Connecting central vowels and high vowel fricativization using double place specification: Evidence from Lutuv (Lautu) Chin

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ABSTRACT: The phonological (i.e. featural) specification of central vowels, specifically high central vowels, has been a source of debate. While several featural representations, ranging from radical under-specification to novel, class-specific features, have been proposed, these approaches do not appear to be readily applicable to central vowels in Lutuv (Lautu), a South-Central Tibeto-Burman Chin language. High central vowels in Lutuv trigger fricativization in aspirated stop onsets: /pʰɨ/ is produced as [psɨ] and /tʰʉ/ as [tfʉ]. In this paper, I argue that, following the "shared features" model of feature geometry (Clements 1991; Clements & Hume 1995), central (high) vowels in Lutuv are specified for two place features, [coronal] and [dorsal]. I further suggest that central vowels of this specification are the natural result of a raising chain shift which centralizes front and back vowels via the addition of an antagonistic place node. This approach also provides a basis for the relationship between centralization and high vowel fricativization, and suggests that the fricativization process in Lutuv is driven by two factors: (a) the historical promotion of V-Place features to C-Place features in fricativized vowels via chain shift, and (b) the spreading of articulatory and perceptual burden of producing complex sounds via linking of C-Place features between segments. This is then accounted for using a series of Optimality Theory (Prince & Smolkensky 1993) constraints designed at replicating the cross-linguistic rarity of place feature combinations such as [coronal][dorsal] and [labial][coronal] which, in Lutuv, interact with constraints encouraging the leftward linking of C-Place-specified features.

1. Introduction

Proposals for featural specification and organization of features, primarily via Feature Geometry (Clements 1985; McCarthy 1988), often overlook the phonological specification of central vowels, especially high central vowels. This is likely a consequence of the overall rarity of high central vowels, especially those that must be underlyingly specified as central due to contrasts with back (and/or front) counterparts. While several representations for central vowels have been proposed, these models tend to either (a) subsume central vowels as an extra specification on front or back vowels (Parker 2000), or (b) argue that central vowels are phonologically placeless (Rice 1995). Both approaches tend to argue that central vowels are not expected to act as a natural class with respect to phonological processes to the exclusion of either front and back vowels; however, high central vowels in Lutuv (or Lautu) Chin (henceforth Lutuv), a South-Central Tibeto-Burman language, appear to contradict these expectations. Lutuv has a large vowel inventory that includes six high vowels, consisting of round–unround pairs at front, central, and back places of articulation, as well as four diphthongs with high vowel targets. This large inventory of high vowels is believed to have partially originated from a historical chain shift in which high front and back vowels centralized, and mid vowels raised (Lotven 2020). The high central vowels are articulatorily complex and demonstrate some degree of high vowel fricativization (HVF, see Faytak 2014): high central vowels partially fricativize aspirated obstruent onsets (e.g., /pəkʰʉ/ → [pəkf͡ʉ], /səkʰɨ/ → [sək͡sɨ]). The characteristics of fricativization are not consonant-dependent, but vowel-dependent: /ʉ/ appears to produce labial frication and /ɨ/ appears to produce coronal frication. The association between /ɨ/ and a coronal property is indicative that the central vowels in Lutuv are not underspecified for place or subsumed under back vowels.

In this paper, I argue that high central vowels in Lutuv are specified for both a front and back component; specifically, following a feature hierarchy adapted from Clements and Hume (1995), I argue Lutuv /ɨ/ and /ʉ/ are both specified for [coronal] and [dorsal] and /ʉ/ is additionally specified for [labial]. This specification can be accounted for as a result of historical centralization processes which involve the addition of an antagonistic place node. The combination of features [coronal] and [dorsal] together appears to be dispreferred, which can be formalized using a series of Optimality Theory (OT; Prince & Smolensky 1993) constraints on feature combinations. I then argue that the dispreference of [coronal] and [dorsal] is crucially higher-ranked than constraints on the appearance of aspiration/consonantal frication. I also argue that HVF in Lutuv can be explained as the promotion of the original, pre-centralization place feature from the V-Place node to the C-Place node, in line with Clements' (1991) account of Swedish HVF. The distinction between C-Place vowel features and V-Place vowel features also provides a succinct explanation for which features are spread by /ɨ/ and /ʉ/, respectively.

The organization of this paper is as follows. In section 2, I present an overview of previous proposals for the specification of central vowels, with a specific focus on high central vowels. In section 3, I provide a comprehensive description of the appearance and alternation of central high vowels in Hnaring Lutuv. Furthermore, I demonstrate that existing models struggle to account for processes involving these vowels. In section 4, I propose a set of featural specifications for the Lutuv vowels that accounts for fricativization with potential cross-linguistic implications. Lastly, in section 5, I provide an OT analysis for partial fricativization of central high vowels in Lutuv. Concluding remarks can be found in section 6.

2. Phonological specification of central (high) vowels

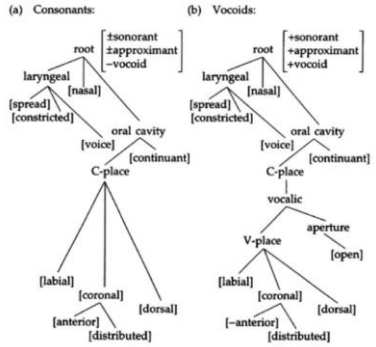
The earliest featural compositions for vowels maintained a single binary feature for vowel backness, [±back] (Chomsky and Halle 1968), allowing for either front or back vowels, but not central vowels. This issue was partly avoided because central vowels in Slavic and Turkic languages patterned with phonological [+back] vowels in processes such as palatalization and vowel harmony (Parker 2000). However, the existence of three-way contrasts, such as Swedish /y/~/ʉ/~/u/ made clear the need for a new featural approach to central vowels. Kenstowicz (1994) proposed a solution of underspecification: back vowels are specified for [+back], front vowels are specified for [-back], and central vowels have no [±back] feature. This approach was supported by Rice (1995), who argues central vowels are placeless under two criteria: their tendencies to (a) assimilate and (b) delete, citing examples from Tulu (Bright 1972) and Korean (Sohn 1987).

Multiple authors (Stockwell 1966; Harms 1967, 1968; Lindau 1978; Ferrari 1984; Labov 1994) refer to the feature [±peripheral], which groups sounds produced on the outer edges of the vowel space (front unrounded, back rounded, and low segments) under the feature [+peripheral] and sounds produced in the interior area of the vowel space (central vowels and front rounded vowels) under the feature [-peripheral], in order to solve the problem of specification in central vowels. This proposal falls short, however, as it groups together front rounded vowels and central vowels, which both dilutes the distinguishing power of the feature [round] and proposes a natural class of which there appears to be no evidence of (Parker 2000). A second issue, acknowledged by Lindau (1978), is that the description of [peripheral] has significant overlap with the feature [ATR], therefore introducing a partially redundant feature.

The original Vowel Place Theory (VPT) model from Clements and Hume (1995) follows Kenstowicz and Rice's approaches to central vowels—they are underspecified. However, Parker

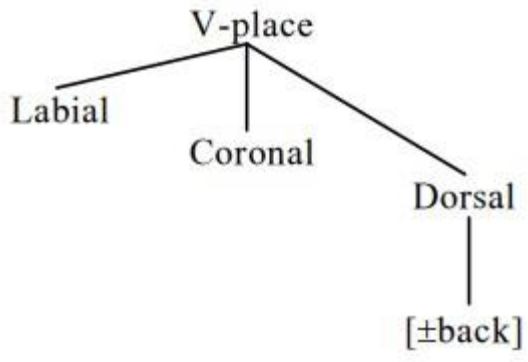
notes that this ignores the cross-linguistic pattern of central vowels patterning with back vowels as opposed to front vowels. He therefore proposes that the feature [±back] be added under the [dorsal] node in a similar manner to [±round] under [labial] (p. 12). This creates a distinction between non-coronal vowels that are central [-back] or back [+back].

Figure 1. Vowel Place model (Clements and Hume 1995)



In place of [±peripheral], Parker (2000) proposes reintroducing the feature [±back] into the Vowel Place Theory (VPT) model of feature geometry proposed by Clements (1991) and Clements and Hume (1995). Under this model, seen in Figure 1, consonants and vowels share a unified set of privative place features, eliminating [±back] and replacing [-back] with [coronal] and [+back] with [dorsal]. Vowel roundedness is still characterized as a [+round] feature under the [labial] node.

Figure 2. Modified VPT model (Parker 2000)



While this approach does provide a sound featural specification for contrastive central vowels, it does not appear to account for allophonic variation in Lutuv central vowels.

3. Lutuv high central vowel fricativization

Lutuv is a language belonging to the South-Central branch of the Tibeto-Burman family. Lutuv is spoken primarily in Chin State in western Myanmar and in neighboring areas of Bangladesh and Eastern India (Eberhard et al. 2021), as well as in refugee communities across Malaysia, Australia, and the United States. The vowel inventory for Lutuv can be seen in Table 1 (Bohnert et al. 2022).

Table 1. Lutuv vowel inventory

	Front	Central	Back	Diphthongs
High	i y	ɨ ʉ	ɯ u	i̯e yə̯ ɯə̯ uo̯
Mid	ɛ	ə	ɔ	
Low		a		

As seen in Table 1, Lutuv maintains a phonemic contrast between six high vowels, consisting of three pairs of round and unround vowels at front, central, and back places of articulation. This contrast can be seen in the contrastive pairs (with Lutuv orthography) in (1).

(1) a. *ki* /ki/ 'hatch' b. *kyi* /ky/ 'break (round things)'
c. *kiy* /kɨ/ 'horn' d. *kuv* /kʉ/ 'hand'
e. *ky* /kɯ/ 'dry up' f. *ku* /ku/ 'break'

The six-way phonemic contrast at one height is incredibly rare. In the UCLA Phonological Segment Inventory Database (UPSID) of 451 genetically- and areally- balanced languages (Maddieson and Precoda 1992), none of the languages maintain a contrast between six, or even five, high vowels.

The central vowels /ɨ/ and /ʉ/ appear to act as a natural class in the context of aspirated stop onsets, where both sounds cause a process of fricativization that produces a distinct stop-fricative sequence as seen in (2) below.

(2) a. *phiy* /pʰɨ/ [psɨ] ‘sweep’ b. *phuv* /pʰʉ/ [pfʉ] ‘escape’
c. *thiy* /tʰɨ/ [tsɨ] ‘blood’ d. *thuv* /tʰʉ/ [tfʉ] ‘paint’
e. *sakhiy* /səkʰɨ/ [səksɨ] ‘deer’ f. *pakhuv* /pəkʰʉ/ [pəkfʉ] ‘cough’

This fricativization process does not occur with other high vowels (i.e., /tʰy/ cannot be produced as [tfy] or [tsy]). This process appears to indicate that /ɨ/ and /ʉ/ are partially fricativized, similar to attested forms of high vowel fricativization (HVF). Faytak (2014) defines high vowel fricativization as the process by which a vowel is produced with both a vocalic articulation using the tongue body and a simultaneous articulation of fricative noise (often using the tongue tip but potentially the lips). In Lutuv, fricativization is more common in /ʉ/ than /ɨ/. The degree of fricativization varies; in non-aspirated onsets it can surface from approximant- or fricative-like constriction at the right edge (i.e. [Cʉ̬̝] to full fricativization (i.e., [Cʏ]) depending on segmental context, speech rate, and other factors. Full fricativization is more common with labial onsets and less common with velar onsets. Observations of high vowel fricativization outside of contexts with aspirated stop onsets have, however, not been phonetically investigated; as such, little can be commented on other than its existence, and the broader conditioning of fricativization is excluded from this analysis.

As can be observed in (2), the place of articulation of the fricative noise is constant for /ɨ/ and /ʉ/ regardless of place of articulation of the stop: for /ɨ/, the fricative is coronal and [s]-like; for /ʉ/, the fricative is labial/labiodental[1] and [f]-like. Because the place features of this fricative noise are not coming from the consonant, the most plausible origin is from the vowel. This would therefore require /ɨ/ and /ʉ/ to contain featural specifications capable of fulfilling the place features of [coronal] and [labial] respectively. The correlation between /ʉ/ and [labial] is rather obvious;

[1] The distinction between labiodental and labial articulation of this fricativized element is variable, and appears to be a fine-grained, phonetic distinction that, considering the larger, phonological focus of this paper, will not be addressed at the present time.

both are specified for [labial] as /ʉ/ requires a labial node containing [+round]. The relationship between /ɨ/ and [s] is less explicable and is less easily accounted for under the models proposed in Section 2: underspecified central vowels (i.e., vowels with no place node) would have no place features to spread and would be expected to not fricativize. A specification of [±back] under the [dorsal] node (Parker 2000) explicitly excludes any interaction with [coronal]. It therefore appears that a different analysis is required.

4. An analysis of Lutuv central high vowel fricativization

For this analysis, I intend to retain Parker's (2000) use of the Vowel Place Theory (VPT) model for two reasons. First, its representation of C-V interaction is paramount. Second, as will be demonstrated below, Clements' (1991) separation of C-Place and V-Place provide a possible explanation for the partial high vowel fricativization in the central vowels.

Under the VPT model, the appearance of [s] in the context of /ɨ/ could be explained as spreading of a [coronal] node. This approach would suggest that the central high unrounded vowel is specified for [coronal]; however, a specification of [coronal] alone would result in a front vowel /i/, suggesting that additional specification is required. There is little reason to assume that this additional specification is under coronal for the same reasons Parker (2000) argues for central vowels to be contained under [dorsal]: central vowels *can* pattern with back vowels. Therefore, additional specification under [coronal] would predict a baseless natural class of front and central vowels. The remaining option within the existing set of features is [dorsal]. The result is a specification that central vowels are doubly specified for [coronal] and [dorsal]. Because /ɨ/ and /ʉ/ pattern together in fricativization processes, I will argue here that both are double-specified and /ʉ/ has an additional [labial] specification.

This approach utilizes a similar form of specification to that of a front rounded vowel, that is both [labial] and [coronal]. I must state here that this approach is not novel; Clements (1991) uses a similar featural description for the Swedish central vowel /ʉ/ (p. 113). However, Clements does not seem to generalize this specification for other central vowels, and Clements' Swedish vowel specification has some differences that will be discussed below. Double specification introduces several benefits: first, the double-specification approach better addresses the cross-linguistic markedness of central vowels relative to other categories by representing central vowels as more articulatorily complex[2]. Second, it provides a featural specification that still accounts for Rice's (1995) observations of central vowels. Looking closer at the specific data Rice (1995) cites in (3) and (4), we see assimilation of /ɨ/ in Tulu, a Dravidian language, and Korean.

(3) Tulu
a. /ari+nɨ/ [arinɨ] 'rice-ACC' b. /uru+nɨ/ [urunu] 'country village-ACC'
(4) Korean
a. /is+ɨmyən/ [isimyən] 'to connect'

In both of these contexts, Rice views the central vowel as placeless and assimilating; however, it could also be seen as a delinking of a place node in the context of an antagonistic feature; that is, in Tulu, [coronal] delinks in the presence of [dorsal], and in Korean, [dorsal] delinks in the presence of [coronal]. This delinking process can then be rationalized as simplification of a marked segment via assimilation.

Another consequence of a double-specification approach is that it aligns with observations of high vowel fricativization (HVF), both in Lutuv and on a larger scale. Let us first consider Clements' (1991) account for HVF and the /y/~/ʉ/~/u/ contrast in Swedish. Dialects of Swedish have been well-documented for having high vowels produced with a considerable degree of

[2] Schwa and low vowels not included, see section 4.

frication (Engstrand et al., 2000; Schötz et al., 2013; Riad, 2013, 2021). Clements characterizes this devocalization or fricativization of Swedish high vowels as the presence of place features split between both the C-Place and V-Place nodes, where the C-Place specification indicates the less vocalic element of the vowel. This approach mirrors the phonetic realities that (a) /ʉ/ and /u/ are labial in nature and (b) /i/ and /y/ are coronal in nature, while also providing a clean featural specification of the central vowel.

Table 2. Feature specification of Swedish high vowels (Clements 1991)

C-Place		/i͡j/	/y͡ɥ/	/ʉ͡β/	/u͡β/
	[labial][3]			+	+
	[coronal]	+	+		
V-Place					
	[±round][4]		+		
	[coronal]			+	

This same approach can be modified to produce our observations from Lutuv with minor changes. First, the [dorsal] node (in V-Place) is also required to adequately specify all six high vowels. Second, whereas Swedish fricativizes all high vowels, Lutuv only fricativizes the central vowels. This can be formally represented by placing all vowel features for non-central vowels solely under the V-Place node. This produces the following featural specifications:

[3] Clements does not include a dorsal node in his diagram. I assume he deems [dorsal] unnecessary for phonological vowel contrasts in Swedish as all dorsal vowels are also labial and can thus be underspecified for [dorsal].
[4] Under [labial].

Table 3. Feature specification of Lutuv high vowels

C-Place		/i/	/y/	/ɨ/	/ʉ/	/ɯ/	/u/
	[labial]				+		
	[coronal]			+			
V-Place							
	[±round]		+				+
	[coronal]	+	+		+		
	[dorsal]			+	+	+	+

Using this set of features, all six high vowels are specified, and the fricativization of /ɨ/ and /ʉ/ is accounted for via C-Place features. If all features of the central vowels were under the V-Place node, there would be little explanation for which features spread for /ɨ/ and /ʉ/, as there is no inherent benefit in spreading [coronal] over [dorsal]; however, if the relevant spreading feature is placed under the C-Place node, it becomes a logical source of spreading over other features.

A question can be posed as to why /ɨ/ and /ʉ/ are specified for [coronal] and [labial], respectively, in the C-Place node. An answer can potentially be found in the relationship between HVF and chain shift. Faytak (2014) argues that high vowel fricativization is cross-linguistically most common as a result of chain shifts. Looking at Sinitic and Bantu languages with HVF, Faytak (2014) finds fricated high vowels have resulted from historic vowel raising processes which impede on the high vowel space. This impediment forces speakers to maintain the distinction using a cue other than vowel height. Fricativization occurs when passive stridency that is inherent to high vowels is reweighted as a cue to a phonological vocalic contrast between two sounds which are no longer easily dissimilated by the first formant. However, fricativization also has the effect of centralizing a high vowel; for example, Schötz et al. (2013) note that Viby dialects of Swedish which fricativize /i/ produce a vowel with formant structure closer to [ɨ]. Faytak (2014) also notes that in cross-dialectal comparison, if a language/dialect in a given group has phonemic fricative high vowels, a related language/dialect often has central high vowels in that same context. From

this, a generalization could be made that fricative vowels are merely underlying central vowels (specified for both [coronal] and [dorsal]) which have promoted a place feature from the V-Place node to the C-Place node. Faytak (2014) directly refers to fricative vowels as "characterized in articulation as having simultaneous tongue tip and tongue body constriction" (p. 53), which matches the specification of [coronal] and [dorsal] is stating under Clements and Hume's (1995) definitions of those features. In all cases, the promoted feature corresponds to the original featural specification; in other words, a vowel /i/ that is underlyingly [coronal] centralizes due to chain shift via the addition of a [dorsal] node; however, in order to preserve the original [coronal] nature of the sound, that feature is promoted to C-Place.

This finding also appears to apply to Lutuv. In Lotven's (2020) reconstruction from Lutuv to Proto-Kuki-Chin (PKC), Lutuv /ɨ/ and /ʉ/ primarily correspond to PKC *ii and *uu, while Lutuv /i/ and /u/ are new vowels resulting from coda loss effects in PKC *eC and *uC, meaning Lutuv high vowels underwent a form of centralization chain shift. The resulting fricativized vowels therefore match Faytak's claim of a connection between centralization/chain shift and HVF.

It must be acknowledged that this analysis does not address non-high central vowels. Lutuv has two non-high central vowels /ə/ and /a/. I do not include these vowels because I believe both are underlyingly underspecified for place. I argue this for several reasons. First, /ə/ and /a/ do not participate in the fricativization phenomenon presented above, suggesting a different underlying specification. Second, /ə/ is a true neutral vowel; it shows large amounts of variation in production and can surface as higher or lower and more front or more back depending on context. Fleming (2007) considers this a lack of a well-defined target; it therefore appears to be a vowel reflective of the neutral position of the tongue which must necessarily be underspecified. The low vowel /a/ functions in a similar manner in Lutuv; a likely explanation is that /a/ is also unspecified for place

but is specified for [low]. Two things account for this: first, we must remember that this representation is the result of centralization chain shifts. Downward chain shifts are rarer and, given the comparative size of the articulatory space for low vowels and high vowels, it is apparent that the high vowel space has more space to centralize while maintaining a phonological contrast. However, the shape of the lower oral cavity provides little space for enough tongue tip or body movement to realize this kind of phonological contrast. This can be evidenced by the lack of a three-way contrast between low front, low central, and low back vowels in many vowel inventories. To articulate a low central vowel specified for [coronal] and [dorsal], the simultaneous tongue tip and tongue body constriction may be too articulatorily complex, especially when an underspecified low vowel produces the same result.

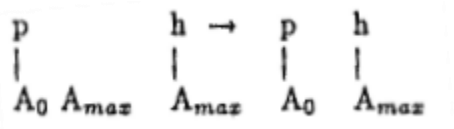
3.1. Aspiration as a target for fricativization

While fricativization in Lutuv is somewhat irregular or results in partial fricativization, it is highly regular and perceptible in the context of aspirated stop onsets. The question then arises as to why fricativization is so robust with aspirated stop onsets. Under most feature-geometric proposals, including the VPT model, aspiration is represented using the feature [spread glottis] under the laryngeal node; however, there is no innate connection between [spread glottis] and vowels that would readily account for spreading. A sensible explanation is available but requires a minor, albeit non-arbitrary, modification to VPT in which we analyze Lutuv aspirated stops as complex segments.

Clements and Hume (1995) treat complex segments, such as prenasalized stops and affricates, as possessing two root nodes because of a constraint in their proposed featural hierarchy on branching. The No Branching Constraint states that configurations where A is any class node (including the root node), A immediately dominates B and C, and B and C are on the same tier, are

ill-formed. Thus, an affricate, which consists of a pair [-continuant][+continuant], places each [continuant] feature into its own root. This approach draws from Steriade's (1991) Aperture Theory (AT), which classifies complex segments as multiple "aperture nodes" specifying the degree of airflow. Under AT, normal stops consist of two aperture nodes, A_0, specifying oral closure (i.e the closure portion of the stop); and A_{MAX} specifying unrestricted airflow (i.e., the release portion of the stop). Steriade posits two possible configurations for aspirated stops. The first is near-identical to traditional specifications: a stop (consisting of nodes A_0 A_{MAX}) where A_{MAX} is specified for [spread glottis]. In her analysis of aspiration and glottalization in Mazateco, Steriade (1994) posits a second form of aspiration which is carried by an independent node that later combines with the stop, as in Figure 4.

Figure 4. (Steriade 1994)

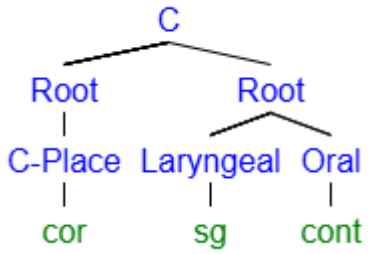


The second form of aspiration is practical in representing aspiration contrasts in languages that have contrastive aspiration outside of oral stops, like Mazateco. Grijzenhout (1996) uses this description of aspiration to account for aspiration and lenition processes in Welsh. Like Mazateco and Welsh, Lutuv has aspiration in sonorants as well as obstruents, suggesting that aspiration in Lutuv could benefit from a similar analysis.

This approach could be replicated in the VPT model. Clements and Hume (1995) translate Steriade's aperture node into the root note, which is then specified for features [continuant], [sonorant], and [approximant]. A sequence of A_0 A_{MAX} A_{MAX} can therefore be interpreted as two root nodes. The first root node represents the stop and contains [-continuant] (which, based on the VPT model's privative features, means it lacks [continuant]) and the place specifications of the

stop. The second node is specified for [continuant] (in line with A_{MAX}) and a laryngeal node containing the feature [spread glottis]. As a result, aspirated stops have a root node that is unspecified for place, making it a primary target for C-Place spreading, and the resulting affricate is represented with minimal change.

Figure 5. Adapted VPT representation of aspirated stop (ex. /tʰ/) in Lutuv



5. OT formalization

To represent this process in Optimality Theory (Prince & Smolensky 1993), several factors must be accounted for. First, the OT analysis should make claims about the combination/organization of place features in such a way that combinations of [coronal] and [dorsal] are dispreferred over other combinations of place features. Specifically, the dispreference of [coronal] and [dorsal] is higher-ranked than a constraint on spreading place features, which must be analyzed as a form of featural simplification. The analysis must also account for the lack of spreading to non-aspirated obstruents[4].

First, the dispreference for [coronal] and [dorsal] can be accounted for by postulating a set of markedness constraints on co-occurrence of place features; specifically, these constraints must

[4] Lutuv contrasts voiceless and voiced sonorants /m n ŋ l r m̥ n̥ ŋ̊ l̥ r̥/. Blevins (2018) and others assume a featural specification for voiceless sonorants that includes [spread glottis], suggesting voiceless sonorants should be integrated into this analysis; however, sequences of voiceless sonorants and /ɨ ʉ/ have not been attested in Lutuv, barring their integration into this analysis. Thank you to the reviewer who noted this gap in the phonological system.

specify that a violation of these features occurs when the place features are under a single root node. For the purposes of this analysis, these constraints are being applied to vowels; however, one could argue that, because place features are shared between consonants and vowels under the Clements and Hume model, these constraints should also apply to consonants. This implementation has potential merit, as labio-coronal and coronal-dorsal complex consonants are far rarer than labio-velar ones (Ladefoged & Maddieson 1996).

This markedness constraint is specified in order to allow repair of the violation via feature spreading; by linking (and thereby sharing) a place node under two root nodes, the "burden" of over-specification is lifted, potentially explaining why spreading is a solution to complex vowel articulation in Lutuv. Another potential solution could be place feature delinking, as outlined in (3) and (4) above. The formalized constraints can be seen in (5-8) below:

(5) *([LABIAL])[CORONAL][DORSAL][5]: The place features [coronal] and [dorsal] must not be dominated by a single root node.

(6) *[LABIAL][CORONAL]: The place features [labial] and [coronal] must not be dominated by a single root node.

(7) *[LABIAL][DORSAL]: The place features [labial] and [dorsal] must not be dominated by a single root node.

Note that this constraint refers to place features contained under both C-Place and V-Place; this is not a problem for the VPT model, as Clements and Hume (1995) overtly state that a place feature under C-Place and an identical place feature under V-Place are on the same plane, which refers

[5] Technically, the central high rounded vowel /ʉ/ is specified for all three place features, [labial], [coronal], and [dorsal]. However, *[LABIAL][CORONAL][DORSAL] operates the same as *[CORONAL][DORSAL] in the following analysis; *[CORONAL][DORSAL] is therefore used for the sake of brevity.

only to the place, not its parent node. Postulating a series of constraints of all place combinations is also useful as it provides a rationale for different patterns in vowel inventories at a higher level: a language may rank *[CORONAL][DORSAL] higher than *[LABIAL][CORONAL], disallowing central vowels but allowing front rounded vowels, or vice versa if *[LABIAL][CORONAL] is ranked higher than *[CORONAL][DORSAL]. A high ranking of both constraints could therefore produce a vowel inventory with no front rounded or central vowels. For Lutuv, we can determine that the combination of [coronal] and [dorsal] (as well as more complex combinations including [labial]) is more marked than all other place combinations, producing the following ranking:

(8) *([LABIAL])[CORONAL][DORSAL] >> *[LABIAL][CORONAL], *[LABIAL][DORSAL]

Spreading of C-Place always moves towards the onset, as Lutuv has no coda consonants except for a nasal stop, which can only co-occur with /i u a/. Spreading can therefore be accounted for using a left-alignment constraint for the node C-Place. This approach is borrowed from McCarthy's (2011) approach to account for wider processes of auto-segmental spreading.

(9) ALIGNL(C-PLACE, σ): Align features under the node [C-Place] to the left edge of the syllable.

In order to account for spreading for central vowels but not other complex vowels, the alignment constraint must be lower-ranked than *[CORONAL][DORSAL] but higher-ranked than the other place combination constraints.

(10) *[CORONAL][DORSAL] >> ALIGNL([C-PLACE], σ) >> *[LABIAL][CORONAL], *[LABIAL][DORSAL]

It must be acknowledged that the transformation of the aspirated element into a fricative violates a simple identity constraint on the feature [spread glottis], which is assumed to be delinked during fricativization. This constraint is lower-ranked than the constraint of *[CORONAL][DORSAL],

allowing fricativization in these contexts, but higher-ranked than *[LABIAL][CORONAL] and *[LABIAL][DORSAL], barring fricativization in these contexts.

(11) *[CORONAL][DORSAL]>> IDENT([SG]) >>*[LABIAL][CORONAL], *[LABIAL][DORSAL]

This set of ordered constraints produces the following output:

Table 4. Tableau of fricativization in /pʰɨ/

/pʰɨ/	*[COR][DOR]	ALIGNL(C-Pl., σ)	IDENT(sg)
a. pʰɨ	*!	**	
☞ b. psɨ		*	*

This tableau successfully accounts for spreading for /ɨ/ with aspirated stop onsets. Candidate (4a) violates the high-ranked constraint of *[CORONAL][DORSAL]; however, candidate (4b) does not, as it has linked the [coronal] feature between two root nodes. Candidate (4b) also violates ALIGNL(C-Pl., σ) one violation less than (4a), as the [coronal] feature in C-Place is one position closer to the left edge of the syllable. This set of constraints also accounts for spreading in /ʉ/, despite [coronal] or [dorsal] not being the C-Place feature which spreads, as the linking of all place features under two root nodes satisfies *[COR][DOR].

Table 5. Tableau of fricativization in /tʰʉ/

/tʰʉ/	*[COR][DOR]	ALIGNL(C-Pl., σ)	IDENT(sg)
a. tʰʉ	*!	**	
☞ b. tfʉ		*	*

However, the current analysis does not yet account for (a) a lack of spreading in non-central high vowels or (b) outputs with different places of fricative noise, such as linking the [dorsal] feature of /ɨ/ instead of [coronal], or the [coronal] feature of /ʉ/ instead of [labial]. These issues can be addressed with a single constraint. As detailed in Section 4, /ɨ/ and /ʉ/ are specified with [coronal] and [labial] under C-Place. Linking a different place feature, such as [dorsal], would

require "promotion" of [dorsal] to C-Place over [coronal]. This change can be viewed as a violation of the identity of the C-Place node.

(12) IDENT([C-PLACE]): Do not alter the value of the feature specified under C-Place.

This identity constraint also prevents the promotion of V-Place features to C-Place in other vowels like /y/. This constraint appears to higher ranked than ALIGNL(C-Pl., σ), as changing the identity of C-Place cannot be used as a way of ensuring left-alignment:

(13) IDENT([C-PLACE]) >> ALIGNL(C-Pl., σ),

These rankings can be seen in action in Tables 6 and 7:

Table 6. Expanded tableau of fricativization in /pʰɨ/

/pʰɨ/	*[COR][DOR]	IDENT([C-PLACE])	ALIGNL(C-Pl., σ)	IDENT([SG])
a. pʰɨ	*!		**	
☞ b. psɨ			*	*
c. pxɨ		*!	*	*
d. tsɨ		*!		*

Table 7. Tableau of non-fricativization in /pʰy/

/pʰy/	IDENT([C-PLACE])	ALIGNL(C-Pl., σ)	IDENT([SG])	*[LAB][COR]
☞ a. pʰy		**		*
b. psy	*!	*	*	
c. pfy	*!	*	*	

These constraints appropriately constrain spreading to only features pre-specified in C-Place as a remedy of a complex central vowel and prohibit promotion of a feature to C-Place, as in (6c) and

(7b-c). As seen in (6d), this constraint also has the added benefit of preventing the vowel place features from further spreading from the aspiration to the stop.

Lastly, we must account for the lack of fricativization with unaspirated stops. To account for the latter, we rely on the proposal in Section 4 that Lutuv aspirated onsets are realized as complex segments with two root nodes. Unaspirated obstruents are specified for only one root. In order for spreading to appropriately apply, an additional root node would have to be inserted. This constitutes a marked violation of a faithfulness constraint, formalized in (14).

(14) DEP(Root): Do not insert an additional root node to a segment

This constraint appears to be undominated. An exemplary tableau is seen in Table 8.

Table 8. Tableau of non-fricativization in /pɨ/

/pɨ/	DEP(Root)	*[cor][dor]
☞ a. pɨ		*
b. psɨ	*!	

6. Conclusion

In this paper, I have argued that the high central vowels in Lutuv are specified for both [coronal] and [dorsal] under a system of shared place features. The specification of [coronal] and [dorsal] appears to originate from a historical process of centralizing chain shift, where front and back vowels are centralized via the addition of an antagonistic place node. The addition of this node introduces articulatory complexity, including simultaneous tongue tip and body articulation, which further drives the production of intrinsic fricative noise. Perceptual factors may then drive the phonologization of this contrast, which can be represented under the Clements and Hume (1995) model as promotion of features from V-Place to C-Place. The featural representation of Lutuv central high vowels can therefore be explained both on a phonological and phonetic level

as a balance of articulatory and perceptual factors which result in a partially-fricated centralized vowel.

The articulatory dispreference can then be formalized with a set of Optimality Theory constraints on place combinations. When combined with constraints on the spreading (as well as restrictions on the ability of spreading to alter C-Place or root node specification), fricativization is accounted for with the following constraint hierarchy:

(15) DEP(ROOT) >> *[CORONAL][DORSAL] >> IDENT([C-PLACE]) >> ALIGNL([C-PLACE], σ) >> *[LABIAL][CORONAL], *[LABIAL][DORSAL]

This OT analysis does not, however, address the variable additional fricativization in syllables with non-aspirated onsets (i.e. /Cʉ/ → [Cʉv] or [Cɣ]). This is likely a result of the same constraints on vowel complexity further combined with an inability to link leftward due to the constraints of DEPROOT and IDENT([C-PLACE]); however, this form of fricativization is not a regular process. It is possible that the *ability* to fricativize the remaining vowel can be accounted for using an OT approach, but that its appearance is ultimately the result of phonetic factors.

While this approach is explanatory for central vowels resulting from historical centralization processes, a crucial next step is to determine (a) the existence of central high vowels in three-way backness-contrasting system that do *not* result from centralization and (b) whether central vowels in these systems are incompatible with a double-specification approach.

References

Blevins, J. (2018). Evolutionary Phonology and the life cycle of voiceless sonorants. In S. Cristofaro & F. Zúñiga (eds.), *Typological Studies in Language* (Vol. 121, pp. 29–58). John Benjamins Publishing Company.

Chomsky, N. & Halle, M. (1968). The sound pattern of English. New York: Harper and Row.

Clements, G. N. (1985). The geometry of phonological features. Phonology Yearbook 2:225-52.

Clements, G. N. (1991). Place of articulation in consonants and vowels: a unified theory. *Working Papers of the Cornell Phonetics Laboratory* 5. Ithaca, New York: Cornell University. pp. 77-123.

Clements, G. N. & Hume, E. V. (1995). The internal organization of speech sounds. In John A. Goldsmith (eds.), *The handbook of phonological theory (Blackwell Handbooks in Linguistics)*. Cambridge, Mass.: Blackwell. pp. 245-306.

Eberhard, D. M., Simons, G. F., & Fennig, C. D. (eds.). (2021). *Ethnologue: Languages of the World*, 24. Dallas, Texas: SIL International. Online version: http://www.ethnologue.com.

Faytak, M. (2014). High vowel fricativization and chain shift. *UC Berkeley Phonology Lab Annual Report*.

Hume, E. (1991). Consonant/vowel interaction in Maltese: implications for feature theory. In B. Birtch et al. (eds), *Proceedings of WECOL 20*. Fresno: California State University.

Kager, R. (1999). *Optimality theory*. Cambridge: Cambridge University Press.

Kenstowicz, M. (1994). *Phonology in generative grammar*. Cambridge, Mass.: Blackwell.

Kirby, J. P. (2011). *Cue selection and category restructuring in sound change*. [PhD dissertation, University of Chicago]

Lindau, M. (1978). Vowel features. *Language* 54, pp. 541-563.

Ladefoged, P. and Maddieson, I. (1996). *The sounds of the world's languages*. Cambridge, Mass.: Blackwell.

Labov, W. (1994). *Principles of Linguistic Change, Volume 1: Internal Factors*. Wiley.

Lotven, S. (2020). Some Diachronic Phonological changes from Proto-Kuki-Chin to Lutuv. *Indiana Working Papers in Southeast Asian Linguistics*, 2(1).

Parker, S. (2000). Central vs. back vowels. *Work Papers of the Summer Institute of Linguistics, University of North Dakota Session*, 44,

Prince, A., & Smolensky, P. (1993). *Optimality Theory: Constraint Interaction in Generative Grammar*. New Brunswick, NJ: Rutgers University Center for Cognitive Science.

Rice, K. (1995). On vowel place features. *Toronto Working Papers in Linguistics*, 14.

Schötz, S., Frid, J. & Löfqvist, A. (2011). Exotic vowels in Swedish: a project description and an articulographic and acoustic pilot study of /i/. *Fonetik,* 51.

Steriade, D. (1993). Closure, release, and nasal contours. In M. K. Huffman & R. A. Krakow (eds.) *Nasals, nasalization, and the velum*, pp. 401–470. Orlando: Academic Press.

Stockwell, R. P. (1966). *Problems in the interpretation of the Great English Vowel Shift*. Unpublished manuscript. Los Angeles.