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RESEARCH

On the historical source of *a* ~ *u* alternations in Dëne Sųłiné optative paradigms

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In most dialects of Dëne Sųłiné, the optative prefix, reconstructed in Proto Dene as **ɢʷə* (Krauss 1969), exhibits an alternation in verb paradigms: an *a*-vowel is found in the 1st and 3rd person singular forms (*ɣʷa, wa*, or *ha,* depending on the dialect), while an *u*-vowel is found elsewhere (*ɣʷu, wu, hu*). This alternation raises three questions. First, how could the same consonant **ɢʷ* trigger both raising and lowering of the following vowel? Secondly, what phonological factors conditioned this alternation historically? And finally, does this alternation still belong to the synchronic phonology of modern Dëne Sųłiné dialects?

In this paper, I will explore what insights the Contrastivist Hypothesis (CH) (Hall 2007, Dresher 2009) can add to our understanding of this alternation. Representationally, the CH makes it possible to describe lowering to *a* as spreading of [low], while raising to *u* involves spreading of [round]. I propose that the choice of which process applied in which forms depended on prosodic factors. In addition, I show what insights the CH can contribute to internal reconstruction. Specifically, I argue that, under the CH, spreading of [low] cannot be a part of the modern synchronic phonology of Dëne Sųłiné, but rather originated at a time before a series of consonant shifts occurred in the language, in particular when the *retroflex* series was still part of the consonant inventory.

Keywords: Dëne Sųłiné; Dene (Athabaskan); historical linguistics; contrast

1 Introduction: Contrast and Internal Reconstruction

The Contrastivist Hypothesis (Hall 2007, Dresher 2009) states that phonological grammars only operate on those features which are necessary to distinguish the phonemes of a language from one another. The main empirical prediction of this hypothesis, when applied to synchronic phonology, is that the set of phonological processes that are active in a given language will be to some extent predictable based on the phonemic inventory of the language. For example, a process which spreads the vocalic feature [high] from a consonant onto a neighbouring vowel is predicted to be possible only if the feature [high] is contrastive as part of the consonant system (for example, to distinguish palatalized [kʲ] from non-palatalized [k]).

In the realm of diachronic linguistics, Oxford (2015) has shown that the Contrastivist Hypothesis can predict possible pathways of sound change within a language family—in particular which pairs of phonemes are likely to undergo merger (2015: 317). In this paper, I will apply the Contrastivist Hypothesis (CH) to a very different type of historical problem: a problem of internal reconstruction. I propose that it is possible to use modern surface alternations to deduce the phonemic inventory and the set of contrastive relations that existed in a language historically. In the case we will be examining, most dialects of Dëne Sųłiné exhibit an alternation between two different vowels in the optative—vowels

which are represented orthographically as *a* and *u*. I propose that this alternation involved the spreading of the features [low] and [round] from the preceding consonant, in different prosodic environments. Following the CH, we may therefore deduce that the features [low] and [round] were contrastive as part of the consonant system, at the time this alternation arose historically. Ultimately this method can inform our reconstruction of the consonant system which existed at an earlier stage of the language. In particular, this leads us to the conclusion that these vowel alternations originated at a time when the Proto Dene *retroflex* series was still part of the consonant inventory of the language.

Dëne Sųłiné is a Dene (Athabaskan) language spoken in northern Canada. With the exception of the Tetsǫ́t'ıné dialect (Jaker & Cardinal under review), all dialects of Dëne Sųłiné exhibit an alternation between two different vowels in optative paradigms, which are usually written as *a* and *u* (LeGoff 1889, Li 1946, Cook 2004). In this paper, I will interpret these vowels phonetically as [ʌ] and [uː], which I will assume bear the features [low] and [round], respectively. Since previously published sources (Li 1946, Cook 2004) constitute the main source of data for this paper, we will begin by considering data from these sources, in the authors' own transcription systems.[1] In Table 1 I provide optative paradigms from Li and Cook. Li's data are from speaker François Mandeville, collected at Fort Chipewyan, Alberta, in the summer of 1928. Cook's paradigms in Table 1 are labelled as simply "A" and "B" in the original source; however we can infer that these are most likely northern Saskatchewan and Fort Resolution, respectively, based on data he provides elsewhere.

In comparing the forms in Table 1, there are two main features which stand out as systematic differences between the dialects. The first is the 3rd person plural form: in the dialect recorded by Li, this form has an *u* vowel with a length mark (*huˑtsaɣ*), whereas in both Dialect A and Dialect B, as recorded by Cook, this form has an *a* vowel (*hewajën, hehajën*). The other main difference is in the initial consonant of the optative prefix: in Li it is consistently *ɣw*, except in the 3rd person plural, whereas in Cook's Dialect A it is *w*, while in Dialect B it is *h*. Apart from these differences, however, we can also discern a basic vowel alternation pattern common to all the dialects, which is to have an *a* vowel in the 1sg and 3sg forms, and an *u* vowel in the 2sg, 1pl, and 2pl forms. What is the source of this alternation?

Table 1: Vowel alternations in optative paradigms, according to Li (1946) and Cook (2004).

	Optative of *hetsagh* 'cry' (Li 1946: 413)	**Optative of *hejën* 'sing', Dialect A (Cook 2004: 44)**	**Optative of *hejën* 'sing', Dialect B (Cook 2004: 44)**
1st person sg	**ɣwa**stsaɣ	**was**jën	**has**jën
2nd person sg	**ɣwų**tsaɣ	**wų**jën	**hų**jën
3rd person sg	**ɣwa**tsaɣ	**wa**jën	**ha**jën
1st person pl	**ɣwú**ˑtsaɣ	**wú**jën	**hú**jën
2nd person pl	**ɣwuh**tsaɣ	**wuh**jën	**huh**jën
3rd person pl	**hu**ˑtsaɣ	**hewa**jën	**heha**jën

[1] When citing data from previously published sources, I have retained the authors' original transcription system. In my analyses, the transcription I use is based on IPA, with two exceptions (following convention for the Dene language family). First, I represent nasality as a nasal hook under the vowel <ą> rather than a tilde over the vowel <ã>. Second, I represent the three laryngeal series for stops and affricates, the 'aspirate', 'plain', and 'ejective' consonants, as <k>, <g>, and <k'>, respectively; in a more narrow transcription, these would be [kˣ], [k], and [k'], respectively. In Cook's orthography in (1), the consonant *j* represents an alveo-palatal affricate [dʒ], while *ë* represents a reduced, mid, front-central vowel [ə] or [ɛ]. Cook also uses <th> for [θ], <dh> for [ð], and <gh> for [ɣ].

I propose that, at an earlier stage of the language, which in this paper I will call "Pre-Dëne Sųłiné", this alternation was prosodically conditioned. Specifically, I propose that the optative prefix exhibited two different surface grades: a *strong grade* and a *weak grade*, as shown in Figure 1 (in IPA transcription). Therefore, I claim that forms with the *u* vowel in them in the modern language are reflexes of the strong grade of the optative, while the modern forms with *a* in them are reflexes of the weak grade. Formally, I will propose that the labio-uvular segment **ʁʷ* in Pre-Dëne Sųłiné was specified as both [round] and [low]; lowering from *ɛ* to *ʌ* (in the weak grade) involved spreading of the feature [low], while raising from *ɛ* to *uː* (in the strong grade) involved spreading and de-linking of the feature [round] (§3.3).

Many of the basic descriptive generalizations upon which this proposal rests have been controversial in the literature. These include the reconstructed form of the optative prefix (§2.1), the reconstructed forms of some of the subject agreement markers (§2.2), as well as the Dëne Sųłiné vowel inventory, both historically as well as in the modern language (§3.2). Furthermore, it is known that Dëne Sųłiné, like many other Dene languages, underwent a chain-shift in the place of articulation of several consonant series (Krauss 1982). This potentially adds another dimension of uncertainty to reconstructing Pre-Dëne Sųłiné, since one does not know, a priori, whether the strong ~ weak alternation depicted in Figure 1 originated before or after this consonant shift.

By adopting the CH, I hope to offer a new perspective on many of these questions. Regarding the vowel system, the analysis I will present, of Pre-Dëne Sųłiné, relies heavily on the existence of a contrast between *full* and *reduced* vowels—essentially a contrast between long and short vowels, respectively, which existed in Proto Dene (Krauss 1964). This analysis is also consistent with the proposal by Krauss (1983) that at least some modern dialects of Dëne Sųłiné still preserve this contrast. Regarding the consonant system, adopting the CH makes it possible to date the alternation in Figure 1 relative to the consonant shift mentioned previously: I will argue that the alternation in Figure 1 must have originated at a stage of the language before the consonant shift had taken place, and in particular while the *retroflex* consonant series was still part of the consonant inventory of the language (§6.0). Finally, the CH can help clarify the extent to which the alternation in Figure 1 might still be part of the synchronic phonology of some modern Dëne Sųłiné dialects. I conclude that this seems to vary by dialect, and depends on the set of phonological contrasts in the dialect—in particular, whether a dialect contrasts a series of labio-velars with plain velars, and whether or not it maintains the full ~ reduced vowel contrast (§7.0).

The remainder of this paper is organized as follows. In §2.0 I provide background on the language, including background on the structure of the Dene verb. In §3.0 I provide

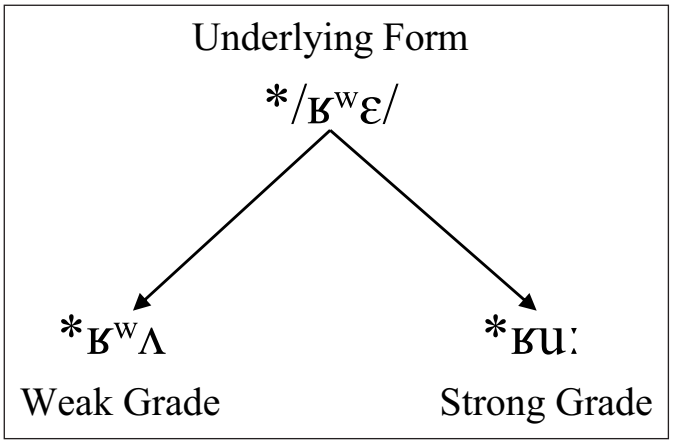


Figure 1: Reconstruction of Pre-Dëne Sųłiné strong grade and weak grade of optative prefix.

a proposal for the historical source of this alternation in Pre-Dëne Sųłiné, in word-initial position. In §4.0, I extend the analysis to account for the behaviour of the optative prefix after conjunct and disjunct prefixes. In §5.0, I argue that spreading of the feature [low], which occurred historically in the weak grade, can no longer be a part of the synchronic phonology of modern Dëne Sųłiné dialects. In §6.0, I extend this argument, to show that the alternation in Figure 1 must have originated at a time before a series of consonant shifts took place, specifically when the retroflex series was still part of the consonant inventory. Finally in §7.0 I explore the synchronic status of *a* ~ *u* alternations in modern Dëne Sųłiné dialects.

2 Background

In this section, I will discuss some of the background assumptions upon which my proposal rests. In §2.1, I discuss the reconstructed form of the optative prefix in Proto Dene (PD). In §2.2 I discuss the reconstructed forms of the subject agreement prefixes. Finally, in §2.3 I provide background on the structure of the Dene verb, and how it has been modeled in Lexical Phonology.

2.1 The historical form of the optative prefix

As shown in Figure 1, I reconstruct the underlying form of the optative prefix in Pre-Dëne Sųłiné as */ʁʷɛ/*, consisting of a voiced labio-uvular fricative, followed by a mid front vowel. This is very similar to the reconstructed PD (Proto Athapaskan) form as proposed by Krauss. Krauss (1969: 63) reconstructs the PD optative prefix as **ɣʷə* (with a labiovelar fricative), derived from an earlier **ɢʷə* (with a labio-uvular stop). Later in the same paper, he suggests that **ɢʷə* was itself derived from a combination of an imperfective prefix **ɢɑ* plus the irrealis prefix **ʊ*, and that this combination had both a full grade **ɢu* and a reduced grade **ɢʷə* (1969: 69)—again very similar to my proposal in Figure 1. In reconstructing the Pre-Dëne Sųłiné optative prefix as **ʁʷɛ*, I am following the methodological principle of reconstructing this intermediate stage as being as close as possible to the modern language, in the absence of evidence to the contrary. Thus, because the reflex of PD **ə* is *ɛ* in Dëne Sųłiné (in prefixes), I reconstruct **ɛ* rather than **ə*; similarly, because the initial consonant of the opative prefix is spirantized in our earliest historical materials (e.g. LeGoff 1889, Li 1946), I reconstruct the initial consonant as **ʁʷ* rather than **ɢʷ*. However, nothing in my analysis depends on these particular assumptions: formally, the analysis in §3.0 would be the same whether the Pre-Dëne Sųłiné optative were **ɢʷə* or **ʁʷɛ*.

An alternative reconstruction of the optative was proposed by Leer (2000). Leer reconstructs the Proto Dene optative as **ʁʊ*, consisting of a voiced uvular fricative, followed by a reduced high-rounded vowel. In my opinion, there are three arguments against this proposal. The most direct evidence comes from the Tłı̨chǫ (Dogrib) language, in which, in the Behchokǫ̀ dialect as described by Ackroyd (1982), the reflex of the optative prefix is *we* [wɛ], as shown in Table 2. Ackroyd's transcription system is given in regular type; my

Table 2: Optative of *edǫ* 'drink' (Ackroyd 1982: 118).

Singular			Plural		
wehdǫ	[**wɛ**hdǫ]	'I must drink'	wìdǫ	[wìdǫ]	'Let's (2) drink'
wı̨dǫ	[wı̨dǫ]	'You (sg) must drink'	wahdǫ	[wahdǫ]	'You (du/pl) must drink'
wedǫ	[**wɛ**dǫ]	'He must drink'	gıdǫ	[gi:dǫ]	'They (du/pl) must drink'
			ts'ıdǫ	[ts'i:dǫ]	'Let's (pl) drink'

standardized re-transcription is added in brackets [ ]; in Tłı̨chǫ, Low tones are marked, while High tones are unmarked.

While *we* [wɛ] is a perfectly regular reflex of **ɢʷə* in prefix position (just as [ɛ] is a regular reflex of PD **ə* in prefixes in Tłı̨chǫ more generally), a sound change from PD **ʊ* > *ɛ* in Tłı̨chǫ prefix vowels has not been previously proposed.[2] A second argument against reconstructing the PD optative prefix as **ʁʊ* is that there are some Dene languages, including North Slavey and the Tetsǫ́t'ıné dialect of Dëne Sųłiné, where the optative prefix is indeed analyzed as /ɣu/ underlyingly. In these languages, there is no *a* ~ *u* alternation in the optative as in Table 1 and Figure 1. Rather, what we observe are either length alternations in the case of Tetsǫ́t'ıné (Jaker & Cardinal under review §5.8), or alternations between *o* and *u* in the case of North Slavey (Rice 1989: 548–550). It is probably not an accident that the optative prefix does not surface as *wa*[3] or *ha* in languages where the underlying form is /ɣu/: the feature [low] will most likely not spread onto a vowel already specified as [round] (see §3.3). It follows that, at the time when the vowel alternation in Figure 1 arose historically, the vowel of the optative prefix was not **ʊ* but rather **ɛ*.

Finally, a sound change from PD **ɢʷə* to *ɣu* seems to be part of a more general sound change in this group of languages, involving the simplification of labialized dorsal consonants to plain velars, with rounding moving onto a neighbouring reduced vowel. Indeed, this is still a change in progress in some Dëne Sųłiné dialects, as shown in the examples in Table 3.

One final question regarding the optative in Pre-Dëne Sųłiné is: why not reconstruct the optative as */ʁʷʌ/*, with the surface form the same as in the weak grade? This is what is assumed for the modern language by Li, who posits the basic form of the optative as *ɣwa* (1946: 413), while Cook posits the basic form as either *wa* or *ha*, depending on the dialect (2004: 39). Formally, it is certainly possible to derive *ʁu*: from *ʁʷʌ* via spreading of the feature [round] and de-linking of [low], and I will suggest that eventually the *a* ~ *u* alternation was indeed re-structured this way (§7.1). However, the goal of this paper is to explain the historical source of this alternation. If the PD optative was **ɢʷə*, as discussed previously, then at some point historically, either **ə* or its reflex **ɛ* must have lowered to **ʌ* in the weak grade, and this lowering process is part of what needs to be explained.

Table 3: Comparison of dialects both with and without labio-velar series (Cook 2004: 23).[4]

Tadoule Lake (conservative)	English gloss	Elsewhere (Innovative)
kwë́n	'fire (wood)'	k**ó**n/k**ú**n
de**gw**ë́th	'it is new'	deg**ó**th/deg**ú**th
yá**gw**ële	'butterfly'	yág**o**le/yág**u**le
su**ghw**a	'good/well'	sugh**a**/suw**a**

[2] See Marinakis (2004) for discussion of the historical development of Tłı̨chǫ consonants and vowels. See also Howren & Coleman (1971) for a study of Tłı̨chǫ optatives.

[3] The optative does surface as *wah* or *ghah* in N. Slavey in the 2nd person plural, where it derives from /ghuah/. E.g. *shéghahtı̨* or *shéwahtı̨* 'you (pl) will eat' and łéghahtsi or łéwahtsi 'you (pl) must break it in half' (Rice 1989: 550, using Rice's orthography).

[4] In Cook's orthography, the symbol <ë> can represent [ɛ], [ə], or [ʌ], depending on phonological environment; Cook does not specify the quality of this vowel following a labiovelar.

2.2 The historical shapes of subject agreement prefixes

Next we will examine the reconstructed historical forms of the subject agreement prefixes. These are the prefixes which occur to the immediate right of the optative prefix (with the exception of the 3pl marker **qɛ*, which occurs to the left), and it is the combination of the optative prefix with the subject agreement prefixes that results in either the full grade or the reduced grade of the optative, as in Figure 1. In Table 4, the subject agreement prefixes are highlighted in bold.

In the third person singular, subject agreement is zero (Ø), such that the optative prefix occurs by itself. The reconstruction of the 1st person singular subject prefix in PD is problematic, in that it has been reconstructed with a special symbol <$>, whose precise phonetic quality is unclear (Krauss 1977: 36; Leer 2000: 105–106). By reconstructing this prefix as **ʃ* for Pre-Dëne Sųłiné in Table 4, I am anticipating my conclusion in that the *a* ~ *u* alternations in the Dëne Sųłiné optative originated before the chain-shift which occurred in consonant place (which shifted **ʃ* > *s*, **s* > *θ*). Thus, **ʃ* is the presumed historical source of modern *s*, prior to the chain shift (cf. Krauss 1982).

The reconstruction of the 1st person dual/plural prefix in PD has also been controversial. Leer reconstructs this prefix as **i'D-*, a single syllable with a full constricted vowel (2000: 105). My reconstruction of this prefix as **íːd* in Pre-Dëne Sųłiné would be the regular reflex of this form, following tonogenesis.[5] On the other hand, Story reconstructs this prefix as originally trisyllabic, **əŋəˀdəD* (1989: 500).[6] For the purposes of this paper, distributional evidence suggests that the 1st person dual/plural prefix behaves as a single, heavy syllable of the shape *V:C*, which is reflected in my proposed reconstruction.

The 2nd person singular prefix in PD is reconstructed as **ŋʲə* (Krauss & Leer 1981: 47; Leer 2000: 105–106). Here again I follow the same logic as with the 1st person singular prefix. In at least some modern Dëne Sųłiné dialects, there is evidence for an underlying palatal nasal /ɲ/, in the 2nd person singular and perfective prefixes, which behaves differently from the alveolar nasal /n/ (Jaker & Cardinal under review: §1.2.2, 2.3). This is similar to what has been reported for Slave (Rice 1989: 61–62). The regular historical source of a modern palatal nasal /ɲ/, prior to the consonant shift, would be **ŋʲ* (a palatalized velar nasal), which happens to be the same as the reconstructed PD consonant.

It has been observed that in some Dene languages, the 2nd person singular prefix has two different forms. In modern Dëne Sųłiné, *ne* is the *disjunct form*, which occurs word-initially or after a so-called *disjunct* prefix, while *ɻ* (with a nasal vowel) is the *conjunct form*, which occurs after one or more *conjunct* prefixes (see §2.3 for explanation of *conjunct* and *disjunct*), as was observed by Li (1946: 409, 411–412). Kari (1975) observed that distinct conjunct and disjunct forms of the 2nd person singular also occur in Navajo and Tanaina.

Table 4: Pre-Dëne Sųłiné combinations of subject agreement prefixes and **ʁʷɛ*.

	Singular		Dual/Plural	
	Underlying form	**Surface form**	**Underlying form**	**Surface form**
1st person	*/ʁʷɛ – **ʃ**/*	**ʁʷʌʃ*	*/ʁʷɛ – **íːd**/*	**ʁúːd*
2nd person	*/ʁʷɛ – **ŋʲɛ**/*	**ʁɻː*	*/ʁʷɛ – **ʊχ**/*	**ʁuːχ*
3rd person	*/ʁʷɛ/*	**ʁʷʌ*	*/**qɛ** – ʁʷɛ/*	**qɛ.ʁuː*

[5] See Krauss (2005) for an overview of the development of tone from glottal constriction in Dene languages.

[6] The late Michael Krauss (p.c.) suggested that this reconstruction was phonotactically unlikely, because Proto Dene did not otherwise have constricted reduced vowels in prefixes. See also Leer (2005: 279) for discussion of constricted reduced vowels.

In both Navajo and Tanaina, Kari derives the conjunct form from the disjunct form by means of a rule of *nasal absorption* (1975: 335, 342). Similarly, for Pre-Dëne Sųłiné, I will treat **ŋʲɛ* (the disjunct form) as the basic underlying form, from which the conjunct form **į:* is derived via regular phonological rules (see §3.3).

In the 2nd person plural, Krauss reconstructs the Proto Dene form of this prefix as **αχʷ*, from a still earlier (Proto Dene-Eyak) **nαχʷ* (1965: 25). That is, with a reduced low vowel (**α*). For Pre-Dëne Sųłiné, I assume that this prefix was already vowel-initial, as its combination with any preceding prefix behaves as a single syllable. I also assume that the labialization had already moved off of the final consonant and onto the preceding vowel, yielding **ʊχ*, as shown in (5). This accounts for the rounded vowels found in the 2nd person plural, both in the optative and elsewhere.

2.3 Left-to-right syllable counting and the Lexical Phonology model

At the beginning of this paper, I suggested that the *a* ~ *u* vowel alternation in Dëne Sųłiné can be thought of as representing different *grades* of the optative: the vowel *a* derives from the weak grade, while the vowel *u* derives from the strong grade. In this section, I will propose that the distribution of strong and weak grades can itself be derived from more general principles: stress and iambic feet. Specifically, I propose that Pre-Dëne Sųłiné was a quantity-sensitive, left-to-right iambic language; as part of this system, the strong grade of the optative was used in the strong position of an iambic foot, while the weak grade of the optative was used in the weak position of an iambic foot.

In a quantity-sensitive iambic system, the three canonical foot types are (Light-Heavy), (Light-Light), and (Heavy) (Hayes 1995: 65). A heavy syllable will always occupy the strong (stressed) position of a foot. If a heavy syllable follows a light syllable, they will form a (Light-Heavy) foot; if it follows another heavy syllable, it will form a (Heavy) foot by itself. If the iambic system is left-to-right, this means that, word-initially, a light syllable will always be in weak position, while a heavy syllable will always be in strong position.

In Table 5 we have a reconstruction of the paradigm for **hɛtɽaːɣ* 'cry' (*hɛtsaːɣ* in the modern language). When the optative prefix is word-initial and is syllabified as part of a light syllable, it occurs in the weak grade, with the vowel **ʌ*. We observe this in the 1st person and 3rd person singular forms (I assume that the 1sg subject prefix **ʃ* did not contribute weight). Where the optative occurs as part of a heavy syllable, word-initially, it occurs in the strong grade, with the vowel **uː*. We observe this in the 2nd person singular, 1st person plural and 2nd person plural forms. In these cases, the word-initial heavy syllable is the result of coalescence rules at the segmental level, which must precede iambic foot parsing (see §3.4). Finally, the 3rd person plural form is somewhat different. In this case, the first two syllables might be expected to form a (Light-Light) foot, but instead form a

Table 5: Pre-Dëne Sųłiné paradigm of **hɛtɽaːɣ* 'cry', with iambic feet.

	Singular		Plural	
	Underlying form	**Output**	**Underlying form**	**Output**
1st person	/ʁʷɛ-ʃ-tɽaːɣ/ OPT-1sgS-cry	(ʁʷʌʃ.ˈtɽaːɣ)	/ʁʷɛ-íːd-tɽaːɣ/ OPT-1plS-cry	(ˈʁúː)(ˈtɽaːɣ)
2nd person	/ʁʷɛ-ŋʲɛ-tɽaːɣ/ OPT-2sgS-cry	(ˈʁųː)(ˈtɽaːɣ)	/ʁʷɛ-ʊχ-tɽaːɣ/ OPT-2plS-cry	(ˈʁuːχ)(ˈtɽaːɣ)
3rd person	/ʁʷɛ-tɽaːɣ/ OPT-cry	(ʁʷʌ.ˈtɽaːɣ)	/qɛ-ʁʷɛ-tɽaːɣ/ 3plS-OPT-cry	(qɛ.ˈʁuː)(ˈtɽaːɣ)

(Light-Heavy) foot, *(qɛ.ˈʁuː). I propose that this is an incidence of *iambic lengthening*. This process will be formalized in §3.4.

If the location of strong and weak positions of iambic feet depends on left-to-right syllable counting, one very important question is: from where exactly do we start counting? There is evidence that this is not necessarily the left edge of the prosodic word. Specifically, in all of our available sources, there are at least some prefixes which do not seem to "count," as far as selecting the grade of the optative is concerned. To illustrate, let us compare two paradigms from Li (1946): the optative of *hɛtsaɣ* 'cry' as seen previously in Table 1, and the optative of *ts'ɛ·ðir* 'wake up'. In the latter case, we see that addition of the prefix *ts'ɛ*[7] has no effect on the form of the optative, and the distribution of strong and weak grades of the optative is the same for both verbs. Forms are given in Li's original transcription; paradigm cells using the strong grade are shaded grey.

Why does the prefix *ts'ɛ* seem to be 'invisible' in Table 6? According to the system originally developed by Li, prefixes can be divided into three groups: "conjunctive" (*conjunct*) prefixes which are closest to the stem, and "disjunctive" (*disjunct*) prefixes, which are farther from the stem (1946: 410), plus a third group of prefixes which are "between" conjunct and disjunct (1946: 410, 415). It is precisely these "in between" prefixes which exhibit variability in the published literature on Dëne Sųłiné optatives. Recall that, in the paradigms in Table 1, the 3rd person plural form exhibits the strong grade of the optative in the example from Li (1946), ***hu·***tsaɣ 'they will cry', whereas the same paradigm cell exhibits the weak grade in the examples from Cook (2004), *he**wa**jën* and *he**ha**jën* 'they will sing'. This variability is related to the fact that *hɛ* is one of the prefixes which Li classifies as "in between" conjunct and disjunct. How might we model this variability?

From the perspective of Lexical Phonology (Kiparsky 1982, 1985), the categories of *conjunct prefixes* and *disjunct prefixes* correspond, loosely speaking, to *stem level affixes* and *word level affixes*, respectively. However, just as Li noted a third category of "in between" prefixes, Lexical Phonology approaches to Dene languages have realized the need for additional lexical levels, besides the Stem Level and Word Level, which are normally assumed for morphologically less complex languages. In fact, a total of 6 levels have been proposed (Hargus 1988, Jaker & Kiparsky under review), as illustrated in Figure 2.

Under the Lexical Phonology model, the Dene verb is viewed as having the structure of a right-branching tree, with successive layers of prefixes being added outward from the stem. This particular structure has been termed the "Stem-Core" model (Halpern 1992; see also Randoja 1990). The prefixes which Li regarded as "in between" comprise the so-called "deictic" prefixes *hɛ* '3pl subject', *ts'ɛ* 'impersonal subject', *ʔɛ* 'unspecified object', *ʔɛdɛ* 'reflexive object', and *łɛ* 'reciprocal object', as well as the object agreement prefixes

Table 6: Comparison of optative paradigms with and without a disjunct prefix (Li 1946).

Optative of *hɛtsaɣ* 'cry' (Li 1946: 413)		**Optative of *ts'ɛ·ðir* 'wake up' (Li 1946: 414)**	
Li's transcription	**English gloss**	**Li's transcription**	**English gloss**
ɣwastsaɣ	'I will cry'	ts'ɛ**ɣwas**θir	'I will wake up'
ɣwųtsaɣ	'you (sg) will cry'	ts'ɛ**ɣwų**ðir	'you (sg) will wake up'
ɣwatsaɣ	'he/she will cry'	ts'ɛ**ɣwa**ðir	'he/she will wake up'
ɣwú·tsaɣ	'we will cry'	ts'ɛ**ɣwú·**ðir	'we will wake up'
ɣwuhtsaɣ	'you (pl) will cry'	ts'ɛ**ɣwuh**θir	'you (pl) will wake up'
hu·tsaɣ	'they will cry'	ts'ɛ**hu·**ðir	'they will wake up'

[7] The meaning of this prefix is uncertain.

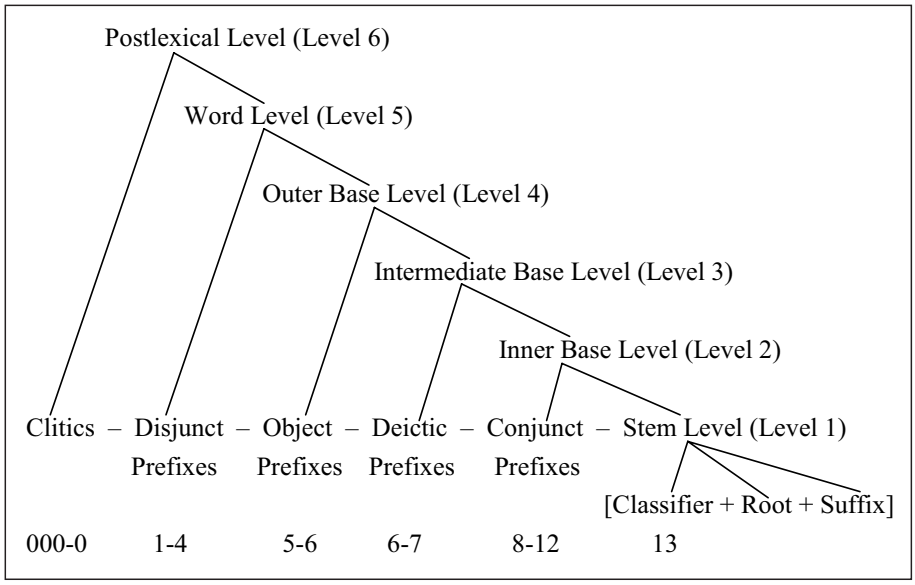


Figure 2: Lexical Phonology model for Dëne Sųłiné (based on Jaker & Kiparsky, under review).

including *sɛ* '1sg object', *nɛ* '2sg object', and *yɛ* '3sg object' (Li 1946: 416; examples in Li's orthography). These occupy positions 5–7 of the Dene verbal template,[8] which correspond to Levels 3 and 4 of the Lexical Phonology model. Thus, from a Lexical Phonology perspective, these "in between" prefixes are added after the conjunct prefixes (at Level 2), but before the disjunct prefixes (at Level 5).

How does this relate to the optative? In Li's data, we observe the strong grade of the optative following the Level 2 prefix *nɛ* (e.g. *nustɛ́* 'I will lie down'), following the Level 3 prefix *hɛ* (e.g. *hʉtsaɣ* 'they will cry') as well as the Level 4 prefix *yɛ* (e.g. *yuɬtsi* 'he/she will make it) (1946: 413–414). On the other hand, in Cook's data, we find the strong grade following a Level 2 prefix (e.g. *nusdá* 'I will sit down (2004: 128)), but the weak grade following a Level 3 prefix (e.g. *hehaj*ën 'they will sing' (2004: 44)). From a Lexical Phonology perspective, it is actually part of the normal life-cycle of phonological processes that they become restricted to smaller and smaller morphological domains over time (Bermúdez-Otero 2015: 382–385). That is, phonological processes begin as 'automatic' phonetic implementation rules Postlexically, where they apply across word boundaries, and enter the lexical phonology at the point where they become restricted to individual words (Kiparsky 2015). In the present case, it appears that for Li's speaker, François Mandeville, whom he recorded in 1928, and who was born in 1878 (Mandeville 2009), the syllable counting and stress assignment which resulted in selection of the strong or weak grade of the optative were Level 4 processes; by the time Cook collected his data in the later part of the 20th century, the same alternation appears to have become a Level 2 process.[9] Thus it would appear we have evidence, from the documentary linguistic record, of a phonological process becoming more restricted in its domain of application during the course of the 20th century. While it is by no means *necessary* for such a change in the domain of application of a process to take place, it is consistent with what researchers in Lexical Phonology have observed of phonological processes generally. We will see in §7.0, however, that there continues to be variation between speakers in the behaviour of Level 3 prefixes, even to the present.

[8] Template positions are based on Rice (1989), shown at the base of the diagram in (8).

[9] Cook does provide a single form *yuɬtsi* 'he/she will make it' (2004: 154), with the strong grade of the optative following an object agreement prefix. However, Cook does not provide any complete paradigms of the optative preceded by object agreement, so it is not clear if this one form is meant to exemplify a more general pattern.

In reconstructing the source of the *a* ~ *u* alternation in Pre-Dëne Sųłiné, we may follow the above logic in reverse. That is, we may hypothesize that, as we go farther back in time, the domain of syllable counting and stress assignment affecting the optative involved larger and larger domains—including disjunct (Level 5) prefixes as well. However, in §4.0 we will see that, in the reconstructed scenario, assigning the optative alternation to Level 5 or Level 4 seems to predict the same result, which may have contributed to its re-analysis as a Level 4 process.

3 Analysis

In the previous section (§2), we considered strong and weak alternations in the optative from a prosodic perspective, in terms of syllable count and syllable weight. In this section (§3), we will consider these same alternations from a segmental perspective. The main question to be addressed will be: given that the complex labio-uvular segment *ʁʷ causes the following vowel ɛ to lower to ʌ in the weak grade, and raise to *uː* in the strong grade, how is it possible that the same segment can cause both raising and lowering of the following vowel? Specifically, if the vowel ʌ (or *a* or *ɑ*) is [+low], while the vowel *uː* is [+high], it would seem that the segment *ʁʷ would need to be specified as [+low, +high]—something which is assumed to be impossible in almost all versions of feature theory (Chomsky & Halle 1968: 305; DeLacy 2007). This problem obtains if one assumes a representational *null hypothesis*, where all features are fully specified, without any internal organization or hierarchical structure.

3.1 The Contrastivist Hypothesis

My solution to this apparent logical contradiction is to adopt underspecified representations (Archangeli 1988). Specifically, the particular version of underspecification theory I will adopt is contrastive specification, as formulated under the *Contrastivist Hypothesis* (CH) (Hall 2007; Dresher 2009). This hypothesis is stated in (1).

(1) The Contrastivist Hypothesis (Hall 2007: 20; Dresher 2009: 74)
The phonological component of a language L operates only on those features which are necessary to distinguish the phonemes of L from one another.

Under this approach, the phonemes of a language are assigned their features through a procedure called the Successive Division Algorithm. This procedure is defined in (2).

(2) The Successive Division Algorithm (Dresher 2009: 16)
   a) Begin with *no* feature specifications: assume all sounds are allophones of a single undifferentiated phoneme.
   b) If the set is found to consist of more than one contrasting member, select a feature and divide the set into as many subsets as the feature allows for.
   c) Repeat step (b) in each subset: keep dividing the inventory into sets, applying successive features in turn, until every set has only one member.

The result of this procedure is that the phonemes of a language are represented in the form of a tree (see Figure 4), where each phoneme is specified for only those features which are necessary to distinguish it from other phonemes. In the case of Dëne Sųłiné, I propose that the vowels ʌ and *ɑː* are specified as [low], while the vowels ʊ and *uː* are specified as [round] (but not [high]). This means that it is possible for a single segment such as *ʁʷ to be specified as both [low] and [round], which can impart both an a-colouring and an u-colouring, respectively, to neighbouring vowels, without resulting in any logically contradictory fea-

ture specifications. The formal representation of feature spreading will be explained in §3.3, following discussion of the vowel inventory in §3.2. In the remainder of sections §3 and §4, I will simply assume that *ʁʷ is specified as [round] and [low]; in §5 and §6 I will justify and make fully explicit my assumptions regarding the place features of consonants.

3.2 Representation of the Dëne Sųłiné vowel inventory

The vowel inventory of modern Dëne Sųłiné has been controversial in the literature. The main question centers around the reflex of PD *full* and *reduced* vowels in Dëne Sųłiné: to what extent this contrast is maintained, and—in so far as it is—whether it should be thought of as a length contrast or a vowel quality contrast.

Cook, in his 1983 paper *Chipewyan Vowels,* described the Dëne Sųłiné language as exhibiting a six vowel system, as depicted in Figure 3.

Cook characterized this system as a vestige of the PD full ~ reduced vowel contrast, in the sense that he regarded *ə* as a reduced vowel, and all of the other vowels as full vowels (1983: 417). However, in his view, "full" and "reduced" refer to vowel quality only, representing peripheral versus central vowels, respectively. Thus, there is no underlying length contrast in Dëne Sųłiné, according to this view (Cook 1983: 424). Ackroyd (1976) reconstructed essentially the same vowel system for 'Proto Northeast Athapaskan' (PNEA), a hypothesized subgroup of languages comprising Tłı̨chǫ, Dëne Sųłiné, North Slavey, South Slavey, and possibly others. Thus, under this view, contrasts such as PD full **ɑː* versus reduced **ɑ*, or full **uː* versus reduced **ʊ*, not only do not survive in modern Dëne Sųłiné, but had already undergone merger in the remote past.

In contrast to this view, Krauss (1983) reported work with a speaker from northern Saskatchewan, Mary Jane Kasyon, whose speech exhibited a vowel length contrast, even in monomorphemic stems. Krauss describes this contrast as being, in many cases, a direct reflex of the PD full ~ reduced vowel contrast. Thus Krauss finds modern Dëne Sųłiné [aˑ] from PD **aˑ*, [ʌ] from PD **ɑ*, [eˑ] from PD **eˑ*, [ɛ] from PD **ə*, [o] and [ʊ] from PD **ʊ*, and [uˑ] from PD **uˑ*. Krauss suggests that the original PD full ~ reduced system may have evolved into a five vowel system with a long ~ short contrast, although there appears to be a gap in the inventory in that there is no short [i] (in stems).

Similarly, in later work, Cook described an underlying vowel length contrast in the dialect of Cold Lake, Alberta (Cook 2004: 28–30). For the Tetsǫ́t'ıné (Yellowknife) dialect, Haas (1968) noted long vowels (deriving from historical full vowels) in at least some stems, e.g. *sɛts'áˑne* 'my wife' (1968: 175). For this same dialect, a phonetic study by Jaker (2018) found evidence for an 8 vowel system: five full vowels [ɑː], [eː], [iː], [oː], [ʉː], and three reduced vowels, [ɐ], [ɘ], and [ɵ].

What we may draw from the above observations is that, if the PD contrast between full and reduced vowels, including the contrasts between **ɑː* vs. **ɑ* and **uː* vs. **ʊ*, is preserved in at least some dialects of modern Dëne Sųłiné, then it is reasonable to infer that this set of contrasts was present at an earlier stage of the language as well. Therefore, for Pre-Dëne Sųłiné, I propose the vowel inventory shown in Figure 4. There are seven underlying

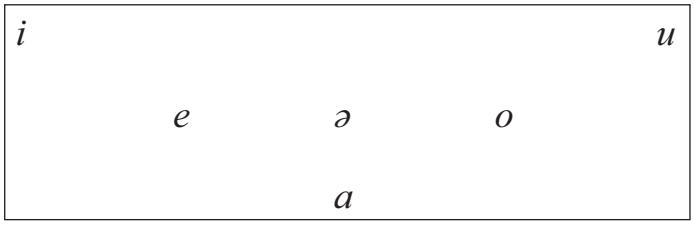


Figure 3: Dëne Sųłiné (Chipewyan) vowel system according to Cook (1983: 416).

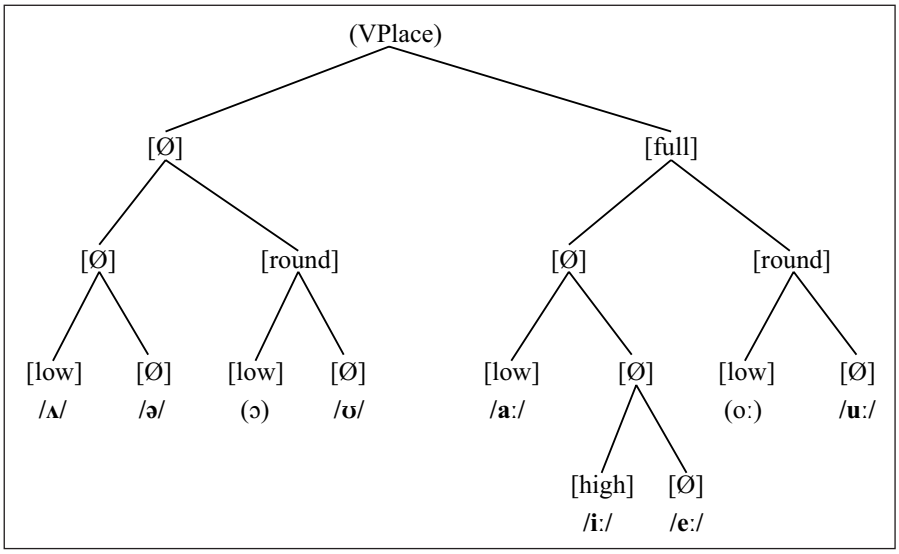


Figure 4: Feature hierarchy for Pre-Dëne Sųłıné surface vowels.[10]

vowels: four full vowels /a:/, /e:/, /i:/, /u:/, and three reduced vowels /ʌ/, /ə/, and /ʊ/. This is essentially the same as the reconstructed PD system. In addition, I propose two additional surface vowels, short [ɔ] and long [o:]. Short [ɔ] is the result of an allophonic vowel lowering process in stems which lowers /ʊ/ to [ɔ] before non-nasal codas, e.g. modern *k'ɔθ* 'cloud' from PD **q'ʊθ* (Krauss 2005: 91); long [o:] results from vowel coalescence in prefixes, i.e. /a:-ʊ/ → [o:]. Formally, I assume that any vowel which bears the feature [full] underlyingly will be interpreted by the phonology as bimoraic, while vowels which do not bear this feature will be interpreted as monomoraic (see Tuttle 1998: 196 for a similar claim regarding full and reduced vowels).

In terms of the Successive Division Algorithm (SDA) in (2), the proposed ordering of features in Pre-Dëne Sųłıné is [full] > [round] > [low] > [high]. There are two characteristics of the vowel hierarchy in Figure 4 which may be somewhat surprising. The first is that there is an asymmetry in the representation of vowel height, if we compare the rounded vowels to the unrounded vowels. Among the unrounded vowels, the contrast between phonetically high and mid vowels is represented by presence or absence of [high]. Thus, /i:/ is [high], while /e:/ lacks [high]. On the other hand, among the rounded vowels, the parallel contrast between phonetically high and mid vowels is represented by the presence or absence of [low]. Thus, [o:] and [ɔ] are [round][low], while /u:/ and /ʊ/ are merely [round] (and not [low]). There are three arguments to support this asymmetrical representation of vowel height. The first is evidence from morphophonemics, from the modern language. In modern Dëne Sųłıné, in verbal prefixes, /a/ and /u/ coalesce to form [o], as in /na-uh-l-zé/ → *nółzé* 'you (pl) hunt (imperfective)' (Cook 2004: 47; example given in Cook's orthography); on the other hand, a similar coalescence of /a/ and /i/ to yield [e] is not attested. This asymmetry in coalescence patterns is predicted by the representations in Figure 4: whereas /ʌ/ or /a:/ can spread a [low] feature onto /ʊ/ or /u:/ to yield a vowel which is [low][round], spreading of a [low] feature onto /i:/ would yield a vowel which is [low][high]—a combination which is formally impossible. A second argument in favour of the asymmetric representation of vowel height is that there is evidence, historically, for a parallel asymmetry in the consonant system—this will be discussed in §6.0. Finally, the most important argument in favour of Figure 4 is that it allows for an elegant account of consonant-vowel interactions: each of the three vowel *colourings*

[10] I assume that the vowel /ə/ has two allophones: [ə] in stems, and [ɛ] in prefixes.

which consonants may impart to neighbouring vowels in Dëne Sųłiné—the *a-colouring*, *i-colouring*, and *u-colouring*—can be accounted for by the spreading of just one feature from a vowel to a neighbouring consonant. Thus, the a-colouring results from spreading of [low], the u-colouring results from spreading of [round], and the i-colouring results from spreading of [high]. These interactions will be examined in more detail in §3.3.

The other characteristic of the representations in Figure 4 is that the phonological features used do not necessarily correspond to surface phonetic properties of the vowels. In particular, use of the feature [low] does not entail that the vowel is phonetically low: the vowels /ɔ/ and /oː/ bear the feature [low], but are phonetically mid vowels. In this case, one could think of the feature [low] as meaning "low*er*": vowels which bear this feature are lower than they would otherwise be by default. Since, under this system [round] vowels are high by default, adding the feature [low] results in a vowel which is lower than a high vowel—i.e. a mid vowel. See Ghini (2001: 192) for a similar use of [low] to distinguish /o/ from /u/, in Miogliola.

3.3 Vowel alternations as feature spreading

In this section, I will provide a formal representational account of consonant-vowel interactions in Pre-Dëne Sųłiné, in terms of feature spreading. The basic facts to be accounted for are the three vowel colourings mentioned above. All three vowel colourings are relevant to a complete account of the optative: the i-colouring is associated with the 2nd person singular subject prefix **ŋʲə*, and helps explain why the 2nd person singular paradigm cell (in the optative) exhibits the strong grade. The a-colouring and u-colouring are both associated with the optative prefix itself: the a-colouring is observed in the weak grade, while the u-colouring is observed in the strong grade.

The first step is to establish the feature-geometric representation of the vowels. I assume that, under a given class node, features are arranged in a one-dimensional, linear string, which reflects the ordering of features in the SDA, for that language (see Spahr 2014: 559 and Spahr 2016: 64–69 for a similar proposal). Regarding place features, following Padgett & NíChiosáin (1993), I employ two place nodes: the *CPlace* node, which hosts consonantal place features, and the *VPlace* node, which hosts vocalic place features. Thus, I assume that for PreDëne Sųłiné, vocalic features are arranged under the VPlace node as shown in Table 7.

We will begin by considering the i-colouring—that is, spreading of the feature [high], which occurs when either the 2nd person singular subject prefix **ŋʲə* is preceded by another conjunct prefix. This results in the so-called 'conjunct form' of these prefixes, which contains the full nasal vowel **į̇ː*. This alternation, between **ŋʲə* ~ *į̇ː*, has been reconstructed all the way back to PD (Krauss & Leer 1981). Even in modern Dëne Sųłiné, Li sometimes writes these forms with a long vowel, e.g. *hį̇·łaɬ* 'go to sleep!' (Li 1946: 400).

If we assume that the conjunct form *[į̇ː] is derived from the disjunct form */ŋʲɛ/ within the synchronic phonology of Pre-Dëne Sųłiné, this actually involves several phonological

Table 7: Vowel features under the VPlace node (Pre-Dëne Sųłiné).

Reduced Vowels				Full Vowels				
/ʌ/	/ə/	/ʊ/	/ɔ/	/aː/	/eː/	/iː/	/oː/	/uː/
[low]		[round]	[round]	[full]	[full]	[full]	[full]	[full]
			[low]	[low]		[high]	[round]	[round]
							[low]	

rules operating in concert: (a) raising of the preceding vowel from *ə* to *iː*, (b) syncope of the following vowel, (c) nasalization of the preceding vowel, and (d) deletion of the nasal consonant itself. Given the complexity of this process, the main question is: are any of these rules responsible for conditioning the others?

I propose that spreading of the feature [high], from **ŋʲ* onto the preceding vowel, was the trigger for this entire set of rules. In particular, since in my reconstruction of the Pre-Dëne Sųłiné vowel system in Figure 4 and Table 7 there is a gap in the vowel inventory, such that there is no short [i] (similar to what Krauss (1983) observed for the modern language), spreading of the feature [high] onto a preceding vowel necessarily requires that the feature [full] also be inserted—otherwise, spreading of [high] would violate *Structure Preservation* (Kiparsky 1985). This is illustrated in Figure 5.

This long vowel then triggers syncope of the vowel of the following syllable, i.e. *iːŋʲɛ* → *iːŋʲ*, which then triggers nasalization of *iː* to *i̧ː* and deletion of the nasal consonant. This entire complex process will be formalized as a rule-based derivation in §3.4.

Next, we will examine the u-colouring—that is, spreading of the feature [round], which occurs in the strong grade of the optative. This process also involves insertion of the feature [full], though for a somewhat different set of reasons in different paradigm cells. In the 2nd person singular form, the vowel following *ʁʷ* would already be full, since the set of rules which derive *i̧ː* from ŋʲɛ (as discussed previously) would have already applied. Similarly, in the 1st person plural form the vowel is also already full, while in the 2nd person plural, the two adjacent reduced vowels would coalesce to form a full vowel, i.e. */ʁʷɛ-ʊh/ → *ʁʷuːh* → *ʁuːh*. Finally, in the 3rd person plural form, I propose that the feature [full] is inserted as part of a proces of *iambic lengthening*, as shown in Figure 6 below.

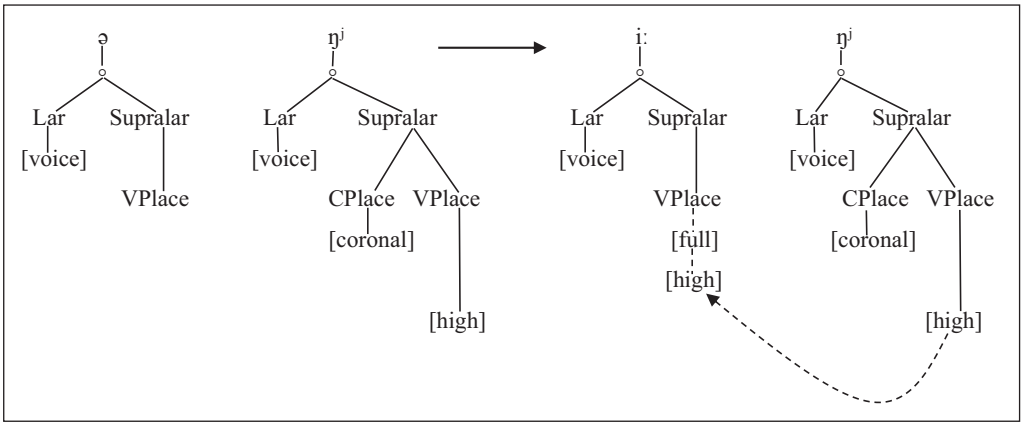


Figure 5: Representation of *əŋʲ → *iːŋʲ (spreading of [high], insertion of [full]).

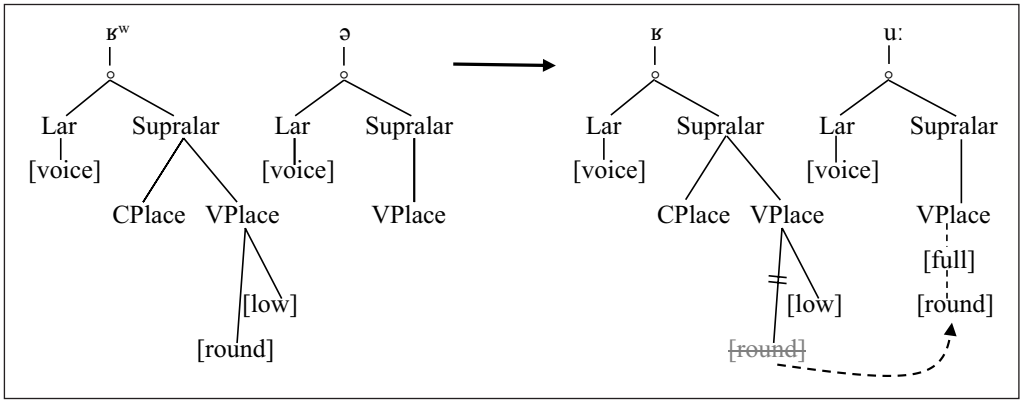


Figure 6: Representation of *ʁʷə → *ʁuː (spreading of [round]).

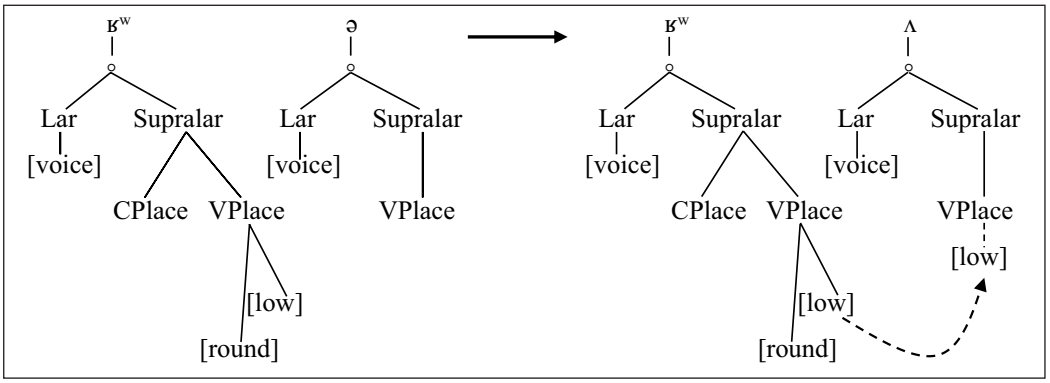


Figure 7: Representation of *ʁʷə → *ʁʷʌ (spreading of [low]).

Finally, we will examine the a-colouring which some consonants may impart onto neighbouring vowels, also called *gamma lowering* (Hargus 1988: 144). I assume that spreading of the feature [low], from **ʁʷ* onto a neighbouring vowel, operates as a kind of default or "elsewhere" rule. This is illustrated in Figure 7.

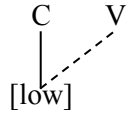
To summarize, we have seen that the representational system which I have proposed in this section, based on the Contrastive Hierarchy, is able to succinctly describe the three colourings which consonants may impart to neighbouring vowels as consisting of the spreading of just one feature: the a-colouring involves the spreading of [low], the i-colouring involves the spreading of [high], and the u-colouring involves the spreading of [round]. In some cases, the feature [full] is inserted as well. In the next section, we will examine how these feature spreading processes are conditioned by, and interact with, the prosodic environments described earlier in §2.3.

3.4 Prosodic conditioning

In §2.3 I provided an account of vowel alternations in the optative from a prosodic perspective, while in §3.3 I provided an account of the same alternation from a segmental perspective. In this section, I will integrate these two perspectives, by showing how feature spreading rules can be conditioned by their prosodic environment. My goal in this section will be to provide a complete derivation of the optative paradigm of the verb **hɛtɽaːɣ* 'cry', as shown in Table 5.

First we will derive the singular forms: **ʁʷʌʃtɽaːɣ* 'I will cry', **ʁɥːtɽaːɣ* 'you (sg) will cry', and **ʁʷʌtɽaːɣ* 'he/she will cry'. The first step is a formalization of the rules. The rule of [low] spreading, which occurs in the 1st and 3rd person singular forms, can be stated as in (3). In order for this rule to apply only in the "elsewhere" case, I have imposed a condition such that (3) applies only if spreading of [round] (to be defined in (9)) has not applied.

(3) Spreading of [low]

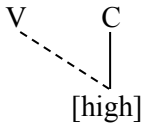


"The feature [low] spreads from a consonant onto the following vowel."
CONDITION: Applies only if Spreading and de-linking of [round] (9) has not applied.

The set of rules involved in deriving the 2nd person singular form is more complicated. Broadly speaking, this can be thought of as a two-step process: first the optative prefix **ʁʷɛ* combines with the 2nd person singular subject prefix *ŋʲɛ* to derive the conjunct form, */ʁʷɛ-ŋʲɛ/ → ʁʷi̯ː*, and subsequently the labialization from **ʁʷ* moves onto the following

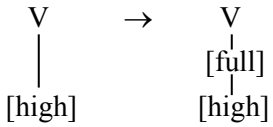
vowel **ʁʷi̯ː* → **ʁɯ̯ː* The first rule in the series, which provides the 'trigger' for all of the following rules, is the spreading of [high] from **ŋʲ* to the preceding vowel, as shown in (4).

(4) Spreading of [high]



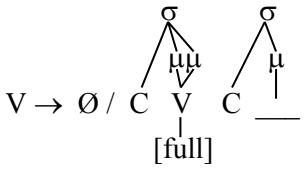
As discussed in §3.3, since short *[i] is, under the current proposal, not part of the vowel inventory for Pre-Dëne Sųłiné, the feature [full] must be inserted as well, in order to satisfy Structure Preservation. The rule for [full] insertion is shown in (5).

(5) Insertion of [full]



The rules so far would yield **ʁʷiːŋʲɛ*. In order to derive **ʁʷi̯ː*, we need a set of rules which will account for syncope of **ɛ*, nasalization of the vowel **iː*, and deletion of the nasal consonant in syllable coda position. These rules are given in (6)–(8).

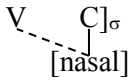
(6) Syncope of a reduced vowel following a full vowel



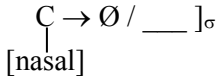
"A monomoraic vowel deletes, when a bimoraic vowel occurs in the preceding syllable."

In (6), I assume that any vowel which is [full] projects two moras on the moraic tier, while any vowel which lacks the feature [full] projects only one mora. The rule in (6) is formally stated in terms of moras rather than in terms of the feature [full] since, when using monovalent features, it is not possible to specify the target of a rule as lacking a certain feature (the rule would simply apply to all vowels).

(7) Vowel nasalization



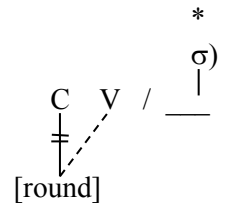
(8) Nasal coda deletion



The rules presented so far would derive **ʁʷi̯ː* from */ʁʷɛ-ŋʲɛ/*. There is one last step necessary in order to derive the desired output **ʁɯ̯ː*, and that is spreading and de-linking of

the feature [round]. This rule applies only in the strong position of an iambic foot, as shown in (9).

(9) Spreading and de-linking of [round]



"The feature [round] de-links from a consonant and spreads onto a following vowel in the strong position of an iambic foot."

This raises the question: what would motivate spreading and de-linking of the feature [round], in the strong position of an iambic foot? According to González (2003), there is a relationship between sonority and prosodic position. Specifically, syllables in prosodically weak positions prefer to have low-sonority nuclei and high-sonority onsets (e.g. *wə*), whereas syllables in prosodically strong positions prefer to have high-sonority nuclei and low-sonority onsets (e.g. *ta*). Regarding the vowels, if we interpret sonority in the strictest sense, referring only to aperture features, then the fact that [uː] occurs in the strong grade, while [ʌ] occurs in the weak grade, seems to run contrary to this proposed generalization—since [uː] is technically less sonorous than [ʌ].

I suggest instead that the locus of explanation for this vowel alternation is actually on the preceding consonant. Specifically, I suggest that spreading and de-linking of the feature [round] in the strong grade serves to make the onset consonant less sonorous, by removing its labial glide articulation. On the other hand, spreading of the feature [low] in the weak grade does not seem amenable to this type of explanation: in the mapping */ʁʷɛ/ → *ʁʷʌ, sonority of the onset consonant is unchanged, while the sonority of the vowel has increased—the opposite of what would be expected in prosodically weak position. Thus, while it is formally possible to formulate the rule of [low] spreading in (3) as applying only in the weak position of an iambic foot, this would imply a certain teleology which is probably not appropriate for this process. Rather, it seems better to think of the two rules, in (3) and (9), as disjunctive: [round] spreading (9) applies in the strong position of an iambic foot, while [low] spreading (3) applies elsewhere.

A derivation of the optative singular forms of the verb **hɛtɽaːɣ* 'cry' is given in Table 8. Numbers in parentheses after each rule refer to the figure where that rule was defined.

The derivation in Table 8 could be summarized as follows: the segmental rules (4)–(8) feed Iambic Foot Construction, and the iambic feet which are constructed feed either spreading and de-linking of [round] (9) or spreading of [low] (3), disjunctively. Thus, in column (b), the rules (4)–(8) transform what would otherwise be a (Light-Light)(Heavy) prosodic pattern into a (Heavy)(Heavy) pattern. Since the optative prefix therefore falls in the strong position of an iambic foot, [round] spreading and de-linking apply. On the other hand, in columns (a) and (c), rules (4)–(8) do not apply, leaving the input (Light-Heavy) pattern unchanged. This places the optative prefix in the weak position of an iambic foot, and therefore [low] spreading applies instead.

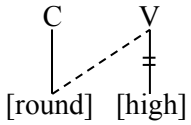
We will now derive the plural forms **ʁúːtɽaːɣ* 'we will cry', **ʁuːχtɽaːɣ* 'you (pl) will cry', and **qɛʁuːtɽaːɣ* 'they will cry', as seen previously in Table 5. Regarding the 1st person plural form, in the mapping */ʁʷɛ-íːd-tɽaːɣ/ → *ʁʷíːtɽaːɣ → *ʁúːtɽaːɣ*, there is a technical issue which arises when the feature [round] spreads onto the vowel [iː], which is already specified as [high]: under the proposed vowel inventory in (12), there is no [high]

Table 8: Derivation of the optative singular forms of **hɛtɽaːɣ* 'cry'.

	Column (a)	**Column (b)**	**Column (c)**
Input	/ʁʷɛ-ʃ-tɽaːɣ/ OPT-1sgS-cry	/ʁʷɛ-ŋʲɛ-tɽaːɣ/ OPT-2sgS-cry	/ʁʷɛ-tɽaːɣ/ OPT-cry
Spreading of [high] (4)	—	ʁʷ**i**.ŋʲɛ.tɽaːɣ	—
Insertion of [full] (5)	—	ʁʷ**iː**.ŋʲɛ.tɽaːɣ	—
Syncope (6)	—	ʁʷiː.ŋʲ.tɽaːɣ	—
Nasalization (7)	—	ʁʷ**j̨**ː.ŋʲ.tɽaːɣ	—
Nasal deletion (8)	—	ʁʷj̨ː.tɽaːɣ	—
Iambic Foot Construction	(ʁʷɛʃ.ˈtɽaːɣ)	(ˈʁʷj̨ː)(ˈtɽaːɣ)	(ʁʷɛ.ˈtɽaːɣ)
Spreading and de-linking of [round] (9)	—	(ˈ**ʁɥ̨**ː)(ˈtɽaːɣ)	—
Spreading of [low] (3)	(ʁʷ**ʌ**ʃ.ˈtɽaːɣ)	—	(ʁʷʌ.ˈtɽaːɣ)
Surface form	(ʁʷʌʃ.ˈtɽaːɣ)	(ˈʁɥ̨ː)(ˈtɽaːɣ)	(ʁʷʌ.ˈtɽaːɣ)
English gloss	*'I will cry'*	*'you (sg) will cry'*	*'he/she will cry'*

[round] vowel, and so the creation of such a vowel would violate Structure Preservation. Therefore, it is necessary that when [round] spreads onto the vowel [iː], the feature [high] be de-linked simultaneously, as shown in (10). Also, in the 1st person plural, the coda consonant *d* of the 1st person plural prefix **ɬːd* must also be deleted in coda position, as shown in (11).

(10) De-linking of [high] conditioned by [round] spreading

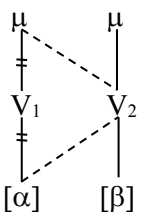


(11) Coda *d* deletion

$$d \rightarrow \emptyset \; / \; \_\_ \;]_{\sigma}$$

In the 2nd person plural form, the main question is the formal representation of vowel coalescence, whereby */ʁʷɛ-ʊχ/ → ʁuːχ. That is, even prior to spreading and de-linking of [round] from the onset consonant **ʁʷ*, the vowels *ɛ* and *ʊ* coalesce to form the full vowel *uː*, which I will assume consists of a single vocalic root node. For present purposes, I will collapse the entire coalescence process down to just two rules. I assume that each of the two input vowels, V_1 and V_2, is already associated with a mora underlyingly. The Coalescence rule in (12) de-links the mora from V_1 and associates it to V_2, and also de-links all place features of V_1 and re-associates them to V_2. V_1 is then deleted by stray erasure.

(12) Coalescence



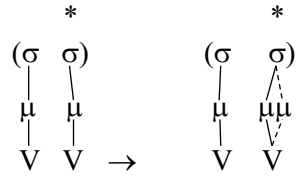
When the features of V_1 associate to V_2, any featural incompatibilities which arise will be resolved according to the language's vowel strength hierarchy. The Contrastive Hierarchy predicts that the vowel (or consonant) strength hierarchy of a language will mirror the ordering of features and the SDA (Dresher 2009: 148). In (10), for example, we saw that the feature [round] displaces the feature [high], and indeed [round] is ordered before [high] in the feature hierarchy in Figure 4. Later, in §7.1, we will also see evidence that, in the modern language, [round] is stronger than [low], which is also predicted by Figure 4.

The result of the coalescence rule in (12) is an output vowel (V_2) which retains the strongest feature(s) of both vowels, and which has two moras. In order to be well-formed, however, a bimoraic vowel requires insertion of the feature [full], as in (13).

(13) Insertion of [full]

Finally, we come to the 3rd person plural form **qɛʁɯːtɽaːɣ*. In order to derive the long vowel *ɯː* in this form, we need to add a rule of *iambic lengthening*. I propose that this rule operates at the moraic level, changing a (Light-Light) iambic foot into a (Light-Heavy) foot (Prince 1990, 1991), which in turn results in insertion of the feature [full], as in (13). The rule of iambic lengthening is defined in (14).

(14) Iambic Lengthening



"A monomoraic vowel becomes bimoraic in the strong position of an iambic foot."

A derivation of the plural forms is given in Table 9. Those rules which are active in this derivation are highlighted in bold.

In Table 9, the rule of [full] insertion must apply twice: after Coalescence (12) in columns (a) and (b), and after iambic lengthening in column (c). It is probably best to regard this rule as a persistent rule, which applies at any point in the derivation to repair mis-matches between mora count and the feature [full].

4 Further issues: the optative following conjunct and disjunct prefixes

In the previous section, I presented an analysis of the optative prefix */ʁʷɛ/ in word-initial position and following the 3rd person plural subject prefix **qɛ*. In §2.3, I also presented data which show that, in modern Dëne Sųłiné, the behaviour of the optative following a disjunct (Level 5) prefix is the same as word-initially. However, there is an important class of examples missing from the analysis so far—namely, the optative */ʁʷɛ/ following a conjunct (Level 2) prefix—this is what is referred to in the Dene linguistics literature as *conjunct position*. In the modern language, the general pattern is that when the optative

Table 9: Derivation of the optative plural forms of **hɛtɽaːɣ* 'cry'.

	Column (a)	**Column (b)**	**Column (c)**
Input	/ʁʷɛ-íːd-tɽaːɣ/ OPT-1plS-cry	/ʁʷɛ-ʊχ-tɽaːɣ/ OPT-2plS-cry	/qɛ-ʁʷɛ-tɽaːɣ/ 3plS-OPT-cry
Spreading of [high] (4)	—	—	—
Coda *d* deletion (11)	ʁʷɛ.íː.tɽaːɣ	—	—
Coalescence (12), **Insertion of [full]** (13)	ʁʷ**íː**.tɽaːɣ	ʁʷ**uː**χ.tɽaːɣ	—
Syncope (6)	—	—	—
Nasalization (7)	—	—	—
Nasal deletion (8)	—	—	—
Iambic Foot Construction	(ˈʁʷíː)(ˈtɽaːɣ)	(ˈʁʷuːχ)(ˈtɽaːɣ)	(qɛ.ˈʁʷɛ)(ˈtɽaːɣ)
Iambic Lengthening (14), **Insertion of [full]** (13)	—	—	(qɛ.ˈʁʷ**eː**)(ˈtɽaːɣ)
Spreading and de-linking of [round] (9), **de-linking of [high]** (10)	(ˈ**ʁú**ː)(ˈtɽaːɣ)	(ˈ**ʁu**ːχ)(ˈtɽaːɣ)	(qɛ.ˈ**ʁu**ː)(ˈtɽaːɣ)
Spreading of [low] (3)	—	—	—
Surface form	(ˈʁúː)(ˈtɽaːɣ)	(ˈʁuːχ)(ˈtɽaːɣ)	(qɛ.ˈʁuː)(ˈtɽaːɣ)
English gloss	*'we will cry'*	*'you (pl) will cry'*	*'they will cry'*

Table 10: Optative paradigms in conjunct position, according to Li (1946: 413–414).

	Optative of *nɛtéih* 'lie down'	**Optative of *tunɛdi̯* 'be drowned'**	**Optative of *hɛlzɛ* 'start to hunt'**
1st person singular	**nu**stɛ́	tu**nu**sdą́	**hu**szɛ
2nd person singular	**nu̯**tɛ́	tu**nu̯**dą́	**hu̯**lzɛ
3rd person singular	**nu**tɛ́	tu**nu**dą́	**hu**lzɛ
1st person plural	**nú**·tés	tu**nú**·dą́	**hŭ**·lzɛ
2nd person plural	**nu**htɛ́s	tu**nu**hdą́	**huɬ**zɛ
3rd person plural	hɛ**nu**tés	tuhɛ**nu**dą́	hɛ**hu**lzɛ

prefix appears in conjunct position, the strong grade is used throughout the entire paradigm. Some examples from Li (1946) are given in Table 10.

Although Li only marks long vowels in the 1st person plural forms (*úˑ* or *ŭˑ*), nevertheless we may consider all of the forms in Table 10 reflexes of the strong grade of the optative, based on my hypothesis in §1.0 that optative forms in the modern language with *u* in them are reflexes of the strong grade, while forms with *a* are reflexes of the weak grade. The question then becomes: why should the optative always surface in the strong grade in conjunct position, and does this follow from the analysis presented previously in §3.4?

The choice of the strong grade in conjunct position is predicted by my proposal, in most cases, without the need for any additional rules. This is illustrated in Table 11, where I derive the reconstructed forms **nɛʁuːʃté:* 'I will lie down', **nɛʁu̯ːté:* 'you (sg) will lie down', and **nɛʁuːté:* 'he/she will lie down'. The gloss 'QUAL' beneath *nɛ* refers to the so-called *qualifier* prefixes, which originated historically as noun class and aspectual prefixes, but now appear to be semantically empty in many modern Dene languages (see Rice 2000: 324–341 for discussion of these prefixes).

As illustrated in Table 11, addition of a conjunct prefix before the optative ensures that the optative will surface in the strong grade in all of the forms shown, via left-to-right iambic foot parsing. When a thematic conjunct prefix such as *nɛ* occurs in the weak position of an iambic foot, it thereby places the optative prefix in strong position. From the

Table 11: Derivation of the optative singular forms of **nɛté:h* 'lie down'.

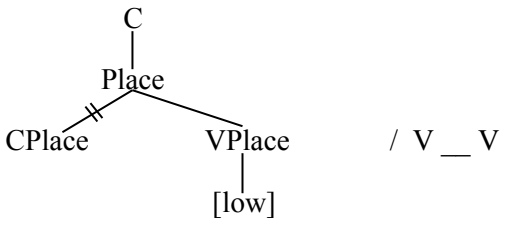
	Column (a)	**Column (b)**	**Column (c)**
Input	/nɛ-ʁʷɛ-ʃ-té:/ QUAL-OPT-1sgS-lie.down	/nɛ-ʁʷɛ-ŋʲɛ-té:/ QUAL-OPT-2sgS-lie.down	/nɛ-ʁʷɛ-té:/ QUAL-OPT-lie.down
Spreading of [high] (4)	—	nɛ.ʁʷ**i**.ŋʲɛ.té:	—
Coalescence (12), **Insertion of [full]** (13)	—	nɛ.ʁʷ**i**:.ŋʲɛ.té:	—
Syncope (6)	—	nɛ.ʁʷi:ŋʲ.té:	—
Nasalization (7)	—	nɛ.ʁʷ**j̃**:ŋʲ.té:	—
Nasal deletion (8)	—	nɛ.ʁʷj̃:.té:	—
Iambic Foot Construction	(nɛ.ˈʁʷɛʃ)(ˈté:)	(nɛ.ˈʁʷj̃:)(ˈté:)	(nɛ.ˈʁʷɛ)(ˈté:)
Iambic Lengthening (14), **Insertion of [full]** (13)	(nɛ.ˈʁʷ**e:**ʃ)(ˈté:)	—	(nɛ.ˈʁʷ**e:**)(ˈté:)
Spreading and de-linking of [round] (9), **de-linking of [high]** (10)	(nɛ.ˈ**ʁu**:ʃ)(ˈté:)	(nɛ.ˈ**ʁų**:)(ˈté:)	(nɛ.ˈ**ʁu**:)(ˈté:)
Spreading of [low] (3)	—	—	—
Surface form	(nɛ.ˈʁu:ʃ)(ˈté:)	(nɛ.ˈʁų:)(ˈté:)	(nɛ.ˈʁu:)(ˈté:)
English gloss	*'I will lie down'*	*'you (sg) will lie down'*	*'he/she will lie down'*

output forms in Table 11, the modern forms can be derived through regular sound change. Thus: **nɛ.ʁu:ʃ.té: > *nɛ.u:ʃ.té: > nus.té:*, **nɛ.ʁų:.té: > *nɛ.ų:.té: > nų.té:*, etc. The set of rules in Table 11, and the same set of later sound changes, predict the strong forms observed in Table 10 in the 1st person and 2nd person plural forms as well.

A complication arises in the 3rd person plural form. In this case, the set of rules in Table 11 actually predicts that the optative should surface in the *weak* grade, in the 3rd person plural, in the presence of a thematic conjunct prefix. Thus, the predicted output for 'they will lie down' is *(qɛ.ˈne:)(ˈʁʷʌ.ˈté:ʃ). The same problem arises more generally in any verb with two thematic conjunct prefixes: my analysis predicts that the language would, in that case, revert to the default pattern as shown in Table 5. It should be noted that instances of the weak grade following a conjunct prefix are attested in the modern language, e.g. *dúwasgay* 'I start to turn white' (Cook 2004: 170) and *hewaszus* 'I start to slide' (Cook 2004: 199). It is therefore not *a priori* impossible that a form such as **qɛnɛ:ʁʷʌté:ʃ* might have existed historically. Nevertheless, this raises the question of how the set of rules in Table 11 could give rise to the modern pattern as shown in Table 10, where the strong grade occurs throughout the paradigm.

I propose that all of the modern forms in Table 10 can be derived from the reconstructed system of rules in Table 11, by regular sound change. In order to derive the 3rd person plural form, however, it is necessary that the consonants *[ʁ] and *[ʁʷ] not be, strictly speaking, deleted intervocalically, but rather *vocalized*. Formally, any consonant which bears the feature [low] loses its CPlace features, intervocalically, as shown in (15).

(15) Low consonant vocalization sound change



"A [low] consonant loses its CPlace features intervocalically."

Table 12: Sound changes to derive modern forms from Pre-Dëne Sųłiné forms.

	Column (a)	Column (b)	Column (c)
Pre-Dëne Sųłiné	*(nɛ.ˈʁuːʃ)(ˈtéː)	*(nɛ.ˈʁɥːˑ)(ˈtéː)	*(qɛ.ˈneː)(ʁʷʌ.ˈtéːʃ)
Low consonant vocalization (31)	*(nɛ.ˈuːʃ)(ˈtéː)	*(nɛ.ˈɥːˑ)(ˈtéː)	*(qɛ.ˈneː)(ˈwʌ.ˈtéːʃ)
Syncope	—	—	*(qɛ.ˈneːw)(ˈtéːʃ)
w > u	—	—	*(qɛ.ˈneː**u**)(ˈtéːʃ)
Vowel coalescence	*(ˈn**uː**ʃ)(ˈtéː)	*(ˈn**ɥː**)(ˈtéː)	*(qɛ.ˈn**uː**)(ˈtéːʃ)
Modern form (Li 1946)	nustέ	nɥtέ	hɛnutέs
English gloss	*'I will lie down'*	*'you (sg) will lie down'*	*'they will lie down'*

The only consonants which consist of only VPlace features, but no CPlace features, are glides. Therefore, the consequences of this sound change are as follows. When the consonant *[ʁ] loses its CPlace node, the result would be a [low] glide; since this is impossible, the segment is deleted. Thus: *[ʁ] > Ø, by (15). On the other hand, in the case of *[ʁʷ], while the feature [low] can not be realized on a glide, the feature [round] can. Therefore, [low] is deleted, and the result is a round glide: *[ʁʷ] > w, by (15). Table 12 shows a sequence of sound changes which take the output of the rules in Table 11 as their point of departure, to derive the modern forms in Table 10.

Finally, we will briefly consider the behaviour of the optative in Pre-Dëne Sųłiné, following a *disjunct prefix*—also known as a Level 5, or Word Level prefix. Previously in §2.3, I showed that, in the modern language, disjunct prefixes are invisible from the point of view of vowel alternations in the optative. This is consistent with what is known about the life cycle of phonological processes generally: they tend to become restricted to smaller and smaller domains over time (Bermúdez-Otero 2015). However, I also noted that, according to this same logic, it follows that phonological processes which today are restricted to small domains (e.g. Level 2) applied over progressively larger domains, the farther we go back into the past. Therefore, it would seem to follow that, in Pre-Dëne Sųłiné, the **ʁʷʌ ~ *ʁɥː* alternations in the optative should have been either a Word Level (Level 5) or even a Postlexical process. This means that disjunct prefixes ought to have been visible to the **ʁʷʌ ~ *ʁɥː* alternation, in much the same way as conjunct prefixes. Therefore, why then do we not observe reflexes of the strong grade of the optative throughout the paradigm whenever a disjunct prefix is present, in much the same way as we do for conjunct prefixes, as in Table 10?

It seems that, in PD, all disjunct prefixes either contained a full vowel (*CVː), or a reduced vowel followed by a consonant (*CVC) (Leer 1975). In other words, all disjunct prefixes, such as **q'eˑ* 'straight in a line' (1975: 6), **naˑ* 'reversative' (1975: 13), and **daɢ* 'up on top' (1975: 9) constituted heavy syllables. In a left-to-right iambic system, a heavy syllable at the left edge of the word will constitute a monosyllabic (Heavy) foot all by itself; therefore, it has no effect on whatever follows it. The same is true if there are multiple disjunct prefixes. To illustrate, let us consider the verb *jałtiː* 'speak, pray' (transcription as discussed in §1.0). In Table 13, we can compare and contrast the reconstructed Pre-Dëne Sųłiné forms in column (a), with the same forms from a modern speaker, Daniel Alphonse from Black Lake, Saskatchewan, in column (b).

The stress and foot boundaries shown in column (b) are based on my own subjective impression; however, my intent in including these is to illustrate that, in the modern language, the selection of the strong or weak grade of the optative bears no direct relation to the position of surface stress—we can see, for example, instances of the weak grade

Table 13: Optative of *jʌɬtiː* 'speak, pray', reconstructed and modern, with footing.

	Column (a) **Pre-Dëne Sųłiné (reconstructed)**	**Column (b)** **Black Lake, SK (modern)**
1st person singular	*('jaː)(**ʁʷʌ**s.'tiː)	(jʌ.'**wʌ**s)('tiː)
2nd person singular	*('jaː)(**ʁu̯**ːɬ)('tiː)	(jʌ.'**wu̯**ːɬ)('tiː)
3rd person singular	*('jaː)(**ʁʷʌ**ɬ.'tiː)	(jʌ.'**wʌ**ɬ)('tiː)
1st person plural	*('jaː)('**ʁú**ːl)('tiː)	(jʌ.'**wú**ːl)('tiː)
2nd person plural	*('jaː)('**ʁu**ːɬ)('tiː)	(jʌ.'**wu**ːɬ)('tiː)
3rd person plural	*('jaː)(qɛ.'**ʁu**ːɬ)('tiː)	(jʌ.'h**u**ːɬ)('tiː)

Data in column (b) elicited on 11/28/19; re-transcribed from author's notes.

(*wʌs, wʌɬ*) occurring in stressed position on the surface. Or more precisely, the relationship is opaque: in column (b), the choice of strong or weak grades reflects the position of stress earlier in the derivation, before the disjunct prefix *jʌ* was added. Conversely, in the reconstructed forms in column (a), the relationship between surface stress and choice of the strong or weak grade is transparent: even though the syllable **jaː* is 'visible' to the optative alternation, it has no effect, because *(jaː) constitutes a foot by itself. Thus, even if the **ʁʷʌ ~ *ʁuː* alternation in Pre-Dëne Sųłiné operated at Level 5, all of the modern forms can be derived from Pre-Dëne Sųłiné surface forms by regular sound changes, such as [low] consonant vocalization and vowel length neutralization, as discussed previously.[11]

Finally, regarding the tendency of phonological processes to become restricted to smaller and smaller domains over time, it is interesting that, so long as all disjunct prefixes constituted heavy syllables, the output predicted from the **ʁʷʌ ~ *ʁuː* alternation being a Level 5 process is the same as if it were a Level 4 process. This surface ambiguity may explain why this alternation was eventually re-assigned from Level 5 to Level 4.

5 Why [low] spreading cannot be a part of the modern synchronic grammar

So far, I have presented a reconstruction of the **ʁʷʌ ~ *ʁuː* alternation in Pre-Dëne Sųłiné. For the remainder of this paper, I will ask the questions (1) what else can we infer about Pre-Dëne Sųłiné, at the time that this alternation arose, and (2) to what extent is this alternation still a part of the synchronic phonology of modern Dëne Sųłiné? To begin, let us first consider the consonant inventory of modern Dëne Sųłiné. Table 14 is based on Li (1946: 398), except that I assume an additional underlying phoneme /ɲ/, a palatal nasal (Krauss & Leer 1981), to account for the behaviour of the 2nd person singular subject prefix, and the perfective prefix—see also Rice (1989: 61–62) for discussion of nasals in Slavey.

The main problem concerns the two dorsal series, which I have labeled "velar" and "labiovelar" above. Recall that, for Pre-Dëne Sųłiné, I have assumed thus far that the segment **ʁʷ*, and by extension the entire labio-uvular series, is specified as both [round] and [low]. Under the CH, this can only be the case if there exist other series which are non-[round] and non-[low]. In the modern language, of the two dorsal series, it is clear that the labiovelar is the only series which is [round] (based on its articulation, and morphophonemic behaviour). However, it is theoretically possible that both the velar and

[11] An alternative interpretation of these facts could be that, in Pre-Dëne Sųłiné, disjunct prefixes were not part of the verb word at all, and only became incorporated into the word later, after the *ʌ ~ uː* vowel alternations had already been established. This would be consistent with the usual assumption in the Dene linguistics literature, that the disjunct prefixes are later additions to the verb word than the conjunct prefixes (Keren Rice, p.c.).

Table 14: Dëne Sųłiné consonant inventory.

		Labial	Inter-dental	Alveolar	Lateral	Alveo-palatal	Velar	Labiovelar	Glottal
Stops and affricates	Plain	b	dð	d, dz	dl	dʒ	g	gʷ	
	Aspirate		tθ	t, ts	tɬ	tʃ	k	kʷ	
	Ejective		tθ’	t’, ts’	tɬ’	tʃ’	k’	kʷ’	ʔ
Fricatives	Voiced		ð	z	l		ɣ	ɣʷ	
	Voiceless		θ	s	ɬ	ʃ	x	xʷ	h
Sonorants	Oral	w		r		j			
	Nasal	m		n		ɲ			

Table 15: Examples of the conjugation marker *ɣɛ* both with and without a disjunct prefix.

Perfective of *hɛdʒən* ‘sing’ (Cook 2004: 264)		**Perfective of *ʃɛ̨tį: ‘eat’* (Li 1946: 413)**	
Cook’s transcription	**English gloss**	**Li’s transcription**	**English gloss**
ghesjën	‘I sang’	cɛ́**ɣɛs**tį	‘I ate’
ghįjën	‘you (sg) sang’	cɛ́ɣį̨tį	‘you (sg) ate’
ghejën	‘he/she sang’	cɛ́**ɣɛ**tį	‘he/she ate’
ghíjën	‘we sang’	cɛ́ɣí·tį	‘we ate’
ghuhjën	‘you (pl) sang’	cɛ́ɣwuhtį	‘you (pl) ate’
heghejën	‘they sang’	cɛ́hɛɣɛtį	‘they ate’

labiovelar series are specified as [low]—perhaps contrasting with the alveo-palatal series, which could constitute a non-[low] series under the dorsal node.

To see that this is not the case, however, consider the data in Table 15, which contain the *ɣɛ* conjugation marker. This prefix is a conjunct prefix just like the optative, and occurs in a very similar set of phonological and morphological environments. Even so, *ɣɛ* never triggers gamma lowering (cf. Hargus 1988: 144), i.e. spreading of [low] onto the following vowel, even in the exact same set of phonological and morphological environments we saw this happen with **ʁʷə*. This is illustrated in Table 15. Examples are given in the author’s original orthography; in Cook’s orthography, <gh> represents [ɣ] and <j> represents [dʒ]; in Li’s transcription, <c> represents [ʃ].

If the *ɣɛ* conjugation marker, and by extension the entire velar series, is not specified as [low], then this creates a problem: it would appear that the labiovelar series is specified as [low] redundantly, something claimed to be impossible under the CH. I will suggest, however, that spreading of [low] in the optative is no longer part of the synchronic grammar of modern Dëne Sųłiné—rather, the underlying form of the optative has been restructured to /ɣʷʌ/—this is also the underderlying form assumed by Li (1946: 413). If neither of the dorsal series are associated synchronically with the feature [low], then it is reasonable to call these series “velar” and “labiovelar” in the modern language, rather than “uvular” and “labiouvular”—this is because the feature [low] is assumed to be a property of uvular and pharyngeal, but not velar consonants (Padgett & Ní Chiosáin 1993).

Even if spreading of [low] is no longer part of the synchronic grammar, the observed asymmetry between the optative prefix and the *ɣɛ* conjugation marker is still interesting, from a historical perspective: why is it that, historically, the opative prefix **ʁʷɛ* triggered gamma lowering, while the *ɣɛ* conjugation marker did not? In the next section, I will suggest that this can tell us something interesting about how the Dëne Sųłiné consonant system was organized historically.

6 The importance of the historical 'retroflex' (*k̲ʷ >*tʃʷ > *tɽ) series

In the previous section, I argued that [low] spreading in the optative cannot be a part of the synchronic grammar of modern Dëne Sųłiné, because if ɣʷ (< *ʁʷ) were specified as a [round][low] segment, it would lack a [round] but non-low segment with which it contrasts. In this section, however, I will argue that such a series of segments did exist historically—and these were what are called the *retroflex* consonants in the Dene linguistics literature.

The retroflex series is so named because in the majority of Dene languages which preserve this series as distinct (e.g. Hän, Gwich'in, Upper Kuskokwim, Tolowa), it is pronounced as a series of posterior, apical affricates and fricatives, with a slight rhotic quality (*tɽ, dɽ, tɽ', sɽ, zɽ*) (cf. Krauss 1964, Krauss 2005). However, there is some disagreement in the literature regarding the historical development of this series. In early work, Krauss proposed that this series originated as a series of rounded front velar consonants in Proto-Athabaskan-Eyak (PAE), which was preserved intact in Proto Athabaskan (Proto Dene): (*k̲ʷ, *g̲ʷ, *k̲ʷ', *x̲ʷ, *ɣ̲ʷ) (1964: 122). This series contrasted with three other dorsal series: a front velar unrounded series (*k̲, *g̲, *k̲', *x̲, *ɣ̲), a rounded uvular ("back velar") series (*qʷ, *ɢʷ, *qʷ', *χʷ, *ʁʷ), and an unrounded uvular series (*q, *ɢ, *q', *χ, *ʁ). Thus, this reconstruction posited an essentially symmetrical system of four dorsal consonant series: front and back velars, both rounded and unrounded.

In later work (Krauss 1982, Krauss 2005), Krauss assumes that, already by the PD stage the front rounded velar series had evolved into a series of rounded alveopalatal consonants (*tʃʷ, *dʒʷ, *tʃʷ', *ʃʷ, *ʒʷ), which then evolved into retroflexes in some of the modern Dene languages. Leer (2005) takes this line of reasoning one step further, and assumes that this consonant series had already evolved into a true retroflex series by the PD stage (2005: 284). All of these proposals are consistent with the view that the series in question originated as a rounded front velar series, which evolved into a rounded alveopalatal series as an intermediate stage, before eventually becoming a retroflex series; the proposals merely differ as to when exactly these changes occurred. In this section, I will use the term *retroflex* in a broad sense, to refer to this series at all stages of its history, given that the precise character of this series historically is somewhat uncertain. However, I hope that some of the arguments presented in this section may provide some insight into the development of the retroflex series historically in Dëne Sųłiné.

If we reconstruct a feature hierarchy for Pre-Dëne Sųłiné under the most stringent possible assumptions—namely that the underlying form should be the same as the surface form, and that the grouping of phonemes under different nodes should reflect their surface phonetic character (for example, coronal segments do not appear under the dorsal node, and vice versa)—then the reconstructed hierarchy in Figure 8 would be consistent with the data presented thus far. For ease of exposition, the labial series has been omitted.

In Figure 8, I assume that dorsal is the default place of articulation, which is unmarked in relation to [coronal]. This representation is supported by the existence of the $t > k$ shift in some dialects of the language (e.g. Haas 1968), which can be modeled as deletion of the [coronal] node. In Figure 8, we can see that in order for the labio-uvular (*qʷ) series to be contrastively specified as [low], it needs to have a contrastive sister located under [round], and under the non-coronal (dorsal) node. It follows therefore that, at the time at which [low] spreading was phonologically active, the "retroflex" series was not only still present in the language, but was still a front rounded velar series (*k̲ʷ). If this series had already evolved into a true retroflex series (*tɽ), or even a rounded alveo-palatal series (*tʃʷ), then this series would need to be moved under the coronal node, in which case the *q^w series would no longer have a contrastive sister, and could no longer be specified

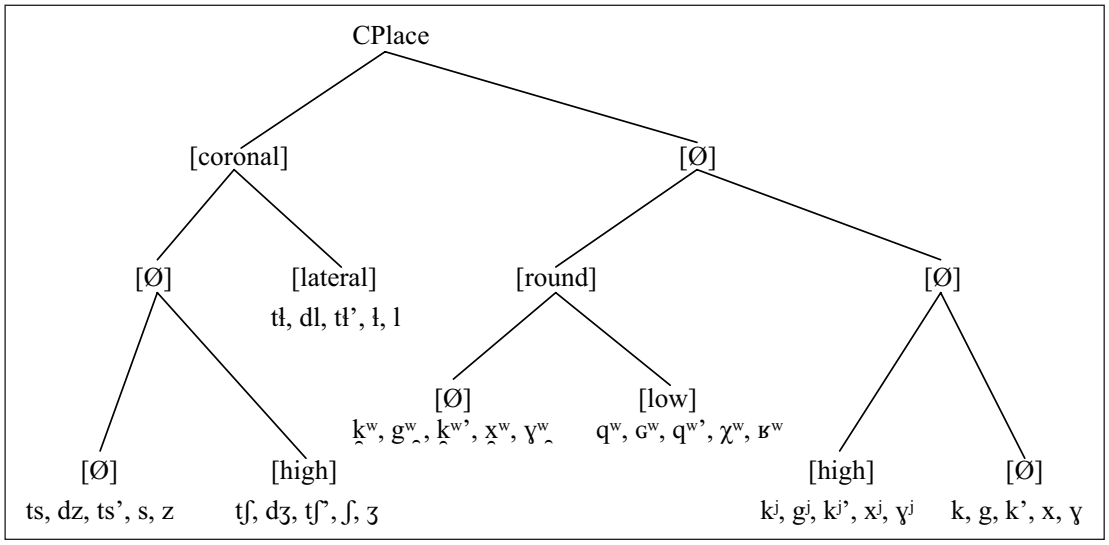


Figure 8: Reconstructed (non-labial) consonant place feature hierarchy for Pre-Dëne Sųłiné.

as [low]. The reconstructed consonant system in Figure 8 therefore closely resembles the system originally reconstructed by Krauss (1964: 122) for PAE.

An additional argument for the reconstructed hierarchy in Figure 8 is that the ordering of vocalic place features is identical to the feature ordering still used in the modern language (as in Figure 4). Thus, the ordering is [coronal] > [lateral] > [round] > [low] > [high], with the last three features in the same order as in the vowel system. Note also that the consonants also exhibit a featural asymmetry in a manner entirely parallel with the vowel system: the [round] consonants contrast in the feature [low], while the unrounded consonants contrast in the feature [high]. This asymmetry is reflected in my transcription, where I write the unrounded front velars, which are phonologically [high], with a superscript *j* (*kʲ), whereas I write the rounded front velars, which are not phonologically specified with the [high] feature, with a subscript (*k̲ʷ).

The asymmetrical feature hierarchy in Figure 8 would explain why, in Dëne Sųłiné, we observe spreading of [low] with the optative prefix, but not with the *ɣɛ* conjugation marker—something which is the opposite pattern of what is observed in many other Dene languages, such as Slavey (Rice 1989) and Tłı̨chǫ (Ackroyd 1982). For Dëne Sųłiné itself, the main empirical hypothesis I would like to advance is that, just as Krauss (1982) demonstrated that the PD **kʲ* series maintained its dorsal place of articulation in Dëne Sųłiné longer than was previously believed, so too there is evidence that the PAE **k̲ʷ* series also retained its dorsal articulation in Dëne Sųłiné much longer than was previously assumed—in particular, long enough to allow for the process of [low] spreading (or gamma lowering) in the optative. And by the same token, we may surmise that the *a* ~ *u* alternations observed in Dëne Sųłiné optative paradigms are quite ancient, dating back to a time when the consonant system resembled that reconstructed by Krauss (1964) for PAE.

7 What is the status of a ~ u alternations in the modern language?

In §5 I argued that spreading of [low] could no longer be a part of the synchronic phonology of modern Dëne Sųłiné, and in §6.0 I attributed this to the loss of the historical retroflex series. However, nothing precludes the spreading of [round] in the synchronic grammar, assuming the UR of the optative has been restructured to /ɣʷʌ/. In this section, I will suggest that that the synchronic analysis of optative *a* ~ *u* alternatıons in Dëne Sųłiné varies by dialect (and possibly from speaker to speaker) based on two criteria: (1) does a labiovelar series exist underlyingly, and (2) does a contrast between full and

reduced vowels exist underlyingly? Based on these criteria, a dialect (or speaker) may exhibit either phonological [round] spreading, phonologically conditioned allomorph selection, or morphologically conditioned allomorph selection.

This typology is consistent with the overall goals of the CH, in that it shows how the synchronic phonological status of an alternation in a given dialect is related to the phonemic inventory of that dialect. In addition, as we shall see, it also describes a pathway by which a phonological alternation can 'exit' the phonology and become morphologized, as it reaches the end of its life cycle. In this section, we will examine each of the three scenarios outlined in Table 16 in turn.

7.1 Vowel alternations as spreading of [round]

First I will present data from a conservative speaker, Allan Adam, now residing in Paddockwood, Saskatchewan (originally from Fond du Lac, Saskatchewan). Mr. Adam is also a trained professional Dëne Sųłiné interpreter and translator. Mr. Adam preserves labiovelar consonants in his speech, and also exhibits a contrast between full and reduced vowels. Thus, the phonological system for this speaker is very similar to the Dëne Sųłiné system described by Li (1933, 1946) many decades ago. The optative paradigm of *hɛdʒən* 'sing' is given in Table 17.

In Mr. Adam's speech, the vowel length difference between [ʌ] and [u:] is very clear, such that the speaker even volunteered (without being asked directly), "it's a long *u* sound. The *u* is long," in reference to the 3rd person plural form. This speaker also exhibits an interesting alternation between [ɣ] in the strong forms, and [w] in the weak forms—consistent with González's (2003) predictions about the relationship between sonority and prosodic position.[12] Given that there is a surface alternation between [ɣ] and [w], and given that the speaker pronounces labiovelars elsewhere, it is reasonable to suppose that the optative prefix is still underlyingly /ɣʷʌ/ for this speaker. That being the case, the alternations in Mr. Adam's optative paradigm can be analyzed in a very similar way to the reconstructed Pre-Dëne Sųłiné system examined in §3: the feature [round] spreads and delinks in the strong forms, in order to decease onset sonority. The only differences are that the vowel [ʌ] in the weak forms is not the result of a spreading process, but is underlying,

Table 16: Summary of criteria for synchronic status of *a* ~ *u* alternations.

Labiovelar series preserved underlyingly?	Full ~ reduced vowel contrast preserved underlyingly?	Synchronic status of *a* ~ *u* alternations
yes	yes	[round] spreading, prosodically conditioned
no	yes	Phonologically conditioned allomorph selection
no	no	Morphologically conditioned allomorph selection

Table 17: Optative paradigm of *hɛdʒən* 'sing' (Allan Adam, Black Lake/Fond du Lac, SK).

	Singular	Plural
1st person	(**wʌ**s.'dʒən)	('**ɣú**:)('dʒən)
2nd person	('ɣų:)('dʒən)	('**ɣu**:h)('dʒən)
3rd person	(**wʌ**.'dʒən)	('**hu**:)('dʒən)

Originally elicited 5/8/2018; re-elicited 12/2/2019.

[12] There is some variation in the strong forms between [ɣ], [w], and [h], whereas the weak forms uniformly have [w]. The speaker's intuition is that in the strong forms, both [ɣ] and [w] are acceptable.

and also /ɣʷ/ lenites to [w] in the weak forms (in this case, to *increase* onset sonority). Under this hypothesis, it is interesting to note that the feature [round] displaces—i.e. is stronger than—the feature [low], which it also outranks in the feature hierarchy in Figure 4. This is predicted by the CH.

7.2 Vowel alternations as phonologically conditioned allomorph selection

Next we will examine data from another speaker, Mr. Daniel Alphonse of Black Lake, Saskatchewan. Mr. Alphonse's phonological system is also conservative in that it maintains a contrast between full and reduced vowels, as shown in Table 18.

The main difference between Mr. Alphonse's dialect in Table 18, and Mr. Adam's dialect in Table 17, is that Mr. Alphonse uses the consonant [w] for the optative prefix throughout the paradigm, rather than having a *ɣ ~ w* alternation. Given this fact, it is somewhat unlikely that one could posit /ɣʷʌ/ as the underlying form of the optative prefix for this speaker. Rather, under standard assumptions regarding phonological abstractness, the initial consonant must be re-structured to /w/ underlyingly.

This has two major consequences. The first is that it is no longer possible to analyze the vowel alternations in (41) as [round] spreading and de-linking in prosodically strong position. Recall from §3.4 that the whole point of [round] spreading is to reduce the sonority of the onset consonant where the rule applies; in this case, since the onset consonant is [w] regardless, such spreading is unmotivated. Therefore, the most likely alternative is that the strong and weak grades of the optative in Table 18 are chosen through *phonologically conditioned allomorph selection*. Phonologically conditioned allomorph selection is when a given morpheme has two (or more) underlying forms, and the phonology selects whichever allomorph would be most harmonic in a given environment (Kager 1996; Rubach & Booij 2001; Anderson 2008). Allomorph selection is used extensively by Hargus in her analysis of the Dene language Witsuwit'en (Hargus 2007: 671–730). In the case of Table 18, if the two allomorphs of the optative are /wʌ/ and /wuː/, what conditions the choice between them?

I suggest that, broadly speaking, the allomorphy is conditioned by stress. /wʌ/ is the default or "elsewhere" allomorph, because, being a light syllable, it can fit into the weak position of an iambic foot. However, /wuː/ is chosen where the syllable needs to be stressed or heavy for independent reasons. For example, the 2sg, 1pl, and 2pl forms all have an additional vowel as part of the subject agreement prefixes *ne, íd,* and *uh*, which add an extra mora and therefore constrain the output vowel to be long.

The only form which seems not to fit this line of explanation is the 3rd person plural form, *hɛwʌdʒən*, where, on the surface, there appears to be a mis-match between stress and the choice of allomorph. However, this is actually the second major consequence of restructuring of the optative from /ɣʷʌ/ to /wʌ/ ~ /wuː/. Since the optative is a Level 2 (conjunct) prefix, at the point where it enters the derivation and the allomorphs are selected, it can only see other Level 2 (conjunct) prefixes. The prefix *hɛ* '3rd person plural'

Table 18: Optative paradigm of *hɛdʒən* 'sing' (Allan Adam, Black Lake/Fond du Lac, SK).

	Singular	**Plural**
1st person	(**wʌ**s.'dʒən)	('**wú**:)('dʒən)
2nd person	('**wụ**:)('dʒən)	('**wu**:h)('dʒən)
3rd person	(**wʌ**.'dʒən)	(hɛ.'**wʌ**)('dʒən)

Originally elicited 5/8/2018; re-elicited 11/28/2019.

is only added later (at Level 3). Therefore, once the vowel alternations in the optative are re-analyzed as allomorph selection, it necessary follows that the choice of allomorph will only be sensitive to Level 2 prefixes.

7.3 Vowel alternations as morphologically conditioned allomorph selection

The third and final logical possibility listed in the dialect typology in Table 16 is a dialect which has lost both the labio-velar series as well as the full ~ reduced vowel contrast underlyingly. Cook, in his chapter on linguistic change and variation in Dëne Sųłiné, suggests that all dialects except Tadoule Lake, Manitoba have lost the labio-velar series (2004: 23), and all dialects except Cold Lake, Alberta have lost the full ~ reduced vowel contrast (2004: 28–30). Therefore, according to Cook, the majority of dialects would fall into this category (although more data are needed in order to verify this claim).

In such dialects, which have lost contrastive vowel length in prefixes, there would no longer be any way to phonologically derive the distribution of *a* and *u* vowels which we have seen. Rather, while we would still posit two allomorphs, /wa/ and /wu/ (note: these no longer differ in length), their distribution would be morphologically governed, based on morphosyntactic features. The most likely analysis would be that /wu/ is constrained to appear only when the subject is 2nd person, or 1st person plural, whereas /wa/ is the elsewhere allomorph.

8 Conclusion

In this paper, I have explored the importance of contrast in informing historical reconstruction. I have used the Contrastive Hierarchy to deduce under what sets of conditions a certain alternation, the *a* ~ *u* alternation in optative paradigms, could have arisen. Specifically, I argued that this alternation arose at a much earlier stage of the language, at a time in which not only was the retroflex series still present, but in fact still retained its front rounded velar (*$\underset{\frown}{k}^{w}$) pronunciation. I also outlined a set of conditions under which this alternation might 'exit' the phonology and be re-interpreted as lexically listed allomorphy. These conditions, too, involve the set of contrasts in the phonological system. I have suggested that what ultimately causes phonological processes to become morphologized is not derivational opacity, but rather a change in the phonological inventory of the language, and the loss of certain key phonological contrasts. In this way, by linking the phonological status of an alternation to the set of contrastive relations in a language, the Contrastivist Hypothesis helps to limit phonological abstractness, and describes a pathway of diachronic change whereby new morphological patterns can arise.

It seems that the Contrastivist Hypothesis is unique among phonological theories, in that it enables one to use morphophonemic alternations to infer other structural properties of a language historically, at the time when these alternations originated. Since opaque and semi-fossilized morphophonemic alternations, such as I have examined here, are found throughout the Dene language family, the Contrastivist Hypothesis may open up new possibilities both for the internal reconstruction of individual Dene languages, as well as comparative reconstruction for the family as a whole.

Abbreviations

1sgS = 1st person singular subject, 2sgS = 2nd person singular subject, 1plS = 1st person plural subject, etc., 1sgO = 1st person singular object, etc., CH = Contrastivist Hypothesis, IPA = International Phonetic Association, OPT = optative, PD = Proto Dene, PNEA = Proto Northeast Athapaskan, SDA = Successive Division Algorithm, PAE = Proto Athabaskan-Eyak, QUAL = qualifier

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Competing Interests

The author has no competing interests to declare.

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