Realization of Gemination in Malayalam Past Tense Morphology

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ABSTRACT
This paper explores the emergence of geminate stops in the morpho-phonology of past-tense inflection in Malayalam verbs. Malayalam has two allomorphs that mark past tense: [-i] and [-u]. While the former attaches to stems with the phonological structure CVCC, CVC and CV without any morpho-phonological sandhi between the stem and affix, the latter allomorph only attaches to CVCC stems with two kinds of morpho-phonological assimilation patterns. Further, the past tense of the causative form of all verbs in Malayalam is uniformly marked by the [-u] allomorph.

In the light of these observations, we propose that the past tense morpheme [-u] Malayalam is underlyingly two distinct morphemes with a consonant that is not linked to the skeletal tier. So, underlyingly these are [-Cu]. The properties of the C emerge on affixation. Using Element Theory (Backey 2011) we propose that this "floating" C is of two types. It is either a dental stop |I?| or a dental nasal stop |I?L|.

1 Introduction

Although Malayalam, a South-Dravidian language, has a phonemic contrast between voiced and voiceless obstruents[1], the voiceless counterpart does not surface as a singleton consonant in an intervocalic context. Similarly, the voiced counterpart does not surface as a geminate. This distributional restriction on obstruents in Malayalam has been shown in (1).

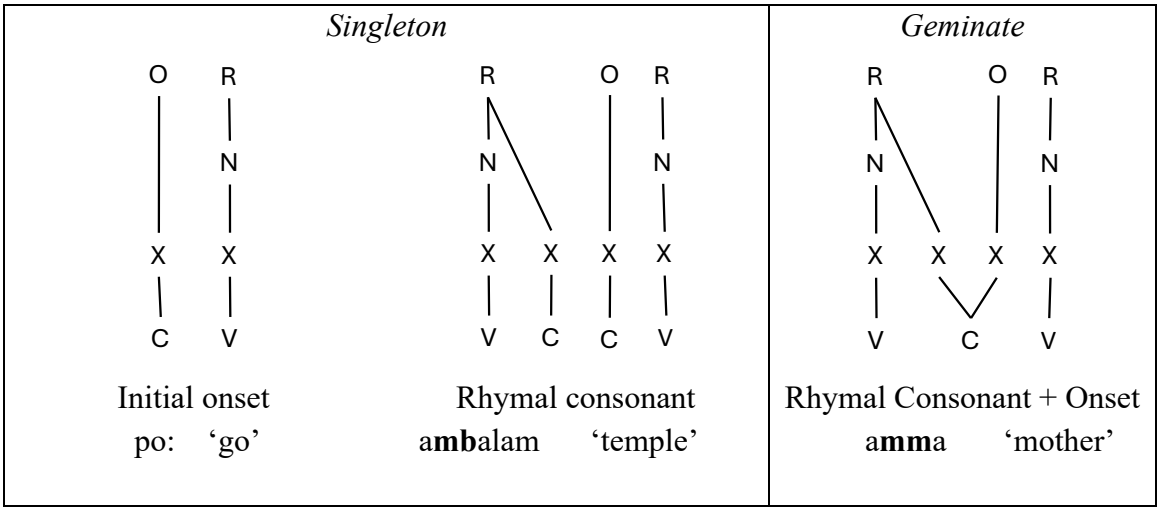
1. Distributional restriction on obstruents in Malayalam (Surface realization)

		Word initially	Intervocalic
Singleton Ç	[p, t̪, ʈ, c, k]	✓	×
Geminate ÇÇ	[pp, t̪t̪, ʈʈ, cc, kk]	×	✓
Singleton C	[b, d̪, ɖ, ɟ, g]	✓	✓
Geminate CC	[bb, d̪d̪, ɖɖ, ɟɟ, gg]	×	×

[1] Proto-Dravidian did not have a laryngeal contrast in voicing. However, many of the modern Dravidian languages have acquired this contrast historically due to the continued contact with Indo-European languages over the centuries that has resulted in lexical borrowings.

Based on these distributional restrictions, gemination and voicing are seen as phonological strategies to avoid singleton voiceless obstruents in intervocalic positions (Namboodiripad & Garellek, 2016). In Government Phonology (KLV 1990), a singleton consonant can either be linked to an onset or to a Rhymal node. While all consonants in the repertoire can be licensed in the onset position, governed by the following nucleus, a rhymal consonant needs to be governed by the following onset. For this, the rhymal consonant must not be more complex than the following onset. While a geminate can be readily analysed as a combination of a rhymal consonant and a following onset, a singleton stop in a word-initial or inter-vocalic context has to be an onset. This is shown in (2).

2. Structural representation of singleton and geminates



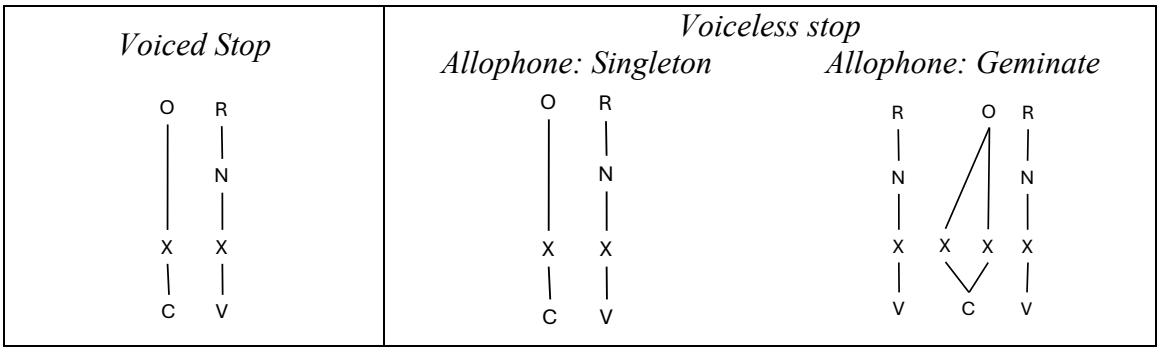
In Malayalam, the geminate stops are not restricted to intervocalic contexts. They can be preceded by laterals or rhotics in medial positions. This is shown in (3).

3. Voiceless geminates and voiced stops preceded by a C in medial position

	preceding lateral		*preceding rhotic*	
Voiced	na**lg**-uga	give.infinitive	a:**rb**a:ɖ-am	luxury
Voiceless	ka**lpp**ikk-uga	order.infinitive	a**rpp**aɳ-am	offering

This shows that the geminate in Malayalam can be formed even when the rhymal position is occupied by another consonant. Based on this we propose that in Malayalam, the geminate can be formed as an onset cluster. In fact, this medial onset cluster geminate is an allophone of the singleton voiceless onset found in word-initial positions. The revised structure of voiced and voiceless stops in Malayalam is shown in (4).

4. Structure of voiced and voiceless stops in Malayalam



The verbal domain of Malayalam shows both singleton and geminate patterns (5).

5. Gemination and voicing in Malayalam verb inflection

	Infinitive	*Past*	
Gemination	no:**kk**-uga	no:**kk**-i	look
Voicing	pa:**ɖ**-uga	pa:**ɖ**-i	sing

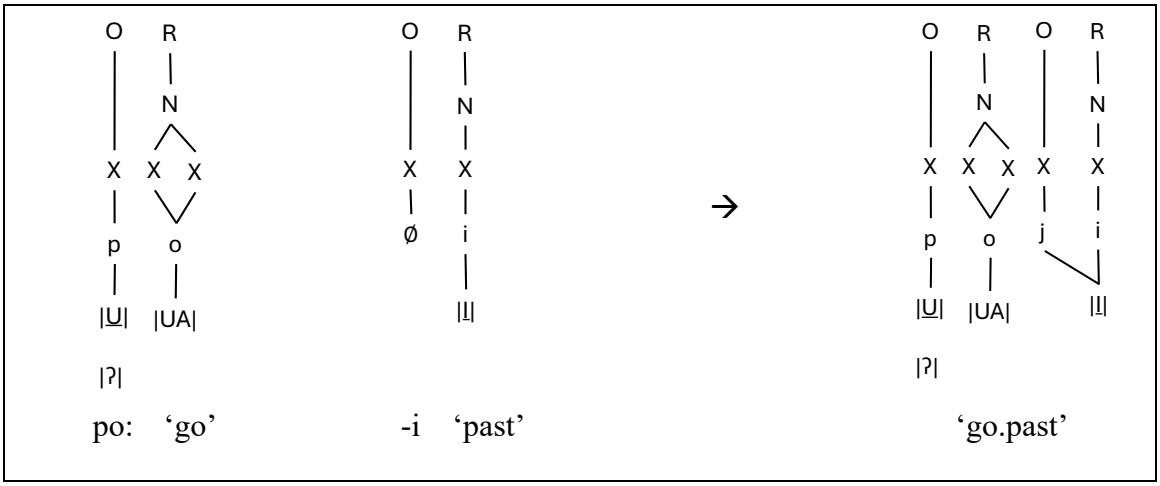
Since both voiced and voiceless stops appear in the same morphologically derived contexts, the difference in laryngeal specification must be part of the underlying phonological representation of the two verb roots in (5). The final C of the verb root in 'look' is specified as an onset cluster, while that of 'sing' is not. In this paper, we denote this structural difference with the sequence $CVCC_0$ and CVC, respectively. Further, we show that the choice of past-tense allomorph [-u] in Malayalam verbs makes a crucial reference to the underlying phonological structure of the verb root. Apart from verbs with the phonological strings $CVCC_0$ and CVC, Malayalam also has CV verbs. The phonological concatenation of these three kinds of verbal stems with suffixal morphemes that begin with V or C is expected to create the phonological strings shown in (6).

6. Phonological concatenation in Malayalam verb roots

Root	*Suffix*	*Resulting phonological string*
$CVCC_0$	-VC	$CVCC_0VC$
	-CV	$CV\mathbf{CC_0C}V$
CVC	-VC	CVCVC
	-CV	CVCCV
CV	-VC	C**VV**C
	-CV	CVCV

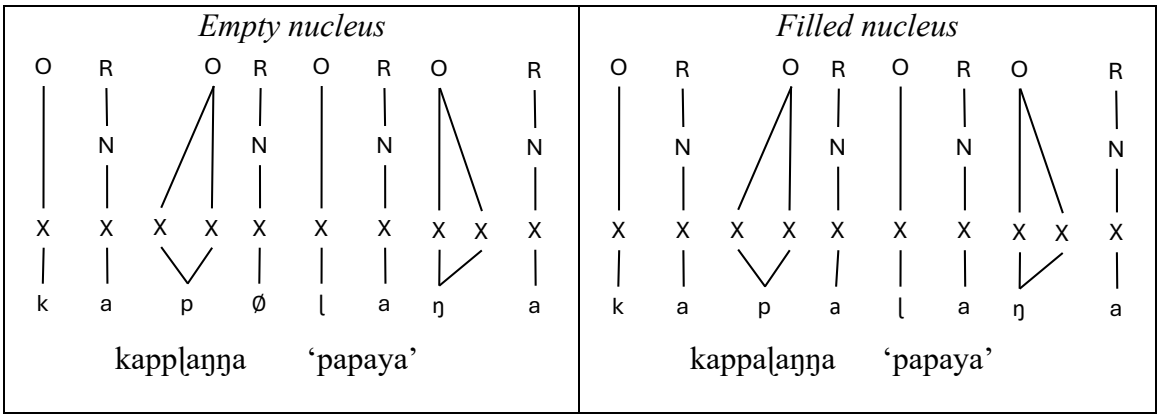
Among these concatenated phonological strings, we expect the CVVC sequence to show morpho-phonological adjustment processes in order to avoid vowel hiatus. The vowel hiatus could either be tolerated, or resolved through vowel deletion, vowel coalescence or consonant insertion. In Malayalam, we see that when a CV verb root like [po:] 'go' concatenates with the past tense suffix [-i], a homorganic glide [j] surfaces between them. This is shown in (7).

7. Realization of homorganic glide in vowel hiatus contexts



Similarly, we expect the sequence CV**CC$_0$C**V to show some phonological adjustment since the suffixal C cannot form a cluster with the geminate. Following strict locality (KLV 1990) an onset can dominate a maximum of two skeletal positions. In Malayalam, both these positions are occupied by the stop in CVCC$_0$ verb stems. If a C were to follow the geminate, it would have to do so with an intervening empty nucleus. In the non-verbal paradigm we can find examples of such CV**CC$_0$C**V sequences with optional intervening vowel. This is shown in (8).

8. Structure of CV**CC$_0$C**V sequences in Malayalam



In the inflectional paradigm of verbs, we do not see this kind of optionality, since all verbal inflections in the language appear to be V-initial suffixes (Asher & Kumari 1997). However, once we look closely at the inflectional domain of Malayalam verbs, one specific inflectional paradigm stands out as a morpho-phonological anomaly that appears to be extremely idiosyncratic. The past tense suffix exhibits a departure from the expected phonological concatenation pattern in two ways. First, the morpho-phonological processes seen at the juncture between the two morphemes in the past tense context is different from the processes seen in case of other v-initial verbal suffixes in Malayalam. This is shown in (9).

9. Contrast between Past Tense and other verbal inflections

Root type	*Past*	*Present*	*Future*	*infinitive*	
$CVCC_0$	viɭicc-u	viɭikkj-uɳɳu	viɭikkj-um	viɭikkj-uga	'call'
CVC	ʈaɳɳ-u	ʈaɾ-uɳɳu	ʈaɾ-um	ʈaɾ-uga	'give'
CV	po:j-i	po:g-uɳɳu	po:g-um	po:g-uga	'go'

All the inflectional markers attaching to the verb roots in (9) are V-initial. Yet, the stem that surfaces with the past tense suffix differs from the present, future and infinitive marked verbs. The right edge of the verbal stem in the past differs from the right edge for the same verb stem in the other morphological contexts. This indicates that the morpho-phonological readjustment at the morpheme juncture in past differs from the rest. For example, the CV root [po:] 'go' is expected to show morpho-phonological adjustment processes to avoid the sequence C**V**VC and does surface with an intervening consonant. But the consonant inserted in the past form [j] is distinct from the one inserted in elsewhere, [g].

Second, the past tense morpheme has two allomorphs, [-i] and [-u], while the other inflections do not exhibit allomorphy. Further, one of these allomorphs [-u] only attaches to C-final stems, $CVCC_0$ and CVC, producing three distinct allomorphic patterns. The data pertaining to this is shown in (10).

10. Attachment of past tense allomorph [-u]

Root Type	*Past*	*Infinitive*	
$CVCC_0$	aɖaɲɲ-u	aɖaj-uga	'close'
	vitt-u	vilkk-uga	'sell'
CVC	ʈoʈʈ-u	ʈoɖ-uga	'touch'

In the first pattern the stem-final consonant is converted to a nasal with the same place of articulation. For example, the palatal /j/ is converted to the palatal nasal /ɲ/ on attaching the past tense [-u]. In the second pattern a stem-final complex [lk] surfaces with the

voiceless alveolar geminate[2] [tt] preceding the morpheme [-u]. In the third pattern, the stem final consonant surfaces as a corresponding geminate preceding [-u] even though the verb root is a CVC. Thus, irrespective of whether the verb root ends in a single C or a CC_0, when attached to the past tense morpheme [-u] the stem ends in a geminate.

Based on the distinct morpho-phonological behavior of the past tense allomorph [-u], we propose that the surface representation for this morpheme is not identical to its lexical specification. Specifically, we argue that this past-tense morpheme is a C-initial suffix where the phonological properties of the suffix-initial C interact with the stem-final C and produce gemination patterns. While the set of verb roots that each of the past tense allomorphs, [-i] and [-Cu], concatenate with is lexically specified and hence unpredictable, the phonological adjustment processes that they undergo post concatenation is completely regular. Thus, we show that the locus of all irregularity in Malayalam past-tense allomorphy is restricted to the vocabulary item insertion rules in the morphological domain, and the domain of phonology is entirely regular.

In the following sections we will reconstruct the underlying phonological forms for the past tense allomorphs and the verb roots based on the phonological concatenation patterns. For this, we will use a combination of the CV Theory (KLV 1990) and Element Theory (Backley 2011). Relevant details of this approach to phonology have been introduced in §2.

2 CV and Element Theory

In this paper, the segmental properties of the phonological string have been analyzed using Element Theory (Backley 2011). All speech segments including consonants and vowels are described using six Elements. These six elements which are divided into three types based on whether they denote place, manner or laryngeal characteristics. These are shown in (11).

11. Three types of Elements

Place of articulation	|I|	|U|	|A|
Manner of articulation	|ʔ|	|H|	
Laryngeal property	|L|		

In this theoretical approach consonantal and vocalic place of articulation is denoted by the same elements denoting place of articulation, |I|, |U| and |A|. Voicing and nasality is denoted by |L| and stop and frication is denoted by the elements |ʔ| and |H] respectively. The element-based configuration of oral and nasal stops has been shown in (12). These will be used for the phonological analysis of sandhi patterns in §3 and §4.

[2] Voiceless alveolar geminates in Malayalam do not have a singleton counterpart. Hence it is restricted to intervocalic environments. However, the geminate is in contrastive distribution with the other voiceless geminate stops including dental and retroflex.

12. Consonantal configuration of elements

	Labial |U|	Dental |I|	Alveolar |A|	Retroflex |A|	Palatal |I|	Velar |U|
Oral stops	p |U?|	t̪ |I?|	t |A?|	ʈ |A?|	c |I?|	k |U?|
Nasal stops	m |U?L|	n̪ |I?L|	n |A?L|	ɳ |A?L|	ɲ |I?L|	ŋ |U?L|

In the table of segmental properties presented in (12), there are pairs of segments that share the same element for the place of articulation. For example, alveolar and retroflex are both marked by the element |A|. These are further distinguished by the property of headedness, marked by a horizontal line below the element. Ordinarily voicing and nasality, both considered to be laryngeal characteristics, is marked by the element |L|. A headed |L̲| marks a voiced obstruent, and without headedness it marked nasality, as in |L|.

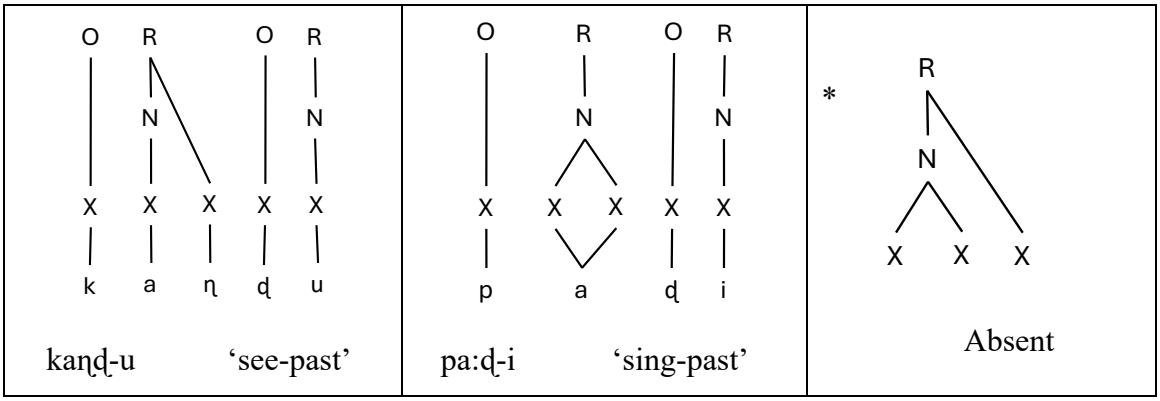
The phonological string is represented by a skeletal tier that comprises of linear sequence of x nodes. The segmental material lexically specified for a morpheme, attaches below these x-nodes. This skeletal tier is further dominated by a sequence of onset O and N nodes. Each x-node dominated by an O must be realized as a consonant and each x-node dominated by an N must surface as a vowel irrespective of the elements it dominates. This is shown in (13).

13. Representational tiers in phonology

O N	O N	O N
| |	| |	| |
x x	x x	x x
| |	| |	| |
|I| |A|	|U| |A|	|A| |A|
ja	wa	ra

Each N node in further dominated by a rhyme node denoted by R. Each of these three structural nodes O, N and R can maximally dominate two x-nodes in a representational structure. This follows from the principle of strict governance, where one of the nodes of a constituent, the governor, must locally govern the other constituent that is dominated by a common mother node (KLV 1990). Thus, a rhyme R might maximally contain either a long vowel, an N dominating two x-nodes, or a rhymal consonant in addition to a short vowel. This is shown in (14).

14. Maximal structure dominated by N and R



In the representational figures that we use to denote sandhi, we will typically show the structure below the skeletal tier unless the higher nodes are crucial to the argument being presented.

3 Morpho-Phonology in Past Tense affixation

In this paper we assume the theoretical position that all concatenative phonology takes place post-syntactically. Specifically, following Chomsky (2001), we assume that the syntactic derivation is shipped out to the phonological module in phases and at each phase the lexicalized phonological material undergoes phonological re-adjustment wherever necessary. As discussed in §1, based on the nature of the morpho-phonological sandhi patterns, we have divided the past tense morpheme into two allomorphs, a C-initial [-Cu] and a V-initial [-i]. In this section, we will discuss further details of each of these.

3.1 The [-Cu] allomorph

There are two patterns of past tense morpho-phonological sandhi on attachment of a [-Cu] suffix to the verb root. In one of these cases the sandhi produces a dental nasal geminate at the juncture of the two morphemes and in another a dental stop geminate.

15. The two patterns of sandhi with the [-Cu] allomorph

Root	*Past*	*Infinitive*	
parakk	para**n̪n̪**-u	para**kk**-uga	'fly'
koɖukk	koɖu**t̪t̪**-u	koɖu**kk**-uga	'give'

The realization of the geminate -kk- sequence with the infinitive in (15), shows that both the verb stems belong to the type $CVCC_0$. Although the phonological environment for the affixation of the past morpheme seems to be identical in both cases, a verb root ending in -kk attaching to [-Cu], the phonological output for them is not the same. In both cases the

velar stop |U?| changes to a dental stop |I?|. Additionally, in some cases, the dental stop is a nasal |I?L|. So, we find that there is a special type of [-Cu] affix, the [-C_Nu], that contains the element [L| in addition to being a velar stop.

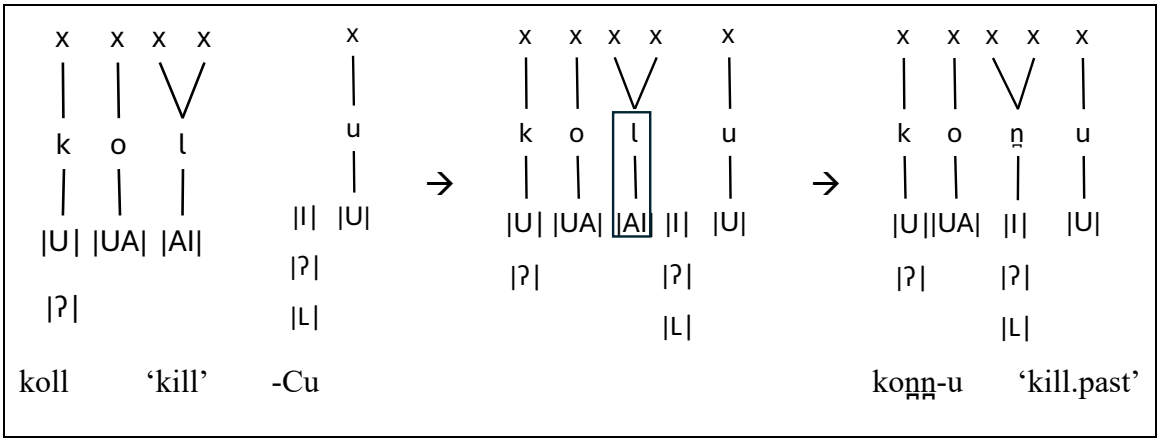
The dental nasal geminate, |I?L|, is not restricted to verb roots ending in the velar stop |U?|. In addition to velar stops it also appears verb roots that end with alveolar laterals and nasals. This is shown in (16).

16. Environment for |I?L|

Root	*Past*	*Infinitive*	
koll	ko**n̪n̪**-u	ko**ll**-uga	'kill'
t̪inn	t̪i**n̪n̪**-u	t̪i**nn**-uga	'eat'
parakk	para**n̪n̪**-u	para**kk**-uga	'fly'

All three verb roots in (16) are of the $CVCC_0$ type where the last consonant of the root is attached to two positions on the skeletal tier. As earlier, this is deduced by examining the infinitive form of the verb where the verb root attaches to the V-initial suffix [-uga]. Irrespective of the place of articulation specified in the underlying representation of the verb root, alveolar |A| or velar |U|, they surface as a dental |I| in the past form. This suggests that the element |I| must have been part of the past suffix. The skeletal positions that were earlier associated with different root specifications are delinked from their original specification and re-linked to the melodic specification of the floating C segment in the suffix initial position. This is schematically shown in (17).

17. Structural representation for dental nasal sandhi



In (17), the past tense suffixal morpheme comes with extra material that is unattached to segmental position. When this suffix concatenates with a verb root, the final melody of the verb root gets delinked in order to accommodate the floating melodic configuration from

the suffix. Just like the final root melody, this floating suffixal melody also gets linked to two adjacent segmental positions at the root edge, forming a geminate dental nasal.

The same past tense allomorph |Iʔʟ|-|U| also attaches to verb roots ending in a singleton rhotic to form geminate dental nasals. This is shown in (18).

18. Geminate |Iʔʟ| from singleton rhotics

Root	*Past*	*Infinitive*	
var	va**n̪n̪**-u	va**r**-uga	‘come’
t̪ar	t̪a**n̪n̪**-u	t̪a**r**-uga	‘give’

As per the element-based classification of consonantal segments in Backley (2011), there are three consonantal articulations that are denoted only by the place feature. These are the palatal glide /j/ corresponding to the element |I|, the labial glide /w/ denoted with |U| and the alveolar rhotic marked as |A|. This was shown in (13) of §2. In Malayalam all these consonantal phonemes that fail geminate. This shows that in order to occupy two segmental positions dominated by an onset, the melodic composition must contain the elements |ʔ| or |H| that are exclusively associated with consonants.

Unlike the voiceless stops, that cannot surface as singletons in medial positions, the nasal consonants do not have any distributional restriction. They can appear as both singleton as well as geminate in medial positions. However, just like the voiceless stops, the dental, palatal and velar nasals only appear as geminates in the word medial position. This is shown in (19).

19. Singleton-geminate contrast in medial nasals

	Singleton		*Geminate*	
|Uʔʟ|			t̪e:ŋŋa	‘coconut’
|U̲ʔʟ|	uma	'name’	umma	‘kiss’
|Iʔʟ|			paɲ̪ɲ̪i	‘pig’
|I̲ʔʟ|			maɲɲə	‘snow’
|Aʔʟ|	a:na	‘elephant’	annam	‘food’
|A̲ʔʟ|	maɳam	‘smell’	maɳɳə	‘soil’

Based on this structural restriction on nasal singletons, we propose that the verbs ending in rhotics surface as geminate due to two independent reasons. First the rhotic |A| cannot geminate, so even if we assume the stem to have the underlying structure of $CVCC_0$ the structural position of the second C will become visible only when the floating consonantal melody is realized. Second, the floating melody of dental nasal stop cannot surface as a

singleton onset, so even if we assume the stem to have the underlying structure of CVC the medial onset with the dental nasal would be realized as a geminate.

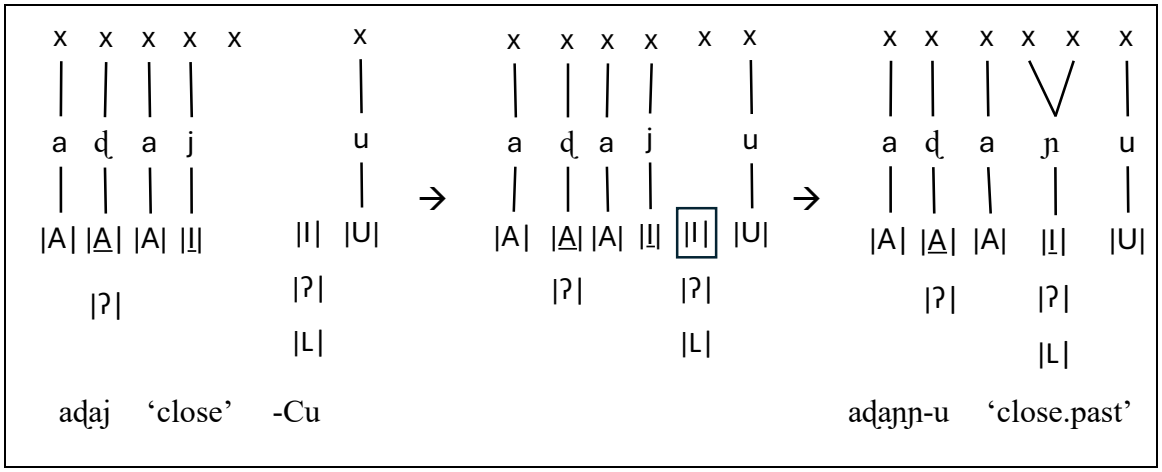
Similarly, a nasal geminate stop also surfaces when the verb root ends in a singleton palatal glide. However, unlike in the case of the rhotic, the palatality of the stem-final melody is preserved in the nasal stop that emerges with the past tense morpheme. This is shown in (20).

20. Geminate palatal nasal stop in past tense

Root	*Past*	*Infinitive*	
aḍaj	aḍa**ɲɲ**-u	aḍa**j**-uga	'close'
karaj	kara**ɲɲ**-u	kara**j**-uga	'cry'

As discussed in (12) of §2, the dental and palatal consonants share the same element |I|. While palatal has a headed |I|, the dental has a non-headed |I|. In a context where the root final consonantal melody shares the same place of articulation with the suffix initial consonantal melody, the former does not delink. Instead, the more intense realization of |I| as a headed |I| in a palatal gets coalesced with the manner and laryngeal specifications of the floating melody |I?L|. This is shown in (21).

21. Structural representation for palatal nasal sandhi



Although Malayalam has six different places of nasal articulation in the language that corresponds to the oral stops, it is crucial to note that only two of these, the dental and palatal surface with the past tense allomorph [-C_N u]. This confirms that the suffix is specified for the melody |I?L| with the element |I| that gets realized as a geminate with $CVCC_0$ type roots.

The [-Cu] allomorph with the melody |I?| shows a similar pattern where it surfaces as a geminate palatal stop when the verb root ends in a palatal consonant, and as a dental elsewhere. This is shown in (22).

22. Geminate |I?| in past tense morphology

Root	*Past*	*Infinitive*	
aḍakkj	aḍa**cc**-u	aḍa**kkj**-uga	‘close’
aḍikkj	aḍi**cc**-u	aḍi**kkj**-uga	‘beat’
koḍukk	koḍu**ṯṯ**-u	koḍu**kk**-uga	‘give’
eḍukk	eḍu**ṯṯ**-u	eḍu**kk**-uga	‘take’

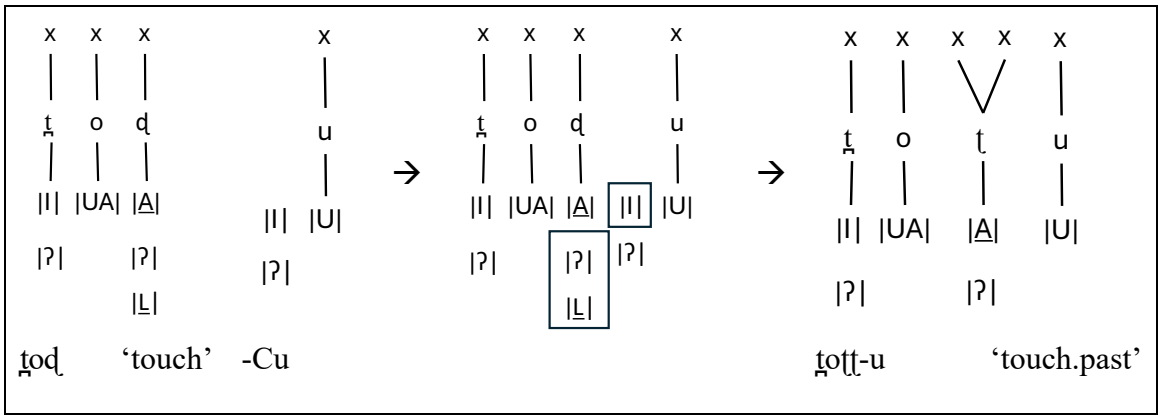
In summary, so far, we have seen two types of [-Cu] past tense suffix in Malayalam. In both cases, the suffix initial consonantal melody |I?L| and |I?| is a floating specification that attaches to the right edge of $CVCC_0$ type verb roots. In a third pattern of [-Cu] suffixation, a CVC type root ending in retroflex stops, |A?|, produces past tense forms with voiceless retroflex geminates. This is shown in (23).

23. Gemination with CVC type roots

Root	*Past*	*Infinitive*	
ṯoḍ	ṯo**ṯṯ**-u	ṯo**ḍ**-uga	‘touch’
viḍ	vi**ṯṯ**-u	vi**ḍ**-uga	‘release’

The pattern of sandhi between a stem-final retroflex, |A?L|, and the [-Cu] allomorph with the melody |I?| is similar to the pattern seen with stem-final rhotics and palatal glides. The singleton onset melody that consists a headed place |A| and voicing |L| is well-formed as an onset. Unless it loses some of its specification, it cannot accommodate any of the melodic elements from the floating C specification. In such a scenario, the stem-final C loses all specifications except place and copies the remaining melody from the floating C. This is shown in (24).

24. Structural representation of sandhi with retroflex



Thus far we have assumed that the suffix-initial C in the [-Cu] past tense allomorph is a floating consonantal specification without an anchoring in the skeletal tier. In an alternative hypothesis we can also consider the floating specifications of |ɪʔL| and |ɪʔ| to be complete segments with an x-node anchor in the skeletal tier. However, in that case we would have to make an additional stipulation for the deletion of one of the x-nodes in the skeletal tier when the [-Cu] attaches to $CVCC_0$ type verb roots. Considering that the [-Cu] allomorph attaches only to C-final verb roots, mostly $CVCC_0$ type, we prefer to analyze it as an un-anchored phonological specification that tries to parasitically express itself on the stem-final consonantal nodes. The geminate outputs are a consequence of either the original skeletal representation of the $CVCC_0$ verb roots, in cases like [t̪inn →t̪in̪n̪-u 'ate'], or a consequence of the restriction on singleton voiceless stops and certain nasal stops in medial positions. A summary of the analysis presented in this section is presented in (25).

25. Summary of [-Cu] affixation

- [-Cu] allomorphs only attach to C-final verb roots
- Based on the melodic specification, they are of two types.
    - Floating melody |ɪʔL|
    - Floating melody |ɪʔ|
- In all cases of concatenation, we see some aspect of the floating melody being realized in coalescence with the melodic specification of the stem final C.
- If the stem final C has a non-headed place feature, then the place feature of the floating melody is expressed in the ensuing geminate.
- However, if the stem final C has a headed place feature, palatal or retroflex, then the place feature of the stem final C is expressed in the ensuing geminate.

Cross-linguistically, we have seen many cases of parasitic exponence where a segment gets expressed only if the preceding or following morpheme meets a certain structural condition. A classic case is that of French liaison where the stem final nasal gets expressed only of the following word is vowel initial like [mõn ami 'my friend']. In Malayalam, the verb roots to which the [-Cu] allomorphs can attach are lexically specified, but all of these have the common characteristic of being C-final. Just like the French nasal that must attach to the empty onset of a following word to be expressed, the Malayalam floating melody must attach to a preceding skeletal position that is dominated by an onset.

3.2 The [-i] allomorph

In contrast to the [-Cu] allomorph that has a phonological dependence on the root type to which it attaches, the [-i] allomorph does not interact with the phonological shape of the verb root at all. Consequently, it attaches to all three types of verb roots. This is shown in (26).

26. Past tense marking with [-i]

Root Type	*Root*	*Past*	*Infinitive*	
$CVCC_0$	uraŋŋ	uraŋŋ-i	uraŋŋ-uga	sleep
	no:kk	no:kk-i	no:kk-uga	look
	poŋŋ	poŋŋ-i	poŋŋ-uga	levitate
	uʈakk	uʈakk-i	uʈakk-uga	stick
	karaŋŋ	karaŋŋ-i	karaŋŋ-uga	rotate
	t̪u:ŋŋ	t̪u:ŋŋ-i	t̪u:ŋŋ-uga	hang
CVC	pa:ɖ	pa:ɖ-i	pa:ɖ-uga	sing
	ka:r	ka:r-i	ka:r-uga	scream
	u:r	u:r-i	u:r-uga	remove
	mu:ɭ	mu:ɭ-i	mu:ɭ-uga	hum
CV	ku:	ku:-w-i	ku:-v-uga	howl
	po:	po:-j-i	po:-v-uga	go

The [-i] allomorph behaves exactly like all the other verbal inflections to produce regular predictable concatenation patterns.

4 Discussion

In this paper we have seen that Malayalam has certain consonants that must appear as onset clusters in the medial position. These include all six voiceless stops as well as the dental, palatal and velar nasals. The melodic configuration of each of these is shown in (27).

27. Melodic configuration of onset cluster geminates

	Labial	*Dental*	*Alveolar*	*Retroflex*	*Palatal*	*Velar*
Oral stops	p |U̲ʔ|	t̪ |Iʔ|	t |Aʔ|	ʈ |A̲ʔ|	c |I̲ʔ|	k |Uʔ|
Nasal stops		n̪ |IʔL|			ɲ |I̲ʔL|	ŋ |UʔL|

While the past tense allomorph [-Cu] has a melodic specification |I|, many of the $CVCC_0$ verb types ending in stops have a melodic specification |U|. The latter can be seen in (28).

28. Verb stems ending in [kk] or [ŋŋ]

With [-Cu] past tense allomorph			*With [-i] past tense allomorph*		
Past	*Infinitive*		*Past*	*Infinitive*	
para-**n̪n̪**-u	para-**kk**-uga	fly	no:kk-i	no:-kk-uga	look
koɖu-**t̪t̪**-u	koɖu-**kk**-uga	give	uɖa-kk-i	uɖa-kk-uga	stick
eɖu-**t̪t̪**-u	eɖu-**kk**-uga	take	ura-kk-i	ura-kk-uga	sleep [caus]
maɖu-**t̪t̪**-u	maɖu-**kk**-uga	fed up	po-kk-i	po-kk-uga	lift
t̪o:**tt**-u	t̪o:l-**kk**-uga	fail	kara-kk-i	kara-kk-uga	rotate [caus]
vi**tt**-u	vil-**kk**-uga	sell	t̪u:-kk-i	t̪u:-kk-uga	hang [caus]
aɖa-**cc**-u	aɖa-**kkj**-uga	close [tr]	ura-ŋŋ-i	ura-ŋŋ-uga	sleep
paɖi-**cc**-u	paɖi-**kkj**-uga	'study'	po-ŋŋ-i	po-ŋŋ-uga	levitate
maɖi-**cc**-u	maʈi-**kkj**-uga	'lazy'	kara-ŋŋ-i	kara-ŋŋ-uga	rotate
kaɖi-**cc**u	kaɖi-**kkj**-uga	bite	t̪u:-ŋŋ-i	t̪u:-ŋŋ-uga	hang
Systematic phonological re-adjustment			No phonological re-adjustment		

While stems ending in [kk] can occur with either of the past tense allomorphs, the velar nasal [ŋŋ] appears only in stems that attach with the [-i] allomorph. Similarly, the stems ending in labial or dental stops [pp] or [t̪t̪] invariably select the [-i] allomorph. Some examples are shown in (29).

29. Verb stems ending in [pp] or [t̪t̪]

Past	*Infinitive*	
capp-i	capp-uga	'lick'
ku:pp-i	ku:pp-uga	'fold'
kut̪t̪-i	kut̪t̪-uga	'stab'

Given our hypothesis, had the $CVCC_0$ verb stems ending in [pp] concatenated with the [-Cu] allomorph, the headed |U| of the labial would have maintained its place in the surface representation just like the headed |I| and |A| or the palatal and retroflex. Consequently, no melodic element from the floating C would have found surface realization. This situation is avoided in the language through allomorph selection.

Unlike [pp] the onset [t̪t̪] does not have a headed characteristic. However, the melodic representation of the stem final C exactly matches with the melodic configuration of the floating C. In this situation, it would be impossible to distinguish between verbs that ended

with other consonants like [kk] and those that end with [ṯṯ] in their past tense forms. Such a lexical merger is avoided through allomorph selection.

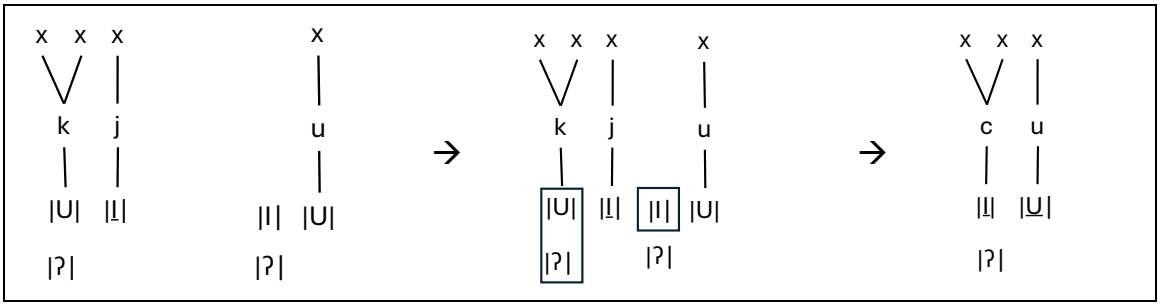
Finally, we observe that there is no lexical selection in past tense allomorphy after the addition of the causative morpheme. Irrespective of whether the non-causative verb form selected for a [-Cu] or a [-i] past tense morpheme, every causative-past is formed by attaching the [-Cu] allomorph. This is shown in (30).

30. Causative-past

	Past	*Causative Past* [-C_0 u]		
	ko-ṉṉu		koll-i-ccu	kill
	para-ṉṉu	para-ppi-ccu	para-ṯṯi / para-ṯṯi-ccu	fly
	va-ṉṉ-u		var-u-ṯṯi/ varu-ṯṯi-ccu	come
[-C_N u]	kara-ɲɲu	karaji-ppi-ccu	karaji-ccu	cry
	ali-ɲɲu	aliji-ppi-ccu	aliji-ccu	melt
	aɖa-ɲɲu		aɖa-ji-ccu	close [unacc]
	koɖu-ṯṯu	koɖu-ppi-ccu		give
	eɖu-ṯṯu	eɖu-ppi-ccu		take
	maɖu-ṯṯu	maɖu-ppi-ccu		fed up
	ṯo:-ttu	ṯo:l-ppi-ccu		fail
	vi-ttu	vil-ppi-ccu/vi-ppi-ccu		sell
[-C_0 u]	aɖa-ccu	aɖa-ppi-cc-u		close [transitive]
	paɖi-ccu	paɖi-ppi-ccu		‘study’
	maɖi-ccu	maɖi-ppi-ccu		‘lazy’
	kaɖi-ccu	kaɖi-ppi-ccu		bite
	ṯoṯ-u		ṯoɖ-i:-ccu	touch
	viṯ-u		viɖ-i:-ccu	release
	no:kk-i	no:kk-i-ppi-ccu	no:kk-i-ccu	look
	uɖakk-i	uɖakk-i-ppi-ccu	uɖakk-i-ccu	stick
	mukk-i	mukk-i-ppi-ccu	mukk-i-ccu	dip [transitive]
	ɲekk-i	ɲekk-i-ppi-ccu	ɲekk-i-ccu	press
	capp-i	capp-i-ppi-ccu	capp-i-ccu	‘lick’
[-i]	ku:pp-i		ku:pp-i-ccu	‘gesture’
	kuṯṯ-i		kuṯṯ-i-ccu	‘stab’
	pa:ɖ-i	pa:ɖ-i-ppi-ccu	pa:ɖ-i-ccu	sing
	ka:r-i	ka:r-i-ppi-ccu	ka:r-i-ccu	scream
	u:ɾ-i	u:ɾ-i-ppi-ccu	u:ɾ-i-ccu	remove
	ku:-v-i	ku:v-i-ppi-ccu	ku:-v-i-ccu	howl

The causative infinitive for all these verbs ends with [-kkj-uga]. This [-kkj-] part phonologically interacts with the [-Cu] past tense allomorph to produce [-ccu] in the causative-past morphology. This is shown in (31).

31. Formation of the causative past morpheme [-ccu]



Since the causative morpheme ends in a palatal glide |I|, the past tense allomorph with the palatal vowel [-i] is systematically avoided in these causative contexts. Malayalam also has a handful of intransitive verbs ending in geminate velar nasals, that form their causative counterpart with velar stops. Since, there is no palatal context in these cases, all these verbs both the intransitive as well as the causative form concatenate with the allomorph [-i] to form the past tense form. This is shown in (32).

32. Selection of [-i] allomorph in non-palatal contexts

Intransitive				*Causative*			
Root	Past	Infinitive		Root	Past	Infinitive	
uraŋŋ	uraŋŋ-i	uraŋŋ-uga	sleep	urakk	urakk-i	urakk-uga	sleep
poŋŋ	poŋŋ-i	poŋŋ-uga	levitate	pokk	pokk-i	pokk-uga	lift
karaŋŋ	karaŋŋ-i	karaŋŋ-uga	rotate	karakk	karakk-i	karakk-uga	rotate
t̪u:ŋŋ	t̪u:ŋŋ-i	t̪u:ŋŋ-uga	hang	t̪u:kk	t̪u:kk-i	t̪u:kk-uga	hang

5 Conclusion

In this paper we have proposed that the past tense morpheme in Malayalam has three allomorphs, [-C_N u], [-C_0 u], and [-i]. Both the [-Cu] allomorphs have a floating dental stop melody that is not anchored to a specific position on the skeletal tier. However, this floating melody needs to be expressed in some manner in the geminate onset cluster preceding the suffixal vowel. For this, these allomorphs attach only to C-final stems. While the allomorph [-C_0 u] can attach to both CVC and $CVCC_0$ stems, the [-C_N u] allomorph only concatenates with $CVCC_0$ stems. In phonological environments where the floating melody would not be

clearly discernable in the melodic properties of the geminate onset, such as stems ending in [pp] or [t̪t̪], the [-Cu] past tense marker fails to attach.

Unlike the [-Cu] allomorphs, the [-i] suffix does not phonologically interact with the verbal stem to which it attaches. Therefore, it can easily attach to all the three types of verbal stems: $CVCC_0$, CVC and CV. However, the [-i] allomorph fails to attach in the phonological environment when the stem final segment is a palatal. We show that this is the reason it fails to appear after the causative morpheme [-kkj-]. These distributional restrictions are summarized in (33) below.

33. Summary of the past-tense allomorphs in Malayalam

	[-C_N u]		[-C_0 u]		[-i]	
Root $CVCC_0$	para-kk	✓	koɖu-kk	✓	ɲekk	✓
Past	para-n̪n̪u	fly	koɖu-t̪t̪u	give	ɲekk-i	press
Root CVC	×		t̪oɖ	✓	pa:ɖ	✓
Past			t̪o-ʈu	touch	pa:ɖ-i	sing
Root CV	×		×		ku:	✓
Past					ku:-v-i	howl

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