɬ/ and compare them with the other fricative segments in this language, namely /f s ʃ x/.

5.4.2 On Nivaĉle ɬ

In terms of articulation, Stell (1989:58) describes /ɬ/ as a voiceless “dento-velar” fricative, and she includes a raised velar fricative in the transcription [^{x}ɬ] of this sound (the strikethrough diacritic means voiceless). Specifically, Stell (1989: 89) adds in a note: “the dento-velar articulation means that the voiceless lateral has a simultaneous coarticulation with a voiceless velar fricative” [my translation from Spanish/AG]. Such transcription suggests two interesting implications: First, it explicitly foregrounds a connection between the lateral fricative and the complex segment /k͡l/ in that she is positing that the articulation of these two Nivaĉle lateral sounds involves a dorsal articulator. Second, this articulatory connection would provide support for Walsh Dickey's (1997) proposal: that laterals can be solely defined in terms of complex corono-dorsal place of articulation.

I postpone the full discussion of how this implication relates to the featural representation and the phonotactic patterning of Nivaĉle laterals until Section 5.5. For now, it is worth mentioning that I have not found any phonological evidence for the lateral fricative patterning with dorsals. Also, from an impressionistic point of view, I did not notice anything velar in the articulation of /ɬ/. If there were a dorsal component in the articulation of the lateral fricative, lower frequency spectral peaks similar to those of back fricatives, e.g., velar fricatives. I now turn to the discussion of FFT and LPC spectra for the comparison within the Nivaĉle fricative set.

5.4.2.1 FFT and LPC spectra

Spectral peaks in fricatives generally relate to the size of the front cavity. As the place of articulation of fricatives moves from front to back, the size of the front cavity increases and the spectral peaks are lower in frequency (Johnson 2008:130).

Below, I present the FFT spectra of /f s ʃ ɬ x/ from two speakers, FR and TS, in Figures 5.9 and 5.10, respectively. Each fricative was recorded preceding the low front vowel /a/ in a stressed syllable. Each speaker pronounced (at least) three tokens of the words listed in (428). The words containing the target fricatives (in bold) were pronounced in isolation. The original sampling rate was 44,100 Hz.

(428)	Target /f/	a.	ɬaf-[á]s wing-PL 'wings'
	Target /ɬ/	b.	ɬá-j fruit- PL 'fruits'
	Target /s/:	c.	ji-sáʃ 1POSS-mucus 'my mucus'
	Target /ʃ/	d.	ji-ʃátet͡ʃ 1POSS-head 'my head'

Target /x/: e. kumxát
work-CAUS
'work'

All analyses were carried out in Praat (Boersma & Weenink 2014). FFT and LPC spectra were calculated over a 100 ms portion at the middle of each fricative. For the LPC spectra, the analysis window was 50 ms (Hanning).

The FFT spectra for three tokens of each segment are given in Figure 5.9 for the male speaker. Spectra for the female speaker appear in Figure 5.10. Because the comparison between the spectra for /x/ and /ɬ/ are of special interest here, I also plot the spectra for these two sounds together at the bottom right of the figure.

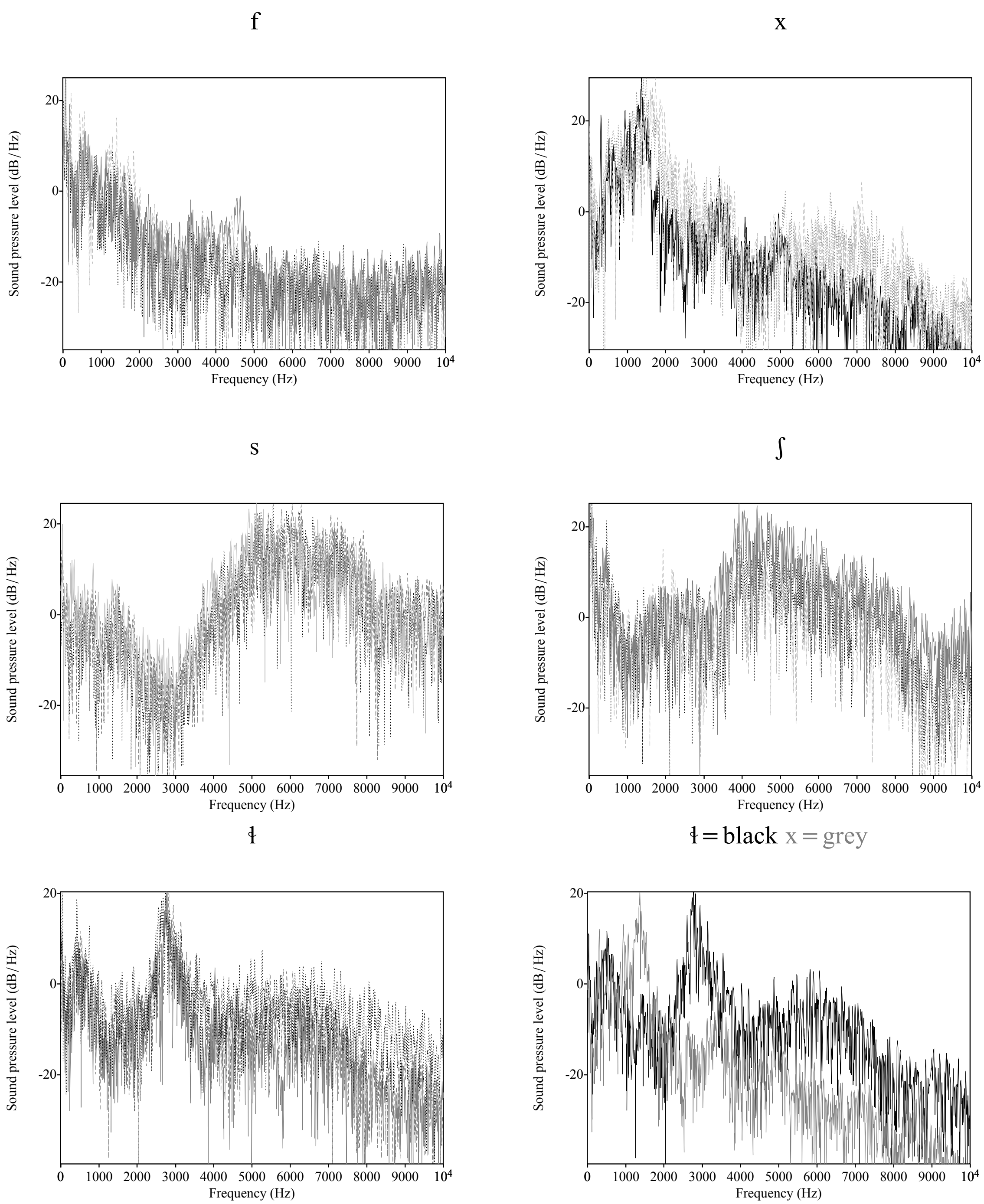


Figure 5.9 FFT spectra of Nivaĉle fricatives /f s ʃ ɬ x/, male speaker FR.

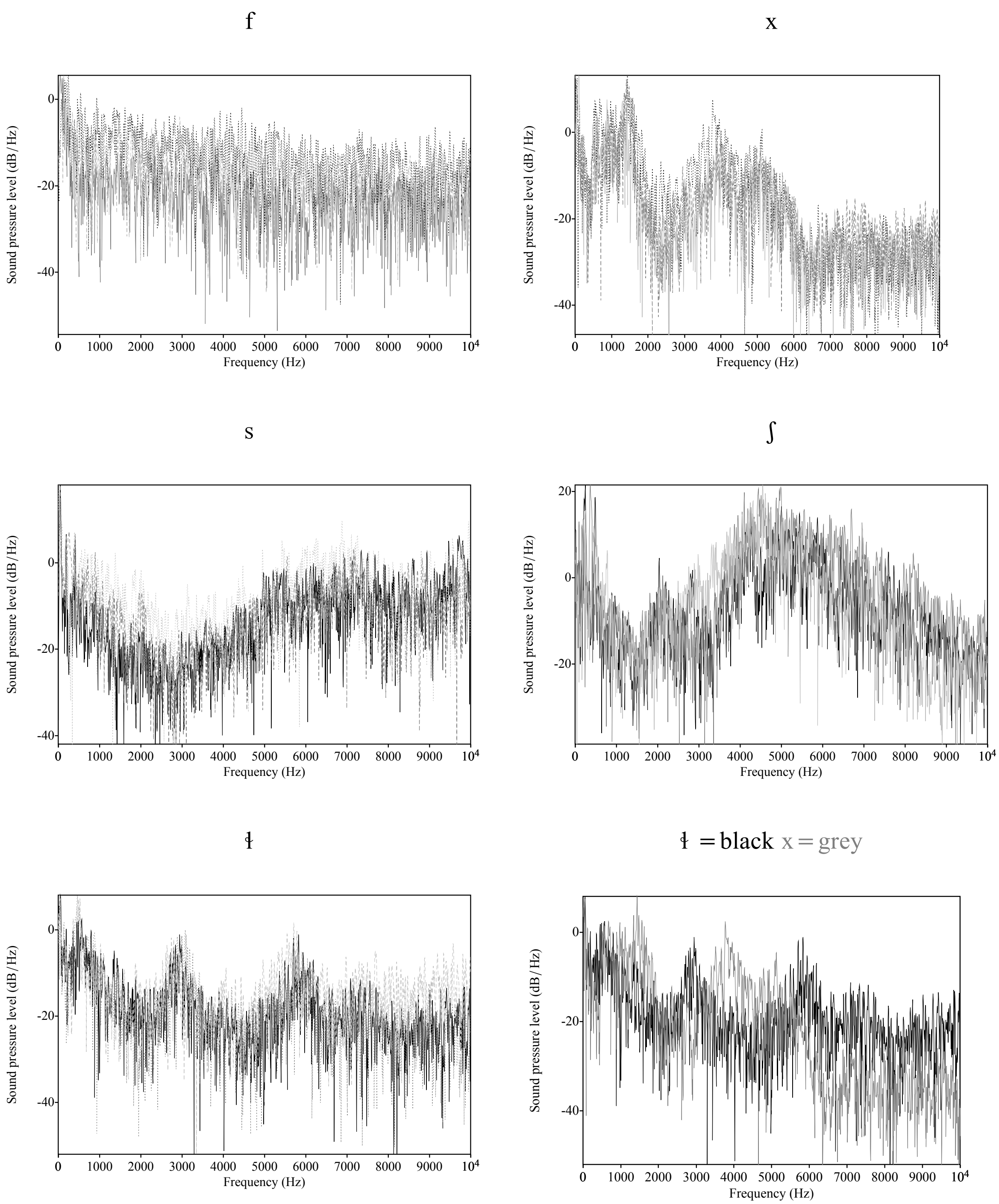


Figure 5.10 FFT spectra of Nivaĉle fricatives /f s ʃ ɬ x/, female speaker TS.

Spectral measures reveal differences among the fricatives within the productions of each speaker. The spectra for the labiodental /f/ are the flattest in both speakers, showing the most gradual drop in intensity as frequency increases. For the velar fricative /x/, a spectral peak can be found between

1,000 Hz and 2,000 Hz in both FR and TS. The fricative /s/ shows the highest frequency concentration; it displays the highest spectral peaks, at almost 6,000 Hz – though they are much sharper for FR than TS. In turn, /ʃ/ has a sharp peak below 5,000 Hz in both FR and TS's spectra. In both FR and TS, a first spectral peak for /ɬ/ can be found at around 2,500 Hz and a second peak (more prominent in TS) can be found at approximately 6,000 Hz. In addition the /ɬ/ displays some low frequency noise below 1,000 Hz in both speakers. Similar spectral characteristics have been reported for the Chickasaw lateral fricative (Gordon et al 2002).

A comparison between the FFT spectrum of /ɬ/ and /x/ is given at the end of Figures 5.9 and 5.10. The spectra for TS show more overlap than those for FR, e.g. there is a sharper intensity drop in FR's /x/ than TS's. However, the first peak of velar /x/ is clearly differentiated from that of /ɬ/ in both speakers.

Figure 5.11 below summarizes the spectral differences displayed by the Nivaĉle fricatives /f s ʃ ɬ x/ from LPC analysis of the male speaker; FR's tokens. LPC spectra were calculated over a 100 ms portion of the middle of each fricative; in short, the analysis window was 50 ms (Hanning).

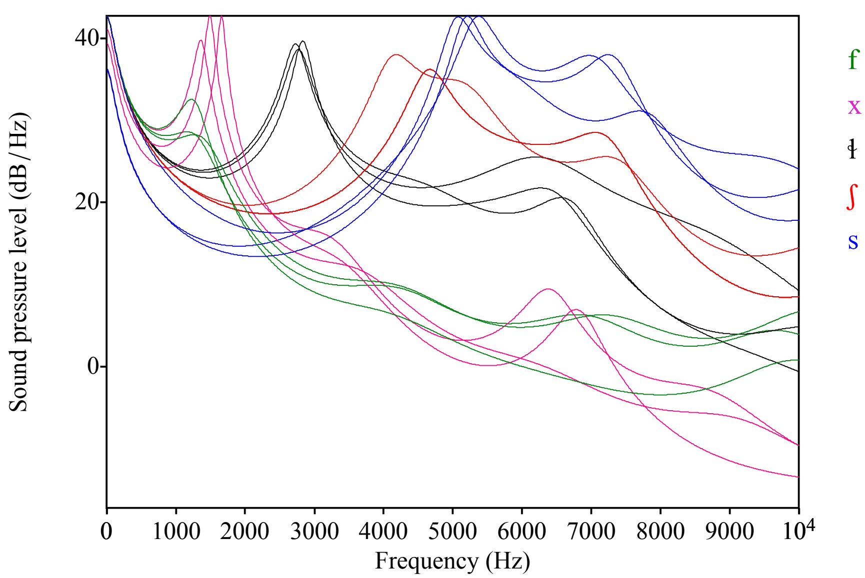


Figure 5.11 LPC spectra of Nivaĉle fricatives, male speaker FR.

As can be observed in Figure 5.11, the LPC spectra for the Nivaĉle fricatives are clearly differentiated. Further, the spectra for FR's lateral fricative show a very distinct peak at around 2,800 Hz. It can be concluded that the spectral properties of the velar fricative do not overlap with the lateral fricative; there is no phonetic evidence for a dorsal component in the articulation of /ɬ/.

5.5 On the featural representation of Nivaĉle laterals

The questions that arise at this point are whether [lateral] is an active feature in the phonology of Nivaĉle, and if so, where this feature might be located in.

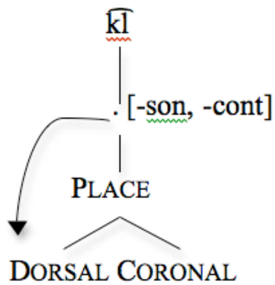
The locus of [lateral] within a model of feature geometry has been the subject of extensive debate and so different analyses can be found in the literature. It has been proposed that [lateral] is: (i) a terminal feature of the CORONAL node (Steriade 1986, McCarthy 1988, Pulleyblank 1988, Blevins 1994), (ii) placed as high up as the place node (Sagey 1986), (iii) a direct dependent of the ROOT node (Shaw 1991), and (iv) a dependent of a SPONTANEOUS/SONORANT VOICE node (Rice & Avery 1991, Rice 1993, Brown 1995).

Interestingly, the existence of [lateral] as a feature has been also contested. For instance, Spencer (1984:29) proposes to eliminate [lateral] and rather redefines [distributed] in order to differentiate rhotics [-dist] from laterals [+dist]. Similarly, Walsh Dickey (1997:17) argues that [lateral] is a redundant feature that is phonologically invalid. Instead, she postulates that laterals should be defined by means of a complex CORONO-DORSAL place of articulation.

Three of the different autosegmental representations that the Nivaĉle complex segment /k͡l/ could have are diagrammed in (429), (430) and (437). The internal structure in (429) is in line with Walsh Dickey's proposal: /k͡l/ is solely characterized by means of two places of articulation: CORONAL and DORSAL. In other words, "there is no feature [lateral] (…) it is only the complex place structure of coronality and dorsality that makes a lateral" (Walsh Dickey 1997:25). The fact that /k͡l/ neutralized to [k] indicates that DORSAL is a major articulator phase for this segment. In (429), the arrow – more precisely, a 'pointer' in Sagey's (1986) model of complex segments – links the root-node to this major articulation feature, indicated by the place-node DORSAL. In the simplification of /k͡l/ to [k], the

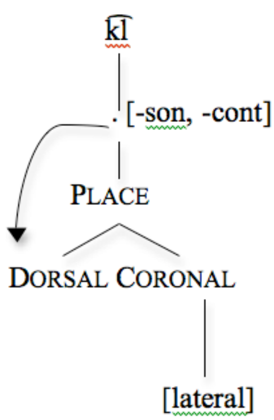
CORONAL place specification would get delinked.

(429)



A variation on this representation is provided in (430), which follows Blevins' (1994) proposal; namely, (i) [lateral] is a distinctive feature, and (ii) [lateral] is a dependent of CORONAL. Under the hypothesis represented in (430) that [lateral] is a dependent of CORONAL, the neutralization of /k͡l/ to [k] would involve delinking of the CORONAL node, and consequently, of [lateral], a daughter of the CORONAL node: decoronalization entails delateralization. This process has also been proposed for other laterals; specifically, velar laterals in Austronesian languages (Blevins 1994).

(430)



One type of supporting evidence for the characterization of /k͡l/ as a complex corono-dorsal segment is that, cross-linguistically, laterals tend to alternate with either coronal or dorsal segments; this alternation relies on syllable position. For instance, in Jibbali (Arabian Semitic), the voiced velar stop

[g] is an allophone of the voiced lateral fricative /ɮ/:[73]

(431) a. ɣeig (sing) 'man'
b. ɣoɮi (dual)
c. iaːg (plural)

(Walsh Dickey 1997:29 (2.11a,b,c))

In (431), it can be observed that the intervocalic voiced lateral fricative in (431b) alternates with a voiced velar stop when this segment is in coda position (431a,c). Under the proposal that the lateral fricative is specified for both coronal and dorsal places, this alternation can be explained in feature tree geometry as the delinking of the coronal node; the velar node is retained.

Similarly, in Mehri (Southern Arabian Semitic) a lateral alternates with a dorsal approximant [w]; a root-final /l/ surfaces as [w] in coda position (Johnston 1975, in Walsh Dickey 1997):

(432) a. /ɬ l θ/ 'third (root)'
b. [ɬoːləθ] 'third (masc)'
c. [ɬəwθeːt] 'third (fem)'

(Walsh Dickey 1997:39 (2.19 a,b,c))

Likewise, in Brazilian Portuguese, /l/ gets realized as a rounded back glide [w] in word final position (433) (Camara 1970, Feldman 1972), and English 'dark l' [ɫ] is realized as [ʊ] (434)-(435) in Cockney English (Wells 1982):

(433) **Brazilian Portuguese**
a. /sa.l-ej.ro/ [sa.lej.ro] 'salt shaker'
b. /sal/ [saw] 'salt'

(434) **English** /mɪlk/
a. RP English [mɪɫk]
b. Cockney English [mɪʊk]

[73] Note that there is an independent phoneme /g/ in the language.

(435) **English** /ʃɛlf/

a. RP English [ʃɛɫf]

b. Cockney English [ʃɛʊf]

With regards to examples such as those discussed (431)–(435), Trigo (1988) considers dorsals to be the unmarked coda consonants; DORSAL is the preferred place of articulation in coda position. This 'unmarkedness' or preference would explain why DORSAL is retained at the expense of CORONAL, that is, why CORONAL is lost. Nevertheless, laterals alternate between a coronal and dorsal component in positions other than coda; for instance vocalization of /l/ ~ [w] occurs in Polish in all syllabic positions (Walsh-Dickey 1997: 37), in contrast with the examples presented in (431)-(435), which are restricted to coda position.

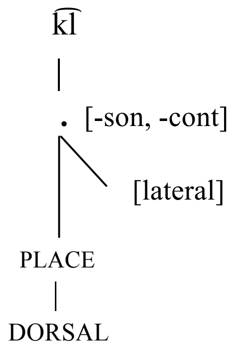
Some arguments against the representation in (430) are worthy of mention. First, it has been shown that, in the case of Nivaĉle, the simplification of /k͡l/ into [k] is not entirely dependent on syllable position, namely, /k͡l/ is systematically retained in onset position, but it is also retained in coda position before a glottal stop. Consequently, the [k͡l] ~ [k] alternation cannot be straightforwardly formalized as the syllable-based generalization that /k͡l/ simplifies to [k] in coda position. Rather, a constraint on sequential featural specification is needed. What is proposed is that in order for the lateral portion to be realized (i.e. /k͡l/), the following segment must not be a consonant specified for place features. (see (437-438) below).

Second, as laid out in Table 5.2 (see also §2.3.1), there is a sequential constraint which holds that no dorsal consonant occurs before /k͡l/: *DORSAL k͡l. However, there is no constraint in Nivaĉle that is sensitive to the CORONAL node. As argued above, no 'consonant' can occur after [k͡l]. In other words, there is no positive evidence for the existence of the place feature CORONAL as part of the internal representation of /k͡l/ in (429) and (430).

Third, consider the fact that [k͡l] simplifies to [k] and not to [l], or even to [t], when a consonant follows, as shown in §5.3.1. Further, in terms of coda consonants, coronal seems to be the least marked place in Nivaĉle; /n/ and /t/ are the most frequent codas.

These three arguments cast doubt on whether CORONAL is an active phonological feature in Nivaĉle /k͡l/. Consequently, another possible featural representation would be one where lateral is not a dependent of CORONAL but rather may be posited to be a dependent of the root node; [k͡l] would be then interpreted as a laterally released dorsal stop:

(436)



In this sense, the constraint presented in (423), repeated in (437), can be reformulated as in (438):

(437) *k͡l [+cons, PLACE]: The complex segment k͡l cannot occur before a consonant specified for place features.

(438) *[lat] [+cons, PLACE]: The feature [lateral] cannot occur before a consonant specified for place features.

The hypothesis [k͡l] is specified for [lateral], and the proposed constraint that [lateral] cannot occur before a consonant, raises questions about the featural representation of [ɬ].

To recapitulate, Blevins (1994) proposes that [lateral] is a necessary distinctive feature that is dependent of CORONAL. In contrast, Walsh-Dickey (1997) proposes that laterals can be solely defined as complex segments with CORONAL and DORSAL places of articulation. Because I do not find phonological evidence for [ɬ] patterning with dorsal segments, I do not assume that [ɬ] is a complex CORONO-DORSAL segment, with CORONAL as the primary node, a proposal that would be in line with Walsh Dickey's (1997) and Blevins' (1994) representations in (429) and (430). In order to differentiate /ɬ/ from the other coronal fricatives, namely /s/ and /ʃ/, only [strident] has to be invoked. Strident fricatives are those with considerable frication noise at higher frequencies caused by a narrow constriction, or "fricatives whose turbulence is due to to edge effects from airflow hitting an obstruction [such as the teeth]" (Laver 1994: 261) In turn, [f] and [x] are distinctively marked as LABIAL and DORSAL. See Table 5.3 for a featural representation of the fricatives and laterals in question.

Table 5.3 Feature representation of fricatives, stops and k͡l

	k͡l	k	ɬ	t	f	s	ʃ	x
LAB					✓			
DOR	✓	✓						✓
COR			✓	✓		✓	✓	
[cont]	-	-		-				
[lat]	+							
[strid]						+	+	

Importantly, in contrast with /k͡l/, which alternates with [k], /ɬ/ does not alternate with another consonant. However, there is a another relevant morphophonemic alternation in Nivaĉle: /t/ alternates with [ɬ] when a sequence of two /t/s would emerge as a result of morpheme concatenation:

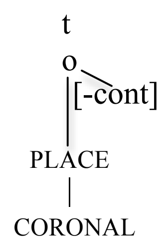
(439) a. ∅-tijá̰x
3S-shoot
'he shoots'
b. ∅-βàt-ɬijá̰x b'. *βàt-tijá̰x
3S-REF-shoot
'he shoots himself'

(440) a. xa-túx
1S-eat
'I eat'
b. βat-ɬúx b'. * βat-túx
INT-eat
'it is edible'

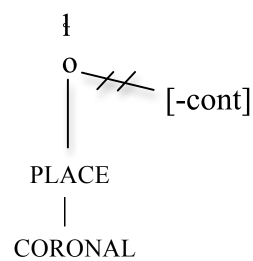
Recall, however, that there is an alternation in the pronominal prefixal domain for the possessive indefinite person: [βata-] ~ [βat-] ~ [βa-] (§2.4). The prefix [βa-] is used before t-initial stems, as in [βa-tíniʃ] INDEF.POSS-necklace 'someone's necklace' In forms like (439b)-(440b) it is not clear why the [βa-] alternant of the intransitivizer (INT) is not surfacing. The phonological alternation to be accounted for here is a dissimilation process: /t-t/ is realized as [t-ɬ]. As seen in Table 5.3, it is hypothesized in the present analysis that what distinguishes /t/ from /ɬ/ is the value for [continuant]. If /t/ loses its [-continuant] value, then it turns into [ɬ]. With this change in the [continuant] value, the contrast across morpheme boundaries is enhanced.

(441)

a.



b.



In the representation in (441b), /ɬ/ is seen to be solely represented in terms of the PLACE node CORONAL. In contrast, recall the proposal (436) that /k͡l/ is represented in terms of DORSAL, [lateral] and [-cont]. The hypothesis that /k͡l/ is marked for [lateral], whose realization is subject to the constraint in (438), explains the more restricted phonotactic behavior /k͡l/ displays in comparison with /ɬ/ (cf. Table 5.2). Recall, in that regard, the wider syllabic distribution of /ɬ/, in comparison with that of /k͡l/, and that this segment can be directly parsed into the syllable, as is the case with the pronominal forms for third person possessive and second person subject (§2.4).

The representations in (436) and (441b) thus lead to an interesting theoretical conclusion: the so-called Nivaĉle ‘laterals’ /k͡l/ and /ɬ/ do not actually form a phonological natural class. What has been shown is that these two segments behave differently in terms of their phonotactic patterning and in terms of their morphophonemic alternations. Moreover, they do not participate in any phonological processes that invoke their ‘lateral’ articulation as a shared phonologically relevant property. What is hypothesized in the present analysis is that these fundamentally different phonological patterns of behaviour are accounted for by the claim that only /k͡l/ bears [lateral] as a distinctive feature; /ɬ/ does not.

5.6 Comparative data from Mataguayan languages

One of the striking differences between the phonemic inventories of Nivaĉle, on the one hand, and Chorote, Maká and Wichí, on the other hand, is the absence (in Nivaĉle) versus presence (in all the others) of a lateral approximant [l].

According to Najlis (1984), there are two reconstructed dental laterals; *l and *hl, in the Proto-Mataguayan phonological system. The former, *l, is ‘simple’ and the latter is ‘aspirated’ (which could be interpreted as a lateral fricative /ɬ/). Further, Najlis proposes that the lateral approximant had a preglottalized allophone [’l]. The context in which this allophone occurred was not addressed by Najlis. Interestingly, there is a glottalized /’l/ within the phonemic inventory of Wichí; it contrasts with /l/ (Nercesian 2014a). Also, /’l/ is analyzed as a phoneme in Riverside or *iyojwa’(a)ja’* Chorote (Carol 2014). However, a preglottalized lateral is found neither in Maká (Gerzenstein 1994) nor in Nivaĉle (Stell 1972, 1989; my data). This phonological patterning within the language family does not seem to be fortuitous. Based on a lexical study of the Mataguayan languages (Tovar 1964), Fabre (2005:3) proposes the existence of two branches within the Mataguayan family. On the one hand, Chorote and Wichí form a branch (these two languages share 50% of their vocabulary), and on the other hand Nivaĉle and Maka form another branch (sharing 43% of their vocabulary). The following table presents a phonemic summary of the lateral systems of the Mataguayan languages.

Table 5.4 The lateral systems of Mataguayan languages

	iyojwa'(a)ja' Chorote		Wichi		Maká	Nivaĉle
	plain	preglot.	plain	preglot.		
lateral approximant	l	ˀl	l	ˀl	l	
complex segment k͡l						k͡l
palatalized lateral	lʲ	ˀlʲ				
lateral fricative	ɬ		ɬ		ɬ	ɬ

The first observation is that the complex segment /k͡l/ is found only in Nivaĉle. Secondly, it appears to be in virtual complementary distribution with the lateral approximants that occur in Chorote, Wichí and Maká. Although there are a small number of lexical items with a plain (not pre-glottalized) lateral approximant in Nivaĉle, all are loanwords from Spanish and/or the other Mataguayan languages.

(442) a. ele (Maká)
'German, missionary'
b. t͡ʃulupi (Spanish)
'Nivaĉle'
c. kaletax (Chorote) < Sp. kareta
cart-SIM
'cart'
d. palawaj < Sp. [paɾagwaj]
'Paraguay'
e. alus < Sp.[aros]
'rice'

Interestingly, there are at least two alleged borrowings from a neighbouring language – Enlhet – where it can be posited that [l] has been reinterpreted as [k͡l]: [**l**ɑp] → [**k͡l**ɑp] 'fast', and [ke**l**ayke] → [kek͡lejt͡ʃe] (Fabre 2014:290).

The following table provides comparative evidence in support of the hypothesis that [k͡l] corresponds to [l] and to ['l] in the other Mataguayan languages. The comparative data included in

Table 5.5 and Table 5.6 come from Gerzenstein (1983, 1994, 1999), Carol (2014), Fabre (2014), and Nercesian (2014) were collated by the author of this dissertation:

Table 5.5 Comparative evidence for *l > l and k͡l

Proto-Mat		**Chorote**	**Wichí**	**Maká**	**Nivaĉle**	**Gloss**
*$_{\sigma}$[l	l	ɬemi ~ lemi'			k͡lim	*white*
		eleʔ/ale	eleʔ/e'le		ek͡le	*parrot*
		le	lixuʔ /lex	lex	k͡le̯ʃ	*wash*
				leema	k͡laman	*to make even*
		alaʔ	xala		**-k͡lɑʔ**	*stick*
		-lan	-lon	-lan	-k͡lɑn	*to kill*
		siwalak		siwalaχ	siβɑk͡lɑk	*spider*
			lup		k͡lo̯p	*winter*
		talok			t'ak͡lu̯k	*blind*
	'l	we'la	iwela/we'la	xuwel	xiβeʔk͡la	*moon*
		ɑ'lena	je'la		jijek͡le	*tapir*
		ʔa'la/alaʔ	ha'lo		a̯k͡l-	*tree*
				kolo	kak͡lɑʔ	*leg*
		'lox			ak͡lox	*a lot*
*l]$_{\sigma}$		sakal		ɑftil cf. ɑftilets	ɑfte̯k cf. ɑftek͡les	*orphan* *orphans*
				het-pil	xat-pek cf. xat-pek͡leɬ	*I return* *we return*
		sakal	sinqal		sɑkɑk.tis cf. sɑkɑk͡lit	*souls* *soul*
		pel	xupel/hupeɬ		xpek cf. xpek͡lis	*shade* *shades*
		telis		t'il	t'ek cf. t'ek͡lis	*rheum(pl)/* *tears*

In Chorote, Maká and Wichí, the proto-Mataguayan *l is realized as a lateral approximant [l] in onset and coda position. In contrast, *l has historically developed into the complex segment /k͡l/ in Nivaĉle. The Nivaĉle phoneme gets realized as [k͡l] in onset position before all vowel qualities. Synchronically, /k͡l/ neutralizes to [k] in coda position (except when followed by a [ʔ] onset to the next syllable, root internally). The correspondent in the other Mataguayan languages of the Nivaĉle neutralized variant [k] in coda position is still [l]. The approximant lateral in these languages can occur in both onset and coda positions, though much less frequently in the latter case (Nercesian 2011). For instance, compare these forms in the Table: [aftil] 'orphan' and [aftilets] 'orphans' (Maká) with [ɑftek̰] and [ɑftek͡les] (Nivaĉle).

In contrast with /l/, the preglottalized lateral /'l/ only occurs in onset position in Wichí (Nercesian 2011: 95) and in Chorote (Gerzenstein 1983). In that regard, consider the forms listed in Table 5.5: [je'la] and [jijek͡le] 'tapir' in Wichí and Nivaĉle, respectively, and ['lox] and [ak͡lox] 'a lot' in Chorote and Nivaĉle, respectively.

In addition to *l, Najlis (1984) proposes that *hl is the proto-phoneme of the lateral fricative [ɬ]. Interestingly, Najlis describes this lateral as the combination of a glottal fricative and a dental lateral. Even though Najlis does not specify that these sounds underwent coalescence, I hypothesize that it can be understood in that way.

Table 5.6 Comparative evidence for **hl* > ɬ

Proto-Mat	Chorote	Wichí	Maká	Nivaĉle	Gloss
*hl	ɬawu	ɬawu		ɬawɑ	*flower*
	aɬuʔ	aɬu	aɬu	aɬu	*lizard*
	ɬoma		neɬu	naɬu	*day*
	wuɬ	weɬu	weɬ	wa̰ɬ	*climb*
			ɬaniʔ	ɬɑn	*to light*
			ɬoq'oq-xiʔ	ɬok-xiʔ	*it's rotten*
	ɬup ~ ɬop	ɬep		ɬṵp	*nest*
	ɬaʔ ~ laʔ	ɬaʔ		ɬaʔ	*fruit*
	luxsa	letʃa		ɬut͡sxa	*young woman*

In Table 5.6 the correspondences between Proto *hl and synchronic /ɬ/ are presented. There are, however, cases in which the lateral fricative in Nivaĉle corresponds to a lateral approximant in another Mataguayan language – for example; compare the form for (i) 'urine' [-ol] in Chorote, and [-uɬ] in

Nivaĉle, (ii) ‘3POSS’ [la-] in Wichí, [ɬa-] in Nivaĉle, and (iii) ‘young woman’: [luxsa], [letʃa] and [ɬu͡tsxa] in Chorote, Wichí and Nivaĉle, respectively.[74]

Interestingly, Najlis (1984:29) observes that *hl underwent a limited number of phonological changes. For instance, “as a pronominal prefix before a consonant, *hl lost its dental portion in Chorote and its aspirated portion in Mataco [Wichí]” [my translation from Spanish/AG,].[75] In contrast, in Maká and Nivaĉle, the lateral fricative is found instead.

Comparative data exemplifying this cross-linguistic variation can be found in the third person possessive pronominal form and the second person subject. Specifically, in (443) and (444), the third person possessive is realized as [la], in free variation with syllabic [l̩] in Wichí (443a,b) as documented by Nercesian (2011:64); as [ɬa] ~ [ɬ] in Nivaĉle (443b, 444a) as seen in (Chapter 2); as [ɬe] in Maká (444b), and as [x] in Chorote (444c):

(443)	a.	la-’wu		
		3POSS-neck		
		‘his/her neck’		
	a’. ~	l̩-’wu	Wichí	(Nercesian 2011: 168 (64))
		3POSS-neck		
	b.	ɬa-βóʔ		
		3POSS-neck	Nivaĉle	(Gutiérrez field notes)
(444)	a.	ɬ-t͡ʃíniʃ		
		3POSS-younger.brother	Nivaĉle	(Gutiérrez field notes)
		‘his/her younger brother’		
	b.	ɬe-k’inix		
		3POSS-younger.brother	Maká	(Gerzenstein1994: 148 (213))

[74] Another interesting point of comparison is the different placement of the velar fricative, probably suggesting a case of laryngeal metathesis of *h. Unfortunately, a more detailed investigation of this falls outside the scope of this chapter.

[75] Mataco has been used not only to refer to both the Wichí language and people, but also to the language family (Loukotka 1968, Greenberg 1987). However, “native speakers reject this name because it has a pejorative sense, and they self-denominate using the native term Wichí” (Nercesian 2014b: 743).

c. xi-kini
3POSS- younger.brother Chorote (Najlis 1984:30)

On the one hand, note that the lateral approximant in the Wichí third person possessive prefix (443a'), similarly to the Nivaĉle lateral fricative (444a) can be "syllabic", without a following vowel. On the other hand, note the contrast between (444a) and (444c), where Nivaĉle shows the palatalized version of [k'] ([t͡ʃ']) and [x] ([ʃ]) in Maká.

Given the comparative evidence described in Tables 5.5 and 5.6, there are some interesting patterns of historical change in the Mataguayan lateral system. The glottalization feature of the allophonic Proto *'l has become phonologized in Chorote and Wichí such that preglottalized laterals now contrast with plain laterals before vowels. These complex segments – the preglottalized laterals – only occur in onset position, as is also the case of Nivaĉle /k͡l/. This similar situation may entertain the hypothesis that /k͡l/ was a direct reflex of the *'l positional allophone described by Najlis. However, because the coda realization [k] must be from earlier /k͡l/, rather than directly from *l, /k͡l/ must have at an earlier/intermediate stage occurred in both onset and coda position.

The development of *l into k͡l in Nivaĉle, the phonologization of the preglottalized laterals in Wichi and Chorote, and the alternation between a plain lateral approximant and a lateral fricative in onset position in Chorote (e.g. lemi' ~ ɬemi), suggest a series of fortition processes in these languages. In the following section, I turn to the discussion of this phenomenon in Nivaĉle.

5.7 Historical perspectives: The emergence of the complex segment k͡l

Having established the historical and family background of Nivaĉle 'laterals', the following sections explore the potential prosodic and perceptual explanations behind the emergence of the complex segment *k͡l*, namely, fortition and prestopping.

5.7.1 Fortition

The concept of *fortition* or *strengthening/hardening* has been object of extensive debate in the literature (Escure 1977, Kirchner 1998, Lavoie 2001, Vijayakrishnan 2003, Brandão de Carvalho, Scheer & Ségéral 2008, among others). Fortition is defined in opposition to *lenition* or *weakening*. A seminal definition of *lenition* as relative weakness is that of Vennemann, found in Hyman (1975:165): “A segment X is said to be weaker than a segment Y if Y goes through an X stage on its way to zero”. Behind this definition (see Bauer 2008:607 for criticisms) lies the idea of consonantal strength, where ‘strength’ is defined in terms of the (likewise another controversial) concept of *sonority* (Vennemann 1988). Various representations of ‘hierarchies or scales have been proposed (see Lass 1984:178, Hock 1986), the basic tenet being that some consonants are stronger than others. More specifically, it has been proposed that certain types of segments are intrinsically strong, i.e. by their very nature, and/or that certain phonological environments are strong. For instance, Escure (1977) claims that the position of a segment in the word is relevant, and proposes a hierarchy of weak positions, from top (weakest) to bottom (strongest). In this vein, ‘strength’ has tried to be represented in terms of hierarchies or scales (Lass 1984:178, Hock 1986): some consonants are stronger that others.

(445)	V_C##	weakest
	V_##	
	V_V	
	##_V	strongest

As pointed out by Lavoie (2001), Escure did not consider either syllable structure or stress as conditioning factors: it is certainly the case that V_V́ is a stronger position for hardening than V́_V is. In that regard, fortition has been related to prosodic prominence: segments occurring at prominent prosodic positions such as onsets, word initial or stressed syllables, roots, phonological word and phonological phrases’ boundaries get strengthened (Zoll 1998, de Lacy 2001, Smith 2000, 2002, Bauer

2006). For example, onsets of strong syllables may demand the presence of low-sonority consonants (Smith 2002), or consonants that are more constricted, have longer duration, make more articulatory contact, and/or exhibit less temporal overlap between the articulatory gestures (Fougeron & Keating 1996, Shattuck-Hufnagel & Ostendorf 1996, Byrd 2000, Chitoran et al 2002, Keating et al. 2003).

In this chapter, I adopt Keating's (2006) definition of hardening in terms of consonantal strength. Consonants that occur at the beginning of some prosodic domain (i.e. syllable, foot, word, intonational phrase) are 'stronger' than consonants that occur finally in the same domain. 'Stronger' is further defined by Keating in terms of the amount of contact between active and passive articulators, and duration of the contact.

If we consider the different articulation of [l] and [k͡l], in the articulation of [k͡l] there is more contact between the passive articulator (the area behind the incisors, the molars and the velum) and the active articulator (tip/blade and back of the tongue) than that found in [l], where only the tip/blade of the tongue touches the area behind the incisors. Note that the complex segment [k͡l] is significantly longer in duration than [l] (370 ms vs. 130 ms, respectively, on average (cf. Figures 5.1 and 5.2). If we reconsider the data presented in Table 5.4, we can posit that *l 'hardened' to [k͡l] in both prosodically prominent (onset) and less prominent positions (coda), and then [k͡l] simplified to [k] in coda position. Note that the emergence of [k͡l] is not tied to the locus of stress. This sound can be found in both unstressed and stressed syllables; for example, [xatùʔk͡lijàn] 'I obstruct', [k͡lasá] 'thin, slim' vs. [xak͡lán] 'I give a massage', [xak͡lḛ́ʃ] 'I wash'. Now, if *l underwent a process of fortition, what are the mechanisms involved in such process? In other words, why is it that *l hardened to [k͡l] instead of, for instance, [ɮ]? How did the lateral get a stop component, and why did not it turn into a homorganic [t͡l] instead of a [k͡l]? I turn to the discussion of these questions in the following section.

5.7.2 Prestopping

One of the possible perceptual explanations for the development of *l into [k͡l] is the phenomenon of prestopping. Laterals (and nasals) have been defined as 'pre-stopped' when their articulations are preceded by a very short closure (e.g. a stop or a tap), which, importantly, bears a homorganic place of articulation.

Prestopping of laterals has been reported in various languages such as Icelandic (Hansson 1996), Faroese (Arnason 2011), Montana Salish (Flemming, Ladefoged & Thomason 2008), and many Australian languages such as Mid-Waghi (Ladefoged & Maddieson 1996), Kuman (Steed & Hardie 2004), and Hiw (François 2010), among others. Ladefoged and Maddieson (1996: 194) note that the velar laterals in Mid-Waghi are "occasionally 'prestopped' ". In turn, Flemming, Ladefoged and Thomason (2008) observe that in most environments, the voiced and voiceless laterals in Montana Salish are usually realized with a brief stop closure that produces a burst-like transient at the beginning of the lateral. Ladefoged and Maddieson (1996: 201) hypothesize that the transients found in Montana Salish laterals "must involve a very brief obstruction of the lateral escape channel", which is already constricted because non-distinctive frication is also present in the spectrograms. In Figure 5.12, these transients can be observed in the spectrogram taken from Figure 6.12 in Ladefoged & Maddieson (1996: 201):[76]

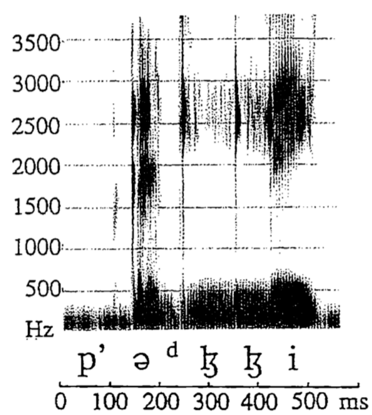


Figure 6.12 The sequence of lateral consonants in the first part of the Montana Salish word **p'əllitʃ'tʃ** 'turned over'. In the narrow transcription beneath the spectrogram the prestopping is indicated by a raised ᵈ.

Figure 5.12 Spectrogram of a prestopped lateral in Montana Salish (Ladefoged & Maddieson 1996:201)

[76] I acknowledge John Willey & Sons, Ltd. for permission to use Figure 6.12 included in Peter Ladefoged and Ian Maddieson, *The Sounds of the Worlds' Languages*, 1996, Blackwell Publishers. "All rights reserved. Except for the quotation os short passages for the purposes of criticism and review, no part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the publisher".

Similarly, Steed & Hardie (2004) note the presence of a transient in the spectrogram of the Kuman velar lateral fricative /ʟ/. Like Ladefoged & Maddieson (1996), Steed & Hardie (2004) also interpret the transient as involving a very brief, tap-like closure. Specifically, the authors hypothesize that the origin of the transient may be due to the presence of closure on only one side of the tongue, which could also explain the low amplitude before the transient (2004:349).

Returning to Nivaĉle, there are two potential phonetic explanations behind the historical development of /k͡l/. First, it can be posited that the lateral approximant was realized with a brief stop closure –in a similar way to that described for Kuman, Mid-Waghi or Montana Salish – and that these spectral transients at the onset of laterals could have been misinterpreted as *real stop bursts* (Hansson 1996), that led to sound change. The stop bursts and the lateral portion could have been reanalyzed as a laterally released stop. With this hypothesis in place, now a further question arises: why did the Proto-Mataguayan *l develop into [k͡l] rather than [t͡l]?

It has been observed that formant transition cues are more limited before lateral [l] than before [r], and so that "stop place contrasts tend to be more limited in this context" (Flemming 2007:236). For instance, note that many languages allow initial [pl, kl] / [bl, gl] clusters, but exclude [tl, dl] (Kawasaki 1982). According to Kawasaki (1982), this asymmetric distribution of clusters reflects a more general cross-linguistic pattern: the contrast between velars and coronal stops tends to be neutralized before a lateral and the preferred result of neutralization is a velar. Supporting evidence for this claim can be found in Flemming (2007); the dispreference for coronal-dorsal contrasts before laterals is based on their acoustic similarity. Specifically, the lateral release has a substantial effect on the acoustics of coronal stops, shifting them acoustically closer to velars. In that regard, Halle, Best & Bachrach (2003:2893) conducted a study where they compared identification of /tl/ and /kl/ clusters by French and Israeli listeners. Whereas /tl/ and /dl/ clusters are permitted in Hebrew, they are not in permitted French. The authors found that French listeners tend to hear "illegal utterance initial [tl] and [dl] clusters as [kl] and [gl], respectively”. Concomitantly, these speakers had difficulty in discriminating between [tl] vs [kl] and [dl] vs [gl] clusters.[77]

Given these findings, one could posit that there was an intermediate stage in the development of /k͡l/. If a brief stop closure present in the acoustics of the lateral approximant was later reanalyzed as the presence of a (homorganic) stop [tl], it may well have been the case that this emergent complex segment underwent another sound change where it was reanalyzed as [k͡l]. Unfortunately, given the late contact between religious missionaries and the Nivaĉle peoples (20th. century), no kind of intermediate stage of the language can be reconstructed based on vocabularies or manuscripts.

In addition, another hypothesis could be posited to account for the emergence of [k͡l]. In Table 5.5, it was shown that some Nivaĉle words with [k͡l] have a preglottalized lateral [’l] as their correspondent sound in other Mataguayan languages. In this regard, a fortition sound change, namely, buccalization could be posited whereby the glottal stop acquired a DORSAL place of articulation *’l > ^{k}l, which was later reanalyzed as [k͡l]~ [q͡l]. I understand that such an approach is the one entertained by Najlis. The author hypothesizes that the preglottalized lateral, which was an allophone of the lateral approximant, was generalized in Nivaĉle, that is, it became phonologized, and then the glottal changed into a uvular stop. Interestingly, in the languages where the preglottalized lateral has been attested, that is, Chorote and Wichí, this sound contrasts with a plain lateral. Even if the preglottalized lateral approximant was not an allophone of the lateral approximant, but rather developed from the proto-lateral approximant, that would suggest a sound change process in a similar fashion to the one proposed here for Nivaĉle k͡l. In other words, the preglottal closure in Chorote and Wichí can be analyzed as a type of fortition as well.

The historical path between the proto-Mataguayan *l and the emergence of the complex segment [k͡l] cannot be unambiguously delineated at this point. A systematic study between the ‘lateral’ systems of the Mataguayan languages is a much-needed enterprise. However, the hypothesis of the

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[77] Note also how the Standard English pronunciation of the word initial cluster in “Tlingit” is [klɪŋkɪt], not [tlɪŋkɪt].

reanalysis of stop bursts as homorganic stops (for example, as emergent stops (Ohala 1997)), along with the ambiguous acoustic nature of the lateral, that is, that they shift identification of coronal place into velar place, offers a plausible explanation for the historical development of this sound.

5.8 Conclusions

In this chapter, I have argued for the analysis of Nivaĉle /k͡l/ as a complex segment that developed from Proto-Mataguayan *l. I do not define /k͡l/ as an affricate because it lacks two of the most recurrent characteristics of an affricate: (i) it lacks a fricative release and (ii) the sequence of two phases does not agree in voicing. Acoustic analysis shows that the occlusive voiceless dorsal onset is released into an alveolar approximant and that the lateral release is voiced, it is not fricated, and it is velarized. I analyze /k͡l/ as a laterally released dorsal stop.

The development of /k͡l/ can be rooted in speech perception factors, specifically: the reinterpretation of stops bursts as emergent stops.

Given the phonotactic patterns of [ɬ], the alternation with [t], and the asymmetrical phonological behaviour with that of [k͡l], I analyze this segment as only specified for CORONAL, that is, as one of the least marked segments in Nivaĉle. An important outcome of this chapter is that [ɬ] and [k͡l] do not form a phonological natural class.

Chapter 6: Vowel-consonant metathesis in Nivaĉle

6.1 Introduction

Metathesis is defined as a process in which, under certain conditions, sounds switch positions with one another. For instance, in a string of sounds where the linear ordering of two sounds is expected to be *xy*, the reverse order – *yx* – is found instead (Hume 2001, 2004). Yet metathesis processes have been long considered to be 'sporadic', 'irregular' (Powell 1985:106) 'rarely productive' (Montreuil 1981:67) or irregular. Cross-linguistically, it is much less common than assimilation, epenthesis, and deletion processes. Moreover, there is no consensus in the theoretical literature as to how metathesis might best be analyzed. One of the commonly cited factors that has played against a unified account of metathesis is the direction of metathesis: certain sounds can be re-ordered in one way in one language and in the exact opposite way in another language. For example, as a result of metathesis, glottals occur after consonants in Hungarian, but before a consonant in Pawnee (Hume 2004:204-206):

(446)

	Input	Language	Surface	Output	Expected order	Gloss
	a. tehernek	Hungarian	terhek	rh	*hr	'load'
	b. ti-ir-hisask-hus	Pawnee	tihrisasku	hr	*rh	'he is called'

(adapted from Hume 2004: 205)

The mirror examples presented in (446) appear to weaken the study on metathesis as a regular and predictable process. According to Hume (2004:204), these are probably some of the reasons the study of metathesis has not received much attention in the literature until recently, where both cross-linguistic surveys (Hock 1985, Blevins & Garrett 1998, 2004, Mielke & Hume 2001, Hume 2004, Buckley 2011) and analyses of individual languages (Dumenil 1987, DeLancey 1989, Hume 1991, 1998, Coetzee 1999, McCarthy 2000, Holt 2004, Hume & Seo 2004, Buckley 2007, Faust 2014, Czaplicki 2009, Hannahs 2009, 2011, Crowhurst & Trechter 2014, among others), have reopened the debate around the nature and treatment of 'metathesis' as a phenomenon.

In phonological theory, the prevailing perspective on metathesis has been mostly teleological (Grammont 1950, Ultan 1978, Hock 1985, McCarthy 1995, Hume 1997, 1998). That is, metathesis has been seen as a phonotactic optimization mechanism: it yields a 'better syllable structure' (Grammont 1950: 239) because it is motivated by syllable well-formedness conditions (Hume 1998:147) and prosodic pressures (McCarthy 2000) in order to satisfy certain templatic constraints or convert a 'phonologically inadmissible or disfavoured sequence into an acceptable one' (Ultan 1978:395, as cited in Blevins & Garrett 1998:509). In other words, the teleological perspective on metathesis relies on a formalized notion of 'markedness' (Trubetzkoy 1939, Jakobson 1941, Chomsky & Halle 1968, Prince & Smolensky 1993, de Lacy 2006, 2011). Specifically, by reversing the linear order of sound elements, "certain structures are avoided while other structures are generated; the avoided structures are called 'marked' while the generated ones are 'unmarked' (de Lacy 2006:1). One of the basic claims behind Optimality Theory (Prince & Smolensky 1993) is that sound patterning is driven by pressures against marked phonological structures.

Blevins & Garrett (1998) argue against the teleological conception of metathesis as a phonotactic optimization mechanism and propose, instead, that metathesis is a phonetically natural motivated type of sound change.[78] Based on Ohala's (1981, 1993) theory of sound change, Blevins & Garrett (1998) propose that sound change stems from the reinterpretation of phonetically ambiguous surface forms. For instance, the authors analyze one type of synchronic and diachronic CV metathesis in terms of 'perceptual metathesis': a phonetic process driven by misperception of 'stretched out' features. These acoustic/perceptual features, e.g., laterality and glottalization, have a relatively long duration and extend over a CV or VC domain. Because listeners are unable to unambiguously establish the relative location or sequencing of a segment with this 'stretched out' type of a feature, this segment or feature is reinterpreted as having originated in a non-historical position. A non-teleological approach is later adopted by Hume (2001; 2004), who states that in order for metathesis to occur there must be (i)

[78] More precisely, "phonetic explanations [but not phonetic optimization] play an important diachronic role in explaining sound change" (Blevins & Garrett 2004:119, my brackets /AG).

indeterminacy in the signal and (ii) "the order of the elements opposite to that one occurring in the input must be an attested structure in the language" (Hume 2004: 209); that is, the output of metathesis must be 'structure preserving' as opposed to 'structure changing'.

Following an Optimality Theoretic (OT) constraint-based approach, (Prince and Smolensky 1993/2004, McCarthy & Prince 1995), I propose a unified account for vowel-consonant metathesis in Nivaĉle. A crucial constraint for analyzing metathesis in OT is LINEARITY, which penalizes the reversal of precedence relations among segments in a string. My analysis of Nivaĉle metathesis draws upon the account of metathesis in Rotuman and Leti presented by McCarthy (2000 [1995]) and Hume (1997; cf. Blevins & Garrett 1998: 541-547), respectively. Both the Rotuman and Leti analyses show that the systematic subordination of LINEARITY to higher ranked markedness constraints explains the change in the linear ordering of segments.

The contribution of this chapter is twofold. First, I establish and provide an OT analysis of the phonological conditions that lie behind VC metathesis in Nivaĉlé, namely the avoidance of complex codas and the satisfaction of the *Syllable Contact Law* (Murray & Vennemann 1983, Vennemann 1988). I argue that metathesis responds to phonological requirements: the avoidance of marked structures in the language. Second, based on the implications of this analysis, I explain certain phonological processes that arise as a consequence of metathesis: in particular, a major process that is attested in conjunction with metathesis is deglottalization of ejective stops and glottalized vowels. It will be seen that the phenomenon of vowel deglottalization that is concomitant with metathesis supports the proposal advanced and discussed in Chapter 3: Nivaĉle glottalized vowels are not phonemic (cf. Stell 1989) but rather are a sequence of a vowel followed by a glottal stop. As such, the study of metathesis contributes to the description and understanding of Nivaĉle phonology at both the segmental and prosodic level.

This chapter is structured as follows. Section 6.2 presents the problem to be addressed in this chapter: the alternation of Nivaĉle forms in the context of affixation processes, i.e. when consonant-initial suffix are attached to consonant-final stem. Section 6.3 provides an OT account for VC metathesis in Nivaĉle: I argue that the avoidance of complex codas and the satisfaction of the Syllable Contact Law are the driving forces behind this phenomenon. Section 6.4 discusses the domain in which metathesis occurs, that is, the root. In Section 6.5, some relevant effects of metathesis in Nivaĉle are discussed, specifically: the deglottalization of ejective consonants and glottalized vowels, and spirantization of the velar stop and alveopalatal affricate. Section 6.6 discusses previous proposals for the Nivaĉle stem alternations in the broader context of historical sound change. Finally, Section 6.7 summarizes the main conclusions of this chapter.

6.2 Alternating vs. non-alternating stem forms

The phenomenon of metathesis is observed in a variety of contexts throughout the Nivaĉle grammar. It occurs in both nominal and verbal domains, characteristically resulting from the affixation of a consonant-initial suffix to a consonant-final stem. This diversity of contexts will be exemplified and discussed in detail in the following sections. However, to introduce the reader to the basic properties of metathesis in Nivaĉle and its relationship to other phonological patterns in the grammar, the focus of this initial section is pluralization in the nominal domain.

Pluralization of nouns in Nivaĉle exhibits a considerable degree of allomorphy, where the choice of allomorph is lexically determined rather than phonologically conditioned. The basic noun plural allomorphs are: /-s/ ~ /-j/ ~ /-k͡l/; the latter will surface as [k] in word final position (cf. Chapter 5). The data presentation below is organized into four sets, presented in §6.2.1 through §6.2.4, illustrating four distinct contexts that differentiate the patterns of phonological alternations in nominal stems suffixed by these plural allomorphs.

6.2.1 Noun plurals: Non-alternating V-final noun stems

(447) a. ɬ-a βotʼí
F-DET turtle
'a/the turtle'

b. na-βa βotʼí-s
DET-PL.N.HUM turtle-PL
‘(the) turtles’

(448) a. ła ek͡lé
F.DET parrot
‘a/the parrot’

b. na-βa ek͡lé-s
DET-PL.N.HUM parrot-PL
‘(the) parrots’

(449) a. na βàt-kofá
DET INDEF.POSS-enemy
‘a/the enemy’

b. na-pi βàt-kofá-s
DET-PL.HUM INDEF.POSS-enemy-PL
‘(the) someone’s enemies’

(450) a. na βa-tʼì-pɑk͡lá
DET INDEF.POSS-eyebrow
‘someone’s eyebrow’

b. na-βa βa-tʼìpɑk͡lá-s
DET-PL.N.HUM INDEF.POSS-eyebrow-PL
‘someone’s eyebrows’

(451) a. na ófo
DET dove
‘a/the dove’

b. na-βa ófo-s
DET-PL.N.HUM dove-PL
‘(the) doves’

(452) a. na ałú
DET lizard
‘a/the lizard’

b. na-βa ałú-s
DET-PL.N.HUM lizard-PL
‘(the) lizards’

(453)	a.	na	kasu͡ts’í
		DET	armadillo
		‘a/the armadillo’	
	b.	na-βa	kasu͡ts’í-k
		DET-PL.N.HUM	armadillo-PL
		‘(the) armadillos’	
(454)	a.	na	k͡lesá
		DET	knife
		‘a/the knife’	
	b.	na-βa	k͡lesá-k
		DET-PL.N.HUM	knife-PL
		‘(the) knives’	
(455)	a.	ɬ-a	βɑt-áko
		F-DET	INDEF.POSS-hip
		‘someone’s hip’	
	b.	na-βa	βɑt-áko-k
		DET-PL.N.HUM	INDEF.POSS-hip-PL
		‘someone’s hips’	
(456)	a.	na	ɬatú
		DET	foam
		‘a/the foam’	
	b.	na-βa	ɬatú-k
		DET-PL.N.HUM	foam-PL
		‘(the) foams’	
(457)	a.	na	ʃtak͡lé
		DET	rubbish
		‘a/the rubbish’	
	b.	na-βa	ʃtak͡lé-j
		DET-PL.N.HUM	rubbish
		‘(the) rubbish’	
(458)	a.	ɬ-a	fanxá
		F-DET	locust
		‘a/the locust’	

b. na-βa fanxá-j
DET-PL.N.HUM locust-PL
'(the) locusts'

(459) a. na uk͡lʔá
DET dove
'a/the turtledove'
b. na-βa uk͡lʔá-j
DET-PL.N.HUM dove-PL
'(the) turtledoves'

The V-final stems in (447)-(459) illustrate the plural allomorphy in Nivaĉle: there are basically three different consonants that function as plural allomorphs -*s*, -*j*, -*k.* There is no discernible phonological conditioning behind the plural allomorphy: the three suffixes each occur after all vowel qualities and, looking to the prevocalic position, the different suffixes occur after the same place/manner of consonants: for example, both the {-j} (458b) and {-s} (448b) variants follow [k͡l]; the {-k} (456b) variant follows [t], and the {-s} variant follows [t] (447b). Note further that the list in (447)-(459) is not exhaustive.

Further, even though there are a few pairs of data in Nivaĉle that suggest a correlation of -*s* with masculine nouns and -*j* with feminine nouns (see (460)-(461) below), the range of data presented here establish that there are three suffixes each occur with both masculine and feminine roots. Note that the epenthetic vowel in (461a) is marked in between square brackets. Recall from Chapter 2 that, non-human nouns are not marked for gender; feminine and masculine gender is marked on the singular determiner forms. In contrast, plural forms differentiate between 'human': /-pi/ and 'non-human' nouns: /-wa/.

(460) a. na-pi k'u͡tsxá-s
DET-PL.HUM elder-PL
'the elders'
b. na-pi k'u͡tsxá-j
DET-PL.HUM elder-PL
'the female elders'

(461) a. na-pi nèkxɑk-[í]s
DET-PL.HUM boys-PL
‘the boys’
b. na-pi nèkxɑk-é-j
DET-PL.HUM boy-FEM-PL
‘the girls’

There is also a -CVC plural suffix /-wot/ (462) that is restricted to kinship terms, its usage currently undergoing attrition in that it is starting to alternate with other plural suffixes (463):

(462) a. ji-ʧín.xɑ
1POSS-younger.sister
‘my younger sister’
b. ji-t͡ʃìn.xɑ-wót
1POSS-younger.sister-PL.KIN
‘younger sisters’
(463) a. βat-t͡ʃitáʔ
INDEF.POSS-elder.sister
‘my elder sister’
b. βat-t͡ʃì.ta-wót ~ βat-t͡ʃì.tá-k
INDEF.POSS-elder.sister-KIN PL INDEF.POSS-elder.sister-PL
‘my elder sisters’

It is worth mentioning that I have documented intra- and inter-speaker variation in the selection of the particular consonantal plural allomorphs /s/ ~ /k͡l/, /s/ ~ /j/, and /j/ ~ /k͡l/:

(464) a. ófo-s ~ ófo-k
dove-PL dove-PL
‘doves’
b. ʃtak͡lé-s ~ ʃtak͡lé-j
rubbish-PL rubbish-PL
‘rubbish’
c. j-ɑs-é-j ~ j-ɑs-é-k
1POSS-child-FEM-PL 1POSS-son-FEM-PL
‘my daughters’

Notably, this kind of variation is not unexpected under the hypothesis that the plural allomorphy is not phonologically, but rather lexically conditioned. Concomitantly, I have observed an ongoing change in that the plural markers in nouns are starting to get omitted; however, plurality is still recoverable from the determiners, in a similar way that gender is (cf. §2.5). In (465), even though the noun is not marked for plurality, the determiner is: /-wa/:

(465) [naβa βosók]
na-wa wosok
DET-PL.N.HUM butterfly
'the butterflies'

It is reasonable to hypothesize that the lack of predictability (e.g., phonological conditioning, semantic cohesion) for determining which plural suffix to use could lead to the tendency to omit it, especially if the 'plural' information is recoverable from the determiners.

6.2.2 Noun plurals: Glottal-final stems

The following data show that noun stems with a final glottal stop systematically lose that glottal stop when suffixed by the plural (cf. §6.5.2). Note that this deglottalization phenomenon is triggered by all the variant allomorphs of the plural suffix. This is a different situation from the one seen in Chapter 3, where the glottal and its associated mora can get preserved (under stress) in a CVC syllable (as [CV̰C]).

(466) a. βat-k͡ɬáʔ
INDEF.POSS-property
'someone's property'

b. βat-k͡ɬá-j b'. *βatk͡ɬá̰j
INDEF.POSS-property-PL
'someone's properties'

(467) a. ji-βɨ́ʔ
1POSS-rib
'my rib'

b. ji-βɬí-s b'. *jiβɬ̰ís
1POSS-rib-s
'my ribs'

(468) a. fajxóʔ
'charcoal'
b. fajxó-k b'. *fajxó̰k
charcoal-PL
'charcoals'

6.2.3 Noun plurals: Metathesis in C-final stems

As will be illustrated in (469)-(478) the forms exhibiting metathesis are all consonant-final in their unsuffixed singular form: the particular stem-final consonants seen to participate in the metathesis process here are /t t͡ʃ ʃ k x/, although, on the basis of the hypotheses advanced in §6.3 below, it is predicted that any stem-final obstruent would participate in metathesis, under the appropriate triggering conditions. The metathesis itself can be characterized as follows: the final vowel and consonant of the unsuffixed stem in (a) of each numbered data set switch their linear order when the plural suffix is attached. Schematically, then, the segments V_1 and C_2 are reordered with the addition of the plural consonantal suffix -C: V_1C_2-C → C_2V_1-C. For example, the plural of 'lip' in (469a) is not **pa.sets* (recall from Chapter 2 that there is an inviolable constraint against complex codas), but rather is *pas.tes.*

Note further that the reordering of segments within the phonological string triggers some featural changes such as deglottalization of consonants (470) and glottalized vowels (471), (477)-(478), and spirantization of /k/ in the nominalizer suffix (475). These concomitant phonological effects will be discussed in §6.5, where it will be argued that some of that data provide additional evidence for the analysis of laryngeal phenomena presented in Chapters 3 and 4. The b' examples show the ungrammatical (non-metathesized) forms with impermissible complex codas.

(469) a. -pɑsét
'lip/beak'

	b.	-pɑsté-s lip-PL 'lips/beaks'	b'.	*pɑset-s
(470)	a.	ap'áx '*yarara*'		
	b.	apxá-s yarara-PL '*yararas*'	b'.	*ap'áx-s
	c.	* ap'xas (cf.§ 6.5.1)		
(471)	a.	-nḭ́ʃ 'odor/perfume'		
	b.	-nʃí-k odor/perfume-PL 'odors/perfumes'	b.'	*-nḭ́ʃ-k (Stell 1989:141)
(472)	a.	kù͡ts-xanáx steal-AG 'thief'		
	b.	kù͡ts-xanxá-s steal-AG-PL 'thieves'	b'.	*kù͡tsxanáx-s
(473)	a.	fináx 'crab'		
	b.	finxá-s crab-PL 'crabs'	b'.	*fináx-s
(474)	a.	βat-ɑ́k 3.INDEF.POSS-meal 'somebody's meal'		
	b.	βat-kɑ́-s 3.INDEF.POSS-meal 'somebody's meals'	b'.	*βatɑ́k-s

(475) a. fin-ɑ́k
suck-NMLZ(RES)
‘tobacco’
b. fin-xɑ́-j b’. *finɑ́k-j
suck-NMLZ(RES)-PL
‘tobaccos’

(476) a. βàt-feɬét͡ʃ
INDEF.POSS-bowl
‘someone’s bowl’
b. βàt-feɬt͡ʃé-j b’. *βàtfeɬét͡ʃ-j
INDEF.POSS-bowl-PL
‘someone’s bowls’

(477) a. tisṵ́x
‘*coronillo* tree’
b. tisxú-j b’. *tisúx-j
coronillo.tree-PL
‘*coronillo* trees’

(478) a. /ɬa-naʔʃ/
ɬ-ná̰ʃ
3POSS-nose
‘his/her nose’
b. /ɬa-naʔʃ-s/ b’. *ɬnáʃ-s
ɬa-nʃá-s
3POSS-nose-PL
‘their noses’

6.2.4 Noun plurals: C-final stems with Vowel epenthesis

The fourth and final set of data show C-final noun stems where, rather than being subject to metathesis as seen in III, a vowel is epenthesized between the final C of the stem and the plural suffix. The b’ forms show the ungrammatical forms with complex codas, and the b” forms show the potential, but not attested, metathesized forms.

(479) a. k͡lǫ́p
'winter'

b. k͡lop-[í]s b'.* k͡lǫp-s
winter-PL b". * k͡lpo-s/*kpo-s (cf. Chapter 5)
'winters'

(480) a. tós
'snake'

b. tos-[í]s b'. * tos-s
snake-PL b". * tso-s
'snakes'

(481) a. t͡ʃint͡ʃẹ́x
'spirit'

b. t͡ʃint͡ʃex-[í]s b'. * t͡ʃin.t͡ʃex-s
spirit-PL b". * t͡ʃin.t͡ʃxe-s
'spirits'

(482) a. ʃk͡lɑkxáj
'wild cat'

b. ʃk͡lɑ̀kxaj-[í]s b'. * ʃk͡lɑk.xaj-s
wild.cat-PL b". * ʃk͡lɑ̀k.xja-s
wild.cat-PL
'wild cats'

(483) a. makók
'frog'

b. makok-[í]k b'. * makók-k
frog-PL b''.* makko-k
'frogs'

These forms raise two sets of analytical questions. First, what differentiates the C-final forms in §6.2.3, which (as will be argued in detail in §6.3 below) exhibit metathesis as a response to the potential violation of *COMPLEXCODA under plural suffixation, from the C-final forms in §6.2.4, which exhibit V-epenthesis as an alternate strategy to avoid a *COMPLEXCODA violation? Whereas this question will be discussed at greater length in §6.2.3, note at this point the relevant generalization: although metathesis would function to repair what would otherwise be an ill-formed complex coda in word-final position (as shown in the *b' forms), metathesis would result in the creation of an ill-formed derived complex onset (as shown in the *b" forms).

The second question revolves around the quality of the epenthetic vowels seen in the data of (479)-(483): what is the default epenthetic vowel? This question is addressed here.

The epenthetic vowel mostly used with the -*s* and -*k* allomorphs is /i/. It occurs after labial, coronal and dorsal consonants. However, the epenthetic vowel [e], is also marginally found, though it is attested much less commonly. In the *shichaam lhavos* (Downriver) regional variant of Nivaĉle, [e] only occurs after coronal-final stems, and its realization is variable:

(484)	a.	βat-kùm-xat-[í]s INDEF.POSS-work-NMLZ-PL 'someone's jobs'	~	b.	βat-kùm-xat-[é]s

The alternation between the two epenthetic vowels [i] ~ [e] in (484) occurs within the *shichaam lhavos* variety and even within the same speaker.

Notably, the [i] ~ [e] alternation has also been signaled by Stell as a consequence of dialectal variation between the *chishamnee* (Upriver) and *shichaam lhavos* (Downriver) speakers (cf. Chapter 1 and 2). Consider the following examples:

(485)	a.	jinkɑp-[í]s year-PL 'years'	*shichaam lhavos*	(Stell 1989)
	b.	inkɑp-[é]s year-PL 'years'	*chishamnee lhavos*	(Campbell & Grondona 2007 (18), 7)
(486)	a.	ko͡tsxat-[í]s land-PL 'lands'	*shichaam lhavos*	(Stell 1989:152)

b. kot͡sxat-[é]s *chishamnee lhavos* (Campbell & Grondona 2007 (26), 7)
land-PL
'lands'

It is worth mentioning that the default epenthetic vowel in Spanish is [e]. I hypothesize that Nivaĉle default epenthetic vowel is [i] and that [e] is a more recent alternant that has come into the language through language contact with Spanish. Based on the results of the 2002 National Indigenous Census (http://www.dgeec.gov.py), Melià (2010:192) highlights the good proficiency in Spanish that 73% of the Nivaĉle younger generation (10-40 years old) has in comparison to speakers of other Mataguayan languages in Paraguay (Maká and Manjui/Chorote. Melià attributes this sociolinguistic situation to the fact that the Nivaĉle speakers have been in contact with the Argentinean *criollos* in the sugar plantations.[79]

Finally, the third pattern of epenthesis manifest is a very small subset of the data in my field corpus. Specifically, there are a few examples where the epenthetic vowel matches the last vowel of the root.

(487) a. xó̰t
'sand'
b. xot-[ó]j b'. *xótj [tj] violates *COMPLEXCODA
sand-PL b''. *xtój [xt] is not a well-formed ONSET

(488) a. [ʔ]ɑftḛ́k
'orphan'
b. [ʔ]ɑftek͡l-[é]j b'. *[ʔ]ɑftetk͡lj [k͡lj] violates *COMPLEXCODA
orphan-PL b''. [ʔ]ɑftk͡léj *ftk͡l is not a well-formed ONSET or CODA
'orphans'

[79] Recall from Chapter 1 that beginning the early 20th century, many Nivaĉles would annually migrate to Argentina to work in the sugar plantations of Ledesma and Mailón (Susnik 1961: 49; 1981:161, as cited in Stell 1989:8; Fritz 2008:155).

Harmonic epenthetic vowels are much less frequent than [i] or [e] epenthesis. They occur most frequenty with the [j] plural allomorph.

While it is not possible, on the basis of the available data, to predict which epenthetic vowel will appear, the basic generalization that holds across all three sets of epenthesis data is that (i) plural suffixation creates an ill-formed consonant cluster, and (ii) metathesis cannot serve as the repair mechanism in these forms because metathesis, in each of these cases, would result in the creation of another different ill-formed consonant sequence. Thus, vowel epenthesis functions as an alternate strategy to repair these cluster violations.

What the examination of noun plural forms in this section has served to illustrate is that Nivaĉle is a language where faithfulness to consonantal identity is highly ranked, sometimes at the expense of consistency in the linear sequencing of segments (though the relative order of consonants never changes; it is the relative order of a consonant and vowel that may) and sometimes at the expense of introducing vowels that are not part of the input representation. The data examined here have also shown an essential interplay between phonological processes of metathesis and epenthesis in relation to well-formedness constraints on syllable structure. The next sections will elaborate more fully on the roles that prosodic constraints on cluster sequences play vis-à-vis the segmental phonological system of Nivaĉle.

6.3 Driving forces behind metathesis: Syllable structure constraints

6.3.1 *COMPLEXCODA

The major hypothesis advanced in this chapter is that metathesis is motivated by syllable structure constraints. Specifically, it was established in Chapter 2 (cf. §2.3) that Nivaĉle does not allow complex codas. As illustrated in §6.2.3 above, plural suffixation on C-final nouns would create an illicit CC coda cluster, in violation of the constraint against complex codas. The proposal advanced here is that metathesis functions as a repair strategy, avoiding a *COMPLEXCODA violation while preserving the core segmental identity of the vocalic and consonant segments in the input. The phonological process offers interesting insights into what are here proposed to be 'core' features of a segment. As observed earlier, laryngeal features may be lost, as in (489b) below (see further discussion in §6.5.2), and lenition may occur as in (491b), (492b) (see further discussion in §6.5.3).

(489) a. /jijɑʔx/ + /-s/
'puma' + /PL/

b. jij.xɑ́-s
puma-PL
'pumas'

b'. *ji.jɑ́x-s
b''. *jijxɑ̰́s

(490) a. -tí.niʃ
'necklace'

b. -tin.ʃí-s
necklace-PL
'necklaces'

b'. *-tiniʃ-s

(491) a. to.wɑ́k
'river'

b. tow.xɑ́-j
river-PL
'rivers'

b'. *towɑ́k-j

(492) a. fe.ɬét͡ʃ
'bowl'

b. feɬ.t͡ʃé-j
bowl-PL
'bowls'

b.' *feɬét͡ʃ-j

Based on the above two basic observations, namely, that there are no complex codas in Nivaĉle and that there is a change in the linear order of the final vowel and consonant of the root, the following basic constraints are proposed, along with the ranking in (493):

(493) LINEARITY-IO: No metathesis (McCarthy and Prince 1995:123)

‘S1 is consistent with the precedence structure of S2, and vice versa’

Let x, y $\in S_1$ and x′, y′ $\in S_2$.

If $x\mathfrak{R}x'$ and $y\mathfrak{R}y'$ then,

$x < y$ iff $\neg (y' < x')$.

(494) *COMPLEXCODA: Codas are simple.

*CC]$_\sigma$

(495) *CC]$_\sigma$ » LINEARITY-IO

The following tableau shows the relative ranking of the constraints in (495)

(496)

/finax + s/	*CC]$_\sigma$	LINEARITY-IO
a. fi.naxs	*!	
b. ☞ fin.xa-s		*

Under the hypothesis that in the grammar of Nivaĉle it is preferable to violate LINEARITY than it is to violate the constraint against a COMPLEXCODA, candidate (b) emerges as the optimal candidate.

6.3.2 Syllable Contact Law

The metathesis pattern is not restricted to plural suffixation. A range of other consonant-initial derivational suffixes trigger the same VC-metathesis phenomenon in a preceding stem, as seen in the following sets of data.

(497) a. nɑ.jíʃ
‘road’
b. nɑ̀j.ʃi-mát b’. *nɑji**ʃ-m**át
road-VLZ(MALEF)
‘to be a bad road’

(498) a. sa.múk
‘excrement’
b. sàm.ku-mát b’. *samu**k-m**át
excrement-VBLZ(MALEF)
‘to evacuate with difficulties’

	c.	sàm.ku-wát	c.’	*samu**k-w**át
		excrement-PLACE		
		‘latrine’		
(499)	a.	fi.n-ɑ́k		
		suck-RES		
		‘tobacco’		
	b.	fìn-kɑ-mét͡ʃ	b’.	*fin-ɑ**k-m**et͡ʃ
		suck-RES-SHAMAN/EXPERT		
		‘shaman that has power over the tobacco’		
	c.	fìn-kɑ-náx	c’.	*fin-ɑ**k-n**áx
		suck-RES-NMLZ		
		‘smoker’		
(500)	a.	kɑ.t͡s’éx		
		‘diarrhea’		
	b.	kɑ̰̀t͡s.xe-náx	b’.	*kɑ̰t͡se**x-n**áx
		diarrhea-NMLZ		
		‘person that has diarrhea’		
(501)	a.	fe.ɬét͡ʃ		
		‘bowl’		
	b.	fèɬ.t͡ʃe-jíʃ	b’.	*feɬe**t͡ʃ-j**íʃ
		bowl-AR		
		‘uterus’		
(502)	a.	∅-wa.k͡lḛ́t͡ʃ		
		3S-walk		
		‘s/he walks’		
	b.	∅-wàk.t͡ʃe-ján	b’.	*wak͡lḛ**t͡ʃ-j**án
		3s-walk-CAUS		
		‘s/he makes sby. walk’		
(503)	a.	na.mát͡ʃ		
		‘axe’		
	b.	nàm.t͡ʃa-wáʃ	b’.	*nama**t͡ʃ-w**áʃ
		axe-MARK		
		‘mark/trace of an axe’		

(504) a. -xpá-jit͡ʃ
straw-AR
'house'

b. -xpà-j.t͡ʃi-**m**a.t͡séx
house-LOC-VLZ(BENEF)
'it is a good house'

b'. *xpɑ-ji**t͡ʃ**-**m**at͡séx

(505) a. ji-ká.jiʃ
1.POSS-neck
'my front side'

b. ji-kɑ̀j.ʃi-**n**úk
1.POSS-neck-KNOT
'my necklace'

b'. *ji-kɑji**ʃ**-**n**uk

What is immediately apparent is that these cases of metathesis do not fall under the same analysis as proposed for the plural suffixation data in §6.2.1: that is, metathesis is not functioning in these cases as a repair strategy to avoid a *COMPLEXCODA violation. What these data show is that a different prosodic markedness constraint – one which optimizes the relative sonority of a consonants across a syllable coda-onset sequence – is at play.

The crucial generalization is that in all the above listed examples, suffixes with an initial sonorant – specifically, /m/, /n/, /j/ and /w/ – are attached to an obstruent-final stem. Rather than the expected linear concatenation, e.g. (499b) *fin-ɑk-met͡ʃ, the final obstruent of the stem metathesizes with the preceding vowel: fin-kɑ-**m**ét͡ʃ. Schematically, where O stands for an Obstruent and R stands for a Resonant, the linear segmental sequence is reordered as follows: *V_1O-RV → OV_1-RV. In the analysis that follows, it is argued that there is a constraint against the trans-syllabic coda-onset sequence of an obstruent-resonant, i.e. *O-R. In these cases, metathesis functions as a strategy to repair what would otherwise be a prosodically non-optimal sequence.

Here I argue that the driving force behind this second type of metathesis is the Syllable Contact Law (SCL). Vennemann & Murray (1983) and Vennemann (1988) propose the Syllable Contact Law in order to explain syllabification patterns and sound change at syllables boundaries:

(506) Syllable Contact Law: the consonantal strength of the coda should exceed or be equal to the consonantal strength of the following onset

Vennemann (1988:8) defines consonantal strength as “a phonetic parameter of […] unimpeded (voiced) airflow”. Vennemann proposes that sounds are organized in a universal ordering known as the Consonantal Strength Hierarchy, tracing back to Sievers (1881) and Brugmann (1997):

(507) Low vowels > Mid vowels > High vowels > Rhotics > Laterals > Nasals > Voiced fricatives > Voiceless fricatives > Voiced plosives > Voiceless plosives

Discussions of the SCL (Parker 2002, 2012, Gouskova 2004) have replaced ‘consonantal strength’ with ‘sonority’, a concept that has been widely invoked as an explanatory principle in several different types of phonological analyses, but that also has been the object of extensive debate and controversy.[80] A number of cross-linguistic tendencies with respect to the distribution and sequencing of segments have been made with reference to sonority hierarchies. When major natural classes are considered, the generalized sonority hierarchy in (507), shich groups subclasses of sounds that are adjacent in the more finely articulated hierarchy of (508) into broader classes, is commonly assumed.

(508) Vowels > Glides > Liquids > Nasals > Obstruents
(Clements, 1990; Kenstowicz, 1994; Smolensky, 1995; de Lacy, 1997)

If the Syllable Contact Law in (506) is interpreted in terms of the Sonority Hierarchy in (508), the data in (497)–(505) show cases where the concatenation of morphemes results in a ‘bad syllable contact’. Specifically, suffixation creates an obstruent-sonorant heterosyllabic sequence, where the sonority of an obstruent coda is less than the sonority of a following onset. It is thus hypothesized that:

[80] Ohala (1993) questions the existence of the sonority hierarchy.

(i) sonority reversals like this are not tolerated in Nivaĉle, and that (ii) metathesis functions as a repair strategy that optimizes an otherwise illicit syllable transition. A vowel-sonorant transition emerges instead at the site of morpheme concatenation, thus optimizing Syllable Contact.

Note at the same time that the (underlying) stem-final obstruent is shifted by metathesis into an Onset position, e.g. the stem-final [ʃ] of (497) *nɑjiʃ-mát → nɑ̀j.ʃi-mát now surfaces as an Onset rather than a Coda in the derived [j.ʃ] sequence. Concomitantly, CV obstruent-vowel transitions are created. Because the most reliable cues to place of articulation in a stop depend on the formant transitions into a vowel, VC-metathesis can be seen from a perceptual approach as an optimizer of the perception of syllable boundaries.

On the basis of my Nivaĉle data, I assume the following sonority scale where adjacent categories or Glides-Nasals and Fricatives-Affricates-Stops are conflated into the single categories of Sonorant and Obstruent, respectively.

(509) Vowels > Sonorants > Obstruents

In an optimality theory analysis, the Syllable Contact Law represents a family of constraints, which can be instantiated for Nivaĉle in the following terms:[81]

(510) SYLLABLE CONTACT LAW (SCL) $*^{[\text{-son}]}]_{\sigma\ \sigma}[^{[+\text{son}]}$ Sonority should not rise across a syllable boundary (from an obstruent to a resonant).

The interaction between the SCL constraint and the previously proposed LINEARITY-IO constraint (493) is illustrated in the following tableau:

(511) SCL, *COMPLEXCODA » LINEARITY-IO

[81] This statement is patterned on common statements of the Sonority Sequencng Principle

(512)

/finɑk + met͡ʃ/	SCL $*^{[\text{-son}]}]_{\sigma\ \sigma}[^{[+\text{son}]}$	*COMPLEXCODA	LINEARITY-IO
a. fi.nɑk.met͡ʃ	*! [… k.m …]		
b. ☞ fin.kɑ.met͡ʃ			*
c. fi.nɑ.kemt͡ʃ		*!	**

The most faithful candidate to the input (a) fatally violates SCL and it is thus discarded. Candidate (b) surfaces as the optimal output because it violates the lower ranked LINEARITY-IO once, whereas (c) violates *COMPLEXCODA and LINEARITY-IO twice. In §6.4, I will discuss the domain where metathesis occurs.

In essence, the hypothesis I am proposing is that syllable contact markedness constraints are highly ranked in Nivaĉle and will trigger metathesis, a LINEARITY-IO violation. Under this proposed analysis, an interesting questions arises: What happens if suffixation of a sonorant-initial suffix to an obstruent-final stem should trigger metathesis in order to avoid violating the SCL but the linear reordering of the final vowel and consonant of the root would itself incur a violation of a higher ranked constraint, for instance *COMPLEX? Interestingly, vowel epenthesis takes place, an issue I discuss in the following section.

6.3.3 Vowel epenthesis

When the linear reordering (metathesis) of the final vowel and consonant of a stem would incur in a violation of a higher ranked constraint, epenthesis emerges as a repair mechanism. In (513), for example, if metathesis were applied to avoid a bad syllable contact […k-w…] (513a), then an illicit complex onset [p'k] would result from that linear reordering (513b). Complex onsets do exist word-initially, but no labial stop-dorsal stop is ever attested: neither *pk nor *p'k (cf. Chapter 2).[82] However, the most signification generalization to be made is that metathesis does not derive a COMPLEXONSET (§6.4). Further, deletion of the final consonant is not observed as an alternative strategy (513c). Faithfulness to consonantal identity of lexical representation is highly ranked in the Nivaĉle grammar.

[82] As will become clear in §6.5.1, candidate (513b) will be ruled out by a laryngeal constraint: ejectives do not occur before consonants.

(513) /p'ok/ 'arrow' - /-waʃ/ 'MARK'

a. * p'ok-waʃ

b. * p'ko-waʃ

c. * p'o-waʃ

d. p'ok-[i]waʃ ✓ 'mark of an arrow'

Since the first rescue strategy, metathesis, does not result in an acceptable syllabic parse, the best repair strategy in this case is vowel epenthesis, a DEP-IO-V violation. In tableau (518) we can see the relative ranking of DEP-IO-V in regards to MAX-SEG, and the two processes, metathesis and epenthesis, jointly "conspiring" (Kisseberth 1970) to eliminate bad syllable-contact sequences, that is, SCL violations. *COMPLEXONSET and *COMPLEXCODA are the conditioning factors that gives rise to the variation between one process and the other. The ranking in (517) crucially establishes that MAX-SEG is higher ranked than DEP-IO-V: vowel epenthesis is a better repair strategy than deletion of the final consonant of the stem.

(514) *COMPLEXONSET: (Onsets are simple) (Kager 1999)

$*[_{\sigma}$CC

(515) MAX- SEG: Input segments must have output correspondents ('No deletion'). (Kager 1999)

(516) DEP-IO-V: Every vowel in the output has a correspondent in the input.

(517) SCL, MAX-SEG » DEP-IO-V, * $[_{\sigma}$CC, » LINEARITY-IO

(518)

/p'ok-waʃ/	SCL$*^{[-son]}]_{\sigma}\,_{\sigma}[^{[+son]}$	MAX-SEG	DEP-IO-V	* $[_{\sigma}$CC	LIN-IO
a. p'ok-waʃ	*!				
b. p'ko-waʃ				*	*!
c. p'o-waʃ		*!			
d. ☞ p'ok-[i]waʃ			*		

While candidates (518a) and (518c) get discarded because they violate SCL and MAX-SEG, an interesting contrast can be seen between (518b) and (518d). Candidates (518b) and (518d) incur one violation of equally ranked constraints $*_{\sigma}[$CC and DEP-IO-V, respectively. Importantly, candidate (518b) also incurs one violation mark of LINEARITY-IO, and so candidate (518d) emerges as the optimal output.

As previously presented in the data seen in §6.2.4, vowel epenthesis is also observed when C plural allomorphs are attached to consonant-final stems. In these cases, DEP-IO-V must be also crucially outranked by an undominated syllable markedness constraint, namely *COMPLEXCODA. It was already established that while complex onsets occur in Nivaĉle complex onsets never emerge as a result of metathesis; $*[_{\sigma}$CC is equally ranked with respecto to Dep-IO-V, and they are both higher ranked than LINEARITY-IO. Through vowel epenthesis the emergence of complex codas and complex onsets are avoided. Let us look at the following example:

(519) a. t͡ʃin.t͡ʃḛ́x
'spirit'
b. t͡ʃin.t͡ʃe.x-[í]s
spirit-PL
'spirits'
c. *t͡ʃin.t͡ʃex-s
d. *t͡ʃin.t͡ʃxe-s
e. * t͡ʃint͡ʃ.xe-s
f. * t͡ʃin.t͡ʃḛ-s

Similarly to the example discussed in (513), metathesis does not occur in (519) because it would either result in a complex onset (519d) or a complex coda (519e). Deletion of the final consonant of the stem (519f), as a strategy to avoid the emergence a complex coda is not permitted. Consider the candidates in (519) in the following tableau along with the following proposed ranking of constraints:

(520) $*\text{CC}]_{\sigma}$, MAX-SEG » DEP-IO-V, $*[_{\sigma}$CC » LINEARITY-IO

(521)

/t͡ʃint͡ʃeʔx + s/	* CC]$_\sigma$	MAX-SEG	DEP-IO-V	* [$_\sigma$CC	LINEARITY-IO
a. t͡ʃin.t͡ʃḛx-s	*!				
b. t͡ʃin.t͡ʃxe-s				*	*!
c. t͡ʃint͡ʃ.xe-s	*!				*
d. t͡ʃin.t͡ʃḛ-s		*!			
e. ☞ t͡ʃin.t͡ʃex[í]-s			*		

Candidate (521e) emerges as the optimal output: vowel epenthesis is the best strategy to avoid the emergence of a complex coda (521a), (521c), or a complex onset due to metathesis (521b) when the root has a medial CC cluster /t͡ʃint͡ʃeʔx/, as opposed to a medial singleton C, e.g. /finax/ (496). Deletion of a segment is worse than epenthesizing a vowel, and so candidate (d) gets discarded. Note that the deglottalization of the glottalized vowel will be discussed in Section 6.5.2.

6.4 Domain of metathesis

In this section, an important issue related to metathesis is considered; namely, its scope or domain. It is often the case in languages where metathesis is driven by the Syllable Contact Law that the consonants across a syllable or morpheme boundary are the ones that metathesize (Gouskova 2004, Holt 2004). For instance in Sidamo (Gouskova 2004: 228-229): /ha**b**-**n**emmo/→ [ha**n**-**b**emmo; /ha**s**-**n**emmo/→ [ha**n**.**s**emmo]. In Old Spanish (Holt 2004: 52) /ka**d**.**n**ado/ → [ka**n**.**d**ado]. However, in Nivaĉle, the ill-formed *O.R consonant sequence across the root-suffix boundary (522b) does not metathesize. Rather, it can be observed that metathesis is root-bound, in the sense that it affects the final consonant of the root and the preceding vowel (522a).

(522) /feɬet͡ʃ + jiʃ/

a. ✓ feɬ.t͡ʃe-jiʃ 'uterus'

b. * fe.ɬej-t͡ʃiʃ

That is, although the trigger for metathesis is the fact that the initial consonant of the *suffix* is more sonorous than the final consonant of the *root*, the repair mechanism for this violation of the Syllable Contact Law does not involve segments in the suffix at all: the segments that metathesize are exclusively within the morphological domain of the root. What I propose in the present analysis is that in addition to LINEARITY, a CONTIGUITY constraint is relevant. McCarthy and Prince (1993, 1995) distinguish CONTIGUITY as defined with reference to the Input string "S1" (I-CONTIGUITY) from CONTIGUITY as defined with reference to the Output string "S2" (O-CONTIGUITY):

(523) a. I-CONTIGUITY: ("No skipping")
The portion of S_1 standing in correspondence forms a contiguous string.
Domain (ℜ) is a single contiguous string in S1.

b. O-CONTIGUITY ("No Intrusion")
The portion of S2 standing in correspondence forms a contiguous string.
Range (ℜ) is a single contiguous string in S2.

Of relevance to the constraint interactions related to metathesis in Nivaĉle is O-CONTIGUITY: effectively what this constraint miliates against are cases where a segment in an output string intrudes, disrupting the (input) contiguity of other segments in that string. To illustrate the different effect of O-CONTIGUITY vis-à-vis LINEARITY violations, let us consider their interaction in the example (522), repeated here in (524), with respect to the well-formed output candidate (a) compared with the ill-formed output candidate (b):

(524) Input: /f e ɬ e t͡ʃ]$_{Rt}$ - j i ʃ/   /f e ɬ e t͡ʃ]$_{Rt}$ - j i ʃ/

Output (a): f e ɬ t͡ʃ e]$_{Rt}$ - j i ʃ   (b): * f e ɬ e j t͡ʃ]$_{Rt}$ - i ʃ

For clarity of reference, the lines between Input and Output in the diagram identify the metathesized segments. Both output candidates incur a single violation of LINEARITY: in the output in

(522a), the precedence relations of [e] and [t͡ʃ] are changed, whereas in (524b), the precedence relations of [j] and [t͡ʃ] are changed.

Consider now CONTIGUITY. As foregrounded by Hume (1998:19, referencing Kenstowicz 1994 and McCarthy 1995), "the relevant domain for the evaluation of contiguity relations is the morpheme". As observed in the introduction to this section, the relevant domain in Nivaĉle is the root: for ease of reference therefore, the right edge of the root is marked in the examples in (524).

The two output candidates in (524) effectively illustrate that violations of O-CONTIGUITY play a crucial role in the intricate constraint rankings governing Nivaĉle metathesis, whereas I-CONTIGUITY violations are never fatal.[83]

More specifically, I-CONTIGUITY, which is informally characterized by McCarthy and Prince (1993, 1995) as "No skipping", is clearly violated in the candidate (a), in that the contiguous relation between [ɨ] and [e] in the input is not preserved in the output. Note, however, that although the input *sequencing* of [e] and [t͡ʃ] is not preserved, these two segments remain "contiguous" in the output in candidate (a): thus, they incur a LINEARITY violation (as discussed above), but not an (additional) I-CONTIGUITY violation. Despite a LINEARITY violation and an I-CONTIGUITY violation, candidate (a) is nonetheless the winner. The unsuccessful candidate (b) also incurs a LINEARITY violation. Where the significant difference lies is in the nature of the CONTIGUITY relations. The definition of O-CONTIGUITY prohibits "intrusion". As indicated by the circled segment in (524b), if metathesis were to operate on reversing the order of the final consonant of the root and the initial consonant of the suffix, then the suffix consonant (here the circled [j]) would intrude in between the [e] and [t͡ʃ] segments of the root, resulting in an O-CONTIGUITY violation. In summary, although this type of root-suffix metathesis would constitute one possible strategy to repair the violation of the SCL, this is seen not to be a viable strategy in Nivaĉle because of the relative ranking of the O-CONTIGUITY constraint.

So, let us hypothesize that there is in Nivaĉle a ranking wherein:

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83 Hence, I-CONTIG will be lowly ranked, and will not figure overtly in the crucial rankings illustrated in the tableaux in this section.

(525) SCL » DEP-IO-V, O-CONTIG » LINEARITY

As seen in §6.3.2, SCL is an undominated constraint. Consider then the following tableaux:[84]

(526)

/feɬe$\widehat{t\int}$]$_{Rt}$ - jiʃ /	SCL	DEP-IO-V	O-CONTIG	LINEARITY
a. fe.ɬe$\widehat{t\int}$] -jiʃ	*!			
b. ☞ feɬ.$\widehat{t\int}$e]-jiʃ				*
c. fe.ɬej.$\widehat{t\int}$]iʃ			*!	*
d. fe. ɬe.$\widehat{t\int}$]-V.jiʃ		*!		

In (526), candidate (b) emerges as the optimal output because it only violates low-ranked LINEARITY, whereas (a), (c) and (d) violate the Syllable Contact Law, O-CONTIG-Root, and DEP-IO-V, respectively. The relevance for DEP-IO-V being unranked with regards to O-CONTIG-Root will become evident in (528). As argued in §6.3.3, when the result of incurring a violation of LINEARITY would have the effect of creating a violation of a higher ranked constraint, DEP-IO-V emerges as the best strategy. And importantly, deleting a segment is not an alternative strategy; MAX-SEG is higher ranked than DEP-IO-V. So, let us reconsider example (513) [p'okiwáʃ] arrow-MARK 'mark of an arrow', where DEP-IO-V is enforced in order to not violate the syllable well-formedness higher ranked constraints, SCL, and the faithfulness constraint MAX-SEG:

(527) SCL » MAX-SEG » DEP-IO-V, O-CONTIG, * [$_\sigma$CC » LINEARITY

(528)

/p'ok-waʃ/	SCL	MAX-SEG	DEP-IO-V	O-CONTIG	*[$_\sigma$CC	LIN-IO
a. p'ok-waʃ	*!					
b. p'o-waʃ		*!				
c. p'ko-waʃ					*	*!
d. ☞ p'ok-[ɨ]waʃ			*			
e. p'owk-aʃ				*		*!

[84] As discussed above, whereas I acknowledge the presence of the constraint I-CONTIG (lower ranked than O-CONTIG-Rt), which the optimal candidate (b) violates, it is not crucial for the present analysis.

Candidates (a) and (b) are discarded because they violate high-ranked SCL and MAX-SEG. Further, the tableau in (528) shows the important role the low-ranked constraint LINEARITY plays in conjunction with O-CONTIG, both of which candidate (e) violates. In other words, epenthesizing a vowel in order to not violate SCL, is better than violating O-CONTIG and LINEARITY, otherwise, candidate (e) would win over (d). Candidate (c) violates both COMPLEXONSET and, importantly, low-ranked LINEARITY. In that regard, it is worthy of mention that, in Nivaĉle, the result of morpheme concatenation never entails the emergence of a derived (marked) syllable structure; e.g. a morphologically derived complex onset in (c). Finally, let us consider another example in which Dep-IO-V is also enforced.

(529) /xpek͡l- ma͡tsex/ shade- BENEF ‘good shade’
[xpèk͡l[i]ma͡tséx]

Note that even though complex onsets occur in word initial position (cf. Chapter 2.3), at most there can be two consonants in word initial position:

(530) $*_{\sigma}$[CCC: No initial triconsonantal clusters. (after Kager 1995)

(531) $*_{\sigma}$[CCC ,*SCL, MAX-SEG » DEP-IO-V, O-CONTIG-Rt, * [$_{\sigma}$ CC » LINEARITY

(532)

/xpek͡l-ma͡tsex/	*CCC]$_{\sigma}$	SCL	MAX-SEG	DEP-IO-V	O-CONTIG	$*_{\sigma}$[CC	LIN-IO
a. xpek͡l-ma.͡tsex		*!				*	
b. xpk͡le-ma͡tsex	*!					*	*
c. xpe-matsex			*!			*	
d. xpemk͡l]a͡tsex					*	*	*!
e. ☞ xpek͡l[i]ma͡tsex				*		*	
f. xepk͡l[i]ma͡tsex				*	*		*!

The above tableau shows, once again, the decisive role that LINEARITY plays; whereas the optimal candidate (e) violates two constraints DEP-IO-V and *[$_\sigma$CC, candidate (d) also violates two constraints O-CONT and *[$_\sigma$CC, but, importantly, LINEARITY as well. Similarly, candidate (f) incurs in two violations: DEP-IO-V and O-CONT, but it is the violation of LINEARITY that is fatal.

6.5 Featural effects of metathesis

6.5.1 Deglottalization of stops

The distribution of ejective stops and affricates is restricted to word initial/medial onset position; they are never realized in coda position (cf. §2.3). Some of the restrictions that apply to ejectives can be seen as strategies to obey the *laryngeal constraint* posited by Lombardi (1995:42): "a laryngeal node is only licensed in a **consonant** if it immediately precedes a [+son] segment in the same syllable" [my emphasis/AG].

```
(533)        σ
            / \                                  (Lombardi 1995, 43)
      [Root]   [+son]
           |
           . Laryngeal node
```

On her part, Steriade's (1997) *Licensing by Cue* approach presents a perceptual motivation of this constraint. Steriade claims that the timing of the laryngeal constriction in ejective obstruents is tied to their release. Thus, "an optimal identification of an ejective (…) will depend on the nature of the right hand context" (Steriade 1997: 78). For Steriade, syllabification does not play any role in laryngeal neutralization: glottalized obstruents neutralize in the absence of a following sonorant, regardless of whether or not they are in the 'same' syllable. An ejective obstruent in coda position would be licit as long as the following consonant is a sonorant. Perception-related phonotactics are thus string-based, rather than syllable-based, under Steriade's approach (cf. also Blevins 2003). Nivaĉle ejective obstruents [p', t', k', t͡s', ʧ'] only occur before vowels. Because no obstruent is found before a sonorant consonant, none of these ejectives are ever found before a sonorant [m, n, j, w].

In order to capture the behaviour of ejectives, consider the relationship between the following markedness and faithfulness constraints:

(534) *[+cons, c.g]/_[+cons]: Ejectives must not precede a segment specified for [+cons].

(535) MAX-IO-[c.g.]: The feature [c.g.] in the input has a correspondent in the output.

Importantly, MAX-IO-[c.g.] must be outranked by the faithfulness constraints MAX-SEG and DEP-IO-V since neither segmental deletion (537c) nor epenthesis (537d) works as a repair mechanism:

(536) $*CC]_\sigma$, *[+cons, c.g.]/_[+cons], MAX-SEG » DEP-IO-V » LINEARITY, MAX-IO-[c.g.]

(537)

/ap'ax+s/	$*CC]_\sigma$	*[+cons,cg]/_ [+cons]	MAX-SEG	DEP-IO-V	LIN	MAX-IO [c.g.]
a. a.p'axs	*!					
b. a.p'a.xVs				*!		
c. a.p'as			*!			
d. ap'xas		*!			*	
e. ☞ ap.xas					*	*

Candidate (e), where metathesis functions to optimize segmental faithfulness, emerges as the optimal candidate but the concomitant change in the segmental sequencing triggers deglottalization of the /p'/, in violation of low-ranked MAX-IO [c.g.]. Comparison of (d) with (e) establishes the crucial ranking of *[+cons, c.g]/_[+cons] over MAX-IO-[c.g.].

Because tautosyllabic ejective-sonorant sequences are independently ruled out by $*CC]_\sigma$, and heterosyllabic ejective-sonorant sequences are independently ruled out by the Syllable Contact Law, Nivaĉle laryngeal neutralization of obstruents seems to be consistent with either the Lombardi or Steriade hypothesis. However, the fact that ejectives are never attested as the first member of a word-initial complex onset casts doubt on a syllable-based phonotactic approach and rather points at the key role the right hand context plays in the recognition of these complex segments, that is, the presence of a following vowel. I conclude that laryngeal neutralization of ejectives in Nivaĉle provides support for string-based rather than syllable-based phonotactics.

6.5.2 Deglottalization of vowels

As established in Chapters 3 and 4, Nivaĉle glottalized vowels deglottalize in various morpho-phonological contexts. A pervasive factor that is required for the realization of glottalized vowels is stress; it has been advanced here that glottalized vowels are licensed by the head of a foot (cf. Chapter 3). Whenever the glottal is not parsed to the head of a foot, this feature is lost. However, it has also been shown that Nivaĉle glottalized vowels can get deglottalized even when they are still in a prominent position (cf. the data set in §6.2.2). Examples (538)-(541) illustrate the loss of a [c.g.] feature that is realized as a coda [ʔ] in word-final position, but is lost under inflectional suffixation, specifically any of the allomorphs of the nominal 'plural' suffix (cf. Chapter 4, §4.5.5)

(538) a. ji-kféʔ
1POSS-ear
'my ear'
b. ji-kfé-j
1POSS-ear-PL
'my ears'

(539) a. fajxóʔ
'charcoal'
b. fajxó-k
charcoal-PL
'charcoals'

(540) a. ɬ-áʔ
3POSS-fruit
'its fruit (of the tree)'
b. ɬ-á-j
3POSS-fruit-PL
'its fruits (of the tree)'

(541) a. -núʔ
'bone'
b. -nú-s
bone-PL
'bones'

Further, and similarly, glottalized vowels systematically get deglottalized when they are involved in VC-metathesis (cf. (477)-(477b), repeated here for convenience in (542)-(543)):

(542) a. tisṵ́x
'*coronillo* tree'

b. tisxú-j
coronillo.tree-PL
'*quebracho* trees'

(543) a. ɬ-ná̰ʃ
3POSS-nose
'his/her nose'
b. ɬa-nʃá-s
3POSS-nose-PL
'their noses'

In all the above (b) examples, the deglottalized vowels are still in a prominent position, yet the laryngeal features have been lost.

Different is the situation depicted in (544) where the underlying glottalized vowel is in a weak (unstressed) position in the suffixed form:

(544) a. ∅-wa.k͡ɬḛ́t͡ʃ
3S-walk
's/he walks'
b. ∅-wàk.t͡ʃe-ján
3S-walk-CAUS
's/he makes s.o. walk'

In this section, the central issue to be accounted for is the pervasive generalization that Nivaĉle glottalized vowels surface as deglottalized if they have undergone metathesis. Recall from Chapter 2 that Stell (1989:92) postulates the existence of a phonemic contrast between 6 modal vowels and 6 glottalized vowels in Nivaĉle. In contrast, I argue that Nivaĉle glottalized vowel are actually sequences of a vowel plus a [c.g.] feature – /Vʔ/ – where the [c.g.] feature can be parsed to the nucleus or to the coda depending on prosodic context (cf. Chapter 3).

The contexts of metathesis with concomitant deglottalization are diverse. The examples in (546)-(550) show inflectional suffixation of the nominal plural (MWd level suffix) and possessive prefixation (MSt2 level prefix).[85] The crucial fact for this study therefore is that Nivaĉle glottalized vowels consistently deglottalize in metathesis processes, that is, when they switch positions with the stem final consonant, regardless of the vowel quality.

(545) input /…VʔC-C/
output […CV-C]

- **Plural suffixes**

(546) a. ti.sṵ́x
'quebracho'

b. tisxú-j b'. *tisxṵ́-j
quebracho-PL
'*quebracho* trees'

(547) a. jij-ḁ́x
'puma'
b. jij-xá-s b'. *jijxḁ́-s
puma-PL
'pumas'

[85] Both these data sets relate to nominal forms.

(548) a. k’u͡tsá̰x
'elderly man'
b. k’u͡tsxá-s b’. *k’u͡tsxá̰-s
elderly.man-PL
'elderly men'

(549) a. [ɬnḭ́ʃ]
/ɬa-niʔʃ/
3POSS-perfume
'his/her perfume'
b. [ɬanʃík] b’. *ɬa-nʃḭ́-k
/ɬa-niʔʃ-k/
3POSS-perfume-PL
'his/her perfume'

(550) a. t’a-k͡lá̰t͡ʃ
INDEF.POSS-song
'someone's song'
b. t’ak.xá-j b’. *t’akxá̰-j
INDEF.POSS-song-PL
'someone's songs'

The data in (546)-(550) establish that even in a stressed context, vowel glottalization is lost in contexts where metathesis has also occurred. In contrast, the examples in (551)-(554) show deglottalization in unstressed contexts.

- **Derivational suffixes**

(551) a. k’u͡tsá̰x
'elderly man'
b. ji-k’ú͡tsxa-n b’. *ji-k’u͡tsxá̰-n
3S-elderly.man-VBLZ
'S/he/it gets old'

(552) a. ji-ná̰ʃ
1POSS-nose
'my nose'

b. jì-n.ʃa-mát b'. *ji-nʃá̰-mat
1POSS-nose-MALEF
'I have an imperfective nose'

(553) a. tɑj-ḛ́x
know-NMLZ
'shaman'

b. tɑ̀j-xe-mét͡ʃ b'. *tɑj-xḛ́-met͡ʃ
know-NMLZ-SHAMAN/EXPERT
'shaman that has power over a shaman'

(554) a. t͡sanṵ́k
'*duraznillo* tree'

b. t͡sàn.ku-mét͡ʃ b'. *t͡sankṵ́-met͡ʃ
duraznillo.tree-SHAMAN/EXPERT
'person that is an expert in constructing bows made of *duraznillo* trees's wood'

c. t͡sàn.ku-mát c'. *t͡sankṵ́-mat
duraznillo-MALEF
'it is a bad/defective *duraznillo* tree' (Stell 1989:129)

In sum, even though glottalized vowels occur only under stress, this hypothesis does not account for those cases where metathesized vowels deglottalize even in the context of stress (546)-(550).

According to the analysis advanced in Chapter 3, the [c.g.] feature in (555) is parsed as a glottal stop coda due to the absence of another consonant in coda position. In contrast, the glottal is lost when the plural consonantal suffix is attached (555b) because *COMPLEXCODA is an undominated constraint in the language:

(555) a. ɬ-áʔ
3POSS-fruit
'its fruit'

b. ɬ-á-j b'. *ɬáʔj
3POSS-fruit-PL
'its fruits'

However, when a stative verb 'to have X/X's property' is created by suffixation of the verbalizer /-j/ to that same nominal root 'fruit', the [c.g.] feature is not lost, but instead is parsed to the nucleus of the syllable:

(556) t-á̰-j
3S-fruit-VBLZ(TO.HAVE)
'It has fruit'

In contrast to the data in (557)-(559) where [c.g.] was seen to be systematically lost in stems suffixed by the inflectional plural /-j/, the [c.g.] feature of all of the ʔ-final roots survives in the derivational context of the verbalizer /-j/:

(557) a. -núʔ
'bone'
b. ta-nṵ́-j
3S-bone-VBLZ(TO HAVE)
'it is bony/it has bones'

(558) a. -axéʔ
'prey'
b. ʃt-axḛ́-j
1PL-prey-VBLZ(TO HAVE)
'we have/bring a prey'

(559) a. -ɬkúʔ
'load'
b. ta-ɬkṵ́-j
3S-load-VBLZ(TO HAVE)
's/he has a load'

As the contrast between the data in (555b)-(556) shows, the palatal glide /j/ is homophonous, serving in one case as an allomorph of the nominal plural marker and in the other case as an allomorph of the intransitive verbalizer. The difference in their morphological identity is reinforced by the different morphophonological effects: in the former case [c.g.] is deleted, in the latter case it is parsed. Consider, in that regard, the near-minimal pair in (561):

(560) t’a-k͡lá̰t͡ʃ
3POSS-song
‘her/his song’

(561) a. t’a-k.xá-j
3POSS-song-PL
‘his/her songs’
b. t’a-k.t͡ʃá̰-j
3S-song-VBLZ
‘he has a shaman’s song’

Another context in which a glottalized vowel can be realized in a metathesized context is documented in (563). The derivational suffix /-p/ means ‘season’:

(562) ànxají-p
scrubland.bean-SEASON
‘season when the scrubland bean blossoms (summer)’

(563) a. tisṵ́x
‘*coronillo* tree’
b. tisxṵ́-p — cf. tisxú-j (538b)
coronillo.tree-SEASON — coronillo.tree-PL
‘season when the *coronillo* tree blossoms (Autumn)’

Once again, whereas /ʔ/ is parsed in the context of a derivational affix it gets deleted in the context of inflectional pluralization.

These contrasts thus suggests that the deletion of /ʔ/ is morphologically conditioned: the consistent pattern is that it cannot occur in either metathesized or non-metathesized forms under nominal plural suffixation. The fact that a vowel cannot emerge as glottalized in a plural (contrarily to the corresponding singular forms) must be a case of 'morphological' idiosyncrasy. Recall that all the other plural allomorphs have the same effect of deleting /ʔ/.[86]

The aforementioned contrast between the effects of inflectional and derivational suffixes carries several theoretical implications:

(i) the /ʔ/ that is variably realized as [Vʔ] or [V̰] must be posited as present in the underlying representation; it is not merely a phonetic enhancement feature of stressed syllables or just a marker of a grammatical boundary or of an intonational phrase.

(ii) The fact that a stem-final /ʔ/ is systematically lost when suffixed by the plural does not conform to any of the phonological generalizations governing deglotallization that have been described here. Consequently, this is treated here as a morphologically-conditioned phenomenon.

Let us now consider how the interaction between a root-final /ʔ/ and plural suffixation might be addressed. To summarize, the proposed analysis (cf. Chapter 3) for the realization of [c.g.] in a stressed syllable aims to account for the observation that Nivaĉle glottalized vowels are differently realized – either (i) as variably 'creaky' [V̰] or 'rearticulated' [V^{ʔV}] or (ii) as 'vowel-glottal coda' [Vʔ] – depending on the syllabic parse of the immediately following segment. This means that the phonetic realization of [c.g.] is not just dependent on what follows (be it a consonant or nothing), but importantly on its prosodic status. If the segment to the right is parsed as a coda, the [c.g.] feature is parsed into the nucleus and a rearticulated or creaky vowel is realized. In contrast, if there is no other subsequent segment, or importantly, if the following segment is parsed to the onset of the following syllable, then the [c.g.] feature is parsed as a coda and is realized as a glottal stop. In sum, it is not the case that the 'vowel-glottal coda [Vʔ] vs. 'creaky/rearticulated' vowel alternation depends on the presence or absence

[86] Because of the partially overlapping homophony of the two suffixes involved here, one might hypothesize Avoidance of Homophony (Rebrus & Törkenczy 2005, Blevins & Wedel 2009) to account for the different surface realizations here but the facts that (i) there are several non-homophonous allomorphs of each, and (ii) the suffixes belong to different lexical classes (Noun vs. Verb) would argue against this.

of an adjacent segment to the right, but rather on whether that segment is parsed to the coda of the same syllable or to the onset of the following syllable.

Because the plural morpheme that triggers deletion of the [c.g.] feature is a single consonantal suffix in all its allomorphs, what would be expected under the proposed analysis is (i) that the plural-C suffix would be parsed as a coda, and (ii) that the [c.g.] feature would be parsed into the nucleus and therefore surface as part of a rearticulated or laryngealized vowel. What is unexpected and therefore needs to be accounted for is that (i) happens, but (ii) does not. Even though I cannot reach an adequate explanation at this point, what is proposed is that the cause for this is a morphologically-idiosyncratic process, where the realization of [c.g.] is prohibited before an adjacent segment that is the output exponent of the plural suffix.

Very interestingly, the relationship between Nivaĉle plural suffixation and deglottalization of glottal final stems can be also observed in two other languages of the family: Chorote and Maká. Note the phonetic similarity of (564) with the cognate Nivaĉle forms: /-woʔ/ 'worm'; [-wo-s] worm-PL 'worms'; [ʃta-wo̰-j] 1S.PL-worm-VBLZ(TO.HAVE) 'we have an infected wound with worms'.

Chorote

(564) a. awoʔ
'worm'
b. awo-s
worm-PL
'worms' (Gerzenstein 1983: 50)

Maká

(565) a. witxiɬaʔ
'head'
b. witxiɬa-ɬ
head-PL
'heads' (Gerzenstein 1994: 73)

(566) a. witkinxeʔ
'hip/side'

b. witkinxe-j
hip-PL
'hips/sides'

Similarly to Nivaĉle, both languages display plural allomorphy; note that not all the plural allomorphs are presented here.[87] Further, note that final glottals are elided regardless of which plural allomorph is being attached to the stem. Even though no discussion of this phenomenon (or the status of vowel-glottal sequences) is found in Gerzenstein's works, I posit that the deglottalization pattern in Chorote and Maká is also lexically motivated.

6.5.3 Spirantization

Another effect of metathesis in the context of plural suffixation is spirantization of /k/ and /t͡ʃ/, underlyingly specified for DORSAL and CORONAL respectively into [x].[88]

(567) a. sa.múk
'excrement'
b. sam.xú-j b'. *sam.kúj
excrement-PL
'excrements'

(568) a. no.βók
'wild cassava'
b. noβ.xó-j b'. *noβ.kój
wild.cassava-PL
'wild cassavas'

[87] Gerzenstein (1983, 1994) states that no phonological conditioning behind the consonantal plural allomorphs has been found for either Chorote or Maká.

[88] Note the similarity between (567) with the following cognates in Maká (i), where the Maká velar stop changes into the glottal fricative [h] instead:
(i) a. witimuk
'excrement'
b. witimhu-j
excrement-PL
'excrements'

(569) a. fi.n-ɑ́k
suck-RES
'tobacco'
b. fin-xɑ́-j b'. *fin.kɑ́j
suck-RES-PL
'tobaccos'

(570) a. t͡sxe.t͡sít͡ʃ
'owl'
b. t͡sxet͡s.xí-s b'. *t͡sxet͡s.t͡ʃís
owl-PL
'owls'

(571) a. t͡ʃa.k͡lét͡ʃ
'flame'
b. t͡ʃak.xé-s b'. *t͡ʃak.t͡ʃés
flame-PL
'flames'

(572) a. j-en-át͡ʃ
1POSS-love-NOM
'my lover'
b. j-en-xá-s b'. *jen.t͡ʃás
1POSS-love-NOM-PL
'my lovers'

Spirantization of velar stops is a common process noted in the cross-linguistic literature. Just to cite a few examples, spirantization of velar stops into fricatives has been documented in Quechua (Adelaar & Muysken 2004), Tigrinya (Schein 1981, Kenstowicz 1982) and Muher (Rose 2000), among others. Nevertheless, the alternation between /t͡ʃ/ and [x] is less well attested. Note, however, that final-k occurs after back vowels (567-569) and the final-t͡ʃ occurs after front vowels (570-572), where /a/ patterns with front vowels and /ɑ/ with back vowels. Further, recall from Chapter 2, §2.4.1, that there exists an alternation between a number of alveopalatal – [ʃ], [t͡ʃ] – and velar-initial – [k], [x] – suffixes complementary distribution is also motivated by the backness of the preceding stem vowel. Based on the alternations between [k] and [t͡ʃ] in other parts of the grammar, Campbell and Grondona (2007:13) suggest that *t͡ʃ*-final stems that spirantize to [x] should be reconstructed historically with *k. I concur with their proposal.

There are two further observations about spirantization that are intriguing. First is the fact that, like the loss of [c.g.] investigated in §6.5.2, velar stops in the context of pluralization spirantize to [x]. Yet, in metathesized forms with the homophonous 'verbalizer' suffix /-j/ or with other derivational suffixes as illustrated below, velar stops remain unaltered. It seems as though the bases are more faithful in the context of derivational suffixes, than they are in the context of the inflectional suffixes.[89] In that regard, compare (567) with (573) and (569) with (574):

(573) a. samúk
'excrement'
b. ta-samkú-j b'. *ta-samxu-j
3S-excrement-VBLZ
'I has rust/it is rusty'

(574) a. finák
'tobacco'
b. fin.ka-nóx b'. *fin-xa-nóx
tobacco-NMLZ (AG)
'smoker'

The second puzzling aspect of spirantization is that sometimes it does not occur in contexts where it might be expected to, on the basis of the data just presented. For example, the unattested spirantized forms (573b') – (574b') illustrate what would be licit consonantal sequences in the language. Some further remarks regarding the status of spirantization can be commented on. First, spirantization is a very restricted process - viz., it targets a very limited set of segments (/k/ and /t͡ʃ/); more specifically, it operates as a morphologically-conditioned alternation only in the context of plural suffixation.

[89] While the distinction between derivation and inflection has been adduced as motivation for different strata in the earlier literature on lexical phonology and morphology, there is not sufficient evidence in my Nivaĉle corpus for a stratal analysis.

Second, it is interesting to note that a similar process of spirantization – exclusively of velar stops – is attested in other Mataguayan languages. Gerzenstein (1994:74) observes that Maká "k-final stems that do not refer to trees [see (577) below] change the placement of the vowel and change /k/ into /h/ when plural suffixes are attached" (my translation from Spanish/AG).[90] The glottal fricative has phonemic status in Maká (Gerzenstein 1994) and Wichí (Nercesian 2011), so this cognate spirantization process entails phonemic neutralization, as does the [k] ~ [x] spirantization in Nivaĉle.

		Maká		**Nivaĉle**
(575)	a.	nijak	a'.	nijɑk
		'rope'		
	b.	niiha-j	b'.	nijxɑ-j
		rope-PL		
		'ropes'		
(576)	a.	finak	a'.	finɑk
		'tobacco'		
	b.	finha-j	b'.	finxɑ-j
		tobacco-PL		
	c.	finka-xi	c'.	finkɑ-xij
		tobacco-LOC(recip)		
		'pipe'		
	d.	finka-xij-its	d'.	finkɑ-xij-is
		'pipes'		
(577)	a.	khatuk	a'.	kxatuk
		'type of cactus'		
	b.	khatkw-i	b'.	kxatku-j
		type.of.cactus-PL		

[90] Also, note the similarity between Maká and Nivaĉle plural suffixes: -(j)[i]t͡s and –[i]s (the latter form also present in Chorote and Wichí).

Further, similarly to Nivaĉle, spirantization in Maká does not occur in the context of derivational suffixes (576c). In Wichí, the *k~h* alternation in the pluralization context is also noted by Nercesian (2011: 259). However, she treats *-hVj* as a special plural suffix.[91] Note the phonetic similarity between 'rope' in Maká and Nivaĉle (575) and in Wichí (579):

(578) a. tolhet-ek
'head'
b. tolhet-hej
'heads'

(579) a. niyo-kw
'rope'
b. niy(o)-hoj
'ropes'

The earliest source on the Nivaĉle language is *Chunupi or Suhin. Grammar, Lessons and Vocabulary*, written by an Anglican priest, Richard J. Hunt, in 1924. In the vocabulary section, Hunt notes two plural forms for 'rope' *niyak*: *niyai* and *nihai*, possibly suggesting a change in progress (note that "y" stands for the glide [j] and "h" stands for the glottal fricative [h]). Hunt's material includes another plural form that shows a metathesized and spirantized output: *namach* [nama͡tʃ] 'axe', *namhai* 'axes'.

To summarize then, spirantization is a very restricted process that affects the velar stop of a commonly shared nominalization suffix across three Mataguayan languages (Maká, Nivaĉle and Wichí).

In most cases, I hypothesize that the Nivaĉle nominalizer has fossilized and it is not possible to reconstruct the original root. Spirantization appears as a limited and no longer productive phonological process. In Nivaĉle, there are only two (out of 60) attested examples that display spirantization of **k* without metathesis: *ta͡kl̰ṵ́k* 'blind person', *ta͡kluxúj* 'blind people', and *ankǫ̰́k* 'person that has a limp',

[91] This presumably means that the [Vk] disappears and is replaced by [hVj] in the plural.

ankoxój 'people that have a limp' (here the the vowel deglottalizes because it is not in a prominent position anymore). This overall picture, along with the fact that /k//t͡ʃ/ ~ [x] only occurs in the context of plural suffixes, makes me conclude that spirantization is as morphologically idiosyncratic as the existence of plural allomorphy in the Mataguayan languages.

6.6 Metathesis and historical vowel deletion

6.6.1 Previous accounts

In this section, I will present and discuss the previous proposals for the aforementioned Nivaĉle stem alternations. From a synchronic perspective, these stem alternations have been regarded as VC-metathesis (Stell 1989, Gutiérrez 2010, 2012). From a diachronic perspective, Campbell and Grondona (2007) have argued that historical vowel deletion is involved.

My current analysis of metathesis is very much indebted to Stell's pioneering work on this language. According to Stell (1989), the last vowel of the stem metathesizes with the last consonant of the stem in order to avoid inadmissible consonantal clusters; she provides a very valuable data set of alternating forms. However, no explicit discussion or explanation of the phonetic or phonological motivations behind such process is included in her thesis.

In turn, Campbell and Grondona (2007) analyze the stem alternation forms presented in (469)-(478) as the synchronic residue of historical vowel deletion. These authors apply internal reconstruction and posit several sound changes in the history of Nivaĉle. A standard assumption underlying their internal reconstruction is that the variants of a morpheme all stem from a single invariant original form. The alternating forms under consideration are singular and plural nouns. According to Campbell and Grondona, a vowel that is present in the singular form is missing from the related forms in the plural column in Table 6.1.[92]

[92] The information in the table has been reorganized with headings and the glide [j] is represented as [j] instead of [y].

Table 6.1 Vowel-alternation examples (adapted from Campbell & Grondona 2007:5)

SINGULAR	ENGLISH GLOSS	PLURAL	ENGLISH GLOSS
1. axutsax	‘hawk’	axutsx-as	‘hawks’
2. ɸatsux	‘centipede’	ɸatsx-us	‘centipedes’
3. snomax	‘ash’	snomx-as	‘ashes’
4. ɬasex	‘seed’	ɬasx-ej	‘seeds’
5. kutsxanax	‘thief’	kutsxanx-as	‘thieves’
6. klutsex	‘bow’	klutsx-es ‘	‘bows’
7. xump’uwaɬex	‘mountain lion’	xump’uwaɬx-es	‘mountain lions’
8. –pɑset	‘lip’	pɑst-es	‘lips’
9. nas-uk	‘*guayacan* tree’	nas-k-uj	‘*guayacans*’

Following the above morpheme parses, Campbell and Grondona assume that the Nivaĉle roots underwent a change, which deleted a vowel when a vowel-initial suffix was added; this change did not affect the singular suffixless words. A reconstruction is then postulated (e.g. (580) *pɑs**e**t-es) through the following sound change:

(580) **V-deletion V > Ø /__C + V**

	*p ɑ s **e** t - e s
V-deletion:	p ɑ s _ t - e s ~ p ɑ s ~~e~~ t e s

Some comments are worth mentioning with respect to their approach. Campbell and Grondona do not clearly motivate why this vowel deletion rule occurs in the presence of a “vowel-initial suffix” (2007:6). On the one hand, a double-sided open syllable is a common environment for syncope; on the other hand, however, if syncope is what is involved here there is no reason to expect the vowel of the root and the vowel-initial suffix to have been identical, unless a historically prior vowel harmony process was involved. The authors neither propose, nor discuss potential vowel harmony in Nivaĉle. Consequently, it would seem, following Campbell and Grondona’s approach, one would have to assume the existence of separate plural suffixes for the examples in Table 6.1: -es, -as, -us, -ej, -uj. The suffix allomorph chosen for a given root/stem would be required to have a vowel that matches the root vowel that is targeted by the postulated syncope processes. The way vowel deletion is presented seems to rely on a 'fortuitious' featural identity between vowels of the root and the suffix's. "Copy-vowel epenthesis" (Kitto & de Lacy 1999, Kawahara 2007), that is, epenthesis of a vowel that has the same vowel quality of a nearby vowel, could be invoked as a possible cause for that 'fortuituous identity'. In Section 6.6.2, I will addresss this issue.

As previously discussed in §6.2.4, the examples in (479)-(486) show that vowel identity between the final vowel of the root and what is here analyzed as an epenthetic vowel between the root and the plural suffix is not required. Under the present hypothesis that the plural suffix is simply a single consonant, the vowel that surfaces in those examples is considered epenthetic and does not consistently match the vowel quality of the final syllable root/stem. Some relevant examples are presented below. Note that the epenthetic vowel is represented with square brackets. The alternating vowel quality in (581b) displays dialectal variation. Recall from Chapter 2 that [e] is more pervasively used in the *chishamnee lhavos* variety.

(581)	a.	kasús	'pumpkin'	kasus-[í]k	'pumpkins'
	b.	utet͡ʃát	'a stand of stones'	utet͡ʃat-[í]s ~ utet͡ʃat-[é]s	'stands of stones'
	c.	ɬṵ́p	'nest'	ɬup-[í]s	'nests'
	d.	-t'ik	'rheum'	-t'ik͡l-[é]j	'rheums'
	e.	kat͡sí-k͡liʃ	'our word'	kat͡sì-k͡liʃ-[á]j	'our words'

Further, the VC ~ CV-C alternation, which I analyze as a metathesis process, is not restricted to the plural suffixation pattern that Campbell and Grondona analyze. As presented in §6.3.2, there are sets of data in which a range of sonorant-initial derivational suffixes trigger the same VC-metathesis phenomenon. Whenever metathesis would incur a violation of higher-ranked constraints, such as constraints on consonant clusters, in both the context of nominal pluralization and derivation, then vowel epenthesis occurs, for example:

(582) p’ok ‘arrow’ *pko.waʃ p’ok-[**i**]waʃ ‘mark of an arrow’

(data from Stell 1989: 211)

With this background, let us return to the consideration of Campbell & Grondona’s syncope analysis. For data like (583) Campbell and Grondona assume vowel deletion. However, it is not very clear what they would posit for the examples in (584):

(583) finɑ́k ‘tobacco’ fin_x-ɑ́j ‘tobaccos’

(584) a. finkɑ-meʧ ‘shaman that has power over the tobacco’
b. finkɑ-nax ‘smoker’

If the application of internal reconstruction involves analyzing the variants (allomorphs) of a morpheme stemming from a single invariant original form, then the same rules of vowel deletion should apply as in (583) as they do in (584). That is, according to their analysis, one would have to assume again that the derivational suffixes begin with the same (syncopated) root vowel: f i n ~~**ɑ**~~ k-**ɑ** m e ʧ and f i n ~~**ɑ**~~ k-**ɑ** n a x, respectively. Therefore, not only pluralization suffixes but also derivational suffixes would need to have vowels identical to the ones that are getting deleted in the final syllable of the root. For instance, one would have to posit that the derivational suffixes in (585)-(587) would have the allomorphs [-emet͡ʃ], [-ɑmet͡ʃ], [-umet͡ʃ] and [-imet͡ʃ], instead of treating them as VC-metathesis and the vowel [i] as epenthetic in (588).

(585) a. tɑjḛ́x
‘shaman’
b. tɑ̀jxe-mét͡ʃ
shaman-SHAMAN/EXPERT
‘a shaman that has power over another shaman’

(586) a. jijɑ̰́x
‘tiger’
b. jìjxɑ-mét͡ʃ
tiger-SHAMAN/EXPERT
‘a shaman that has power over the tiger’

(587) a. t͡sanṵ́k
'duraznillo'
b. t͡sàn.ku-mét͡ʃ
duraznillo.tree-SHAMAN/EXPERT
'person that is an expert in constructing bows made of *duraznillo* trees'

(588) a. saxét͡ʃ
'fish'
b. saxèt͡ʃ-[i]mét͡ʃ
fish-SHAMAN/EXPERT
'shaman that has power over fish'

Another problematic issue in Campbell & Grondona's analysis is the glottal stop deletion sound change (Table 6.2, below), which is proposed along with the vowel deletion sound change. With respect to the glottal deletion, recall from Chapter 3 that Campbell and Grondona consider the glottal articulations following the vowels to be phonemic; only six vowels are included in the phonemic inventory (contra Stell 1989), and the glottal stop is considered to be phonemic. However, the relationship between the glottal stop and glottalization on vowels is not explicated.

Table 6.2 Vowel-deletion with loss of /ʔ/ (after Campbell & Grondona 2007:7)

Proto-Nivaĉle	tisuˀx + uj 'quebrachos'	kut͡saˀx + as 'old men'
/ʔ/loss	tisuxuj	kut͡saxas
V-deletion	tisxuj	kut͡sxas

Campbell and Grondona do not formalize a context for glottal deletion or clearly state a reason behind this historical process. They simply posit that glottal stop deletion (historically) took place *before* the vowel deletion sound change (580), which they reformulate as (589) due to the existence of examples like the ones in (590):

(589) $V > \emptyset\ /VC_1\_\_C_2 + V$

(590) <u>Loss of /ʔ/ without vowel deletion [C&G 2007:7]</u>

a. k'utxaʔn 'small cactus thorn' k'utxan-is 'small cactus thorns'
b. ɬuʔp 'nest' ɬup-is 'nests'

In (590), only the glottal stop is being deleted in the context of plural suffixation, but there is no vowel deletion (*k'u**txn**is, ***ɬp**is). Campbell & Grondona (2007:7) conclude that vowel deletion did not take place when the vowel was preceded by two or more consonants –for instance /tx/ in (590a) – or by a word initial-single consonant (590b) because it would yield "non-permitted consonant clusters". While this claim is in principle aligned with the thrust on the analysis proposed here, Campbell & Grondona, do not specify the syllabic nature of these clusters or the prosodic status of the glottal stop. What their revised formulation of the V-deletion rule in (589) does instead is build in linear string restrictions: V-deletion in (590a) is prevented by the stipulation in (589) that there can be at most one consonant immediately preceding the target vowel. In turn, V-deletion in (590b) is prevented by the further stipulation in (589) that there must be another vowel preceding the target vowel. While Campbell and Grondona's analysis captures these two factors, it does not give them a unified or principled interpretation. The proposal advanced here argues that all these observed factors receive a more coherent and integrated interpretation under a prosodic analysis of syllable structure constraints and the prosodic analysis of the [c.g.] feature.

First, in Gutiérrez (2010, 2012), as well as in the present work, I posit that metathesis is blocked in (590a) because it would result in an illicit syllable structure (either a word-medial complex onset *[k'ut.**xn**as] or a complex coda *[k'u**tx**.nas]. As a result, vowel epenthesis occurs. Furthermore, with respect to Campbell & Grondona's (2007:7) explanation that vowel deletion does not take place in a form like (590b) [ɬup-is] where the vowel is preceded by a word initial-single consonant because it would yield "non-permitted consonant clusters", note in this case that the unattested output *[**ɬp**is] is not attributable to [ɬp] being illicit, as this *is* in fact a permissible word-initial cluster, as documented in Table 2.5 in §2.3.1.1. Also, what is observed in the present analysis (§.6.4) is that metathesis never derives complex onsets, this being systematically accounted for by the constraint ranking in (527), illustrated in the tableau in (528).

Secondly, in the present analysis, the deglottalization of the glottalized vowels is rooted in the set of prosodic constraints laid out in Chapter 3: neither in (590a) nor in (590b) does the [c.g.] feature, and the associated mora, get parsed as the head of the foot: (k'ùt)(xa.nís) or (łu.pís), respectively. Consequently, the [c.g.] does not get realized. Recall in that regard, that Campbell and Grondona provide no conditioning environment for their *ʔ > ∅ sound change.

6.6.2 Theoretical perspectives on metathesis

Having established the broad range of properties which characterize and constrain the VC-metathesis process in Nivaĉle, one of the remaining issues is to consider how this Nivaĉle VC-metathesis case fits the broader typological picture of metathesis from a cross-linguistic perspective.

Under the theoretical umbrella of Evolutionary Phonology (Blevins 2004) where historical, non-teleological, and phonetic explanations are posited for synchronic sound patterns, Blevins & Garrett (2004) propose four categories of 'phonetically natural' metathesis processes. The examples are extracted from their article.

(i) *perceptual* metathesis: features with elongated phonetic cues are reinterpreted in non-historic positions (e.g. laryngeal metathesis in Cayuga)

(ii) *compensatory* metathesis: within a foot, a feature in a weak syllable shifts to a strong syllable (eg. $V_1CV_2 \rightarrow V_1V_2C$ in Rotuman)

(iii) *coarticulatory* metathesis: the overlap in gestures of two adjacent segments, that is, CC coarticulation, results in a reinterpreted ordering (e.g. Mokilese kp → pk).

(iv) *auditory metathesis*: the sibilant noise present in a sequential speech stream is decoupled from the speech stream (e.g. sibilant-stop, stop-sibilant metatheses).

The authors state that other synchronic alternations such as VC > CV or CV > VC metathesis that lack the 'phonetically natural' properties listed in the above typology, are actually cases of *pseudometathesis* (Mills & Grima 1980). More precisely, what looks on the surface like synchronic CV or VC metathesis may actually involve two processes (also known as *telescoping* (Wang 1968)): copy-vowel epenthesis and historical vowel deletion. The challenge posed by *pseudometathesis* processes is that the two discrete processes might not be independently recoverable and so are opaque.

The Nivaĉle VC-CV synchronic alternations motivated by prosodic constraints do not fall in any of the metathesis categories proposed by Blevins & Garrett (2004). Let us consider, therefore, two options. One is that the Nivaĉle VC > CV alternations are a case of *pseudometathesis*. The other is that the Nivaĉle data argue for an additional category in the cross-linguistic typology.

Under the first hypothesis, namely that the Nivaĉle data are best interpreted as a case of *pseudometathesis,* two diachronic processes could be posited: (i) epenthesis of a copy-vowel into an otherwise illicit syllable structure, and (ii) deletion/syncope of the underlying vowel of the stem that served as the base for the copy-vowel epenthesis process.

(591) "Stage I":	/finax - s/	crab - PL	'crabs'
(i) COPY-V EPENTHESIS:	finax -[a] s		
(ii) VOWEL SYNCOPE:	fin~~a~~x- a s		
"Stage II":	[finxas]		

In contrast with (or as a more fully fleshed out version of) Campbell & Grondona's (2007) proposal, this approach would have the advantage of reducing the number of suffix allomorphs at both the inflectional and derivational domains: that is, instead of a multiplicity of vowel initial allomorphs that are required to match the preceding vowel in the stem (e.g. *-is, -es, -as*, *-ɑs, -os, -us*, *-ij, -ej, aj,* etc.), the lexical identity of the allomorphs would be simply consonantal (e.g. *-s, -j, -k*, etc.)

Some evidence for COPY-V-EPENTHESIS can be shown in (592)-(595) (presented in §6.2.4) where suffixation of the plural allomorph *–j* to a consonant-final stem with a glottalized vowel involves a harmonic epenthetic vowel:

(592) a. ɑftḛ́k
'orphan'

b. ɑ̀ftek͡l-[é]j
orphan-PL
'orphans'

(593) a. xǫ́t
'sand'
b. xot-[ó]j
sand-PL
'sandy lands'

(594) a. ji-sá̰ʃ
1POSS-hair
'my hair'
b. ji-saʃ-[á]j
1POSS- hair-PL '
'my hairs'

(595) a. ji-sɑ̰́t
1poss-vein
'my vein'
b. ji-sɑt[á]j
1POSS-vein-PL
'my veins'

In (592)-(595) vowel syncope (or metathesis) does not occur because it would yield an illicit consonant cluster (either a complex coda or a word-medial complex onset) in *aft.k͡lej/ af.tk͡lej* (592), an unattested (and derived) complex onset combination *xt* (593) or medial cluster *s.ʃ* (594). It is not very clear, though, why *[jistɑj] is not an optimal output (595). I can only hypothesize at this point that [s] was in fact, at some stage, in variation with [t͡s], as originally pointed out by Hunt (1924). Interestingly, the [t͡s] and [s] alternation was not exclusively circumscribed to coda position, as has been discussed here, but also is found in onset position. If that were the case, then *t͡s.t* would have been an illicit medial cluster (cf. Table 2.6).

In sum, two historical processes: COPY-V-EPENTHESIS and VOWEL SYNCOPE could be proposed in order to account for these synchronic patterns. This approach is yet not exempt from a problematic issue. As discussed in §6.1, the most regular Nivaĉle epenthetic vowel is [i]. What would be the motivation, then, for a subset of nouns undergoing harmonic vowel epenthesis while another larger set adopting [i]-epenthesis? Recall from Chapter 4 that the most pervasive case of vowel harmony involves regressive translaryngeal vowel harmony.[93] While all the forms listed above have glottalized vowels, it is also true that [i]-epenthesis also applies to roots with glottalized vowels. This is still a puzzling topic, and unfortunately, I cannot reach an adequate explanation.

Returning to vowel syncope, it sometimes involves vowel identity between the stem and the suffix's vowels (596)-(597) but sometimes it does not (598)-(599):

Syncope of [e] before [e]:

(596) a. niβak͡lé
'man'

b. niβak-t͡ʃé
man-FEM
'woman'

Syncope of [a] before [a]:

(597) a. k͡lòj-xanáx
dance-AG
'dancer'

b. k͡lòj-xanx-á
dance-AG-FEM
'female dancer'

[93] Also recall that the [i] ~ [e] alternation varies according to the regional dialects.

Syncope of [a] before [i]:

(598) a. j-ofáɬ
3S-burst
'it bursts'
b. j-ofɬ-ít
3S-burst-CAUS
's/he breaks'

Syncope of [i] before epenthetic [a]:

(599) a. nɑjíʃ
'road'
b. nɑjʃ[á]j
road-PL
'roads'

The fact that vowel deletion, [ʔ] deletion, and both harmonic and non-harmonic vowel epenthesis are attested phonological processes point to the diverse strategies the Nivaĉle stems undergo in the context of suffixation. Importantly, non-harmonic vowel epenthesis, and the fact that [i]-epenthesis and "copy-vowel epenthesis + syncope (i.e. synchronic metathesis) seem to be in a principled, complementary distribution, represents a challenge for a *pseudometathesis* account. More specifically, if epenthesis were a historically earlier change (rather than syncope), why would epenthesis have involved a copy-V in exactly those environments that would eventually – at a later time – be subject to syncope, but a non-copy-vowel [i] in those environments where, it turned out, the eventual syncope (later in time) would not happen?

The possibility that VC-metathesis arose through the reanalysis of what originated diachronically as a copy vowel epenthesis and (unstressed) vowel syncope sound changes needs to be further explored across the Mataguayan languages. Recall the existence of metathesized cognates in Chorote, Maká, and Wichí.

Whatever its historical origin, what I propose is that synchronic VC-metathesis functions as a phonological strategy to avoid syllable structure constraints or to optimize the sonority cline of heterosyllabic consonant clusters. As Crowhurst & Trechter (2014:148) point out in their analysis of vowel-rhotic metathesis in Guarayu, phonological factors may contribute to the diffusion and the generalization of metathesis as the innovative pattern. Moreover, the elimination of complex codas and bad syllable contacts is structure preserving: neither complex codas nor obstruent-sonorant sequences are ever attested as well-formed structures in the Nivaĉle language. What is more, the correlation between metathesis and structure preservation has been suggested by Hume (2004: 221): "any order of two segments is a potential output of metathesis, provided that the reordered sequence forms an attested structure in the language". I argue that what I analyze as synchronic VC-metathesis in Nivaĉle, thus, conforms this general model of metathesis. Furthermore, it has been observed in the context of the proposed analysis that VC-metathesis is blocked when the output of metathesis would incur violations of high-ranked syllable markedness constraints such as *COMPLEX; instead, vowel-epenthesis occurs. Metathesis and vowel epenthesis can be seen as two conspiring mechanisms driven by the avoidance of marked structures.

Similarly, Hannahs (2009, 2011) shows that epenthesis, deletion and metathesis in Welsh illustrate a case of 'unity within diversity'. These processes are all connected because they serve to avoid a sonority sequencing violation in final consonant clusters (a consonant followed by [n], [r] or [l]), while preserving foot binarity and prosodic minimallity. Specifically, Hannahs argues that epenthesis occurs with monosyllabic input forms, while deletion and metathesis occur with bisyllabic input forms.

A detailed analysis of the interrelation of deletion, epenthesis and metathesis in Nivaĉle, and within the Mataguayan family, definitely constitutes an issue for future investigation.

6.7 Conclusions

In this chapter, I have provided an optimality theoretic account for vowel-consonant metathesis in Nivaĉle, which takes place in the presence of some inflectional and derivational affixation processes such as pluralization of nouns and nominal/verbal derivation. I have also showed how an alternative analysis – historical vowel deletion and glottal stop deletion (Campbell & Grondona 2007) does not account for a wider range of data.

Here I have argued that there are two distinct motivations behind vowel-consonant metathesis in Nivaĉle. One source of metathesis is constituted by the avoidance of an illicit syllable structure: complex codas and derived complex onsets are never allowed in Nivaĉle. The other source of metathesis comprises the optimization of the sonority contact in coda-onset sequences. Both types of constraints constitute well-attested cross-linguistic tendencies to avoid (i) complex syllable margins, and (ii) the rising of sonority values across syllable edges. $*CC]_\sigma$ and the Syllable Contact Law, in interaction with LINEARITY-IO, successfully captured the two generalization patterns respectively.

In addition, CONTIGUITY accounts for the domain of metathesis. Only segments within the root can metathesize, that is, elements from other domains, i.e., the suffix, cannot intrude into the root. These patterns confirm the cross-linguistic tendencies for metathesis discussed in Hume (2004): (i) metathesis involves adjacent segments, and (ii) ordering reversals are preferred at the end of stems and words, because word position and proximity constitute significant factors for speech processing (Mielke & Hume 2001).

Finally, two additional effects of metathesis have been discussed. Since segments switch their linear order, resyllabification takes place and thus new environments trigger featural changes. For instance, ejective stops lose their [c.g.] feature in the absence of a following vowel, a neutralization pattern that is well-attested across languages. In turn, the deglottalization of Nivaĉle surface glottalized vowels in the context of metathesis is consistent with the prosodic representation advanced in Chapter 3. Glottalized vowels occur as the head of a foot. Whenever the [c.g] feature is not parsed to the head of a foot due to resyllabification, this feature is lost. Cases where a final [c.g] is not realized when a C-initial suffix is added merits further investigation.

Chapter 7: Conclusions

In this chapter, I present the main findings and contributions of this dissertation, identify remaining issues, and propose future research directions.

7.1 Summary and contributions

Throughout this dissertation, a series of phonological and phonetic aspects of the Nivaĉle language has been presented and analyzed. Focus has been concentrated on the phonological status of the glottal stop, the glottalized vowels and their patterns of deglottalization, the Nivaĉle prosodic system and stress patterns, the phonological and acoustic properties of the lateral obstruents, and the morpho-phonological process of VC-metathesis.

Furthermore, this work makes a twofold contribution. First, it adds to the documentation of an understudied indigenous language of the Gran Chaco in Paraguay and Argentina. What is more, in my research I analyzed and compared two dialects, one of which had not been documented.

It is also worth mentioning that the early stage of this research felicitously coincided with the creation of the Linguistic Committee of the Nivaĉle People (CLPN). Some of the topics presented in this dissertation formed part of lively discussions during the CLPN regular meetings that I attended, where I helped focus the discussion of the Nivaĉle sound system and the orthography revisions. Nivaĉle teachers and advocates for the promotion of the language have had concerns about the phonological status and pronunciation of certain Nivaĉle segments and their orthographic representation; e.g.: "How should glottalized vowels be written? Is there any difference between [j] at the beginning of the word and at the end of the word? What is the status of [x] and [χ]? Why is [k͡l] so 'distinct'? How can the [k͡l] segment be differentiated from the Spanish [kl] cluster so that future generations do not confuse them? What kind of dialectal variation is there in the pronunciation of Nivaĉle words?" among others. Whereas it was beyond the scope of this dissertation or my role in the CLPN to determine how Nivaĉle sounds "should" be represented, the documentation and description included in this thesis provide further insights into the understanding and representation of this language, and serve as the basis for future research endeavors relevant to community level education. In sum, the findings of this study are intended to improve the documentation of the Nivaĉle language, and also to support the community in its effort to promote literacy for future generations in Nivaĉle.

Second, the analysis in this work deepens our understanding of Nivaĉle segmental phonology by bringing additional data, comparative dialectal insights, and new theoretical and analytical perspectives to the pioneering work of Stell (1972, 1989) on the phonology of this language: in particular, (i) it reinterprets the Nivaĉle vowel inventory (6 not 12 vowels), (ii) it offers a formal analysis of the relationship between /V/ and /ʔ/, (iii) it explains a diversity of deglottalization processes, (iv) it provides phonetic and phonological evidence for the dorsal component of k͡l and offers a plausible account of its historical development (v) it explains the systematic interaction of two principled conspiracies: vowel-consonant metathesis and vowel epenthesis.

Moreover, this study advances the first analysis of Nivaĉle prosodic phonology: no details of the Nivaĉle prosodic system, such as the moraicity of its segments, the minimal word, foot types, and phonological domains are addressed in other studies. Furthermore, the analysis and the theoretical implications embedded within this work contribute to the discussion of issues pertaining to the relationship between segmental and prosodic phonology that are of cross-linguistic interest, e.g., What is the relationship between the [c.g.] feature, its phonetic manifestation as vowel length, and stress prominence? Closely related to the proposed analysis of glottal stop, this dissertation contributes to three other topics of theoretical interest in the Nivaĉle prosodic system: (i) the role of the mora, (ii) the role of the Nucleus of the syllable, and (iii) the role of morpho-phonological domains in the assignment of stress and the realization of the Nivaĉle glottalized vowels.

Hereafter, I recapitulate the main findings of each chapter and lay out the theoretical implications raised by the issues thereby analyzed.

In Chapter 2, I provide an overview of the Nivaĉle phonological system and phonological processes, on the basis of both Stell's (1989) thesis and my own fieldwork data. One of the major differences is the analysis of the vowel system. Whereas Stell posits a phonemic distinction between plain vowels /i e a ɑ o u/ and "glottalized" vowels /ỉ ẻ ả ɑ̉ ỏ ủ/, I advance a principled analysis whereby "glottalized" vowels are underlying sequences of a vowel plus glottal stop /Vʔ/. Further, I claim that their variant surface realization as (i) *creaky/rearticulated* [V̰] ~ [Vʔ$^{\text{V}}$] and as (ii) *vowel-glottal coda* [Vʔ], as well as the deglottalization patterns that these glottalized vowels undergo, are fundamentally rooted in a series of prosodic constraints that I analyze in depth in Chapters 3 and 4.

In Chapter 3, I establish the featural and prosodic representations of the Nivaĉle glottal stop and the glottalized vowels. Specifically, I show the different prosodic parsings of the glottal stop, compare its patterning with other segments, and present evidence for its contrastive value. I propose that the glottal stop is specified for [c.g.] but unspecified for place features. Several arguments for the placeless specification of the glottal stop are advanced; namely, laryngeal transparency, the asymmetric pattern between the glottal stop and the ejectives in coda position, and the fact that uniquely the glottal stop can occur between the complex segment /k͡l/ and a following vowel.

Concomitantly, I propose that glottalized vowels are underlying vowel-glottal sequences: /Vʔ/ and, importantly, that the glottal stop is underlyingly associated with a mora. This glottal stop can (i) attach to the nucleus of the syllable and form part of a complex nucleus – phonetically realized as a *creaky/rearticulated* vowel – or (ii) it can be parsed directly to the syllable node as coda. Phonetic and phonological evidence for the complementary relationship between creaky/rearticulated and vowel-glottal coda is provided in the context of the effect of affixation processes on syllabic parsing.

In this same chapter I likewise discuss some of the acoustic properties of Nivaĉle glottalized vowels. These vowels involve a sequencing of modal phonation and glottalization, where the post-vocalic constricted glottis realization is manifested as aperiodicity in the signal (creaky) or as a full glottal closure (vowel-glottal coda). The complexities of both the phonetic implementation of this post-vocalic glottalization and its phonological implications are of considerable theoretical interest.

One of the interesting results presented in Chapter 3 is that the durational difference between *creaky/rearticulated* and *modal* vowels is statistically significant: *creaky/rearticulated* vowels are double the duration of *modal* vowels. Evidence for the durational difference between vowel-glottal coda and modal vowels is less conclusive (§7.2). Whereas the phonological relationship between "glottalization" and weight (as realized through stress prominence) is pervasively consistent, the relationship between "glottalization" and "length/duration" is much less straightforward and merits further acoustic study. To account for the robust correlation between glottalization and stress prominence, I propose that the "weight" of the glottal stop in Nivaĉle is appropriately represented by its being linked to the *mora*, as a consistent unit of weight in Nivaĉle. Thus, the property of being moraic both unifies vowels and glottal stop as a subclass, and differentiates them from all other segments. Given that glottalized vowels only surface under stress, and adopting the notion of the Nucleus as head of the syllable, I propose that in Nivaĉle, the Nucleus functions as the prosodic unit that hosts all and only the moraic units of the language. There is no evidence that segments other than vowels and glottal stops are moraic.

In Chapter 4, I analyze the internal structure of the Nivaĉle Prosodic Word and stress assignment patterns both at the nominal and verbal domain. Nivaĉle represents an interesting case study in that the Nivaĉle Minimal Word does not conform to the bisyllabic/bimoraic binarity generalizations of the standard prosodically-defined notion of a "Minimal Word". A diversity of arguments is presented in support of the claim that the Minimal Word in Nivaĉle is CVC. In the subsequent examination of the stress system, it is shown that CVC also functions as a minimal foot. The proposed constraint rankings in the grammar reflect the important generalization that it is not, however, an optimal foot. Nevertheless, only in the case of a monosyllabic word does a CVC foot receive primary stress. Elsewhere a CVC foot only ever receives secondary stress. The emergent generalization is that the Head of the PrWd is, whenever possible, disyllabic, in satisfaction of the FT-BIN-σ constraint.

In addition, three main proposals have been advanced with regards to Nivaĉle stress placement. First, Nivaĉle stress is quantity-sensitive: consistent with the analysis that the glottal stop is associated with a mora, glottalized vowels bear weight and their occurrence conforms to the WEIGHT-TO-STRESS Principle. Only when parsed to the head of a foot do glottalized vowels get realized. Importantly, CVC foot minimality provides an argument for the glottal stop functioning as a coda if there is no other segment parsed into that position. Second, the rhythm type is iambic. Third, Nivaĉle stress assignment patterns are edge-based and related to the presence of morphological categories (MCat): Root, MSt1, MSt2 and MWd. The role of prefixes and suffixes with regards to stress placement play a crucial role leading to an analysis where stress is argued to be subject to both Left-edge and Right-edge alignment constraints. A major generalization at the uppermost prosodic level is that primary stress falls on the rightmost foot of the PrWd.

One of the main contributions in this chapter is that "deglottalization" of "glottalized vowels" finds a principled account under the proposed prosodic representation and the consideration of the alignment constraints operative at the different morpho-phonological domains to which reference stress is assigned. For example, it is shown that whereas faithfulness to the underlying glottal and mora is preserved at the root domain, it is overridden by alignment constraints enforced by the higher MCat domains. The formal OT analysis developed in this chapter succeeds in offering a coherent theoretical treatment of some of Stell's observations with respect to vowel deglottalization.

In Chapter 5, I describe the quite unique Nivaĉle lateral system, which is constituted by two lateral obstruents /k͡l/ and /ɬ/. Unlike Stell (1989), I do not define /k͡l/ as an affricate because it lacks two of the most recurrent characteristics of an affricate: (i) there is no fricative release and (ii) the sequence of two phases does not agree in voicing. Acoustic analyses confirm this description and shows evidence for the veleralized lateral release. I analyze /k͡l/ as a laterally released dorsal stop. Further, I hypothesize that the development of /k͡l/ from Proto-Mataguayan **l* can be rooted in speech perception factors, specifically: the reinterpretation of stop bursts as emergent stops. This historical development can concomitantly be understood in terms of a strenghtening process. Interestingly, a comparable pattern can be adduced for Chorote and Wichí where there is a contrast between plain /l/ and preglottalized /'l/ laterals. It is hoped that the research proposals here lay the foundation for a more extensive historical reconstruction of the lateral system within the Mataguayan languages.

In addition, given the phonotactic patterns of /ɬ/, its alternation with [t], and the asymmetrical phonological behaviour with that of /k͡l/, I analyze this segment as only specified for CORONAL. Further, an acoustic comparison between /ɬ/ and the other Nivaĉle fricatives shows no phonetic evidence of a dorsal component as posited by Stell. That is, the /ɬ/ does not seem to behave as a complex CORONO-DORSAL segment.

One of the outcomes of Chapter 5 is that /ɬ/ and /k͡l/ do not form a natural class because they do not share the feature [lateral]. Similarly to the issues raised in Chapter 3 and 4 with regards to [c.g.] and duration, this proposal signals a mismatch between articulatory phonology and a phonological theory of features, and a mismatch between acoustic phonetics and phonology. In other words, one would have to asssume that the correspondence between phonological and phonetic descriptions do not have to be necessarily established on the basis of a one-to-one correspondence in terms of features.

Integrating the segmental and suprasegmental issues analyzed in previous chapters, in Chapter 6, I provided an optimality theoretic account for vowel-consonant metathesis in Nivaĉle where I demonstrate that metathesis responds to phonological requirements: to avoid marked structures in the language: complex codas, derived complex onsets, and bad syllable contacts. In comparison with the historical vowel deletion analysis presented in Campbell & Grondona (2007), the metathesis analysis advanced here considers a wider range of data. The prosodic analysis of syllable structure constraints and of glottal phenomena thus aims to provide broader empirical coverage, as well as a more coherent and integrated theoretical interpretation.

7.2 Future research directions

This dissertation has focused on segmental and prosodic structure of Nivaĉle. The data and analyses presented here, however, are not a complete treatment of the prosodic patterns of Nivaĉle and further research is needed in several areas.

First, while this work identifies a consistent relationship between the glottal stop, the mora as a unit of weight, and prosodic prominence at the Prosodic Word level, more data is needed in order to understand why the mora in creaky/rearticulated vowel, besides weight, consistently manifests duration, while the mora associated with a vowel-glottal coda, in contrast, does not provide consistent evidence for the relationship between a mora as a unit of weight and a mora as a unit of duration.

Second, the phonetic study of glottalized vowels has only concentrated on duration. A wide-varied range of acoustic analyses, such as the analysis of fundamental frequency, jitter and spectral tilt, has yet to be performed under more carefully controlled conditions. One of the goals of such study would be to understand the location and amount of aperiodicity/creak across the vowel portion and whether there is variation in the implementation of glottalization related to gender or age, as has been suggested by other research on Otomanguean languages, e.g. Gordon & Ladefoged (2001) and Munro, Lillehaugen & Lopez (2008). In addition, it would be interesting to conduct perceptual studies. One of the relevant questions to ask is: What makes a creaky vowel perceptually different from a modal vowel? More specifically, How much creak and where should creak be located in order to satisfy the identification of a "glottalized vowel"? Further, how does this correlate with length? Given the interrelated pattern of creaky/rearticulated vowels and duration, and that, even if infrequently, sometimes these vowels get pronounced without audible laryngealization, does duration in itself qualify as the relevant acoustic cue that listeners can draw on?

Third, more work is needed in order to understand the intricacies between glottalization and issues that lie in the clitic range beyond the MWd level. There are patterns of deglottalization that are not well understood and require a better understanding of the phonological phrase and the intonational phrase, as well as the interaction with morpho-phonological and morpho-syntactic processes.

Fourth, a comparison between glottalized vowels in Nivaĉle and the vowel glottal sequences in the other Mataguayan languages is a much-needed enterprise in order to understand the historical evolution of glottalization in this language family. While contrastive glottalization in vowels has not been reported in Chorote, Maká or Wichí, preglottalized sonorants have been reported in Chorote and Wichí. Similarly, as already mentioned, an interesting avenue of research is the comparison between the lateral systems of the Mataguayan languages.

In conclusion, there are many lines of inquiry for the continued investigation of Nivaĉle phonetics and phonology, for both academic and community purposes. In addition, and more generally, there is a special need to continue the documentation and analysis of Nivaĉle varieties, and to conduct a phonological comparative study within the Mataguayan language family. Based on the seminal work of Stell (1989) and my own fieldwork and analysis, this dissertation adds to our understanding of Nivaĉle segmental and prosodic phonology.

Bibliography

Aadelar W. & Muysken P. (2004). *The Languages of the Andes.* Cambridge: Cambridge University Press.

Alderete, J. (2001). Root-controlled accent in Cupeño. *Natural Language & Linguistic Theory, 19*(3), 455-502.

Allen, W.S. (1973). *Accent and rhythm. Prosodic features of Latin and Greek: a study in theory and in reconstruction.* Cambridge: Cambridge University Press.

Archangeli, D. & Pulleyblank D. (1994) *Grounded phonology.* Cambridge, MA: MIT Press.

Arellanes, F. (2009). *El sistema fonológico y las propiedades fonéticas del zapoteco de San Pablo Güilá. Descripción y análisis formal* (Doctoral dissertation). México: El Colegio de México.

Avelino, H. (2004). *Topics in Yalálag Zapotec, with particular reference to its phonetic structures* (Doctoral dissertation). University of California, Los Angeles.

Avelino, H. (2011) (Ed.) *New Perspectives in Mayan Linguistics.* Newcastle upon Tyne: Cambridge Scholars Publishing.

Bagemihl, B. (1991). Syllable structure in Bella Coola. *Linguistic Inquiry, 22*, 589-646.

Baird, B.O. (2011). Phonetic and phonological realizations of 'broken glottal' vowels in K'ichee'. In K. Shklovsky, P. Mateo Pedro & J. Coon (Eds.), *Proceedings of Formal Approaches to Mayan Linguistics: MIT Working Papers in Linguistics*, *63* (pp. 39-49). Cambridge, MA: MITWPL.

Baird, B.O. & Pascual. F. (2012). Realizaciones fonéticas de /Vʔ/ en Q'anjob'al (Maya). In *Memorias del congreso de idiomas indígenas de Latinoamérica V.* Austin, TX: The University of Texas Archive of Indigenous Languages of Latin America. Retrieved January 23 2014 from http://www.ailla.utexas.org/site/events.html

Bateman, N. (2007). *A cross-linguistic investigation of palatalization* (Doctoral dissertation). University of California, San Diego.

Bauer, M. (2006) Prosodic boundary effects as a sociolinguistic variable: Evidence from devoicing in Iron Range English. *University of Pennsylvania Working Papers in Linguistics: Selected Papers from NWAV 34, 12.2*, 39-52.

Beckman, J. N. (1998). *Positional faithfulness.* (Doctoral dissertation). University of Massachusetts, Amherst.

Beckman, J. N. (2004). On the status of the CodaCon in Phonology. *International Journal of English Studies* 4(2), 105–134.

Bessell, N., & Czaykowska-Higgins, E. (1991). Interior Salish evidence for placeless laryngeals. *North East Linguistics Society, 21*, 35-49.

Bessell, N. (1992). *Towards a phonetic and phonological typology of post-velar articulation* (Doctoral dissertation). University of British Columbia, Vancouver.

Beaumont, C. H. (1979). *The Tigak Language of New Ireland.* Canberra: Australian National University.

Bird, S. (2002). Dakelh Ejectives: Evidence for New Ways of Classifying Sounds. Paper presented at the 76th Meeting of the Linguistic Society of America. San Francisco, CA.

Bladon R. A. W. (1979). The production of laterals: some acoustic properties and their physiological implications. In Hollien H. & Hollien P. (Eds.), *Currents Issues in the Phonetic Sciences: Proceedings of the IPS-77 Congress*, Miami Beach, Florida. 17-19 December 1977(pp.501-508). Amsterdam: John Benjamins.

Blankenship, B. (2002). The timing of nonmodal phonation in vowels. *Journal of Phonetics, 30*, 163–191.

Blevins, J. (1993). Klamath laryngeal phonology. *International Journal of American Linguistics, 59*, 237-279.

Blevins, J. (1994). A place for lateral in the feature geometry. *Journal of Linguistics, 30*, 301-48.

Blevins, J. (2003). The independent nature of phonotactic constraints: an alternative to syllable-based approaches. In C. Féry & R. van de Vijver (Eds.), *The syllable in optimality theory*. (pp. 375-403). Cambridge: Cambridge University Press.

Blevins, J. (2004). *Evolutionary phonology: The emergence of sound patterns*. Cambridge: Cambridge University Press.

Blevins, J. & Garrett, A. (1998). The origins of Consonant-Vowel Metathesis. *Language*, *74*(3), 508-556.

Blevins, J., & Garrett, A. (2004). The evolution of metathesis. In B. Hayes, R. Kirchner & D. Steriade, (Eds.), *Phonetically-based phonology* (pp. 117-156). Cambridge: Cambridge University Press.

Boersma, P., & Weenink, D. (2014). Praat: doing phonetics by computer [Computer Program] Version 5.3.08, Retrieved March 3 2014 from http://www.fon.hum.uva.nl/praat/

Borroff, M. (2007). *A landmark underspecification account of the patterning of glottal stop* (Doctoral dissertation). Stony Brook University, Stony Brook, NY.

Brandão de Carvalho, J., Scheer, T. & Ségéral, P. (Eds.). (2008). *Lenition and fortition.* New York: De Gruyter Mouton.

Broselow, E. (2001). Uh-oh: glottal stops and syllable organization in Sulawesi. In E. Hume, N. Smith, J. van de Weijer (Eds.), *Surface Syllable Structure and Segment Sequencing* (pp. 77-90). Leiden: Holland Institute of Generative Linguistics.

Broselow, E, Chen S-I & M. Huffman (1997). Syllable weight: convergence of phonology and phonetics. *Phonology, 14*, 47-82.

Browman, C. P., & Goldstein, L. (1989). Articulatory gestures as phonological units. *Phonology, 6*, 201-251.

Brown, C. (1995). The feature geometry of lateral approximants and lateral fricatives. In H. van der Hulst & J. van de Wiejer (Eds.), *Leiden in Last. HIL Phonology Papers*. Vol.1 (pp. 41-88). The Hague: Holland Academic Press.

Brugmann, K. (1897). *Einleitung und Lautlehre. First volume of the Grundriss der vergleichenden Grammatik der indogermanischen Sprachen* (Brugmann, Karl and Delbrück, Berthold). Second edition. Straßburg: Karl Trübner.

Byrd, D. (2000) Articulatory vowel lengthening and coordination at phrasal junctures. *Phonetica, 57(1*), 3-16.

Buckley, E. (1994). *Theoretical aspects of Kashaya phonology and morphology*. Stanford: CSLI Publications.

Buckley, E. (2007). Vowel-sonorant metathesis in Alsea. *International Journal of American Linguistics, 73*, 1-39.

Buckley, E. (2011). Metathesis. In M. van Oostendorp, C. Ewen, E. Hume and K. Rice (Eds.) *The Blackwell Companion to Phonology* (pp. 1380–1407). Malden, MA.: Wiley-Blackwell.

Campbell, L. (2012). Classification of the Indigenous Languages of South America. In L. Campbell & V. M Grondona,. (Eds.), *The indigenous languages of South America.* (pp. 59-166). Berlin: De Gruyter Mouton.

Campbell, L. & Grondona, M. V. (2007). Internal reconstruction in Chulupí (Nivaklé). *Diachronica, 24*(1), 1-29.

Campbell, L. & Grondona, M. V. (2010). Who speaks what to whom? Multilingualism and language choice in Misión La Paz. *Language in Society*, *39*(5), 617-646.

Campbell, L. & Grondona, M. V. (2012). Languages of the Chaco and Southern Cone. In L. Campbell & V. Grondona (Eds.), *The indigenous languages of South America. A comprehensive guide* (pp. 625-67). Berlin: De Gruyter Mouton.

Carol, J. (2014). *Lengua chorote (mataguayo). Estudio fonológico y morfosintáctico*. Munich: Lincom.

Carlson, B. F., Esling J H. & Fraser, K. (2001). Nuuchahnulth. *Journal of the International Phonetic Association, 31*, 275-279.

Casali, R. F. (1997). Vowel elision in hiatus contexts: Which vowel goes?. *Language*, *73*, 493-533.

Catford, J. C. (1964). Phonation types: the classification of some laryngeal components of speech production. *In honour of Daniel Jones*. London: Longmans, Green & Co. Ltd., 26–37.

Catford, J. C. (1977). *Fundamental problems in phonetics*. Edinburgh: Edinburgh University Press.

Chávez-Peón, M. E. (2010). *The interaction of metrical structure, tone, and phonation types in Quiaviní Zapotec* (Doctoral dissertation). University of British Columbia, Vancouver.

Chase-Sardi, M. (1981). *Pequeño Decameron Nivaclé. Literatura oral de una etnia del Chaco paraguayo*. Asunción: Ediciones Napa.

Chase-Sardi, M. (1990). Resumen de la cultura Nivaclé. *Suplemento Antropológico, 25*(2), 7-18.

Chitoran, I., Goldstein, L., & Byrd, D. (2002). Gestural overlap and recoverability: articulatory evidence from Georgian. In C. Gussenhoven & N. Warner (Eds.), *LabPhon 7*. (pp. 419-447). Berlin: de Gruyter.

Chomsky, N., & Halle, M. (1968). *The sound pattern of English*. Cambridge, MA: Massachusetts Institute of Technology Press.

Clements, G. N. (1985). The Geometry of Phonological Features. *Phonology Yearbook 2,* 225-52.

Clements, G. N. (1990). The Role of the Sonority Cycle in Core Syllabification. In J. Kingston & M. Beckman (Eds.), *Papers in Laboratory of Phonology I. Between the Grammar and Physics of Speech* (pp. 283-333). Cambridge: Cambridge University Press.

Clements, G. N. (1999). Affricates as Noncontoured Stops. In O. Fujimura, B. D. Joseph, & B. Palek (Eds.), *Proceedings of LP '98: Item Order in Language and Speech.* (pp. 271-99). Prague: The Karolinum Press.

Clements, G. N., & Hume, E. (1995). The internal organization of segments. In J. Goldsmith (Ed.), *Handbook of Phonological Theory*. Cambridge, MA: Blackwell.

Coetzee, A. W. (1999). Metathesis in Tiberian Hebrew: A perspective from Optimality Theory. *Theoretical Linguistics, 25*, 99–131.

Cohn, A. C. (1990). *Phonetic and Phonological Rules of Nasalization* (Doctoral dissertation). University of California, Los Angeles.

Cohn, A. C. (1993) A survey of the phonology of the feature [±nasal]. In *The Working Papers of the Cornell Phonetics Laboratory, 8*, 141-203.

Colantoni, L. & Steele, J. (2005). Phonetically-driven epenthesis asymmetries in French and Spanish obstruent-liquid clusters. In R.S. Gess & E.J. Rubin (Eds.), *Theoretical and experimental approaches to Romance linguistics.* (pp. 59-73). Amsterdam: John Benjamins.

Crowhurst, M. J. (1994). Foot extrametricality and template mapping in Cupeño. *Natural Language & Linguistic Theory*, *12* (2), 177-201.

Crowhurst, M. J., & Michael, L. D. (2005). Iterative footing and prominence-driven stress in Nanti (Kampa). *Language*, *81*(1), 47-95.

Crowhurst, M. J. & Trechter S. (2014). Vowel-rhotic metathesis in Guarayu. *International Journal of American Linguistics 80* (2), 127-173.

Comrie, B., Haspelmath, M. & Bickel, B. (2008). *The Leipzig Glossing Rules: Conventions for interlinear morpheme-by-morpheme glosses*. Leipzig: Max Planck Institute for Evolutionary Anthropology & Department of Linguistics of the University of Leipzig. Retrieved 8 April 2012 from www.eva.mpg.de/lingua/pdf/LGR08.02.05.pdf

Comrie, B., Golluscio, L., González, H., & Vidal, A. (2010). El Chaco como area lingüística. In Z. Estrada Fernández & R. Arzápalo Marín (Eds.), *Estudios de lenguas amerindias 2. Lenguas Indígenas* (pp. 84-130). Hermosillo: Departamento de Letras y Lingüística División de Humanidades y Bellas Artes, Universidad de Sonora.

Czaplicki, B. (2009). Non-teleological approaches to metathesis: Evidence from dialects of Polish. *Poznan Studies in Contemporary Linguistics, 45*, 353–446.

Davies, J. (1981). *Kobon*. Lingua Descriptive Studies, vol. 3. Amsterdam: North-Holland.

DGEEC. (2012). *III Censo Nacional Indígena de Población y Viviendas 2012: Pueblos indígenas del Paraguay*. Asunción: Dirección General de Estadística Encuestas y Censos. Retrieved July 15 2013 from www.dgeec.gov.py de Lacy, P. (1997). *Prosodic categorization.* (Master Thesis). University of Auckland.

de Lacy, P. (2006). *Markedness: Reduction and Preservation in Phonology*. Cambridge, MA: Cambridge University Press.

de Lacy, P. (2011). Markedness and faithfulness constraints. In M. van Oostendorp. C. J. Ewen, E. Hume, E. & K. Rice (Eds.), *The Blackwell Companion to Phonology*. Oxford: Wiley-Blackwell.

Delancey , S. (1989). Tibetan evidence for Nungish metathesis. *Linguistics of the Tibeto-Burman Area*, *12*, 25–31.

DiCanio, C. T. (2008). *The Phonetics and Phonology of San Martín Itunyoso Trique* (Doctoral dissertation). University of California, Berkeley.

Dilley, L., Shattuck-Hufnagel, S. & Ostendorf, M. (1996). Glottalization of word-initial vowels as a function of prosodic structure. *Journal of Phonetics, 24*, 423-44.

Dryer, M. S. & Haspelmath, M. (Eds.). (2013). *The World Atlas of Language Structures Online*. Munich: Max Planck Digital Library. Retrieved June 20 2013 from http://wals.info/

Dumenil, A. (1987). A rule account of metathesis in Gascon. *Linguisticae Investigationes, 11*(1), 81–113.

Echeverría, M. S. & Contreras, H. (1965). Araucanian Phonemics. *International Journal of American Linguistics, 31*, 132-135.

Edmondson, J. A., & Esling, J. H. (2006). The Valves of the Throat and Their Functioning in Tone, Vocal Register and Stress: Laryngoscopic Case Studies. *Phonology*, *23*(2), 157–91.

Elfner, E. (2006). *The mora in Blackfoot.* (Master Thesis). University of Calgary.

Elías Ulloa, J. A. (2006). *Theoretical aspects of Panoan metrical phonology: Disyllabic footing and contextual syllable weight* (Doctoral dissertation). Rutgers University, New Brunswick, New Jersey.

Elías Ulloa, J. A. (2009). The distribution of laryngeal segments in Capanahua. *International Journal of American Linguistics, 52*, 159-206.

England, N. (1983). *A Grammar of Mam, a Mayan Language.* Austin: University of Texas Press.

Escure, G. (1977). Hierarchies and phonological weakening. *Lingua, 43*, 55-64.

Esposito, C. M. (2003). Santa Ana del Valle Zapotec phonation (M.A. thesis). University of California, Los Angeles.

Esposito, C. M. (2010). The effects of linguistic experience on the perception of phonation. *Journal of Phonetics, 38*, 306-16.

Fabre, A. (2005). Los pueblos del Gran Chaco y sus lenguas, segunda parte: Los Mataguayo. *Suplemento Antropológico, 40*(2), 313-435.

Fabre, A. (2009-10) El sufijo -sh del Nivaĉle (familia mataco-mataguayo) como instrumental, incremento de valencia y subordinador. In L.A. Golluscio & A. Vidal (Eds.), *Les langues du Chaco. Structure de la 70 phrase simple et de la phrase complexe. Amerindia* 33/34, 43-72.

Fabre, A. (2012). Interacción entre alineamiento inverso (jerárquico) y orientación verbal hacia P/T o R en los verbos transitivos del Nivaĉle (Chaco paraguayo). *LIAMES*, *12*, 87-101.

Fabre, A. (2014). Estudio grammatical de la lengua Nivaĉle (Unpublished manuscript). Kangasala, Finlandia.

Faust, N. (2014). Templatic metathesis in Tigre imperatives. *Phonology, 31*, 209-227.

Féry, C. (1997) Uni und Studis: die besten W¨orter des Deutschen. *Linguistische Berichte*, *172*, 461-489.

Fischer-Jørgensen, E. (1967). Voicing, tenseness, and aspiration in stop consonants, with special reference to French and Danish. *Annual Report of the Institute of Phonetics of the University of Copenhagen*, 3.

Flemming, E. (2007). Stop place contrasts before liquids. *Proceedings from The XII International Congress of Phonetic Sciences,* 233-36.

Flemming, E., Ladefoged, P., & Thomason, S. (2008). Phonetic Structures of Montana Salish. *Journal of Phonetics, 36*, 465-91.

Fougeron, C. & Keating P. (1997). Variations in velic and lingual articulation depending on prosodic position: Results for 2 French speakers, *UCLA Working Papers in Phonetics, 92*, 88-96.

François, A. (2010). Phonotactics and the prestopped velar lateral of Hiw: resolving the ambiguity of a complex segment. *Phonology,* 27, 393-434.

Frazier, M. (2009) *The Production and Perception of Pitch and Glottalization in Yucatec Maya* (Doctoral dissertation). University of North Carolina, Chapel Hill.

Fritz, M. (1994). *Los Nivaclé: Rasgos de una cultura paraguaya.* Quito: Abya-Yala.

Fritz, M. (1997) *Nos han salvado. Misión: Destrucción o salvación?* Quito: Abya-Yala.

Fritz, M. (2008). Indígenas y la Guerra del Chaco. El impacto de lo indecible. In N. Richard (Ed.), *Mala guerra: Los indígenas en la Guerra del Chaco, 1932-1935* (pp. 149-70). Asunción: Museo del Barro, Servilibro & Colibris.

Fujimura, O., & Lovins, (1978). Syllables as concatenative phonetic units. In A. Bell & B. Hooper (Eds.), *Syllables and segments* (pp. 107-120). Amsterdam: North Holland.

Gallagher, G. (2008). The role of contrast in laryngeal cooccurrence restrictions. In N. Abner & J. Bishop (Eds.), Proceedings from *WCCFL* 27. Somerville, MA: Cascadilla Press.

Garrett, E. (1999). Minimal words aren't minimal feet. In Gordon M. (Ed.), *UCLA Working Papers in Linguistics, 1,* 68-105.

Garvin, P. L. (1948). Kutenai 1: Phonemics. *International Journal of American Linguistics, 14*, 37-43.

Gerfen, C. (1999). *Phonology and Phonetics in Coatzospan Mixtec.* New York: Springer Publishing.

Gerfen, C. & Baker, K. (2005). The production and perception of laryngealized vowels in Coatzospan Mixtec. *Journal of Phonetics, 33*, 311–334.

Gerzenstein, A. (1983). *Lengua chorote. Variedad No 2.* Buenos Aires: Facultad de Filosofía y Letras, Universidad de Buenos Aires.

Gerzenstein, A. (1994). *Lengua maká. Estudio descriptivo. Archivo de Lenguas Indoamericanas.* Buenos Aires: Facultad de Filosofía y Letras, Instituto de Linguística, Universidad de Buenos Aires.

Gerzenstein, A. (1999). *Diccionario Etnolinguístico Maká-Español* (DELME). Buenos Aires: Universidad Nacional de Buenos Aires.

Gick, B., Campbell, F., Oh, S. & Tamburri-Watt, L. (2006). Toward Universals in the Gestural Organization of Syllables: A Cross-Linguistic Study of Liquids. *Journal of Phonetics, 34*(1), 49-72.

Goldsmith, J. A. (1976). *Autosegmental phonology* (Doctoral dissertation). Massachusetts Institute of Technology, Cambridge, MA.

Goldsmith, J. A. (1990). *Autosegmental and Metrical Phonology*. Oxford: Basil Blackwell.

Golla, V. (1977). A note on Hupa verb stems. *International Journal of American Linguistics, 43*(4), 355-358.

Golluscio, L, González, H. & Vidal, A. (2009). *El Chaco como área lingüística: contacto, relaciones históricas y tipología*. Proyecto PICT 2007-01827. Agencia Nacional de Promoción Científica y Tecnológica (ANPCYT), Buenos Aires, Argentina.

Golluscio, L. & Vidal, A. (2009/2010). Recorrido sobre las lenguas del Chaco y los aportes a la investigación lingüística *Amerindia* XX, 3-40.

Golston, C. & W. Kehrein. (2004). A prosodic theory of laryngeal contrasts. *Phonology*, *21*, 1-33.

Gómez Rendon, J. & Adelaar, W. (2009). Loanwords in Imbabura Quechua. In M. Haspelmath & U. Tadmor (Eds.), *Loanwords in the world's languages: a comparative handbook* (pp. 944 -967). The Hague: De Gruyter Mouton.

González, H. (2003). A typology of stops in South American Indian Languages. Proceedings from *The 1st Conference on the Indigenous Languages of Latin America* (CILLA I), University of Austin. Retrieved 20 October 2012 from http://www.ailla.utexas.org/site/cilla1_toc.html

González, H. (2012). Fonología de las lenguas chaqueñas y andinas: rasgos tipológicos y areales. In H. A. González & B. Gualdieri (Eds.), *Lenguas indígenas de América del Sur. Fonología y procesos de formación de palabras* (pp. 40-58). Buenos Aires: Sociedad Argentina de Lingüística.

González, H. (2014). Procesos fonológicos como rasgos areales: el caso de la palatalización en las lenguas chaqueñas. Campinas: *LIAMES*, *14*, 11-40.

Gordon, M. (1998). The Phonetics and Phonology of Non-Modal Vowels: A Cross-Linguistic Perspective. In Bergen, B. K., Plauché, M. C. & Bailey, A. C. (Eds.), Proceedings from *The Twenty-Fourth Annual Meeting of the Berkeley Linguistics Society, February 14-18, 1998: General Session and Parasession on Phonetics and Phonological Universals* (pp. 93-105). Berkeley, CA: Berkeley Linguistics Society.

Gordon, M. (2002). A phonetically driven account of syllable weight. *Language, 78*, 51–80.

Gordon, M. & Ladefoged, P. (2001). Phonation Types: A Cross-Linguistic Overview. *Journal of Phonetics*, *29*(4), 383-406.

Gordon, M., Barthmaier, P. & Sands, K. (2002). A cross-linguistic acoustic study of voiceless fricatives. *Journal of the International Phonetic Association 32*(2), 141-174.

Gordon, M. (2006). *Syllable weight: phonetics, phonology, typology.* New York: Routledge.

Gouskova, M. (2004). Relational hierarchies in Optimality Theory: The case of syllable contact. *Phonology, 21*, 201-50.

Grammont, M. (1933). *Traité de Phonétique.* Paris: Delagrave.

Greenberg, J. H. (1987). Tentative Linguistic Classification of Central and South American languages. In A. Wallace (Ed.), *Men and cultures: Fifth international congress of anthropological and ethnological sciences* (pp. 791-794). Philadelphia: University of Pennsylvania Press.

Gruzov, L. P. (1960). *Sovremennyi marijskij jazyk: fonetika.*

Gussenhoven, C. (2009). Vowel duration, syllable quantity and stress in Dutch. In K. Hanson & S. Inkelas (Eds.), *The Nature of the Word. Essays in Honor of Paul Kiparsky* (pp. 181-98). Cambridge, MA: Massachusetts Institute of Technology Press.

Gutiérrez, A. (2010). Metathesis in Nivaĉle. Proceedings from *The XV Workshop on the Structure and Constituency in Languages of the Americas* (WSCLA). *UBC Working Papers in Linguistics 29*, (pp. 115-125). Vancouver: University of British Columbia.

Gutiérrez, A. (2011). Evidentiality distinctions in Nivaĉle determiners. Proceedings from XVI Workshop on the Structure and Constituency of the Languages of the Americas WSCLA. *UBC Working Papers In Linguistics* 31 (pp. 55-73). Vancouver: University of British Columbia.

Gutiérrez, A. (2012). La metátesis como un fenómeno fonológico: El caso Nivaĉle. In H. A. González, H. A. & B. Gualdieri (Eds.), *Lenguas Indígenas de América del Sur I. Fonología y procesos de formación de palabras* (pp. 75-90). Mendoza: Sociedad Argentina de Lingüística/ Universidad Nacional de Cuyo.

Gutiérrez, A. (2013). Las vocales glotalizadas del nivaĉle. Proceedings from *The 6th Conference on the Indigenous Languages of Latin America* (CILLA VI), University of Austin, October 24-26. Retrieved 7 July 2014 from http://www.ailla.utexas.org/site/cilla6_toc.html

Gutiérrez, A. (2014). La ambigüedad fonológica de los segmentos complejos: El caso de la consonante nivaĉle k͡l. *LIAMES, 14*, 7-25.

Hallé, P. A., Best, C. T., & Bachrach, A. (2003). Perception of /dl/ and /tl/ clusters: A cross-linguistic perceptual study with French and Israeli listeners. *International Congress of Phonetic Sciences, 15*, 2893-96.

Halle, M. & Stevens, K. N. (1971). A note on laryngeal features. *Technical report*, MIT. Research Laboratory in Electronics.

Hannahs, S. J. (2009). Welsh svarabhakti: Sonority sequencing and foot structure. *Journal of Celtic Linguistics, 13*, 21–44.

Hannahs, S. J. (2011). Unity in Diversity in Welsh: the Avoidance of Sonority Sequencing Violations. In Carnie, A. (Ed.) *Formal approaches to Celtic Linguistics*. Newcastle upon Tyne: Cambridge Scholars Publishing.

Hansson, G. O. (1996). The phonetics and phonology of Modern Icelandic. (Unpublished manuscript). University of California, Berkeley.

Hayes, B. (1985). Iambic and trochaic rhythm in stress rules. *Proceedings of the Annual Meeting, Berkeley Linguistics Society, 11*, 429–446.

Hayes, B. (1987). A Revised Parametric Metrical Theory. *North East Linguistic Society*, *17*, 274-289.

Hayes, B. (1989). Compensatory Lengthening in Moraic Phonology. *Linguistic Inquiry*, *20*(2), 253-306.

Hayes, B. (1995). *Metrical Stress Theory: Principles and Case Studies*. Chicago: University of Chicago Press.

Henry, J. (1936). The linguistic position of the Ashlushlay Indians. *International Journal of American Linguistics*, *10*, 86-91.

Herrera Zendejas, E. (2009). *Formas sonoras: mapa fónico de las lenguas mexicanas.* México: El Colegio de México, Centro de Estudios Lingüísticos y Literarios.

Hill, J. H., & Hill, K. C. (1968). Stress in the Cupan (Uto-Aztecan) Languages. *International Journal of American Linguistics, 34*, 233-241.

Hollenbach, B. E. (1984). *The phonology and morphology of tone and laryngeals in Copala Trique* (Doctoral dissertation). University of Arizona, Tuscon.

Hock, H. H. (1985). Regular metathesis. *Linguistics*, *23*, 529–546.

Holt, E. (2004) Optimization of syllable contact in Old Spanish via the sporadic sound change metathesis. *Probus, 16*, 43-61.

Hooper, J. B. (1976). *An Introduction to Natural Generative Phonology.* New York: Academic Press.

Howe, D. & Pulleyblank, D. (2001). Patterns and timing of glottalisation. *Phonology*, *18*, 45-80.

Hulst, H.G. van der (1999). *Word prosodic systems in the languages of Europe*. Berlin & New York: Mouton de Gruyter.

Hunt, R. (1915) Apéndice D. Chunupî or Suhin y vocabularios castellano-inglés-chunupî-suhin. *Revista del Museo de La Plata*, *23*, 257-305.

Hunt, R. (1924) *Chunupi or Suhin. Grammar, lessons and vocabulary*. Embarcación: Misión Chaqueña.

Hume, E. (1998). Metathesis in Phonological Theory: The Case of Leti. *Lingua*, *104*, 147-80.

Hume, E. (2001). Metathesis: formal and functional considerations. In E. Hume, N. Smith & J. van der Weijer (Eds.) *Surface Syllable Structure and Segment Sequencing* (pp. 1-25). Leiden: Holland Institute of Linguistics.

Hume, E. (2004). The Indeterminacy/Attestation Model of Metathesis. *Language*, *80*, 203-37.

Hume, E. & Odden D. (1996). Reconsidering [consonantal]. *Phonology*, *13*(3), 345-76.

Hume, E. & Seo M. (2004) Metathesis in Faroese and Lithuanian: from speech perception to Optimality Theory. *Nordic Journal of Linguistics, 27*(1), 35-60.

Hyman, L. M. (1985). *A theory of phonological weight* (Vol. 19). Cinnaminson, NJ: Foris Publications.

Hyman, L. M. (2006). Word-prosodic typology. *Phonology*, *23*(2), 225-57.

Hyman, L. & Katamba F.S. (1999). The syllable in Luganda phonology and morphology. In H. G. van der Hulst & N.A. Ritter (Eds.) *The Syllable: Views and Facts* (pp. 349-416). Berlin: Mouton de Gruyter.

Howe, D. & Pulleyblank, D. (2001). Patterns and timing of glottalisation. *Phonology*, *18*, 45-80.

INDEC. (2004-2005). *Encuesta Complementaria de Pueblos Indígenas*. Instituto Nacional de Estadística y Censos, Argentina. Retrieved 15 August 2012 from www.indec.mecon.ar/webcenso/ECPI/index ecpi.asp

Itô, J. (1988). *Syllable theory in prosodic phonology* (Doctoral dissertation). University of Massachusetts at Amherst, New York [Published by Garland, New York 1988].

Itô, J. (1989). A prosodic theory of epenthesis. *Natural Language and Linguistic Theory, 7*, 217-259.

Itô, J. & Mester, A. (1994). Reflections on CodaCond and Alignment. In J. Merchant, J. Padgett & R. Walker (Eds.), *Phonology at Santa Cruz III* (pp. 27-46). Santa Cruz: Linguistics Research Center.

Itô, J. & Mester A. (1999). Realignment. In R. Kager, H. van der Hulst & W. Zonneveld (Eds.) *The Prosody-Morphology Interface* (pp. 188-217). Cambridge: Cambridge University Press.

Jakobson, R., Fant, G. & Halle, M. (1952). Preliminaries to speech analysis. The distinctive features and their correlates. Acoustics Laboratory, Massachusetts Institute of Technology, Technical Report No. 13. MIT press, seventh edition, 1967.

Jany, C. (2007). Phonemic Versus Phonetic Vowel Length in Chuxnabán Mixe. Proceedings from *The 33rd Annual Meeting of the Berkeley Linguistics Society: Languages of Mexico and Central America*. Berkeley, CA: University of California, Berkeley.

Jespersen, O. (1904). *Phonetische Grundfragen*. Leipzig and Berlin: Teubner.

Johnson, K. (2008). *Acoustic and Auditory Phonetics*. 2nd. Edition. Oxford: Blackwell.

Junker, P., Wilkskamp, J. & Seelwsiche, J. (1968) Manual de la gramática chulupí. *Suplemento Antropológico*, *3*(1-2), 159-248.

Kaye, J. D. (1970). *The Desano verb: Problems in semantics, syntax and phonology* (Doctoral dissertation). New York: Columbia University.

Kager, R. (1999). *Optimality Theory*. Cambridge: Cambridge University Press.

Kari, J. (1990). *Ahtna Athapaskan Dictionary*. Fairbanks: Alaska Native Language Center.

Kaufman, T. (1990). Language History in South America: What we know and how to know more. In Payne, D. L. (Ed.). *Amazonian Linguistics* (pp. 3–74). Austin: University of Texas Press.

Kavitskaya, D. (2002). *Compensatory lengthening: phonetics, phonology, diachrony*. Routledge, Outstanding Dissertations in Linguistics.

Kawasaki, H. (1982). *An acoustical basis for universal constraints on sound sequences* (Doctoral dissertation). University of California, Berkeley.

Keating, P. (2006). Phonetic coding of prosodic structure. In J. Harrington & M. Tabain (Eds.), *Speech production* (pp. 167–186). New York: Psychology Press.

Keating P., Cho T., Fougeron C. & Hsu. C. (1999). Domain-initial strengthening in four languages, *UCLA Working Papers in Phonetics, 97*, 139-151.

Kehrein W. (2002). *Phonological Representation and Phonetic Phasing: Affricates and Laryngeals*. Tübingen: Niemeyer.

Kenstowicz, M. J. (1982). Gemination and spirantization in Tigrinya. *Studies in the Linguistic Sciences 12*(1), 106-123.

Kenstowicz, M. J. (1994). *Phonology in generative grammar*. Cambridge, MA: Wiley-Blackwell.

Kenstowicz, M. J. (1997). Quality-sensitive stress. *Rivista di Linguistic*, *9*, 157–87.

Kenstowicz, M. J. (2005). The phonetics and phonology of Korean loanword adaptation. In S. J. Rhee (Ed). Proceedings from *The First European Conference on Korean Linguistics*.

Kenstowicz, M. J. & Kisseberth, C. (1979). *Generative phonology*. New York: Academic Press.

Kingston, J. (1985). The Phonetics and Phonology of the Timing of Oral and Glottal Events. (Doctoral dissertation). University of California, Berkeley.

Kiparsky, P. (1993) Blocking in Non-derived environments. In S. Hargus & E. Kaisse (Eds.), *Phonetics and Phonology 4: Studies in Lexical Phonology* (pp. 277-313). San Diego: Academic Press.

Kiparsky, P. (2000). Opacity and Cyclicity. *Linguistic Review*, *17*, 351-367.

Kirchner, R. (1998). *An effort-based approach to consonant lenition*. (Doctoral dissertation). UCLA.

Kirk, P., Ladefoged, P. & Ladefoged, J. (1984). Using a spectrograph for measures of phonation types in a natural language. *UCLA Working Papers in Phonetics*, *59*, 102-13.

Kirk, P. L., Ladefoged, J., & Ladefoged, P. (1993). Quantifying acoustic properties of modal, breathy and creaky vowels in Jalapa Mazatec. In A. Mattina & T. Montler (Eds.), *American Indian linguistics and ethnography in honor of Laurence C. Thompson*. Missoula, MT: University of Montana Press.

Kitto, C. & de Lacy P. (1999). Correspondence and epenthetic quality. In C. Smallwood & C. Kitto (Eds.) *Proceedings of AFLA VI: The Sixth Meeting of the Austronesian Formal Linguistics Association* (pp. 181-200). Toronto, University of Toronto,.

Klein, H. (1992). South American Languages. In W. Wright (Ed.), *International Encyclopedia of Linguistics*, Vol. 4, (pp. 31-35). Oxford: Oxford University Press.

Klein, H. & Stark, L.R. (1977). Indian Languages of the Paraguayan Chaco. *Anthropological Linguistics, 19* (8), 378-401.

Krause, S. R. (1980). Topics in Chukchee phonology and morphology. (Doctoral dissertation). University of Illinois at Urbana-Champaign.

Kuipers, A. H. (1960). *Phoneme and Morpheme in Kabardian*. The Hague: Mouton.

Ladd, D.R. (2014). *Simultaneous structure in phonology*. Oxford: Oxford University Press.

Ladefoged, P. (1971). *Preliminaries to linguistic phonetics*. Chicago: University of Chicago Press.

Ladefoged, P. (1983). The linguistic use of different phonation types. In D. M. Bless & J. H. Abbs (Eds.), *Vocal fold physiology: Contemporary research and clinical issues* (pp. 351–360). San Diego: College-Hill Press.

Ladefoged, P. & Maddieson, I. (1996). *The Sounds of the World's Languages*. Malden, MA: Blackwell.

Ladefoged, P. & Johnson K. (2011). *A course in Phonetics.* Cengage Learning.

Laver, J. (1980). *The phonetic description of voice quality* (Vol. 31). New York: Cambridge University Press.

Laver, J. (1994). *Principles of phonetics*. Cambridge: Cambridge University Press.

Lavoie, L. (2001). *Consonant Strength: Phonological Patterns and Phonetic Manifestations.* New York: Garland Publishing.

Levi, S. V. (2008). Phonemic vs. derived glides. *Lingua, 118*(12), 1956-1978.

Levi, S. V. (2011). Glides. In M. van Oostendorp, C. J. Ewen, E. Hume & K. Rice (Eds.) *The Blackwell Companion to Phonology* (pp. 341-366). Cambridge, Boston: Wiley-Blackwell.

Lindau, M. (1984). Phonetic Differences in Glottalic Consonants. *Journal of Phonetics*, *12*, 147-155.

Lombardi, L. (1991). Laryngeal features and laryngeal neutralization (Doctoral dissertation). University of Massachusetts, Amherst, MA.

Lombardi, L. (1995). Laryngeal neutralization and syllable wellformedness. *Natural Language and Linguistic Theory*, *13*, 39-74.

Lombardi, L. (2002). Coronal epenthesis. *Phonology*, *19*, 219-51.

Loukotka, Č. (1968). *Classification of South American Indian Languages.* Los Angeles: UCLA Latin American Center.

Lubowicz, A. (2005). Locality of Conjunction. In J. Alderete, C. Han & A. Kochetov (eds.) *Proceedings of the 24th West Coast Conference on Formal Linguistics.* (pp. 254-262). Somerville, MA: Cascadilla Press.

Macaulay, M. & Salmons, J. (1995). The Phonology of Glottalization in Mixtec. *International Journal of American Linguistics*, *61*, 38-61.

Maddieson, I. (1984) *Patterns of Sounds.* Cambridge: Cambridge University Press.

Maddieson, I. (2013). Lateral Consonants. In M. S. Dryer & M. Haspelmath (Eds.), *The World Atlas of Language Structures Online.* Leipzig: Max Plank Institute. Retrieved 20 June 2013 from http://wals.info/chapter/8

Maddieson, I. & Emmorey, K. (1984) Is there a valid distinction between voiceless lateral approximants and fricatives? *Journal of Phonetics*, *41*, 181-190.

Maddieson, I., Smith, C. L. & Bessell, N. (2001). Aspects of the Phonetics of Tlingit. *Anthropological Linguistics*, *43*, 135-176.

McCarthy, J. J. (1988). Feature geometry and dependency: a review. *Phonetica*, *43*, 84-108.

McCarthy, J. J.(1991). Semitic gutturals and distinctive feature theory. In B. Comrie & M. Eid (Eds.), *Perspectives on Arabic Linguistics III* (pp. 63-91). Amsterdam: John Benjamins Publishing.

McCarthy, J. J. (1993). A case of surface constraint violation. *Canadian Journal of Linguistics*, *38*, 127-153.

McCarthy, J. J. (1994). The Phonetics and Phonology of Semitic Pharyngeals. In P. Keating (Ed.), *Papers in Laboratory Phonology III: Phonological Structure and Phonetic Form* (pp. 191-233). Cambridge: Cambridge University Press.

McCarthy, J. J. (2000). Extensions of faithfulness: Rotuman revisited. *Natural Language and Linguistic Theory, 18*, 147-97.

McCarthy, J. J. (2003). Comparative markedness. *Theoretical Linguistics*, *29*, 1-51.

McCarthy, J. J. (2007). What is Optimality Theory? *Language and Linguistics Compass*, *1*, 260-291.

McCarthy, J. J. & Prince, A. (1993). Generalized alignment. In G. Booij & J. van Marie (Eds.), *Yearbook of Morphology* (pp. 79–153). Dordrecht: Kluwer.

McCarthy, J. J. & Prince, A. (1995). Faithfulness and reduplicative identity. *University of Massachusetts occasional papers in linguistics*, *18*, 249–384.

McCarthy, J. J. & Prince, A. (1986/1996). Prosodic Morphology. Technical Report #32, Rutgers University Center for Cognitive Science, 1996.

McCarthy, J. J. & Prince, A. *Prosodic Morphology* ([1986] (1996). Linguistics Department Faculty Publication Series. Paper 13. Retrieved 20 December 2013 from http://scholarworks.umass.edu/linguist_faculty_pubs/13

Mason, J. A. (1950) The languages of South America. In J. Steward (Ed.), *Handbook of South American Indians* Vol. 6 (pp. 157-317). Washington, D.C.: Government Printing Office.

Melià. B. (2010). Lenguas Indígenas en el Paraguay y Políticas Linguisticas. *Currículo sem fronteiras 10*(1), 12-32.

Messineo, C. (2003). *Lengua toba (guaycurú). Aspectos gramaticales y discursivos.* Alemania: Lincom.

Michael, L. (2008). Nanti evidential practice: Language, knowledge, and social action in an Amazonian society. (Doctoral dissertation). University of Texas at Austin, Austin.

Mielke, J. (2008). *The emergence of distinctive features*. New York: Oxford University Press.

Mielke, J. & Hume, E. (2001). Consequences of word recognition for metathesis. In E. Hume, N. Smith & J. van de Weijer (Eds.), *Surface Syllable Structure and Segment Sequencing* (pp. 135-158). Leiden, NL: Holland Institute of Generative Linguistics.

Mielke J. & Hume, E (2006). Distinctive Features. In K. Brown (Ed.), *Encyclopedia of Language and Linguistics* (2nd edition). Oxford: Elsevier.

Miller, E. (Ed). (1999). *Peoples of the Gran Chaco. Native peoples of the Americas*. Westport, CT: Bergin & Garvey.

Miller, M. (1999). *Desano Grammar: Studies in the Languages of Colombia 6*. Arlington: Summer Institute of Linguistics and University of Texas.

Mills, R. & Grima J. (1980). Historical Developments in Lettinese. In P. Buenaventura Naylor (Ed), *Austronesian studies: Papers from the Second Eastern Conference on Austronesian Languages*, 273-284.

Moisik, S. R. & Esling, J. H. (2011). The 'Whole Larynx' approach to laryngeal features. In *Proceedings of the 17th International Congress of Phonetic Sciences* (pp. 1406-9). Hong Kong: City University of Hong Kong.

Moisik, S. R, Czaykowska-Higgins, E. & Esling, J. H. (2012). The epilaryngeal articulator: a new conceptual tool for understanding lingual-laryngeal contrasts. In A. McKillen & J. Lougran (Eds.), Proceedings from *The Montreal-Ottawa-Toronto (MOT) Phonology Workshop 2011: Phonology in the 21st Century: In Honour of Glyne Piggott*. Montreal: McGill Working Papers in Linguistics 22 (1).

Morelli, F. (1999). The phonotactics and phonology of obstruent clusters in Optimality Theory (Doctoral dissertation). University of Maryland, College Park.

Morelli, F. (2003). The Relative Harmony of /s+ Stop/ Onsets Obstruent Cluslers and the Sonority Sequencing. In C. Féry & R. van de Vijver (Eds.), *The syllable in optimality theory*. Cambridge University Press.

Morén, B. (1999). Distinctiveness, coercion and sonority: A unified theory of weight. (Doctoral dissertation). University of Maryland, College Park.

Morgan, L. R. (1991). A Description of the Kutenai Language. (Doctoral dissertation). University of California, Berkeley.

Murray, R. & Vennemann, T. (1983). Sound Change and Syllable Structure: [Problems] in Germanic Phonology. *Language*, *59*, 514-28.

Munro, P. & Lopez, F. H. (1999) [with O. V. Méndez Martínez, R. García & M. R. Galant]. *Di'csyonaary x:tèe'n dìi'zh sah Sann Lu'uc (San Lucas Quiaviní Zapotec Dictionary / Diccionario Zapoteco de San Lucas Quiaviní)*. Los Angeles: UCLA Chicano Studies Research Center Publications.

Munro, P., Lillehaugen, B. D. & López, F. H. (2008). *Cali Chiu? A Course in Valley Zapotec*.

Munshi, S. & Crowhurst M. J. (2006). Weight sensitivity and syllable codas in Srinagar Koshur. *Journal of Linguistics*, *48*(2), 427-472.

Narayanan, S. S., Alwan A. A. & Haker K. (1997). Toward articulatory-acoustic models for liquid approximants based on MRI and EPG data. Part I. The laterals. *Journal of the Acoustical Society of America*, *101*(2), 1064–1077.

Nercesian, V. (2011). *Gramática del wichí, una lengua chaqueña. Interacción fonología-morfología-sintaxis en el léxico*. Buenos Aires: Facultad de Filosofía y Letras de la UBA.

Nercesian, V. (2014a). *Wichi lhomtes. Estudio de la gramática y la interacción fonología-morfología-sintaxis-semántica*. Munich: Lincom.

Nercesian, V. (2014b). Mataguayan. In R. Lieber & P. Štekauer (Eds.), *Handbook of derivational morphology*. Oxford: Oxford University Press.

Najlis, E. (1984). *Fonología de la protolengua mataguaya. Cuadernos de Lingüística Indígena* 9. Buenos Aires: Universidad de Buenos Aires.

Nespor, M. & Vogel I. (1986/2007). *Prosodic Phonology*. Dordrecht: Foris Publications.

Ní Chasaide, A. & Gobi, C. (1997). Voice source variation. In W. J. Hardcastle & J. Laver (Eds.), *Handbook of Phonetic Sciences* (pp. 427- 461). Oxford: Blackwell Press.

Nordenskiöld, E. (1910). *Indianlif i El Gran Chaco*. Estocolmo: Bonniers Förlag.

Odden, D. (1988), Anti anti-gemination and the OCP. *Linguistic Inquiry, 19*, 451–475.

Ohala, J. J. (1981). The listener as a source of sound change. In C. Masek, R. Hendrick & M. F. Miller (Eds.), *Papers from the parasession on language and behavior* (pp. 178-203). Chicago: Chicago Linguistics Society.

Ohala, J. J. (1990). Alternatives to the sonority hierarchy for explaining segmental sequential constraints. In M. Ziolkowski, M. Noske & K. Deaton (Eds.), *CLS 26: The Parasession on the Syllable in Phonetics and Phonology* Vol.2. (pp. 319-338). Chicago: CLS.

Ohala, J. J. (1993). The phonetics of sound change. In C. Jones (Ed.), *Historical linguistics: Problems and perspectives* (pp. 237-78). London: Longman.

Ohala, J. J. (1997). Emergent stops: diachronic and phonetic data. In *Proceedings of the Seoul International Conference on Linguistics* (pp. 84-91). Seoul: Linguistic Society of Korea.

Ola Orie O. & Bricker, V.R. (2000). Placeless and historical laryngeals in Yucatec Maya. *International Journal of American Linguistics, 3*, 283-317.

Palavecino, E. (1936). Las culturas aborígenes del Chaco. *Historia de la Nación Argentina*, *1*, 429-72.

Palavecino, E. (1939). Los indios chulupí del Chaco Boreal. *Revista de Geografía Americana, 3*(31), 231-37.

Palosaari, N. & Campbell, L. (2011). Structural Aspects of Language Endangerment. *Cambridge Handbook of Endangered Languages, Section 1*. Cambridge: Cambridge University Press.

Parker, S. G. (2002). *Quantifying the sonority hierarchy*. (Doctoral dissertation). University of Massachusetts, Amherst.

Parker, S. G. (2008). Sound level protrusions as physical correlates of sonority, *Journal of Phonetics, 36*, 55–90.

Parker, S. G. (2012). *The sonority controversy. Phonology and Phonetics, 18*. Berlin: De Gruyter Mouton.

Peterson, T. (2004). The Distribution of the Glottal Stop in Blackfoot. Proceedings from *The Workshop on American Indigenous Languages; April 30-May 2, 2004*. University of California, Santa Barbara.

Picanço, G. (2005). *Mundurukú: Phonetics, Phonology, Synchrony, Diachrony*. (Doctoral dissertation). University of British Columbia, Vancouver.

Pierrehumbert, J. (1990). Phonetic and phonological representations. *Journal of Phonetics, 18*, 375-394.

Piggott, G. L. (1995). Epenthesis and syllable weight. *Natural Language and Linguistic Theory, 13*, 283-326.

Powell, J. V. (1985). An occurrence of metathesis in Chimakuan. For Gordon H. Fairbanks. In V.Z. Acson & R. L. Leed (Eds.) (pp. 105–10). Honolulu: University of Hawaii Press.

Pulleyblank, D. (1988). Vocalic Underspecification in Yoruba. *Linguistic Inquiry*, *19*, 233-270.

Prince, A. (1980). A metrical theory for Estonian quantity. *Linguistic Inquiry*, *11*, 511–562.

Prince, A. & Smolensky, P. ([1993] 2004). *Optimality Theory: Constraint Interaction in Generative Grammar* (2nd ed.) Malden, MA: Blackwell Publishing.

R Core Team (2013). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Retrieved 25 May 2013 http://www.R-project.org/

Rebrus, P. & Törkenczy, M. (2005). Uniformity and contrast in the Hungarian Verbal Paradigm. In L. J. Downing, T.A. Hall & R. Raffelsiefen, *Paradigms in Phonological Theory*, eds. (pp. 263-295). Oxford: Oxford University Press.

Recasens, D. & Espinosa, A. (2005). Articulatory, positional and coarticulatory characteristics for clear /l/ and dark /l/: evidence from two Catalan dialects. *Journal of the International Phonetic Association, 35*(1), 1–25.

Rice, K. (1993). A reexamination of the feature [sonorant]: the status of 'sonorant obstruents'. *Language, 69*(2), 308-344.

Rice K. & Avery P. (1991) On the Relationship between Laterality and Coronality. In C. Paradis & J.F Prunet (Eds.), *Phonetics and Phonology 2: The Special Status of Coronals* (pp. 101-124). San Diego, California:Academic Press, Inc.

Romero-Méndez, R. (2008). *A Reference Grammar of Ayutla Mixe (Tukyo'm Ayuujk).* (Doctoral dissertation). University of New York at Buffalo, Buffalo.

Rose, S. (1996). Variable Laryngeals and Vowel Lowering. *Phonology, 13*(1), 73-117.

Rosenthal, S. & Hulst, H. G. van der (1999). Weight by Position. *Natural Language and Linguistic Theory*, *17*, 499-450.

Sadeniemi, M. (1949). *Metriikkamme perusteet.* Helsinki: SKST

Sagey, E. C. (1986). *The Representation of Features and Relations in Non-linear Phonology*. (Doctoral dissertation). Massachusetts Institute of Technology, Cambridge.

Sagey, E. C. (1988). On the ill-formedness of crossing association lines. *Linguistic Inquiry*, *19*, 109-118.

Samely, U. (1991). *Kedang (Eastern Indonesia), some aspects of its grammar.* Hamburg: Helmut Buske Verlag.

Sapir, E. & Swadesh, M. (1960). *Yana dictionary* [University of California Publications in Linguistics 22]. Berkeley: University of California Press.

Schane, S. A. (1973). *Generative phonology.* Prentice-Hall Foundations of Modern Linguistics Series. Englewood Cliffs, NJ: Prentice Hall.

Seelwische, J. (1975a). *Gramática Nivaclé. Na Lhasinônash napi Nivaĉle.* Asunción: El Gráfico.

Seelwische, J. (1975b). *Castsitenjayash. Lecturas en chulupí.* Asunción: Zamphirópolos.

Seelwische, J. (1980). *Nivaĉle-lhcliish - Sômto lhcliish.* Diccionario Nivaĉle Castellano. Asunción: Biblioteca Paraguaya de Antropología 1. UCNSA.

Seelwische, J. (1990). *Diccionario nivaclé: nivaclé-castellano, castellano-nivaclé.* dad Católica. Mariscal Estigarribia/Asunción: Centro de Estudios Antropológicos de la Universidad Católica.

Seelwische, J. (1993a). *Na casnôyiish. Nuestro camino. Libro de lectura para enseñanza bilingüe Nivaclé-Castellano, 2° grado.* Mariscal Estigarribia: Vicariato Apostólico del Pilcomayo.

Seelwische, J. (1993b). *Na castsitenjayish. Nuestra tierra. Libro de lectura para enseñanza bilingüe Nivaclé-Castellano, 3° grado.* Mariscal Estigarribia: Vicariato Apostólico del Pilcomayo.

Seelwische, J. & Avalos, P. (1972). *Castsitenyayish - Nuestra tierra. Lecturas en Chulupí con traducción al castellano.* Asunción.

Selkirk, E. (1980). Prosodic domains in phonology: Sanskrit revisited. In M. Aronoff & M. L. Kean (Eds.), *Juncture* (pp. 107-129). Saratoga, CA: Anma Libri.

Selkirk, E. (1984). *Phonology and Syntax: The Relation between Sound and Structure*. Cambridge, Mass.: MIT Press.

Selkirk, E. (1986). On derived domains in sentence phonology. *Phonology Yearbook, 3*, 371-405.

Selkirk, E. (1995). The prosodic structure of function words. In J. Beckman, L. Walsh Dickey & S. Urbanczyk (Eds.), *Papers in Optimality Theory* (pp. 439-470). Amherst, MA: GLSA Publications.

Shaw, P. A. (1989). The complex status of complex segments in Dakota. In D. Gerdts & K. Michelson (Eds.), *Theoretical Perspectives on Native American Languages* (pp. 3-37). Albany: State University of New York Press.

Shaw, P. A. (1991). The laryngeal/post-velar connection (MS). Paper presented at the Conference on Phonological Feature Organization, LSA Summer Linguistic Institute, UCSC.

Shaw, P. A. (1992).Templatic evidence for the syllable nucleus. In A. Schafer (ed.), *Proceedings of the 23rd annual meeting of the North East Linguistic Society* (pp. 463-477). Amherst, MA: Graduate Linguistic Student Association.

Shaw, P. A. (1994). The prosodic constituency of minor syllables. In E. Duncan, D. Farka & P. Spaelti (Eds.), *The proceedings of the twelfth West Coast Conference on Formal Linguistics* (pp. 117-132). Stanford, CA: Center for the Study of Language and Information.

Shaw, P. A., Blake S. J., Campbell J. & Sheperd C. (1999). Stress in hen'q'emin'em' (Musqueam) Salish. *UBC Working Papers in Linguistics* 2 (pp. 131-163). Vancouver: University of British Columbia.

Shaw, P. A. (2009). Inside Access: The Prosodic Role of Internal Morphological Constituency. In K. Hanson & S. Inkelas (Eds.), *The Nature of the Word: Essays in honor of Paul Kiparsky* (pp. 241-272). Cambridge: Massachusetts Institute of Technology Press.

Sherer, T. (1994). *Prosodic phonotactics*. (Doctoral dissertation). UMass, Amherst.

Sievers, E. (1881). *Grundzüge der Phonetik*. Leipzig: Breitkopf und Hartel.

Siffredi, A. (1989). Interacción y cognición: el caso nivakle. *América Indígena*, *49*(3), 509-43.

Silva, W. (2010). The glottal stop and glottalization in Desano. Paper presented at the Amazonicas III: Phonology and Syntax, Universidad Nacional de Colombia, Bogotá, Colombia. April 2010.

Silverman, D. (1997). Laryngeal Complexity in Otomanguean Vowels. *Phonology*, *14*(2), 235-61.

Silverman, D., Blankenship, B., Kirk, P., & Ladefoged, P. (1995). Phonetic Structures in Jalapa Mazatec. *Anthropological Linguistics*, *37*(1), 70-88.

Sivertsen, E. (1956). Pitch problems in Kiowa. *International Journal of American Linguistics, 22*, 117-130.

Skorik, P. J. (1961). *Grammatika chukotskogo jazyka. Chast' pervaja*. Moscow / Leningrad: Akademija Nauk SSSR.

Smith, Jennifer L. (2002). *Phonological augmentation in prominent positions.* (Doctoral dissertation). UMass, Amherst.

Smolensky, P. (1993). Harmony, Markedness, and Phonological Activity. Handout of talk presented at Rutgers Optimality Workshop-1, Rutgers University, New Brunswick, NJ. [ROA-87.]Retrieved July 10 2014 from http://roa.rutgers.edu/

Spencer, A. (1984). Eliminating the feature [lateral]. *Journal of Linguistics*, *20*, 23-43.

Sproat, R. & Fujimura, O. (1993). Allophonic variation in english /l/ and its implications for phonetic implementation. *Journal of Phonetics, 21*, 291-311.

Steed W. & Hardie P. (2004). Acoustic Properties of the Kuman Voiceless Velar Lateral Fricative. *Proceedings of 10th Australian International Conference on Speech Science & Technology*, 346-351.

Stell, N. N. (1972). *Fonología de la lengua Axluxlaj.* Buenos Aires: Universidad de Buenos Aires.

Stell, N. N. (1989). *Gramática descriptiva de la lengua niwaklé (chulupí)* (Doctoral dissertation). Facultad de Filosofía y Letras de la Universidad de Buenos Aires, Argentina, Buenos Aires.

Stenzel, K. (2004). *A reference grammar of Wanano* (Doctoral dissertation). University of Colorado, Boulder.

Stenzel, K. (2007). Glottalization and other suprasegmental features in Wanano. *International Journal of American Linguistics, 73*, 331-66.

Steriade D. (1982). Greek prosodies and the nature of syllabification. (Doctoral Dissertation). MIT.

Steriade, D. (1986). A note on coronal. Ms. MIT.

Steriade, D. (1987). Locality conditions and feature geometry. In J. McDonough & B. Plunkett (Eds.), *Proceedings of North East Linguistic Society* 17 (pp. 595-617). Amherst: GLSA.

Steriade, D. (1997). Phonetics in Phonology: The Case of Laryngeal Neutralization. Retrieved 1 May 2008 from http://www.linguistics.ucla.edu/people/steriade/papers/phoneticsinphonology.pdf

Stonham, J. (1999). *Aspects of Tsishaath Nootka Phonetics and Phonology.* München: Lincom Europa.

Storto, L. & Demolin, D. (2012). The Phonetics and Phonology of South American Languages. In L. Campbell & V. Grondona (Eds.), *The Indigenous Languages of South America: A comprehensive guide* (pp. 331-90). Berlin: Mouton De Gruyter.

Susnik, B. (1959). Afinidades estructurales del verbo chulupí y maka. *Boletín de la Sociedad Científica del Paraguay y del Museo Etnográfico Andrés Barbero, 3*(1), 12-80.

Susnik, B. (1961). *Apuntes de etnografía paraguaya I.* Asunción: Museo Etnográfico “Andrés Barbero”.

Swadesh, M. (1959). *Mapas de clasificación lingüística de México y las Américas.* México: Universidad Nacional Autónoma de México.

Tovar, A. (1951). Un capítulo de linguistica general. *Boletín de la Academia Argentina de Letras, 20* (77), 369-403.

Tovar, A. (1961). *Catálogo de las lenguas de América del Sur.* Buenos Aires: Editorial Sudamericana.

Trigo, R. L. (1988). On the phonological derivation and behavior of nasal glides. (Doctoral dissertation). Massachusetts Institute of Technology.

Trigo, R. L. (1991). On Pharynx-Larynx Interactions. *Phonology, 8*, 113-36.

Trubetzkoy, N. S. (1939). *Grundzüge der Phonologie*. Göttingen: Vandenhoek & Ruprecht.

Urbanczyk, S. (1996). *Patterns of Reduplication in Lushootseed* (Doctoral dissertation). University of Massachusetts at Amherst, Amherst.

Vennemann, T. (1988). *Preference Laws for Syllable Structure and the Explanation of Sound Change (With Special Reference to German, Germanic, Italian, and Latin).* Berlin: De Gruyter Mouton.

Vidal, A. & Nercesian V. (2009). Wichí vocabulary. In M. Haspelmath & U. Tadmor (Eds.) *Loanwords in the world's languages: a comparative handbook* (pp. 1015-1034). The Hague: Mouton De Gruyter.

Viegas Barros, J. P. (1993). ¿Existe una relación genética entre las lenguas mataguayas y guaicurúes?. In J. Braunstein (Ed.), *Hacia una nueva carta étnica del Gran Chaco* V. Informe de Avance 1989/90 (pp. 193-213). Las Lomitas: Centro del Hombre Antiguo Chaqueño (CHACO).

Viegas Barros, J. P. (2004). Guaicurú no, Macro-Guaicurú sí. Una hipótesis sobre la clasificación de la lengua Guachí (Mato Grosso do Sul, Brasil). Biblioteca Virtual, Grupo Etnolingüística.

Voegelin, C. F. & Voegelin, M. F. (1977). *Classification and index of the World's Languages*. New York: Elsevier.

Walsh Dickey, L. (1997). *The phonology of liquids* (Doctoral dissertation). University of Massachusetts, Amherst.

Watkins, L. J. (with the assistance of Parker McKenzie). (1984). *A Grammar of Kiowa*. Lincoln: University of Nebraska Press.

Wicke C. & Chase-Sardi, M. (1969). Componential analysis of Chulupí (Ashlushlay) kinship terminology. *Ethnology, 8*(4), 484-93.

Wright, R., Hargus S. & Davis K. (2002). On the Categorization of ejectives: data from Witsuwit'en. *Journal of the International Phonetic Association, 32*, 43-77.

Wright, R (2004). A review of perceptual cues and cue robusness. In B. Hayes, R. Kirchner & D. Steriade (Eds.), *Phonetically based phonology* (pp. 34-57). Cambridge, New York: Cambridge University Press.

Wolf, M. (2008). Optimal Interleaving: Serial Phonology-Morphology Interaction in a ConstraintBased Model (Doctoral dissertation). University of Massachusetts, Amherst.

Zec, D. (1988). Sonority constraints on prosodic structure. (Doctoral dissertation). Stanford University.

Zec, D. (1995). Sonority constraints on syllable structure. *Phonology, 12*, 85-129.

Zoll, C. (1996). *Parsing Below the Segment in a Constraint Based Framework* (Doctoral dissertation). University of California, Berkeley.

Zoll, C. (1998). *Positional Asymmetries and Licensing*. Ms. MIT. Rutgers Optimality Archive #282. Retrieved April 17 2012 from http://roa.rutgers.edu/