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Chapter 4

Consonant Mutation as a Perceptually Motivated Process

4.1 Introduction

Nivkh Consonant Mutation consists of alternations of morpheme-initial obstruents in certain phonological and morpho-syntactic contexts. There are two directions of alternation: Spirantization, in which a plosive changes to a fricative, and Hardening, in which a fricative changes to a plosive. These two processes exhibit an interesting asymmetry with respect to their application to word-initial obstruents. While Spirantization applies in both VPs (1a) and NPs (1b), Hardening applies only in VPs (2a) but not in NPs (2b).

- | | | | | |
|-----|----|------------------------------|----------------------------|------------------|
| (1) | a. | k ^h erqo- ‘catch’ | c ^h o xerqo- | ‘catch fish’ |
| | b. | pɨŋx ‘soup’ | p ^h eq vɨŋx | ‘chicken soup’ |
| (2) | a. | χa- ‘shoot’ | cxif q ^h a- | ‘shoot a bear’ |
| | b. | vo ‘village’ | t ^h ulv vo | ‘winter village’ |
| | | | Cf. *t ^h ulv bo | |

Together with the observation that CM targets morpheme-initial segments (but not medial or final ones), some authors regard this asymmetry as a support for the view that CM is primarily a syntactically motivated process, which has little to do with synchronic phonology (e.g. Kreinovich 1937: 60).

In this chapter, however, I will present new data which supports the view that CM is a synchronic phonological process. I compare CM with processes which are regarded as being morpho-syntactically motivated, such as CM in Irish, and discuss how they differ from Nivkh CM. In particular, I argue that Spirantization and Hardening are perceptually motivated processes. I will present several arguments in support of the view that Spirantization is an instance of perceptually motivated process of lenition, in the sense of Harris (Harris and Urua 2001, Harris 2005). The perceptually based approach to lenition contrasts with the articulatory based approach.

In the literature, there are two different approaches to lenition. One approach defines lenition in articulatory terms, as defended by authors such as Flemming (1995) and Kirchner (1998, 2004). These authors assume that lenition occurs in order to minimize articulatory effort. An advantage of this approach is that it captures the speech rate-sensitive nature of lenition, a widely observed characteristic cross-linguistically. A faster speech rate involves shortening of articulatory gestures. This goes hand in hand with an increase in the velocity of the constriction gesture. Greater velocity implies a greater effort. To achieve some constriction target, more effort is required in higher speech rate than in slower speech rate (Kirchner 1998: 217-218). This is the reason why in faster speech lenition often has larger domains.

While this articulatory model captures the types of lenition which are speech-rate sensitive, it fails to cover processes which are not sensitive to speech rate. Nivkh Spirantization is such a process; it does not expand its domain in proportion to the speech rate. In addition, Spirantization exhibits characteristics which are not observed in articulatorily motivated lenitions. These are non-derived environment blocking and sensitivity to domain-internal morpheme juncture.

An alternative view is to regard lenition as a perceptually motivated process, defined as a phonological operation which diminishes the amount of information in order to accentuate syntagmatic contrast (Harris and Urua 2001, Harris 2005). I will show how this approach succeeds in accounting for the above-mentioned characteristics of Spirantization which the articulatory-based model fails to cover.

The perceptually motivated approach has an additional advantage that it accounts for many of the shortcomings in the previous descriptions of CM. For instance, some authors analyzed CM as a local phonological process, which involves both assimilation and dissimilation (Mattissen 1999, 2003, Kaneko 1999). However, this analysis has the disadvantage that it divides Spirantization in different contexts into two distinct processes (i.e. assimilation and dissimilation). I will show that such a division is undesirable from a phonological point of view, and argue that all instances of Spirantization can be unified, once we regard it as a non-local (non-assimilatory) process, which has no specific segments as triggers.

A similar problem exists in descriptions which describe Spirantization and Hardening as distinct rules (e.g. Hattori 1955). Such a description misses the crucial generalization that the segmental outputs of the two processes exhibit ‘conspiracy’. Notably, Spirantization fails to apply precisely in contexts where Hardening applies, and Spirantization applies in contexts where Hardening fails to apply. Clearly, there is a phonological conspiracy of the segmental effects which the two processes create. The discussions in this chapter make clear that it is this conspiracy of segmental effects which is used to demarcate certain morpho-syntactic boundaries in Nivkh. In

particular, I will argue that the conspiracy observed in the application of Hardening and the blocking of Spirantization is due to local phonological effects which disfavors specific sequences of segments for perceptual reasons. This contrasts with Spirantization, which is a non-local phonological process without any specific segments as triggers. The overall picture of CM that the current thesis depicts is that it involves both local and non-local phonological processes which are perceptually motivated.

The final discussion in this chapter concerns the asymmetry between Spirantization and Hardening with respect to the domain of application, demonstrated above (1-2). In the literature, there are two approaches to deal with this asymmetry. The most straightforward analysis is to stipulate that fricative-initial nouns are exceptions to Hardening (e.g. Kreinovich 1937: 64, Panfilov 1962: 15, Gruzdeva 1997: 89, Mattissen 2003: 49). Another analysis makes use of ‘prespecification’; the manipulation of the underlying form of transitive verbs so that they undergo different phonology than nouns (Blevins 1993, Shiraishi 2000). Both analyses stipulate the exceptional behavior of lexical items, albeit in different ways, and their adequacy is difficult to evaluate from the known empirical facts. I will conclude the discussion with some suggestions for future research.

Finally, I would like to add that this chapter has the additional aim to make a contribution to the description of the phenomenon. In particular, I shed light on characteristics of CM to which hitherto little attention was paid, or which were simply unknown. As the discussion in this chapter reveals, such characteristics are nevertheless important in capturing the overall nature of the phenomenon. These are sensitivity to pause insertions and applicability to loanwords, among others.

As in the other chapters, most of the examples in this chapter are from my own fieldwork recordings. Generally speaking, the pattern of CM observed in these data is comparable with the earliest descriptions of the phenomenon in the beginning of the 20th century (Shternberg 1908, Kreinovich 1934, 1937). This fact verifies the reliability of those early descriptions, and the linguistic competence of the contemporary speakers, who are all bilingual in Russian and do not use Nivkh on a daily basis.

This chapter is organized as follows. I begin with a descriptive sketch of CM in sections 4.2, 4.3 and 4.4. In section 4.5, I introduce the hypothesis regarding the diachronic development of Hardening by Jakobson (1957) in order to explain why of the content words only transitive verbs undergo Hardening. Section 4.6 points out the problems that CM pose to existing theoretical understandings of related topics from a phonological point of view. In the past, various solutions to these problems have been advocated. I will review these in section 4.7. In section 4.8, I propose an alternative

analysis which unifies all instances of Spirantization as an instance of perceptually motivated lenition. Section 4.9 discusses contexts in which Spirantization and Hardening conspire to achieve the same sequence of segments. It will be proposed that that the output sequences of segments in these contexts are the results of local restrictions due to local cooccurrence restrictions of segments which are perceptually motivated. Section 10 discusses how to account for the fricative-initial nouns, which exceptionally fail to undergo Hardening. Section 4.11 concludes.

4.2 Descriptive Sketch 1: Phonological Contexts

Nivkh CM targets morpheme-initial obstruents and changes their continuancy in certain phonological and morpho-syntactic contexts. I will begin the sketch with description on the phonological contexts. The morpho-syntactic conditions are described in section 4.3.

4.2.1 Spirantization

Spirantization occurs when the initial plosive of a morpheme follows a vowel (4), glide (5) or a plosive (6). A linear version of the rule of Spirantization is given in (1).

(3) Spirantization

Plosive > Fricative

$$\left[\begin{array}{l} \text{Vowel} \\ \text{Glide} \\ \text{Plosive} \end{array} \right] \left[\text{ } \right]$$

([] denote morpheme boundaries)

- (4) a. t^hom ‘fat’ c^ho ɾom ‘fish fat’ (FN)
 b. c^ho ‘fish’ liyi so ‘salmon’ (FN)
 c. piɲx ‘soup’ c^ho viɲx ‘fish soup’ (FN)
 d. kujva ‘ring’ toto yujva ‘a silver ring’ (Pukhta 2002: 66)
- (5) a. ciyɾ ‘tree’ qoj ziɾ ‘larch tree’ (SL2: 3)

(6)	a.	cif	‘trace’	p ^h -itik zif	‘father’s trace’	(SL1: 9)
	b.	tif	‘house’	Galik rif	‘Galik’s house’	(FN)
	c.	t ^h om	‘fat’	hijk rom	‘fat of a hare’	(FN)
	d.	p ^h ix	‘soup’	p ^h eq vijx	‘chicken soup’	(FN)
	e.	p ^h oqi	‘air bladder’	mikik foqi	‘air bladder of dace’	(FN)
	f.	c ^h ijr	‘grass’	k ^h erq sijr	‘sea grass (= seaweed)’	(SL2: 54)

On the other hand, Spirantization does not apply when the plosive follows a fricative (7) or a nasal (8).

(7)	a.	t ^h om	‘fat’	c ^h xif t ^h om	‘bear fat’	(FN)
	b.	coŋr	‘head’	c ^h xif coŋr	‘bear head’	(SL3: 54)
	c.	p ^h ix	‘soup’	c ^h xif p ^h ix	‘bear soup’	(FN)
	d.	cus	‘meat’	c ^h xif cus	‘bear meat’	(FN)
(8)	a.	q ^h al	‘clan’	pilavon q ^h al	‘the clan of Pilavon’	(SL1: 11)
	b.	k ^h iri	‘urine’	qan k ^h iri	‘urine of dog’	(SL1: 21)
	c.	coŋr	‘head’	qan dzoŋr	‘dog head’	(SL1: 22)
	d.	paŋk	‘only’	aŋ baŋk	‘who else?’	(SL3: 26)
	e.	tif	‘house’	niŋ dif	‘our house’	(SL3: 49)

Following nasals, non-aspirated plosives undergo voicing, as the transcriptions indicate (Chapter 3, section 3.3.1).

Following a lateral, there is fluctuation in the pronunciation. In my data, there are both instances of plosives and fricatives surfacing after laterals, as shown in the examples below. The examples are few since not many words end in a lateral in Nivkh.

(9) Plosive

a.	ostol t ^h xi	‘on the table’	(SL3: 71)
b.	vil-bilu-r	‘roll (reduplication)’	(SL1: 39)

(10) Fricative

- | | | | |
|----|-------------|---------------------------------|-----------|
| a. | kul fi-n-gu | ‘people who dwell on the shore’ | (SL3: 57) |
| b. | vul-vulu- | ‘black (reduplication)’ | (SL1: 9) |
| c. | qal-ʁala | ‘bright (reduplication)’ | (SL1: 9) |

4.2.2 Hardening

The phonological context of Hardening is complementary to that of Spirantization; it applies when a morpheme-initial fricative follows either a fricative (12) or nasal (13).

(11) Hardening

$$\text{Fricative} > \text{Plosive} \left[\begin{array}{l} \text{Fricative} \\ \text{Nasal} \end{array} \right] \left[\text{---} \right]$$

- | | | | | | |
|---------|--------|----------|--|-------------------------|---------------------|
| (12) a. | xu- | ‘kill’ | c ^h xif k ^h u- | ‘kill a bear’ | (SL1: 7) |
| b. | fi- | ‘dwell’ | vo ɲaqr p ^h i- | ‘dwell in a village’ | (SL1: 7) |
| c. | fɨɲ- | ‘throw’ | c ^h xif p ^h ɨɲ- | ‘throw to the bear’ | (SL1: 8) |
| d. | ɾu- | ‘follow’ | p ^h -itik zif t ^h u- | ‘follow father’s trace’ | (SL1: 9) |
| e. | ra- | ‘drink’ | c ^h aχ ta- | ‘drink water’ | (SL2: 15) |
| (13) a. | xu- | ‘kill’ | aɲ k ^h u- | ‘kill whom?’ | (SL3: 21) |
| b. | ɾxɨɾp- | ‘forget’ | ɲɨɲ t ^h xɨɾp- | ‘forget us’ | (SL3: 64) |
| c. | za- | ‘beat’ | qan dʒa- | ‘beat a dog’ | (Gruzdeva 1997: 90) |
| d. | zosq- | ‘break’ | ivɲ dʒosq- | ‘break an oar’ | (Gruzdeva 1997: 90) |

There is a discrepancy between content words and function words in this context. In function words, only plosives surface after nasals. On the other hand, there is variation in the initial obstruent of content words.¹ As Kreinovich and Gruzdeva point out, there are instances of both application and non-application of hardening (Kreinovich 1937:

¹ These are restricted to transitive verbs for reasons that will be laid out in section 4.5.

50, Gruzdeva 1997: 90-91). In my data, hardening applies in the majority of cases, but there is also an instance of non-application.²

- (14) meŋ vo-
 rudder hold
 ‘to steer’ (SL2: 74)

It should be pointed out that homorganicity between the nasal and fricative is not relevant in determining the application of Hardening. Hardening applies regardless of whether the nasal is homorganic with the following obstruent, as some of the examples in (13) show. This is also the case with Spirantization; post-nasal plosives do not spirantize regardless of whether they are homorganic with the preceding nasal (see the examples in (8)). This lack of homorganicity indicates that a primarily articulatory account of Hardening is problematic, as we will see in section 4.9.2.

Hardening does not apply when the fricative follows a vowel (15), glide (16) or a plosive (17).

- (15) a. xu- ‘kill’ ŋa xu- ‘kill an animal’ (SL1: 11)
 b. ʏuz- ‘pull out’ p^h-saqo ʏuz- ‘pull out one’s own knife’ (SL2: 14)
 c. xaw- ‘dry’ ma xaw- ‘dry fish’ (SL3: 45)
- (16) a. sew- ‘dry’ kij sew- ‘dry a sail’
- (17) a. xavu- ‘warm’ tɪmk xavu- ‘warm hands’ (SL1: 12)
 b. ɾni- ‘see’ p^h-atik ɾni- ‘saw her younger sister’ (SL2: 42)
 c. ʏe- ‘marry’ nanak ʏe- ‘marry the elder sister’ (SL3: 53)

4.2.3 Summary

The input and output sequences of CM are listed below. In principle, the input sequences are not allowed to surface across morpheme boundaries. When these

² It is not clear what causes this variation. Panfilov (1962: 16) lists a group of transitive verbs which never undergo hardening, e.g. /vaw-/ ‘chew’. My informants, however, exhibit hardening for some of these verbs: [paʁla als povu-] ‘chew cowberries’ (SL3: 36)

sequences arise due to morpheme concatenation, either Spirantization or Hardening applies to repair them.

(18)	Input sequences		Output sequences
a.	Vowel - Plosive	>	Vowel - Fricative
b.	Glide - Plosive	>	Glide - Fricative
c.	Plosive - Plosive	>	Plosive - Fricative
d.	Fricative - Fricative	>	Fricative - Plosive
e.	Nasal - Fricative	>	Nasal - Plosive

Whether the output sequences on the right are achieved by Spirantization or Hardening is a matter of input. Spirantization applies when a plosive is in the input and Hardening does when a fricative is in the input. In this way, Spirantization and Hardening conspire to achieve these output sequences of segments. However, some previous works overlooked this conspiracy and described the two processes as if they had independent structural goals. We will discuss this in section 4.6 below.

4.3 Descriptive Sketch 2: Morpho-Syntactic Contexts

CM applies across morpheme-boundaries within a specific domain which is syntactically defined.³ The latter has two subtypes. One domain has a transitive verb as its head, and spans the complement and the verb.

(19)	VP _{[NP[Noun-suffix-]][Verb-suffix-]]}	
	E.g. c ^h xif	k ^h u-c
	bear	kill-IND
		‘kill a bear’

Another domain has a noun as its head. The specifier in such an NP can be either a modifier or a possessor.

(20)	NP _{[[Noun][Noun-suffix]]}	
	E.g. c ^h o	vjɲx
	fish	soup
		‘fish soup’

³ There is various terminology in the literature to refer to this domain: ‘dependent-head constellation’ (Mattissen 2003: 44), ‘polythematic section’ (Jakobson 1957: 80), etc.

Within this domain, CM targets every morpheme-initial obstruent, i.e. it applies iteratively from the innermost morpheme to the outermost string of morphemes.

Crucially, CM is sensitive to domain-internal morpheme junctures. This means that it does not apply ‘across-the-board’ within the designated domain. In this connection, it should be pointed out that CM fails to apply in non-derived environments. In the examples below, the phonological conditions on CM are met and yet it does not apply. This is because these words are monomorphemic and do not constitute a derived environment.

- | | | | | |
|------|----|------|-------|----------|
| (21) | a. | utku | *utyu | ‘man’ |
| | b. | itik | *irik | ‘father’ |
| | c. | ɲiys | *ɲiyc | ‘teeth’ |

Likewise, word-initial plosives do not undergo CM when they do not follow any morpheme.

- | | | | | |
|------|----|-----------------------|----------|-------------|
| (22) | a. | pɨɲx | *vɨɲx | ‘soup’ |
| | b. | c ^h o vɨɲx | *so vɨɲx | ‘fish soup’ |

The morpho-syntactic context of CM can be summarized as follows. CM applies to morpheme-initial obstruents when the latter is preceded by another morpheme within the designated syntactic domain (complement-head (VP) or specifier-head (NP)). Within this domain, various morpho-syntactic processes create CM contexts. Cliticization, reduplication, affixation, NP and VP formations may all feed CM. In the preceding sections, I illustrated cases of NP and VP formations. In the following sections, I illustrate CM in other morpho-syntactic contexts.

4.3.1 Cliticization

In Nivkh, pronouns truncate and cliticize to the following host to form a possessive construction (Chapter 2, section 2.6). These truncated forms trigger Spirantization of the following plosive. This is illustrated below with the truncated forms of the reflexive pronoun /p^hi/.⁴

⁴ After /p^h-/ only voiceless fricatives surface (cf. Chapter 2, section 2.6.1).

- (23) a. caqo ‘knife’ p^h-saqo ‘one’s own knife’ (SL2: 14)
 b. tot ‘arm’ p^h-rot ‘one’s (own) arm’ (SL2: 59)
 c. qan ‘dog’ p^h-χan-gu ‘one’s own dogs’ (SL2: 6)

4.3.2 Reduplication

Reduplication is commonly used to express intensification, iteration or multiplication in Nivkh (Mattissen 2003: 19). The examples below illustrate that the reduplicants, copied to the right of the base, are not faithfully realized in case faithful realization yields a sub-optimal sequence of segments (i.e. segmental sequences on the left of (18)). The output sequences all conform to the structural goals of CM as outlined in section 4.2.3 above.

- (24) a. pulk-vulk-u- ‘round’ (base /pulk/) (SL2: 8)
 b. c^herk-serk- ‘break’ (SL1: 39)
 c. yur-kurd- ‘to stick’ (SL1: 26)
 d. c^haf-c^hava- ‘wet’ (base /c^haf/) (SL2:56)

4.3.3 Suffixation

The initial obstruents of suffixes are subject to the same regulations of CM as in other morpho-syntactic contexts. This is illustrated below with the allative marker /-roχ/.

- (25) a. pxi-roχ ‘to the taiga’ (SL2: 6)
 b. t^hut-roχ ‘to the fireplace’ (SL2: 31)
 c. c^haχ-toχ ‘to the water’ (SL2: 58)
 d. c^hiŋ-doχ ‘to you’ (SL2: 39)

Not all suffixes undergo CM. Postverbal suffixes often resist Spirantization and surface with sub-optimal sequences of segments (Jakobson 1957: 96-97, Mattissen

2003: 81).⁵ Postnominal suffixes, on the other hand, undergo genuine application of CM. The reason why suffixes behave differently is historical. In earlier stages of the Amur dialect (to which WSN belongs), there was a participle suffix /ŋ/ between the verbal stem and some of the verbal suffixes. This suffix triggered regular application of CM after nasals (to be discussed in detail in section 4.4.4). Later in the course of history, this suffix dropped (Jakobson 1957, Mattissen 2003: 81-82). The loss of this suffix created a case of a phonological opacity (section 4.4.4). Accordingly, in the current Amur dialect it is impossible to tell whether a given verbal suffix undergoes CM. This information should be stored in the lexicon in the synchronic grammar (the examples below do not exhaust the list of suffixes).

(26) Alternating suffixes

- a. -yit-/git- completive
- b. -vara/-bara counter-assertive focus

(27) Non-alternating suffixes

- a. -ku- causative
- b. -f local noun formation
- c. -s instrument noun formation

4.3.4 Maximal Domain of Application

As mentioned above, the maximal domain of CM is restricted to the minimal domain which spans either complement-head (VP) or specifier-head (NP). By ‘minimal’ I mean that there may be no intervening material like adverb or PP between the complement and the head; these constituents should be structurally adjacent in order to undergo CM. The insertion of adverb or PP between the complement and the head is disliked, as the examples below demonstrate (28a, 29a).

⁵ According to Mattissen (2003: 81), 75% of the post-verbal suffixes which begin with an obstruent undergo CM.

- (28) a. [NP_j-imik][NP_{lep}][ADV namnamgur] [V_{ra}-] *...namnamgur t^ha- (FN)
 1SG-mother bread well bake
 ‘My mother bakes bread well.’
- b. Preferred word order:
 [NP_j-imik] [ADV namnamgur] [NP_{lep}][V_{ra}-]
- (29) a. [NP_j-imik][NP_{lep}][PP_{tiv-ux}] [V_{ra}-] *...tiv-ux t^ha- (FN)
 1SG-mother bread house-LOC bake
 ‘My mother bakes bread in the house.’
- b. Preferred word order:
 [NP_j-imik] [PP_{tiv-ux}][NP_{lep}] [V_{ra}-]

In fact, adverbs and PPs never trigger CM between adjacent morphemes, neither as a trigger nor as a target.

- (30) a. [NP_j-ax] [ADVnijaq][V^ho-ku-] *...nijaq xo-ku-
 3SG-CAUS a_bit sleep-CAU
 ‘(She) let her sleep for a while.’ (SL2: 31)
- b. [NP^hi][ADVsik][VP[NPcaqo-yu mulk-yu][V^ho-]] *...sik saqo-...
 REF all knife-PL basket-PL take
 ‘He took all his knives and baskets.’ (SL2: 43)
- c. [NP^hi][ADVirk] [Vkinzir-] *...irk yinzir-
 REF already go_insane
 ‘She was already insane.’ (SL2: 26)

In addition, CM fails to apply when the target morpheme is preceded by a morpheme which belongs to a different CM domain. For instance, CM does not apply when the target morpheme is preceded by a subject.

(31) Subject-Predicate

- [NP^hisk][VPqoju-] *k^hisk ɔju-
 cat cry
 ‘A cat cried.’ (SL2: 3)

(32) Subject-Object

- a. [NPk^heq][VP[NPk^he] uy-] *k^heq xe uy-
fox net get_into
‘The fox got into the net.’ (SL2: 16)
- b. [NPPikar timk][VP[NPk^huti] rulku-] * ...timk xuti...
big hand hole come_into
‘A big hand came inside from the hole.’ (SL2: 26)
- c. [NPj-imik][VP[NPp^h-oyla] k^hez-] * j-imik f-oyla....
3SG-mother REF-child tell
‘The mother told her child.’ (SL1: 9)

The two sentences below differ minimally from each other with respect to the application of Hardening. In (33a), the initial fricative of the predicate verb does not undergo Hardening since the preceding noun is the subject and lies outside of the CM domain (complement-head). On the other hand, in (33b) the initial fricative of the predicate undergoes Hardening since the noun is the complement and forms a VP with the verb.

- (33) a. [NPeylŋ][VPŋo-] (‘child’ is subject)
child hold
‘The child holds (something).’
- b. [VP[NPeylŋ][V t^ho-]] (‘child’ is object)
child hold
‘(Someone) holds the child.’
(Gruzdeva 1997: 83, East-Sakhalin dialect)

4.4 Descriptive Sketch 3: Other Characteristics

4.4.1 Pause-Sensitivity

CM is sensitive to pause insertions. When a pause intervenes between the triggering morpheme and the target morpheme, CM does not apply. This is observed for both Spirantization (34a,b) and Hardening (34c).

- (34) a. qoj ‘larch’ vac....qoj ‘iron larch’ (Kreinovich 1937: 15)
 b. t^hom ‘fat’ hijk.... t^hom ‘fat of a hare’ (FN)
 c. ruv- ‘burn’ ciy^ɾ..... ruv- ‘burn woods’ (SL2: 25)

Kreinovich was aware that CM is a pause-sensitive process and criticized the way his precursor Lev Shternberg recorded data from the consultants (Kreinovich 1937: 15). Shternberg (or his consultants) dictated Nivkh stories word-by-word, thereby ignoring regular applications of CM. Indeed, Shternberg’s publication of Nivkh texts (e.g. Shternberg 1908) contains many forms which do not follow canonical patterns of CM. Taking into consideration the way Shternberg dictated data, these forms can be considered as citation forms which appeared in extraordinarily deliberate speech.

Pause-sensitivity indicates that temporal adjacency is crucial for the application of CM, in addition to structural adjacency.

4.4.2 Non-Hardening of Fricative-Initial Nouns

As illustrated in the section title, word-initial fricatives of nouns do not undergo Hardening. These fricatives remain unchanged in Hardening contexts, that is, when preceded by fricatives or nasals.

- (35) a. vo ‘village’ mayr vo ‘the place name Maghr’ (SL3: 34)
 b. ri ‘door’ tif ri ‘entrance door’ (FN)
 c. vo ‘village’ viy^ɾkun vo ‘the place name Vygrshkun’ (SL3: 5)
 d. vaqi ‘box’ t^hej vaqi ‘coal box’ (S&T 1970: 381)
 e. vijⁿ ‘pot’ la-ŋ vijⁿ ‘iron pot’ (SL1: 12)

4.4.4 Elided Nasal and Phonological Opacity

In the Amur dialect group, final nasals in some words and suffixes are deleted. Although these nasals never surface, they can be reconstructed by comparing Amur dialect forms with forms found in the Sakhalin dialect. In the latter dialect these nasals are retained.

(39)	Amur dialect		Sakhalin dialect	
	a.	eya	eyaŋ	‘cow’
	b.	pityi	pityaŋ	‘book’
	c.	oyla	eylŋ	‘child’
	d.	-gu/-yu	-gun/-yun	plural suffix

Although unpronounced, elided nasals pattern with overt nasals in CM: they block Spirantization and trigger Hardening. This is shown in the examples below. In these examples, elided nasals cause opaque applications of CM (elided nasals are indicated by superscripted ^N).⁷

(40)	a.	pjɲx	‘soup’	eya ^N bjɲx	‘beef soup’	(FN)
	b.	riw-	‘learn’	pityi ^N diw-	‘learn (to read) a book’	(FN)
	c.	ɾo-	‘take’	p ^h -umgu oyla ^N t ^h o-	‘take the daughter’	(SL2: 45)

The opaque application of CM is mainly confined to the speech of the oldest generation. The younger generation tends to neglect elided nasals in favor of a transparent application. The examples below exhibit this gradation in the speech of four speakers of the Amur dialect (three WSN, one Continental). For comparison, I add examples of overt nasals in the list.

Consultant VK (WSN. Born in 1929)

(41)	Nasal	a.	p ^h ikin dif	(< tif)	‘one’s brother’s house’
	Elided nasal	b.	eya ^N t ^h om		‘cow fat (butter)’
		c.	eya ^N bjɲx		‘cow soup’

⁷ This is an opacity created by the counterbleeding type of rule interaction.

Consultant AK (Continental. Born in 1936)

- | | | | | |
|------|--------------|----|-------------------------------------|--------------------|
| (42) | Nasal | a. | Data missing | |
| | Elided nasal | b. | urla ^N t ^h om | ‘good fat’ |
| | | c. | eɣa ^N t ^h om | ‘cow fat (butter)’ |
| | | d. | eɣa ^N cus~dʒus | ‘cow meat (beef)’ |

Consultant LK (WSN. Born in 1939)

- | | | | | |
|------|--------------|----|--|----------------------|
| (43) | Nasal | a. | ɲ-ikin dif | ‘my brother’s house’ |
| | Elided nasal | b. | urla ^N t ^h om | ‘good fat’ |
| | | c. | eɣa ^N ɾom (< t ^h om) | ‘cow fat (butter)’ |
| | | d. | horla ^N pɨɲx | ‘delicious soup’ |
| | | e. | eɣa ^N dʒus (< cus) | ‘cow meat (beef)’ |
| | | f. | loci ^N rif (< tif) | ‘Russian house’ |

Consultant SP (WSN. Born in 1942)

- | | | | | |
|------|--------------|----|---------------------------------------|--------------------|
| (44) | Nasal | a. | keɲ t ^h om | ‘whale fat’ |
| | | b. | ɲiɲ vɨɲx~bɨɲx (< pɨɲx) | ‘our soup’ |
| | | c. | ikin dif (< tif) | ‘brother’s house’ |
| | Elided nasal | d. | horla ^N vɨɲx~bɨɲx (< pɨɲx) | ‘delicious soup’ |
| | | e. | eɣa ^N zus (< cus) | ‘cow meat (beef)’ |
| | | f. | eɣa ^N t ^h om | ‘cow fat (butter)’ |

While the older two speakers (VK and AK) exhibit opaque application of CM, the younger two speakers (LK, SP) show variation between opaque and transparent pronunciations. The youngest speaker SP exhibits fluctuation even in a single context: [horla^N vɨɲx]~[horla^N bɨɲx] ‘delicious soup’.

4.5 The Diachronic Development of Hardening

Jakobson (1957) postulated the following diachronic scenario of Hardening. In Early Nivkh, there were no roots which began with a fricative. This can be still observed in old loanwords from Tungusic: fricative-initial roots are adapted to Nivkh with initial plosives (Kreinovich 1937: 53-54).

(45)	Nivkh	Tungusic	
	a.	c ^h afq	safugu ‘chopsticks’
	b.	c ^h am	saman ‘shaman’
	c.	c ^h oxc-	sokto- ‘to get drunk’
	d.	q ^h al	xala ‘clan’
	e.	q ^h ac-q ^h ac	xasi-xasi ‘different’

Most of the fricative-initial words in the contemporary Amur dialect belong to one of the following vocabulary: 1) lexically marginal items such as recent loanwords, onomatopoeia⁸ and taboo-words,⁹ 2) words which are historically derived from plosive-initial roots, and 3) words which are historically derived from initial labial glides.¹⁰ In Contemporary Nivkh, Hardening applies only to words which belong to 2). This group consists of transitive verbs. In Nivkh, a number of pairs of transitive and intransitive verb roots differ only in the continuancy of the initial obstruent.

(46)	Intransitive verb roots	Transitive verb roots
	a.	piks- ‘disappear’ viks- ‘throw’
	b.	tiw- ‘to get accustomed’ riw- ‘teach’
	c.	t ^h a- ‘to be roasted’ ɾa- ‘roast’

Similarly, there are a number of nominal roots which differ minimally in the continuancy of the initial obstruents from their verbal counterparts.

(47)	Nominal roots	Verbal roots
	a.	p ^h uf ‘saw’ fuf- ‘to saw’
	b.	c ^h afq ‘chopsticks’ safq- ‘to eat with chopsticks’
	c.	k ^h es ‘information’ xes- ‘to tell’

Regarding these pairs, Jakobson hypothesized that fricative-initial transitive verbs were historically derived from plosive-initial forms through the attachment of the

⁸ E.g. /ral/ ‘frog’, /xaj/ ‘pigeon’, /zaq/ ‘tomtit’ (Jakobson 1957: 93).

⁹ E.g. /raf/ ‘the little house erected in the cemetery for the deceased kinsman after the cremation of his body’ (Jakobson 1957: 91).

¹⁰ The original form which contains an initial glide can be observed in the Sakhalin dialect: /wat/ ‘iron, metal’ for the Amur form /vic/.

prepositive pronoun /i-/ (or /e-/), ‘someone/something’. When attached to verbal roots, this pronoun indicates the transitive voice and the absence of a definite object. In Early Nivkh, the absence of the definite object had to be expressed explicitly by this pronoun. The objectless use of transitive verbs was prohibited. This is shown below with the verb /-k^hu-/ ‘kill’.

(48) Early Nivkh (* = reconstructed forms)

- a. *ŋa k^hu-
animal kill
‘kill an animal’

- b. *liʏs k^hu-
wolf kill
‘kill a wolf’

- c. *i-k^hu-¹¹
INDF-kill
‘kill someone/something’

The initial plosive of the verbs changed to fricatives when preceded by a vowel, due to Spirantization: /ŋa k^hu-/ > /ŋa xu-/ ‘kill an animal’, /i-k^hu-/ > /i-xu-/ ‘kill someone/something’.¹²

The combination indefinite pronominal prefix+transitive verb was subject to a further change. In the course of history, the initial /i-/ dropped, probably for phonological reasons. Front high vowels are inherently short and therefore vulnerable to deletion. Support for this scenario comes from cases in which /i-/ is retained before consonant clusters. In such a case /i-/ is harmonically dependent on the vowel of the host and alternates with /e-/ when the latter is /o/ or /a/. Vowels which undergo vowel harmony indicate recessive nuclei (Harris 1997: 361).

¹¹ The final /u/ later dropped.

¹² I follow here Robert Austerlitz’s amendment to Jakobson’s hypothesis (Austerlitz 1977).

Whereas Jakobson assumed that /i-/ concatenated with fricative initial roots (/i-xu-/), Austerlitz assumed plosive-initial roots. Taking into account the phonotactic regularity that words should begin with plosives (see the examples in (41)), Austerlitz’s amendment (spirantization by /i-/), then loss of /i-/ seems plausible.

- (49) a. i-γlu- 'be afraid of'
 b. i-rli- 'pull'
 c. i-ndi- 'see' (Kreinovich 1937: 94)

- (50) a. e-гъop- 'touch'
 b. e-ъna- 'spread'
 c. e-ъra- 'bore' (Kreinovich 1937: 94)

The /i-/ survived only in cases in which its loss would otherwise yield phonologically marked structure, such as a word-initial consonant cluster or syllables with an empty onset (including /h/). In roots which begin with /h/ or a vowel, /i-/ becomes non-syllabic and fills the onset (52c, d).

(51) i-deletion

- a. *i-lit- > lit- 'do'
 b. *i-zu- > zu- 'wash'

(52) i-retention

- a. i-γri- > iγri- 'to be with someone'
 b. i-γlu- > iγlu- 'be afraid of'
 c. i-is- > jis- 'call'
 d. i-hijm- > jijm- 'know'

After i-deletion,

- (53) "...there arose the possibility of an objectless use of transitive verbs, as, for instance /lit/. Then /i-/ in such forms as /iγri-/ ceased to act as a pronominal object and was reinterpreted as a prothetic vowel." (Jakobson 1957: 88-89)

This hypothesis explains why fricative-initial nouns do not undergo Hardening (section 4.4.2). Nominal roots did not follow the diachronic path of the transitive verbs. Crucially, fricative-initial nouns are not derived from their plosive-initial counterparts, since there are no such plosive-initial counterparts. This constitutes a critical difference with transitive verbs.

At the same time, fricative-initial nouns escaped the phonotactic restriction that roots should begin with a plosive. This was either because they were marginal in the lexicon, or because they were loanwords borrowed after this phonotactic constraint had lost power.¹³ This made the behavior of fricative-initial nouns in CM a unique one. Alternatively, this is the reason why, among content words, only transitive verbs undergo Hardening.

4.5.1 Plosive-Initial Transitive Verbs

While most of the transitive verbs begin with fricatives for the reason mentioned in the previous section, a small set of such verbs begins with plosives.

- (54) a. pota- 'dry some fish'
 b. kiwr- 'pad footwear with grass'
 c. k^herqo- 'fish with a hook'

These verbs are morphologically analyzed as noun+verb complexes, e.g. /pota-/ < /poti-a-/, where /poti/ is 'a hole made in a fish in order to string it on a stick for drying' and /-a-/ 'to dig across, to make' (Jakobson 1957: 91). These forms were then reanalyzed as simplex forms and subsequently used as transitive verbs. This is obvious from the fact that these verbs subcategorize for an internal argument. As expected, the initial plosives of these verbs undergo Spirantization.

- (55) a. liyi vota-
 salmon dry_fish
 'dry salmon'
- b. ki yiwr-
 footwear adjust_footwear
 'pad footwear with grass'
- c. c^ho xerqo-
 fish take_on_the_hook_for_the_net
 'angle for fish'

¹³ E.g. /seta/ 'sugar', /xo/ 'bottle', /xaza/ 'scissors' (all from Nanai. Kreinovich 1937).

As Jakobson (1957: 91) points out, these transitive verbs are newly formed verbs after i-deletion took place. This is the reason why they begin with plosives in citation forms.

4.6 Problems with Previous Analyses of CM

4.6.1 Introduction

Having observed the basic characteristics of CM, we are now ready to discuss the nature of this process. In particular, we want to know what the driving force behind CM is. Why should it occur and what is its function in the grammar of Nivkh? In pursuing this issue, I will compare the operation of CM with various phonological phenomena in other languages.

In order to narrow down the issue, I focus on the following concrete questions. Each concerns specific aspects of CM.

Question 1: Why do vowels, glides and plosives all trigger the same process (Spirantization) in spite of the fact that they do not form a natural class?

Question 2: Why is Spirantization blocked after fricatives and nasals? And why does Hardening apply in this context?

Question 3: Cross-linguistically, spirantization is triggered by continuants, typically vowels and glides (Kirchner 1998, 2004). However, in Nivkh, plosives trigger Spirantization to the same extent as vowels and glides. How can we account for this fact?

Question 4: There is a cross-linguistic tendency that spirantization targets segments in prosodically weak positions, such as root-final positions, unstressed syllables and affixes (Kirchner 1998, Harris and Urua 2001, Harris 2005). This is attested in many of the world's languages which have lenition processes: e.g. Spanish (Harris 1969), Campidanian Sardinian (Bolognesi 1998) and Ibibio (Harris and Urua 2001). On the other hand, spirantization in prosodically strong positions, such as root-initial, stressed syllables, content words, is rare and if it

happens it implies spirantization in weak position as well (Kirchner 1998, Ségéral and Scheer to appear). This is the case with, for instance, Florentine Italian (Giannelli and Savoia 1979). In contrast, in Nivkh it is the morpheme-initial position which is targeted by Spirantization to the exclusion of medial and final positions. How can we account for this?

As we will see below, some of these questions have already been discussed in the literature. In the subsequent sections, I will begin with considering question 1) and review various approaches to this problem proposed in previous works.

4.6.2 The ‘Natural Class’ Problem

As seen in section 4.2.1 above, Spirantization applies after vowels, glides and plosives. On the other hand, it does not apply after fricatives and nasals. Regarding this grouping of triggering segments, one may ask what the driving force behind Spirantization is, given the fact that segments of the triggering set do not form a natural class.¹⁴ The spreading of [+continuant] from neighboring continuants (mostly vowels), which is the standard autosegmental approach to spirantization (e.g. Padgett 1995), is not applicable since plosives trigger Spirantization to the same extent as vowels do.

In general, spirantization occurs more readily the greater the openness of the flanking segments of the target consonant (Kirchner 1998, 2004). This is a cross-linguistic tendency, and is dubbed the *Aperture Conditioning Generalization* by Kirchner (1998).

(56) The Aperture Conditioning Generalization

Ceteris paribus, if a consonant C lenites when preceding (or following) X, and X' has an aperture greater than or equal to X, then C lenites, to the same extent or to a greater extent, when preceding (or following) X' as well.

(Kirchner 1998: 189)

¹⁴ “No formal statement of Gilyak (Nivkh) lenition has succeeded in stating the set of triggering segments as a natural class.” (Blevins 1993: 1)

Thus lenition is more likely to occur in an [a-plosive-a] sequence than in an [ə-plosive-ə] context since in the former the displacement of the articulator (tongue/jaw) is greater (i.e. must travel further) to reach its constriction target. The idea behind this generalization is that lenition is driven by a phonetic imperative to minimize articulatory effort (Kirchner 1998: 2-3). The greater the displacement involved in a gesture, the greater the force required for the gesture, hence the greater the effort cost thereof. Lenition targets more effortful gestures since “the impetus to lenite more effortful gestures is stronger than the impetus to lenite easier gestures.” (Kirchner 2004: 315)

The openness of the segments is represented in the Aperture Scale below. This scale is based on studies of jaw movements and the typological survey of lenition triggers (Kirchner 1998: 197).

- (57) The Aperture Scale (greater openness > smaller openness)
 low vowels > mid vowels > high vowels > liquids > glides > nasals >
 plosives > strident fricatives ...> full or partial geminate

A typical example of spirantization that follows the Aperture Conditioning Generalization is found in the Dravidian language Shina. In this language, plosives spirantize when the aperture of the flanking segments is greater than or equal to that of [r] (Kirchner 1998: 185, data from Rajapurohit 1983).

- (58) a. baβo ‘father’
 b. səði: ‘monkey’
 c. muɣur ‘bowl’
 d. darβak ‘race’
 e. paɾða ‘veil’
 f. ɣurɣur ‘churning rod’

There is, however, no spirantization after a plosive. This is predicted by the Aperture scale; plosives have smaller openness than [r].

- (59) a. ekbo ‘alone’
 b. səkdər ‘file (tool)’

In contrast, Nivkh Spirantization does not follow the Aperture Conditioning Generalization. The Spirantization context is not proportional to the Aperture Scale, which is defined on the degree of jaw aperture of the flanking segments. Examples like /k^herq snjir/ (< /c^hɲir/) ‘seaweed’ (section 4.2.1) show that Spirantization applies even when the plosive is flanked by a plosive and a nasal. As their low ranking on the Aperture Scale indicates, these segments are not typical lenition-triggers at all.

In the literature, there are roughly three approaches to account for the natural class problem, which I will call the Syntactic approach, the Assimilation-dissimilation approach and the Underspecification approach, respectively. In what follows, I will review these approaches and point out their problems.

4.7 Review of Previous Approaches

4.7.1 The Syntactic Approach

One solution to circumvent the natural class problem is to give up phonological analysis altogether and assigns CM to the morpho-syntax. CM is then the remnant of what once was a productive phonological rule that has fossilized in the morpho-syntax of the language, comparable to the consonant mutations of Celtic languages. Kreinovich, (1937, 1958, 1966), Austerlitz (1990), Watanabe (1992) and Gruzdeva (1997) take such a view (or something close to it). These authors regard CM as a pure syntactic marker that highlights syntactic relations such as modifier-noun or object-predicate. For instance, Watanabe (1992: 185) claims that CM compensates for the lack of overt morphological case marking in Nivkh. Being conditioned syntactically, there is no need for a phonological explanation to account for the fact that the triggering set of segments does not form a natural class.

The problem with this approach, however, is that it overlooks the phonological traits of Spirantization. First, as mentioned in section 4.4.1, Spirantization is sensitive to pause insertion. This is in sharp contrast with consonant mutation in Irish, which is reported not to be sensitive to pause insertion (Rotenberg 1978). In Irish, consonant mutation takes place even when a substantial pause intervenes between the triggering and the target segments.

- (60) Ba.....[dh]ochtuir i
 was doctor her
 ‘She.....was a doctor.’ (Rotenberg 1978: 96)

Pause sensitivity is used as a diagnostic for rule types in theoretical frameworks such as Lexical Phonology (Mohan 1982, etc.) and Prosodic Phonology (Kaisse 1985, 1991, Nespor and Vogel 1986, Hayes 1990, etc.). This difference with Irish is therefore crucial and should not be overlooked.

Second, CM is not restricted to indicate a specific syntactic relation or category. It applies to every morpheme-initial obstruent within a designated domain. Thus the claim that CM demarcates boundaries of words which are in specific syntactic relationship, such as attributive-noun or object-predicate, cannot be generalized to, for instance, CM in suffixes.

Third, in Nivkh there are practically no restrictions on the vocabulary which triggers Spirantization. As seen in section 4.4.3, even recent loanwords from Russian may participate in CM as triggers. Again, this contrasts with Irish, which exhibits severe restrictions on the triggering set of constituents. In Irish, the triggers of consonant mutation are a closed set of items which are typically associated with functional categories, such as complementizers, tense and negative morphemes, determiners and pronominal possessive markers (Duffield 1997).

Fourth, Spirantization is applicable to a wide range of vocabulary in Nivkh. As seen in section 4.4.3, it only excludes recent loanwords. This contrasts with morpho-syntactic processes in other languages such as Rendaku (Sequential Voicing) of Japanese, which is largely limited to native vocabulary (Vance 1987, Ito and Mester 1995, 1999, Takayama 2005, etc). Another difference with Rendaku is that Rendaku has a number of idiosyncratic exceptions (Vance 1987, Ohno 2005) whereas in Nivkh exceptions are either systematic (recent loanwords) or marginal (some verb suffixes, see section 4.3.3), but crucially not idiosyncratic.

To conclude, the syntactic approach fails to capture the main phonological characteristics of Spirantization and groups it mistakenly with consonant mutation in Irish or Rendaku in Japanese, in which morpho-syntax plays an important role.

4.7.2 The Dissimilation-Assimilation Approach

The second approach to CM divides Spirantization into two distinct processes, and seeks solutions for the natural class problem. This approach analyzes CM as consisting of assimilation and dissimilation. Proponents of this analysis assume that Spirantization and Hardening are local phonological processes which apply in order to avoid the clustering of two plosives or two fricatives (Mattissen 1999: 299, 2003: 52-53, Kaneko 1999: 273-274). These are the segmental alternations which occur in plosive-plosive and fricative-fricative clusters. On the other hand, Spirantization after

vowels and glides, and voicing after nasals are considered processes of assimilation. Since dissimilation and assimilation are distinct processes which are triggered by different segments, it is no longer necessary to group plosives with vowels as members of the triggering group of Spirantization. As a result, the natural class problem disappears.

The shortcomings of this approach are the following. First, this analysis divides Spirantization into two processes (assimilation and dissimilation), thereby fails to relate the facts which all instances of Spirantization share. These are i) common outputs (fricative) and ii) common domains of application. Thus in this approach, it is a pure coincidence that both dissimilation and assimilation yield a fricative, and that no other measures are taken to avoid the clustering of plosives or fricatives (such as vowel epenthesis).

Second, this approach fails to explain why Spirantization targets morpheme-initial obstruents but not medial or final ones. The latter option seems more natural, in view of the prosodically non-prominent nature of non-initial positions cross-linguistically. In fact, the initial position of words is the most lenition-inhibiting context cross-linguistically (Harris 1997, Kirchner 1998, Honeybone 2005, Ségéral and Scheer to appear, etc.). The typological implication is that if a language exhibits lenition in strong positions, segments in weak positions should also be targeted by lenition, but not vice versa. Florentine Italian exemplifies such a case. In this dialect, word-initial plosives undergo spirantization when they are preceded by a vowel (61b, d, f). It is therefore expected that plosives in prosodically weaker positions undergo spirantization as well. This prediction is borne out. In medial positions, only fricatives surface (62).

- (61) a. pentola ‘pot’
 b. la fentola ‘the pot’
 c. tavola ‘table’
 d. la θavola ‘the table’
 e. kasa ‘house’
 f. la xasa ‘the house’

- (62) a. kafo ‘head’
 b. praθo ‘meadow’
 c. amixo ‘friend’

(Giannelli and Savoia 1979. Cited from Kirchner 1998: 254)

In fact, it is reported that many Florentine speakers have difficulty in producing voiceless plosives in such medial positions when attempting to imitate Standard Italian (Giannelli and Savoia 1979).

Cypriot Greek exhibits another case of spirantization which targets weak positions. In this dialect, successive plosives are avoided by spirantizing the first plosive of the cluster (Kaisse 1988, 1992). The forms with the plosives can be observed by comparing Cypriot forms with those found in other Greek dialects.

(63)	Cypriot	Standard Greek	
a.	extimo	ektimo	‘I appreciate’
b.	hefta	hepta	‘seven’
c.	skafto	skapto	‘I dig’

Crucially, Cypriot Greek does not repair the plosive clusters by spirantizing the second plosive. This is because the second plosive in a cluster is prevocalic and thus in a strong position. This is in contrast with Nivkh, in which Spirantization targets the second plosive in the cluster. However, the Dissimilation-assimilation approach fails to explain where this difference with Cypriot Greek comes from. Why does Nivkh repair the clustering of plosives by spirantizing the one in strong position (second segment), unlike Cypriot Greek?

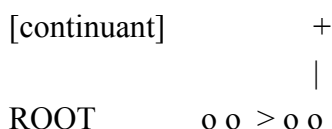
An Optimality Theoretic analysis using positional faithfulness (Beckman 1998) helps to highlight the problem. This framework breaks up faithfulness constraints according to the context, and assumes that the constraint which is associated with prominent position (root-initial, stressed syllable, foot-initial, syllable onset, etc.) is universally high-ranked. While such an analysis correctly captures the prosodic asymmetry between prominent and non-prominent positions, it becomes problematic to handle the type of processes as observed in Nivkh, in which the morpheme-initial position is targeted to the exclusion of medial and final positions (e.g. [mikik foqi] ‘air bladder of dace’ *[miʔiʔ foʔi]). This is a serious problem for the Dissimilation-assimilation approach.

Without linguistically plausible solutions to these problems, the Dissimilation-assimilation approach cannot be accepted as a satisfactory alternative.

4.7.3 Underspecification Approach

Blevins (1993) advocates a third analysis, in which she makes use of underspecification. In order to group the triggering segments as a natural class, she proposes to underspecify the feature [continuant] in plosives and group them with vowels and glides. Spirantization applies when there are successive segments which are not specified for [continuant] at the underlying level. Blevins further assumes that Spirantization is a feature-filling rule which inserts [+continuant] on the second segment (Blevins 1993: 8).

(64) Spirantization



To make this rule work, Blevins assumes the following feature specifications for the consonantal inventory of Nivkh (only the relevant features are shown).

(65)	[consonantal]	[continuant]
Aspirated plosives	/p ^h /	
Non-aspirated plosives	/p/	
Voiceless fricatives	/f/	+
Voiced fricatives	/v/	+
Nasals	/m/	-
Lateral	/l/	(-)
Glides	/j/	-

There are, however, a number of problems with this analysis. First, the underspecification of [continuant] in plosives is not independently motivated in the phonology of Nivkh. Blevins motivates it from the universal markedness of segment types: all languages have plosives, while not all languages have fricatives (Blevins 1993: 6). However, there is no language-internal evidence in Nivkh which supports this underspecification.

Second, this analysis postulates a rule which is language specific. Formulated as in (64), it is hard to see any relation between Nivkh Spirantization and spirantization in other languages. As a consequence, this analysis gives the impression that

Spirantization is an isolated phenomenon with no parallels in the phonological systems of the world's languages.

Third, the Spirantization rule (64) says nothing about the phonological nature of the process. Why should successive segments with unspecified [continuant] features be repaired by the insertion of [+continuant] on the second member? Blevins (1993: 8) admits that this rule is “phonologically odd” and concludes disappointingly that this oddness cannot be explained in synchronic terms (Blevins 1993: 9, footnote 9).

Fourth, her analysis assumes a rule which is sensitive to the absence of feature specification. Although Blevins carefully eschews the use of the term ‘constraint’ and refers to (64) as a “context-sensitive feature filling rule” (Blevins 1993: 9), this rule is practically indistinguishable from an OCP constraint of the type *[0continuant][0continuant]. The existence of constraints (or rules) which are sensitive to the absence of feature specifications (and not their presence) is controversial (cf. Dresher, Piggott and Rice 1994, Inkelas, Orgun and Zoll 1997, Avery and Idsardi 2001, etc.) and such phonological tools should be treated with caution.

This part of her analysis depends on a version of Underspecification theory in which she works with. In this theory, which she calls ‘Relative Underspecification’, it is assumed that negatively specified features and unspecified features can be treated separately in the phonology. This is the reason why Spirantization rule (64) does not apply after nasals. Nasals are specified as [-continuant] and thus behave differently from plosives, which are unspecified for [continuant]. Therefore, both nasals and fricatives (which are specified as [+continuant]) are able to block Spirantization, although they do not share feature specifications and do not form a natural class.

In sum, Blevins’ analysis depends on the assumption that [continuant] expresses a ternary contrast ([+continuant] vs. [-continuant] vs. [0continuant]). Introducing ternary contrasts in the feature system opens the way to an excessively powerful descriptive device and should be avoided (cf. Stanley 1967, Dresher, Piggott and Rice 1994).

4.8 A Unified Account of Spirantization

4.8.1 Introduction

In section 4.6, I laid out the problems which Spirantization poses for current understandings of lenition. In the preceding sections, I reviewed the solutions of previous authors with special emphasis on the ‘natural class’ problem. The three approaches reviewed above differ substantially from each other, and indicate that there

is no agreement on how to capture the process. In particular, these works either gave up on analyzing the phenomenon as a synchronic phonological process (the Syntactic approach and the Underspecification approach), or on treating Spirantization as a unified phenomenon (Dissimilation-assimilation approach).

In this section I propose an alternative analysis which unifies all instances of Spirantization. I will present arguments in support of the hypothesis that CM is a synchronic phonological process which is motivated on perceptual grounds. In particular, I argue that Spirantization is an instance of a perceptually motivated process of lenition, characterized as a phonological operation which degrades information in the speech signal to accentuate the syntagmatic contrast among constituents (Harris and Urua 2001, Harris 2005). In what follows, I will unpack these remarks and show how they answer the problems seen above.

4.8.2 Lenition Degrades Phonetic Information

Harris, in a number of publications on lenition, describes the acoustic events that occur during spirantization as follows (Harris 1997, 2005, Harris and Urua 2001). When plosives undergo spirantization, the closure phase of the plosive is suppressed. In acoustic terms, this implies the loss of abrupt and sustained drop in amplitude from the speech signal. This signal cue characterizes the silent interval during the closure, and is a crucial perceptual cue to perceive and identify the acoustic event as that of a plosive, together with formant transitions and the noise bursts of release. Since spirantization removes such a cue, which is associated with the closure of the plosive, the spirantized segment lacks the selection of cues that are present in the non-spirantized congener. This is illustrated below with an example of the spirantization of a labial plosive [p] to a labial fricative [v]. The signal cues which are present are put in square brackets.

		Signal cue
(66)	a. Labial plosive [p]	[Abrupt and sustained drop in amplitude] [Noise] [Labial spectral pattern]
	b. Labial fricative [v]	[Noise] [Labial spectral pattern]
	Lost signal cue	<Abrupt and sustained drop in amplitude>

For lexical access, the listener has to reconstruct the original non-spirantized segment from the acoustic cues that have survived spirantization. These are the spectral pattern and the continuous noise associated with fricatives.

Since spirantization suppresses a signal cue, the non-spirantized segment is always richer in phonetic content (signal cue) than the spirantized congener. Spirantization is not the only process which suppresses the phonetic content of a segment. If the release burst is suppressed together with abrupt amplitude drop, the output is a frictionless bilabial glide [w], which would involve an instance of vocalization [p]>[w]. Similarly, if the spectral peak is suppressed, debuccalization [ɸ]>[h] occurs. The common denominator of these processes is the loss of perceptual information from the speech signal. This is the reason why Harris unifies these processes (spirantization, vocalization and debuccalization) as instances of lenition, even though they look different from each other on the surface.

4.8.3 Elements

Lenition, defined as information loss, cannot be adequately described using traditional binary systems of phonological features (Harris 1997, 2005, Harris and Urua 2001). In a system of binary features, spirantization is formulated as a feature-changing operation, such as [-continuant] > [+continuant]. This rule simply states a change of feature value and fails to capture the informational asymmetry between the input and output of the process. Binary features are not suitable to capture the observation made above that the informational weight is not identical in the input and output of lenition.

Instead of binary features, Harris proposes to use alternative phonological units which he calls ‘elements’. Unlike features, elements are unary, like the features in MCS (Chapter 3); they are either present or absent. When spirantization occurs, the element [edge], which characterizes the abrupt and sustained drop in overall amplitude, is suppressed (see (68)). The elements [noise] and [rump], which represent aperiodic energy and labial spectral pattern respectively, survive spirantization.

(67)			Elements
a.	Labial plosive	p	[rump, edge, noise]
b.	Labial fricative	ɸ	[rump noise]
c.	Labial approximant	w	[rump]

- (68) Spirantization (suppression of [edge])
[rump, <edge>, noise]

4.8.4 Spirantization as a Perceptually Motivated Process of Lenition

In section 4.8.2, we observed that lenition refers to a number of phonological processes which degrade information from the speech signal. The next question is why signal cue should be suppressed and perceptual information degraded. Harris' answer is the following. The loss of a perceptual cue highlights the informational asymmetry between segments which stand in syntagmatic contrast to each other. The citations below illustrate the point.

- (69) a. "The flow of phonetic information across speech signals is uneven: linguistically significant modulations are of greater magnitude at certain points in time than at others. (...) Segments in strong positions should bear richer feature specifications than segments in weak positions." (Harris 2005: 128)
- b. "Information is not evenly distributed across phonological strings, its occurrence being subject to segmental, prosodic, or morphological conditions. Rich informational content is typically concentrated in positions of prosodic or morphological prominence... Informationally impoverished positions, such as those displaying neutralization, typically occur in contexts that are prosodically weak or morphologically recessive (affixes for example)." (Harris and Urua 2001: 86)
- c. "Positionally sensitive vowel reduction, like consonantal lenition, can be understood as accentuating the syntagmatic contrast between information-heavy prominent syllables and information-light weak syllables." (Harris 2005: 132-133)

Aspiration of English provides an example.

- (70) Aspiration in English is not only paradigmatically informative, acting as the most robust local cue to the 'voice' identity of plosives, but it is also syntagmatically informative to the extent that it adheres to the onset of a stressed syllable and thus demarcates the left edge of a foot." (Harris and Urua 2001: 76)

Another example comes from Ibibio.¹⁵ In this language, non-foot-initial plosives undergo lenition (vocalization) in prevocalic context (Harris and Urua 2001).¹⁶

- (71) a. dip ‘hide’ diβe ‘hide oneself’
 b. deep ‘scratch’ deeβe ‘not scratching’
 c. bɔp ‘tie’ bɔβɔ ‘tie oneself’
 d. bet ‘shut’ bere ‘be shut’
 e. koot ‘call’ kooro ‘not calling’
 f. fɔk ‘cover’ fɔγɔ ‘cover oneself’
 g. faak ‘wedge’ faaya ‘not wedged’
- (72) a. kɔp ‘lock’ kɔβ usɔŋ ‘lock the door’
 b. bet ‘push’ ber owo ‘push someone’
 c. kɔk ‘shut’ kɔγ usɔŋ ‘shut the door’

On the other hand, plosives in foot-initial position are immune to lenition. Thus there is an informational asymmetry with plosives in non-initial position. Crucially, informational asymmetry is realized in a restricted domain in Ibibio, which is the foot. Vocalization is not an automatic process which lenites plosives in every intervocalic context. Foot-initial plosives resist lenition even when they are located in intervocalic contexts as a result of morphological concatenation. The examples below illustrate such a case with prefixation ([] demarcate foot boundaries) (Harris and Urua 2001: 91).

- (73) a. u-[taŋ] *uraŋ ‘plaiting’
 b. u-[kɔp] *uγɔp ‘covering’
 c. i-[tooro] *irooro ‘(s)he is praising’

These examples show that for lenition to occur, the target should be located in a prosodically weak position. There is independent evidence that prefixes lie outside of the foot in Ibibio (Harris and Urua 2001: 87). The blocking of vocalization would be expected if the domain of vocalization were the foot.

¹⁵ A Lower Cross language of the Delta Cross (Benue-Congo) family, spoken in Nigeria.

¹⁶ Tones are omitted from the transcription.

Similarly, plosives which fall outside of the foot do not undergo vocalization either (Harris and Urua 2001: 91).¹⁷

- (74) a. [dappa]-ke *dappaya ‘not dream’
 b. [kɔŋŋɔ]-ke *kɔŋŋɔɔ ‘not unhook’
 c. [damma]-ke *dammaɔ ‘is not crazy’

The domain-sensitive nature of lenition in Ibibio is reminiscent of Nivkh Spirantization. Like vocalization in Ibibio, Spirantization is not an automatic process; it strictly occurs within the specific domain which is defined syntactically (specifier-head (NP)/complement-head(VP)). This domain is strictly observed even in faster speech rate, unlike lenition in Florentine Italian. This observation leads us to conclude that Spirantization is not an articulatory motivated process (Kirchner 1998, 2004), but that it is perceptually motivated, like vocalization in Ibibio. Spirantization diminishes perceptual cues from the speech signal. When combined, domain-sensitivity and information loss function in a way which Harris characterized as the fundamental motivation of lenition; the accentuation of syntagmatic contrast. From this point of view, the lenition processes in Ibibio and Nivkh are identical. In Nivkh, the domain of Spirantization is larger than in Ibibio (the units which are syntagmatically contrasted are also larger, as we will see below). But crucially, it shares with Ibibio the generalization that i) lenition degrades information from the speech signal, and ii) lenition operates within a specific informational domain.

The analysis that Spirantization is lenition is supported independently by the fact that it yields non-strident fricatives. Being an information-degrading operation, lenition is supposed to yield non-strident fricatives instead of strident fricatives, which are rich in phonetic information (Harris and Urua 2001). The measurements conducted by the Russian phoneticians report that the frication of Nivkh fricatives is extremely weak (Zinder and Matusevich 1937, Rushchakov 1981). This matches my own impression. During the interviews with the consultants, I often heard a labio-velar approximant [w], which is reported not to occur in onset positions in WSN (Chapter 2). Later on, I found that this sound corresponds to [v]. This impression is shared by Zinder and Matusevich who note that the dental articulation of [v] is very weak (Zinder and Matusevich 1937: 119).

¹⁷ Vowels within the foot exhibit vowel harmony.

4.8.5 Informational Asymmetry: the Units

In Nivkh, Spirantization creates informational asymmetry in the designated syntactic domain, which is specifier-head (NP) and complement-head (VP). Within these informational domains, the initial morpheme does not undergo Spirantization while the remaining non-initial morphemes may be targeted by Spirantization. Clearly, there is an informational asymmetry between the domain-initial morpheme and the remaining non-initial morphemes. By spirantizing the initial plosives of the latter, the domain-initial morpheme is contrastively highlighted.

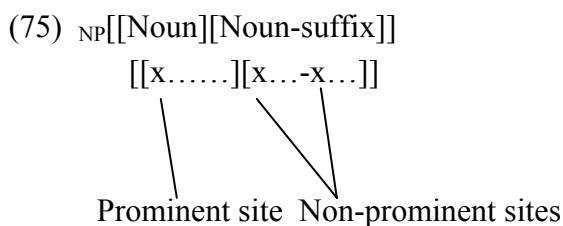
In this respect, the differences between Spirantization and vocalization in Ibibio are interesting and are worth pointing out. First, Spirantization has a larger domain than vocalization. In Spirantization the maximal domain of application is the domain that spans the syntactic constituents complement-head (VP) or specifier-head (NP). In Ibibio it is the foot. Second, and most importantly, Spirantization is sensitive to domain-internal (morpheme) junctures while vocalization in Ibibio is not. In the current analysis, this difference is captured as the difference in the units which enter the syntagmatic contrast. In Nivkh, informational asymmetry is realized among morphemes, as is obvious from the fact that Spirantization targets only morpheme-initial segments. It does not target every plosive within its domain. This is obvious from the fact that it exhibits non-derived environment blocking (section 4.3), and is exemplified in the existence of words such as [mɪkɪk foqi] ‘air bladder of dace’ from [p^hoqi] ‘air bladder’. If Spirantization were not sensitive to domain-internal morpheme junctures and applied ‘across-the-board’, it would yield a form like *[mɪɣɪɣ foɕɪ]. This is not what we observe.

On the other hand, in Ibibio, informational asymmetry is realized between the foot-initial segment and every non-foot-initial segment. Within the foot, vocalization is not sensitive to any juncture. This contrasts with Spirantization, which is sensitive to internal junctures within its informational domain. In the traditional way of description of phonological processes, Spirantization should be classified as a ‘cyclic’ process, in the sense that it applies successively to each morpheme within a specific domain (NP, VP).

Cyclic application is problematic in much of the previous literature which deals with lenition. Most works deal only with lenition processes which apply non-cyclically. These are lenitions which typically target non-initial positions, to the exclusion of the prosodically prominent word-initial positions. In addition, it is also often the case that such processes expand the domain of application in proportion to speech rate; in faster speech, the domain becomes larger and/or the type of lenition

becomes radical (debuccalization, or the segment drops entirely). This is observed in lenition in the Italian dialects. On the other hand, Nivkh exhibits the opposite case. Spirantization targets initial position of morphemes to the exclusion of non-initial position. In addition, it does not expand its domain in proportion to speech rate.

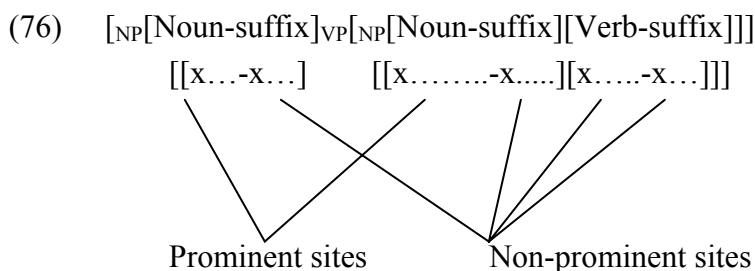
My proposal is that lenitions which are sensitive to domain-internal junctures differ from lenitions which are insensitive to these junctures with respect to the units which are syntagmatically contrasted. While in the latter case it is each position within a specific domain which are contrasted, in the former it is morphemes (content words, suffixes, particles). This means that in Spirantization, the initial plosive of the CM domain fails to undergo lenition not because it is word-initial, but because it is in the most prominent position of this domain. On the other hand, the initial segments of non-initial morphemes are in weak positions and may be targeted by Spirantization, even though they are morpheme-initial. This is schematically illustrated below.



Since NPs constitute Spirantization domains, each non-initial morpheme enters the syntagmatic contrast by spirantizing the initial plosive. Suffixes never begin a CM domain. Therefore, Spirantization always applies to the initial position of a suffix whenever it can.

In a transitive structure, the subject is separated from the object-predicate cluster which constitutes a CM domain by itself.¹⁸ In this structure, there are two prominent positions: the initial positions of the subject and the object. On the other hand, the initial plosive of the transitive verb is embedded in the complement-head domain (VP) and may be targeted by Spirantization (recall the examples in section 4.5.1).

¹⁸ Subjects constitute separate prosodic domains in many sandhi phenomena, such as in tone sandhi in Ewe (Clements 1978), obstruent voicing in Korean (Cho 1990) and vowel shortening in Kimatuumbi (Odden 1990).



4.8.6 Advantages of the Lenition Approach

The current approach has a number of advantages over previous analyses. Notably, it succeeds in explaining many of the peculiarities of CM which were pointed out in section 4.6.1 above.

First, it explains why the target is restricted to morpheme-initial positions to the exclusion of medial and final positions. In the current analysis, this is because the units which enter the syntagmatic contrast are morphemes. Segments in medial and final position do not undergo Spirantization, since they are irrelevant for the contrast among morphemes. Medial and final positions are typically targets in lenition processes which apply across-the-board within a specific domain. This is exemplified, for instance, in Florentine Italian,¹⁹ and most of the lenition processes discussed in Kirchner's dissertation (Kirchner 1998).

Second, the current approach does not face the natural class problem. Since Spirantization is motivated by perceptual demands (accentuating syntagmatic contrast), there is no need to group the triggering set of segments (vowels, glide, plosives) as a natural class. This is because in the current approach Spirantization is not a local process which occurs between adjacent triggers and targets. Plosives undergo Spirantization when they are in informationally light positions and not because they are preceded by vowels, glides or plosives. In this sense, there is no specific segment or group of segments which trigger Spirantization.²⁰

Third, the current approach does not violate Kirchner's Aperture condition (section 4.6.2). This condition is defined in articulatory terms. The perceptually motivated analysis of lenition does not challenge generalizations which are defined in articulatory terms.

¹⁹ Nespor and Vogel (1982) assume the domain of spirantization of Florentine Italian to be the Intonational Phrase.

²⁰ Spirantization is blocked, however, by a specific group of segments (fricatives and nasals) as mentioned earlier. These contexts will be taken up in section 4.9 below.

Fourth, the current approach succeeds in explaining the difference with Irish with respect to sensitivity to pause insertions. Pause-sensitivity characterizes the phonological nature of Spirantization. It indicates that when prosodic and syntactic domains do not coincide, it is the prosodic domain to which the process gives priority. This is a characteristic shared by many of the phonological processes in the world's languages which apply in relatively large prosodic domains (Nepor and Vogel 1986, several contributors to Ewen and Anderson 1987, and Inkelas and Zec 1990, among others).

On the other hand, mutation in Irish is not sensitive to pause insertions (Rotenberg 1978 and section 4.7.1 above). This is because consonant mutation in the Celtic languages is not phonologically motivated (Grijzenhout 1995, Duffield 1997, Jaskuła to appear, etc.). Rather, it marks certain syntactic and morphological categories by means of phonological alternations (cf. Rotenberg 1978 on Irish). In contrast, characteristics such as pause-sensitivity indicate that Nivkh Spirantization is a phonological process. It is used to demarcate syntactic domains, but crucially, not morphosyntactic categories. This constitutes a crucial difference with consonant mutation in Celtic.

4.9 Blocking of Spirantization and the Application of Hardening

Spirantization does not target morpheme-initial plosives in all phonological contexts. As seen in section 4.2.1, it does not apply after fricatives and nasals. At the same time, these are the contexts where Hardening is triggered. In what follows, I will examine segmental alternations in similar contexts in other languages, and discuss why segments surface in the way they are on the surface. The discussions reveal that the segmental alternations in these contexts are local, i.e. triggered by the interaction of adjacent segments. This is in contrast with Spirantization, which I argued to be a non-local process in the above sections.

4.9.1 Post-Fricative Context

Cross-linguistically, successive fricatives tend to be disfavored as outputs of phonological processes. In what follows, I introduce such cases.

In Polish, spirantization is blocked if it would result in successive fricatives (Łubowicz 2002).

- (77) dronǰ+ek > dron[ʒ]ek ‘pole (diminutive)’
 Cf. róžǰ+ek > róžjek *róžž+ek ‘brain (diminutive)’
 ǰ= postalveolar affricate, ʒ= postalveolar fricative

In English, there is the sporadically observed hardening of [θ] to [t] when it follows a fricative: [sikst] ‘sixth’, [twɛlft] ‘twelfth’ (Boersma 1998: 434).

The problem with successive fricatives has a perceptual basis. The cues in aperiodic signals are highly vulnerable and easily masked by other aperiodic noise (Wright 2004: 45).

On the other hand, fricative+plosive clusters preserve auditory cues much better. In such a cluster the offset frequency of the fricative spectrum serves as a cue to the place of articulation of the following plosive (Wright 2004: 38).

From these observations, I conclude that the post-fricative context blocks Spirantization for perceptual reasons. Successive fricatives yield weak auditory cues as compared to fricative+plosive clusters. This is an instance of dissimilation, disfavoring identical manner of articulation in successive fricatives. This dissimilation, however, is not operational in all lexical items. As seen in section 4.4.2, fricative-initial nouns never undergo Hardening. In such a context there is no other option except to yield the perceptually disfavored fricative+fricative clusters.

The current approach incorporates the dissimilation of adjacent fricatives in the following way. As discussed above, Spirantization applies to domain-internal morpheme junctures and creates informational asymmetry among morphemes within the domain. However, in case Spirantization leads to outputs that are extremely weak in auditory cues due to the local phonological environment (successive fricatives), it fails to apply and an alternative output with a stronger auditory cue is selected. Likewise, the same perceptual motivation triggers Hardening in the appropriate morpho-syntactic context.

This option is available only across morpheme boundaries. In monomorphemic words, we observe a number of examples with successive fricatives both medially and finally.

- (78) a. aʏri ‘spit’ (FN)
 b. covʌaj ‘wooden bowl’ (Pukhta 2002: 58)

	c.	ɲæŋi	‘shoulder’	(Pukhta 2002: 68)
(79)	a.	hays	‘clothes’	(FN)
	b.	taɤs	‘ornament’	(FN)
	c.	pivs	‘pestle’	(Pukhta 2002: 58)
	d.	luvɾ	‘spoon’	(Pukhta 2002: 58)
	e.	livs	‘dish’	(Pukhta 2002: 58)

In derived environments, successive fricatives surface in the following two contexts; i) when the fricative is part of a nominal stem (section 4.4.2), and ii) when the fricatives are part of morphemes which belong to different CM domains.

To conclude, what we observe in the post-fricative context is the result of a conflict between two opposing requirements; lenition (degrading of information) and preservation of auditory cues. In this particular context, the latter one wins.

4.9.2 Post-Nasal Context

The second context in which Spirantization fails to apply and Hardening is triggered is after nasals (section 4.2.1). But before discussing this context, I would like to emphasize once again that the nasal+plosive cluster surfaces irrespective of whether these segments are homorganic or not (/pilavon q^hal/ [pɪlavon q^hal] ‘the clan of Pilavon’). We emphasize this because cross-linguistically, homorganic nasal+plosive clusters tend to block spirantization. This is reported, for instance, in Spanish (Harris 1969) and Liverpool English (Honeybone 2005). In these languages, plosives that constitute part of geminate and/or a homorganic nasal+plosive cluster resist spirantization. In Spanish, spirantization of the voiced plosive is blocked in the latter context: *a Barcelona* [aβarθelona] but *en Barcelona* [embarθelona] (Honeybone 2005: 187). Liverpool English spirantizes non-initial [t, k]: e.g. *book* with a final [x] and *city* with a medial [θ]. In nasal+plosive clusters, however, spirantization is incomplete: *moment* with a final [tθ] and *inconvenience* with a postnasal [kx] are the preferred forms (Honeybone 2005: 182). On the other hand, in Nivkh, a nasal+plosive cluster needs not be homorganic to block Spirantization; any nasal+plosive cluster does so. This refutes an analysis which attributes the blocking of Spirantization to ‘(partial) geminate inalterability’ (Hayes 1986, Kirchner 1998, Honeybone 2005).

Similarly, the blocking cannot be due to the Nasal/Continuant Marking Condition of Padgett (1995). According to this condition, nasal+fricative clusters are disfavored for the following reason. While nasals frequently place-assimilate to a following plosive, they rarely assimilate to a following fricative: e.g. *impossible* but *infamous*, instead of **infamous*. According to Padgett, this is because place assimilation implies stricture assimilation. Thus, when a nasal assimilates to the place node of the following segment, it will automatically assimilate to the stricture node as well. Accordingly, assimilation to a fricative yields a nasalized fricative, a phonologically highly marked segment. This is the reason why in nasal+fricative contexts, languages show diverse outputs: no assimilation (English, see above), default place assignment (Polish), or deletion of the nasal (Zoque, Lithuanian). According to Padgett, these are all strategies to prevent nasalized fricatives.

Again, this is not a viable analysis for Nivkh. In Nivkh, Spirantization is blocked independently of place assimilation. Obviously, the clustering of nasals and fricatives should be disfavored for another reason. The lack of homorganicity between the nasal and the fricative indicates that an articulatory account is not promising.

As a first observation, it should be pointed out that nasals are the most typical segments which induce voicing of the following (lenis) plosive in WSN (Chapter 2 and 3). Thus, in discussing the phonological events that occur in post-nasal contexts, it seems promising to focus on this characteristic of the nasals.

In Nivkh, voiced plosives hardly ever occur in word-initial position. It is reported that initial voiced plosives occur only in names (80) or in affective-expressive forms (81) (Kreinovich 1937: 81-82, Panfilov 1962: 7, Mattissen 2003: 73).

- | | | | |
|------|----|-------------------|--------|
| (80) | a. | Benik | |
| | b. | Dun | |
| | c. | Gudan | |
| | | | |
| (81) | a. | bilkir- < pilkir- | ‘big’ |
| | b. | duzla- < tuzla- | ‘cold’ |

On the basis of this restricted distribution of voiced plosives, Mattissen points out that voiced plosives are an indication of medial position (Mattissen 2003: 74). This assumption is compatible with the current approach, if we conceive of voicing as an instance of lenition. In fact, voiced plosives are even better signals of medial position than fricatives: while fricatives occur word-initially (at least in Contemporary Nivkh), the initial occurrence of voiced plosives is rare. The use of voiced plosives as a cue to signal medial position is, however, restricted, because in order to undergo voicing,

plosives should be preceded by sonorants, notably nasals (Chapter 3). The blocking of Spirantization after nasals indicates that whenever a voiced plosive is available in the phonological environment, it is selected in preference to the fricative, the former being a more suitable cue of medial position than the latter. I assume that it is this perceptual motivation which blocks lenis plosives from undergoing Spirantization after nasals. Or, put differently, in this context lenition takes the form of voicing instead of Spirantization.

The case with aspirated plosives requires a different explanation. Aspirated plosives do not undergo voicing and thus cannot signal medial position in the way lenis plosives do. Yet they resist Spirantization (section 4.2.1).

The key lies, again, in the voicing effect of nasals. The post-nasal context is a voicing-inducing context cross-linguistically (cf. Pater 1999 and references therein). As seen above, Nivkh is not an exception to this tendency. This voicing, however, does not neutralize the laryngeal contrast between fortis and lenis obstruents (Chapter 3). The maintenance of a laryngeal contrast in such a voicing-inducing context does not come for free, however. It is reported that languages which maintain a laryngeal contrast in post-nasal contexts adopt special measures to protect the voicelessness of plosives. Hayes and Stivers (in progress) compared the pronunciation of nasal+plosive clusters of the pseudo-words *tompa* and *tomba* of English speakers in an experiment and observed that in /mp/ the nasal was (relatively) short and the plosive long, whereas in /mb/ the nasal was long and the plosive short. From this observation, they conclude that the greater length of the plosive in /mp/ relative to /mb/ is an important factor in maintaining the perception of the voicelessness of /p/. Another means of resisting voicing that they found was aspiration (vocal cord abduction). The plosive of /mp/ had a significantly longer voice onset time than the plosive in /rp/ (in the pseudo-word *tarpa*). Hayes and Stivers assume that aspiration is a speaker-specific strategy in English to maintain the voicelessness of /p/ (Hayes and Stivers in progress: 30).

Hayes and Stivers' point is that voicing is preferred after nasals in all languages which have nasal+plosive clusters, and that this voicing is a threat to those languages which have a laryngeal contrast in this position. The result is that some languages give up on maintaining the laryngeal contrast (as in the native Yamato vocabulary of Japanese). English maintains the contrast by the enhancement strategies mentioned above: durational adjustment and aspiration. Nivkh patterns with English in maintaining a laryngeal contrast after nasals. Although no measurements were conducted, it is highly possible that Nivkh has enhancement strategies like English to over-differentiate the laryngeal contrast in post-nasal context. This is especially likely since Nivkh, like English, is an aspiration language (Chapter 3).

In general, fricatives are less suited to bear a laryngeal contrast than plosives (Steriade 1993, Avery 1996, Jansen 2004). Fricatives have relatively restricted phonetic means of expressing laryngeal contrast as compared to plosives. The continuous airflow across an oral constriction required for the production of fricative noise puts inherent limitations on the number of laryngeal actions and configurations that are available (Jansen 2004: 83). The inferiority of fricatives in exercising a laryngeal contrast as compared to plosives is typologically confirmed. According to Jansen (2004: 79-80), the UCLA Phonetic Segment Inventory Database (UPSID, 1984 version) counts 236 (74.4%) languages out of 317 languages which have a laryngeal contrast (based on some sort of VOT distinction) in plosives, but only 119 (40.5%) of the languages have a laryngeal contrast in fricatives. This suggests that laryngeal contrast (supported by voicing distinctions) is less stable in fricatives than in plain stops (Jansen 2004: 80).

From these observations, I conclude that Spirantization is blocked in the post-nasal context in order to maintain the laryngeal contrast. The voicing associated with nasals provides a constant pressure to the following obstruent to undergo voicing. To counterbalance this pressure and protect the laryngeal contrast, plosives fare better than fricatives. By not spirantizing the plosive, the laryngeal contrast maintains the rich phonetic means which are available in plosives (VOT, presence and relative amplitude of aspiration noise and release burst) but not in fricatives.

To conclude, the conflict here is between a syntagmatic contrast (lenition) and a paradigmatic contrast (maintain laryngeal contrast). The data show that it is the paradigmatic requirement that wins in this context.

4.9.3 Summary

We account for the two contexts in which Spirantization and Hardening conspire to yield the same sequences of segments, which are fricative+plosive and nasal+plosive, in the following way: these sequences surface due to perceptual demands which operate on local basis (i.e. between adjacent segments). The disfavored outputs are fricative+fricative and nasal+fricative clusters. The former is avoided because of the weak auditory cues which successive fricatives yield. This is an instance of dissimilation. The latter cluster is avoided for perceptual reasons as well. A nasal induces voicing of the following plosive. Since voiced plosives are better cues for domain-internal positions, voicing is preferred in this context. At the same time, voicing is a threat for the maintenance of laryngeal contrast. Since plosives are more suited to resist voicing from the nasal than fricatives, and to bear laryngeal contrast in

general, they are selected as outputs. In both contexts, the preferred outputs appear for local perceptual reasons.

4.10 Hardening: How to Account for the Exceptions

In the previous sections, we saw that transitive verbs are the only targets of Hardening among content words. When preceded by a complement, it is predictable from the phonological context whether the initial obstruent of the verb is a plosive or fricative. In other words, the contrast between a plosive and a fricative is neutralized in this context. A plosive is the preferred output when the preceding segment is either a nasal or a fricative. When preceded by a vowel, a glide or a plosive, transitive verbs surface with an initial fricative. Since the citation form of many of the transitive verbs begins with a fricative for historical reasons (section 4.5), we identified the appearance of plosive-initial forms in the relevant context as a result of Hardening.

On the other hand, fricative-initial nouns do not undergo Hardening in the phonological context in which transitive verbs undergo Hardening (section 4.4.2). In fact, fricative-initial nouns never exhibit Hardening in any context. In section 4.5, we saw that this asymmetry had an historical origin. Fricative-initial transitive verbs are considered to be derived historically from plosive-initial forms by the attachment of the indefinite pronominal prefix *i-/e-* (Jakobson 1957, Austerlitz 1977). In many cases, these plosive-initial forms were the intransitive counterparts of transitive verbs (section 4.5).

In contrast, nouns did not undergo such a derivation. Unlike transitive verbs, fricative-initial nouns did not derive from plosive-initial forms. This crucial difference between the transitive verbs and nouns led to their different behavior with respect to Hardening. The question is how to account for this difference, which has an historical origin, in the synchronic analysis.

There are two ways of describing this noun/verb asymmetry in previous literature. One sort of description is to stipulate that fricative-initial nouns are exceptions to Hardening (e.g. Kreinovich 1937: 64, Panfilov 1962: 15, Gruzdeva 1997: 89, Mattissen 2003: 49). Another way of description is to make use of ‘prespecification’,²¹ and to manipulate the underlying form of transitive verbs. In this approach, transitive verbs

²¹ ‘Precompilation’ is a similar notion used by Hayes (1990). Nivkh CM (thus both Spirantization and Hardening), however, differs from typical cases of precompiled phrasal processes discussed by Hayes. For instance, a typical precompiled process is not sensitive to pause insertions (Hayes 1990: 107), whereas Nivkh CM is (section 4.4.1).

are regarded as ‘exceptions’ which solely undergo Hardening (Blevins 1993, Shiraishi 2000). This analysis follows the diachronic development of transitive verbs (section 4.5), and assumes that transitive verbs begin with a plosive at the underlying level. As a consequence, transitive verbs behave like plosive-initial nouns: they undergo Spirantization when preceded by a vowel, a glide or a plosive, but when preceded by a nasal or a fricative, they surface with an initial plosive. This is illustrated below.

(82) Derivation of transitive verbs

Underlying form	/q ^h a/	‘shoot’	(Cf. citation form /χa-/)
a.	c ^h xif q ^h a	‘shoot a bear’	
b.	ŋa χa-	‘shoot an animal’	

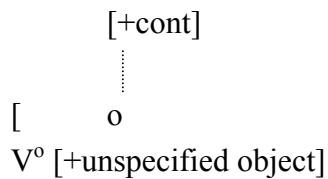
(83) Derivation of Nouns

Underlying form	/pɪjɲx/	‘soup’	(Cf. citation form /pɪjɲx/)
a.	c ^h xif pɪjɲx	‘bear soup’	
b.	c ^h o vɪjɲx	‘fish soup’	

As a consequence of such a prespecification, this analysis eschews Hardening, refusing it any status in Nivkh phonology. In order to derive the surface forms, only Spirantization is needed. Like nouns, the only process which transitive verbs undergo is Spirantization. Since the underlying form of the transitive verbs begins with a plosive, there is no need to postulate a process of Hardening in order to account for the plosive-initial forms which appear after nasals and fricatives. In other words, plosive-initial forms do not surface as a result of Hardening, but are regarded as the underlying forms. Thus what looks like the result of Hardening on the surface is in fact the result of the blocking of Spirantization.

Note that this analysis postulates different forms for the underlying and the citation forms of the transitive verbs. The latter is derived by a rule which spirantizes the initial plosive of the transitive verbs. Crucially, this rule targets only transitive verbs. It applies when the transitive verb lacks an overt complement, and signals that the complement is an unspecified object ‘someone/something’. Blevins (1993) expresses this as an addition of the lexical feature [+unspecified object] in her rule of Verb spirantization.

(84) Verb spirantization (Blevins 1993)



The prespecification approach explains the noun-verb asymmetry in the following way. Since there is no process of Hardening, there is no way for the initial fricatives of nouns to change to plosives even in contexts where fricatives are the disliked outputs (section 4.4.2). What we observe as CM on the surface is thus the result of either Spirantization or the blocking of it. There is no active process of Hardening which changes fricatives to plosives. Accordingly, there is no need for a rule-specific stipulation which states that fricative-initial nouns are systematic exception to Hardening.

From the known empirical facts on the phenomenon, it is difficult to evaluate the adequacy of the two approaches. Both approaches stipulate in the grammar that there are exceptional items (exceptions to a rule, or exceptionally prespecified items), and are therefore indistinguishable on that point. It goes without saying that an analysis without any stipulation is desirable. Such an analysis seems possible, since the exceptions to Hardening are not arbitrary but systematic in Nivkh. The exceptional items of Hardening are the nouns. Likewise, in the prespecification approach, the lexical items which undergo prespecification are transitive verbs, and not an arbitrary set of lexical items. I will leave this issue for future research.²²

4.11 Conclusion

In this chapter I advocated an analysis which regards CM as a perceptually motivated process. Like processes such as vocalization and debuccalization, spirantization diminishes perceptual information from the speech signal, thereby creating informational asymmetry within a specific domain. In Nivkh, Spirantization targets every initial position of a non-initial morpheme within the designated syntactic domain. As a result of this operation, segments in domain-initial positions are contrastively

²² Shiraishi (2004a) proposes an analysis of Hardening which attempts to avoid morpheme-specific stipulations.

emphasized. Seen from this perspective, Spirantization is a non-local process in the sense that it has no specific segments as triggers.

On the other hand, there are also contexts in which Spirantization fails to apply. Since these are exactly those contexts in which Hardening applies, it is obvious that the two processes conspire to achieve the same sequence of segments. These are the contexts where fricatives are disliked for perceptual reasons. As a result, it is plosives which surface in these contexts, either as a result of Hardening or the blocking of Spirantization.

The overall picture of CM should now be clear. CM involves local and non-local processes, which are both perceptually motivated. Spirantization is a non-local process, which applies in order to create informational asymmetry among morphemes within a specific domain. However, it fails to apply if its application would create perceptually problematic sequences of segments. At the same time, Hardening applies in the same contexts in order to repair problematic sequences of segments. The current analysis captures this conspiracy of Spirantization and Hardening as an interaction of local and non-local perceptual demands. Accordingly, we maintain the view that Nivkh CM is a perceptually motivated process.