Quality-conditioned stress as length: glide epenthesis in Moksha

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Abstract

In Strict CV, it has been argued that stress can be represented by syllabic space, i.e. by empty CV slots (Larsen 1998, Szigetvári & Scheer 2005). If Strict CV phonology is on the right track in assuming empty CVs to represent stress, we expect various stress-sensitive phenomena to correlate in a way that is attributable to the CVs' presence. This paper is dedicated to a piece of evidence that supports the above mentioned correlation – the interaction between stress and glide epenthesis in Moksha, where /i/ and /u/ can spread to form a glide before vowel-initial suffixes. Vowel spreading can happen after polysyllabic nouns but not after the monosyllabic ones. This ostensibly syllable-counting rule is linked to the representation of stress as length and given an explanation without abandoning locality. The analysis rests on the assumption that Moksha stress, despite being conditioned by vowel quality on the surface, corresponds to underlying phonological length.

Keywords: stress, vowel length, Strict CV phonology, Element Theory, glide epenthesis, vowel-glide alternations, Moksha

1 Introduction

Strict CV is a lateral autosegmental approach to phonology (Kaye, Lowenstamm & Vergnaud 1990, Scheer 2012), which has a special exponent for stress – the syllabic unit, or an empty CV (Larsen 1998, Szigetvári & Scheer 2005). The idea behind this representation for stress is that it is a non-diacritical phonological object that can handle the effects that occur in vicinity of stress. These effects are constrained: not every process can be triggered by stress (see Giavazzi 2010 for the discussion of stress-induced effects). Not only are stress-related processes restricted, they often coincide with phonological phenomena that are typical for other positions. For example, consonants can be observed to undergo fortition in the initial position, after codas and before/after stress (Szigetvári & Scheer 2005). Morphosyntactic boundaries have also been argued to be represented by an empty CV (Scheer 2012). The fact that stress and morphosyntactic boundaries can have the same phonological effects lends support to the suggestion that they share an exponent.

There are numerous case studies where the representation of stress as syllabic space has been applied. Larsen (1998) discusses the interaction that tonic lengthening and raddoppiamento sintattico (lengthening of word-initial consonants) have with stress and suggests an explanation that rests on the representation of stress as an empty CV inserted after the stressed syllable. What unifies the analyses of the two phenomena is proper government (PG) – one of the fundamental mechanisms of Government phonology and Strict CV. Since PG affects the empty CV responsible for stress no less than any other CV in the phonological representation, it is an elegant way to account for several patterns at once. Enguehard

(2015) proposes an analysis of devoicing of fricatives in Old Norse, where the stress-encoding CVs coincide with the boundary CVs. The implications of this analysis are even stronger: not only are stress CVs visible to other phonological processes, but boundaries and stress can be represented by the exact same entity.

This paper presents another piece of data that illustrates the influence of the empty CV representing stress, which comes from intervocalic glide epenthesis in Moksha. In this case, I suppose that stress coincides with length: both stressed and underlyingly long vowels are bipositional, i.e. they occupy two V-slots. This assumption allows a local reanalysis to a rule that seems to refer to syllable count. I also argue that even though stress is dependent on vowel quality on the surface, the distinction between "heavy" and "light" vowels is better modelled in terms of phonological length.

The paper is laid out as follows: Section 2 introduces the data and summarises the patterns of behaviour of suffixes that start with schwa, /a/ and /u i/, as well as the stress placement in Moksha. Section 3 contains the proposed analysis of the glide insertion as spreading of short vowels and the corollary accounts of other phenomena reviewed in connection to the glide insertion. Section 4 concludes the paper.

2 Data

Moksha is a Mordvinic language that belongs to the Uralic language family and is spoken in Mordovia republic, a region located in the European part of Russia, as well as in some neighbouring regions. The primary sources of data for the present study are the Moksha corpus, Kukhto's (2018) chapter on Moksha phonology and Kozlov & Kozlov's (2018) chapter on morphophonology. If not stated otherwise, examples come from the corpus. A practical transcription adopted from Toldova & Kholodilova (2018) is used throughout the paper; the IPA correspondence table is provided in the appendix. In the following section, I will give a brief introduction into Moksha phonology and morphophonology.

2.1 Moksha

As described by Kukhto (2018), the vowel inventory of Moksha comprises 7 phonemes (see Figure 1 below).

i		(ɨ)	u
e	(ɘ)	ə	o
ɛ		a	

Figure 1: Vowel inventory of Moksha

[ɨ] is an allophone of /i/ that occurs after non-palatalised vowels (1) and [ɘ] is an allophone of schwa that comes after palatalised consonants (2).

(1) *ksti* [ɨ] 'berry' – *kšťi* [i] 'dance.CN'

(2) *mol'əms* [ɘ] 'to go'

The consonant inventory, which is characterised by contrastive palatalisation and voicing, can be found in Figure 2 below. The phoneme /x/ only occurs in loanwords.

m		n n’				
p b		t d t’ d’				k g
	f v	s z s’ z’		š ž šč	j̊	(x)
		c c’		č		
					j	
			r̥ r r̥’ r’			
		l̥ l	l̥’ l’			

Figure 2: Consonant inventory of Moksha

The Moksha language allows remarkably heavy syllables (Kukhto 2018: p. 31). There can be up to three consonants in the final coda in non-derived words (3) and up to four consonants in one cluster at morpheme boundaries (4).

(3) CC/CCC codas in non-derived words

a. *počf* ‘flour’

b. *traks* ‘cow’

c. *ir̥’ks* ‘rib’

(4) CCC/CCCC clusters on morpheme boundaries

a. *ir̥’ks-t* ‘rib-PL’

b. *kstiks-t* ‘berry garden-PL’

c. *bratksc’* ‘fraternise.PST.3SG’

Initial clusters range from zero (*od* ‘new’) to three consonants (5).

(5) CC/CCC onsets

a. *kši* ‘bread’

b. *ksti* ‘berry’

c. *ftal* ‘back, behind’

Default stress is on the leftmost syllable, however, vowel quality affects stress placement (Kukhto 2018). Syllables can be divided into *heavy* (with /a ɛ e o/ as nuclei) and *light* (with /u i ə/). The stress is borne by the leftmost heavy syllable (6–7), or, in words without heavy syllables, by the leftmost light one (8).[1]

(6) *ˈt’ɛd’ɛ*
‘mother’

(7) *kuˈvaka*
‘long’

(8) *ˈkijə*
‘who’ (Kukhto 2018: p. 34)

The stress rule is synchronically non-productive: consider late Russian loanwords in examples (9–10), which defy the rule of stressing the leftmost heavy syllable. In both *ˈkruška* ‘cup’ and *ˈkniga* ‘book’, the

[1] I will continue to refer to the vowels that constitute the nuclei of heavy and light syllables as heavy and light vowels respectively.

initial light syllable is stressed, despite the following syllable being heavy, because the original Russian stress is preserved.

(9) *'kruška*
'cup'

(10) *'kniga*
'book' (Kukhto 2018: p. 34)

Stressed vowels are longer than the unstressed ones; unstressed vowels are centralised but not neutralised (Aasmäe et al. 2013, Kukhto 2018).

Since the present paper focuses on glide epenthesis, which is a strategy of vowel hiatus resolution, it is important to describe some positional restrictions on the occurrence of vowels in native Moksha words, i.e. which vowels can create the hiatus on the boundary between the base and the suffix.

When it comes to bases, /e/ can only be found in stressed initial syllables (Kukhto 2018: p. 30), so it can only occupy the word-final position in monosyllabic words like *pe* 'end' The search of the dictionary by Serebrennikov, Feoktistov & Poljakov (1998) and the Moksha corpus reveals a lack of non-borrowed words that end in /o/; although Kukhto (2018) provides an example of an /o/-final word – *oc'o* – a dialectal variant of the word *oc'u* 'big', I will assume that /o/-final bases are extremely rare to nonexistent in Moksha. Word-finally, we can find /a ɛ e ə u i/, as exemplified in Table 1 below.

Final vowel	Word	Translation
/a/	*ava*	woman
/ɛ/	*pr'ɛ*	head
/e/	*pe*	end
/ə/	*kizə*	year
/u/	*kelu*	birch
/i/	*kši*	bread

Table 1: Examples of vowel-final bases

The vast majority of affixes in the Moksha language are suffixes, with a very small minority of prefixes (Kholodilova & Korjakov 2018). There are no suffixes that start with /o/, /e/ or /ɛ/; examples of suffixes that start with other vowels – /a ə u i/ – are provided in Table 2.

Initial vowel	Suffix	Gloss	With C# base	Translation
/a/	*-an*	1SG	*az-an*	say-1SG
/ə/	*-ən'*	GEN	*ruz-ən'*	Russian-GEN
/u/	*-u/v/i*	LAT	*kud-u*	home-LAT
/i/	*-i/j*	3SG	*ul'-i*	be-3SG

Table 2: Examples of vowel-initial suffixes

To provide a full account of hiatus resolution on morpheme boundaries, I will first describe the behaviour of vowel-initial suffixes. Section 2.2 deals with schwa-initial suffixes, Section 2.3 is devoted to the /a/-initial ones, and Section 2.4 reports the behaviour of /u i/-initial suffixes. Section 2.5 provides a summary of the patterns.

2.2 Schwa-initial suffixes

There is a rule in Moksha that is described by Kozlov & Kozlov (2018) as an glide insertion occurring after bases ending in /u/ or /i/ before vowel-initial suffixes. This is essentially a process of homorganic glide epenthesis: /v/ is inserted after /u/ (11) and /j/ is inserted after /i/ (12).[2]

(11) *jožu + əl' → jožuv-əl'*
‘(3SG was) smart-IPF’ (Kozlov & Kozlov 2018: p. 42)

(12) *t'ɛči + ən' → t'ɛčij-ən'*
‘today-GEN’

There is no epenthesis after unreduced vowels /a e ɛ/ (13–15): rather, the hiatus is avoided by deleting the initial schwa of the suffix.

(13) *pe + ən' → pe-n'*
‘end-GEN’

(14) *at'ɛ + ən' → at'ɛ-n'*
‘end-GEN’

(15) *ava + əl' → ava-l'*
‘(3SG was a) woman-IPF’

After consonant-final bases, the suffixal schwa is retained (16–17).

(16) *ruz + ən' → ruzən'*
‘Russian-GEN’

(17) *ruz + əl' → ruzəl'*
‘(3SG was) Russian-IPF’

A curious proviso to the glide insertion rule is that no epenthesis happens with monosyllabic bases (18–20).

(18) *ši + ən' → ši-n'*
‘day-GEN’

(19) *mu + əms → mu-ms*
‘find-INF’

(20) *vi + əms → vi-ms*
‘bring-INF’

The behaviour of glides in between /u i/ and suffixal schwa is summarised in Table 3 below. A# corresponds to the unreduced vowels /a e ɛ/.

	C#	A#	u#	i#
monosyllabic	*ən'*	*n'*	*n'*	*n'*
polysyllabic			*vən'*	*jən'*

Table 3: Suffix *ən'* ‘GEN’ with different kinds of bases

All monosyllabic bases exhibit the same behaviour – no glide epenthesis and no schwa in the suffix. Polysyllabic bases differ according to the final segment: if it is /u/ or /i/, the schwa remains and a homorganic glide appears; if it is some other vowel, the schwa disappears; after final consonants, the suffix appears with a schwa.

It is important to note that the glide insertion is not synchronically productive, that is, it does not affect loanwords. The strategy for loanwords is to treat /u i/ exactly like other vowels: to drop the schwa altogether (21–23). The syllable count is of no importance with loanwords: no glide appears either after the disyllabic toponym *soči* ‘Sochi’ or after the monosyllabic personal name *li* ‘Li’.

(21) *žuri + ən' → žuri-n'*
‘jury-GEN’

(22) *soči + ən' → soči-n'*
‘Sochi-GEN’
(Kozlov & Kozlov 2018: p. 42)

(23) *li + ən' → li-n'*
‘Li-GEN’
(online fieldwork)

Epenthesis of glides is not restricted to schwa-initial suffixes, but behaves differently with the /a/-initial ones.

[2] The part of the gloss in parentheses is not a part of the actual translation and serves to indicate that these forms are used as nominal predicates. The epenthetic /v/ and /j/ will be referred to as glides for the sake of simplicity, despite /v/ not being a glide.

2.3 /a/-initial suffixes

Suffixes that begin with /a/ cause homorganic glide epenthesis when attached to /u i/-final polysyllabic bases, as exemplified in examples (24–25). These suffixes are agreement markers *-an* '1SG' and *-at* '2SG', which can mark both verbal and nominal predicates (Kholodilova 2018, Toldova 2018).

(24) *jožu + an → jožuvan*
'(I am) smart-1SG'

(25) *vidi + an → vidijan*
'(I am) a sower-1SG'

The peculiar property of the /a/-initial suffixes is that in monosyllabic bases ending in /u i/, no matter which vowel it is, /j/ is inserted at all times (26–27). This pattern is in stark contrast with how schwa-initial suffix behave: there *is* a glide after monosyllabic bases, and this glide is not homorganic with the preceding vowel: it always surfaces as /j/.

(26) *mu + an → mujan*
'(I) find-1SG'

(27) *li + an → lijan*
'(I) fly-1SG'

Final full vowels /a ɛ/ disappear before suffix-initial /a/ (28–29); this phenomenon is described by Kozlov & Kozlov (2018) as "a-coalescence". This is in line with the behaviour of suffix-initial schwa after /a ɛ/ – it disappears as well.

(28) *jaka + at → jakat*
'(you) go-2SG'

(29) *at'ɛ + an → at'an*
'(I am an) old man-1SG'

In single-syllable bases ending with /a/, no a-coalescence occurs and /j/ is inserted (30–31).

(30) *sa + an → sajan*
'(I) come-1SG'
(Kozlov & Kozlov 2018: p. 57)

(31) *šna + an → šnajan*
'(I) praise-1SG'

The pattern is summarised in Table 4.

<table>
<tr><th></th><th>C#, ə#</th><th>A#</th><th>u#</th><th>i#</th></tr>
<tr><td>monosyllabic</td><td rowspan="2">an</td><td>jan</td><td>jan</td><td rowspan="2">jan</td></tr>
<tr><td>polysyllabic</td><td>n</td><td>van</td></tr>
</table>

Table 4: Suffix *an* 'NPST.1SG' with different kinds of bases

Monosyllabic bases are once again all similar but in a different way: with schwa-initial suffixes, there was no epenthesis, whereas with /a/-initial suffixes, /j/ is inserted both after /u i/ and after /a ɛ/. With polysyllabic bases, we observe a pattern almost identical to that of schwa-initial suffixes: the suffix loses the /a/ after full vowels /a ɛ/ but retains it after consonants and schwa (the schwa disappears); with final /u i/, there is homorganic glide insertion.

I now turn to the description of /u i/-initial suffixes.

2.4 Suffixes starting with /u i/

There is one more phenomenon that is relevant to the glide insertion problem. Those are several suffixes in Moksha that start with a high vowel, for instance, *-i/j* 'NPST.3SG' and *-u/v/i* 'LAT' (Kozlov & Kozlov 2018). As evident from my exposition of these morphemes, they alternate between the vowel and the glide, the lative case marker having an additional variant that appears after palatalised consonants. The distribution of these variants is similar: the glide comes after vowels, the vowel – after consonants; see (32–34) for the 3SG agreement marker and (35–36) for the lative.

(32) *jaka-j* 'go-3SG'

(33) *šam-i* 'empty-3SG'

(34) *magazin-u* 'shop-LAT'

(35) *vir'-i* 'forest-LAT'

(36) *lavka-v* 'shop-LAT' (Kozlov & Kozlov 2018: p. 52)

The examples in (32–36) show that high vowels in Moksha can alternate with glides, that is, /v j/ can be argued to have something in common with /u i/ in their representation that allows an alternation between the former and the latter. An analysis that would give a unified account of homorganic glide insertion and the glide-vowel alternations is one of my goals in this paper.

2.5 Summary

To summarise the behaviour of vowel-initial suffixes after vowel-final bases, four different processes can be noted that happen at the word-internal V#V boundary (37).

(37) Hiatus resolution strategies in Moksha with examples

a. Schwa deletion:
/əa/ → /a/
vir'-sə + an → vir'san 'forest-IN-1SG' (Kozlov & Kozlov 2018: p. 40)
/aə/ → /a/
ava + ən' → avan' 'woman-GEN'

b. First vowel deletion:
/ɛa/ → /a/
at'ɛ + an → at'an '(I am) old man-1SG'
/aa/ → /a/
ava + an → avan '(I am) woman-1SG'

c. Homorganic glide insertion:
/uə/ → /uvə/
kelu + ən → keluvən' 'birch-GEN'

d. /j/-insertion:
/aa/ → /aja/ (monosyllabic bases only)
sa + an → sajan 'come-1SG'

e. Glide-vowel alternation:
/ai/ → /aj/
sa + i → saj 'come-3SG'

While I will not explore vowel deletion in much detail, I will attempt to answer several questions regarding glide insertion and glide-vowel alternations. First, what is the difference between the two different glide epenthesis processes: one that inserts a homorganic glide (/j/ after /i/, /v/ after /u/) and one that inserts /j/ after any vowel? These two types of glides must have different sources because they occur in different contexts: homorganic glides can appear before schwa, whereas /j/ cannot. If both of them are mere floating glides, then their divergent behaviour is a mystery. Is it true that homorganic glides come from vowel spreading, whereas the /j/ is a floating glide?

Next, what is the nature of the vowel-glide alternations? If homorganic glides come from vowel spreading, why can a spreading vowel produce two segments – a vowel and a glide – but an alternating suffix can only surface as either a single vowel or a single glide?

I argue that homorganic glide epenthesis and /j/-insertion indeed have different sources: the latter results from vowel spreading and is constrained by stress, and the former is the realisation of a floating segment, which is only affected by the right context. As for the alternating suffixes, their representations contain segments that cannot spread. The next section elaborates on the proposed analysis.

3 Glide epenthesis is conditioned by stress

Those vowels that can trigger homorganic glide insertion – both /u/ and /i/ – are light in the stress assignment algorithm. In other words, what triggers glide insertion are base-final unstressed light vowels that are not schwa. I will now demonstrate where this generalisation can go, assuming that "heaviness" and "lightness" of syllables, as well as stress, are underlyingly vowel length.

I claim that the heavy vowels /a o ɛ e/ and the stressed light vowels /u i ə/ are long; in Strict CV terms, they are associated to two CV slots. The stress falls on the leftmost long vowel, and where there are no long vowels, an empty CV is inserted to the right of the leftmost vowel so that it is lengthened. This assumption makes the vowels that do not participate in the glide insertion, that is, heavy vowels and the stressed base-final ones (i.e. light vowels in monosyllabic bases) into a natural class: they share a property of being long. Long vowels cannot spread further than the two slots they already occupy, so no homorganic glide appears. The restriction on triple association, or extra-long segments, as pointed out by an anonymous reviewer, is widely attested and may be universal (Chekayri & Scheer 2004, Enguehard 2018).

I also suggest linking vowel quality and underlying length by means of Element Theory (Kaye, Lowenstamm & Vergnaud 1985): let heavy vowels consist of two elements and light vowels consist of just one element (see Figure 3 below for the first attempt at representing Moksha vowel inventory with elements). Now, heavy vowels are heavier because they comprise two entities, whereas the light ones only have one. The difference between /e/ and /ɛ/ is headedness: /e/ is headed by |I| and /ɛ/ is headed by |A|.

i $\|I\|$		u $\|U\|$
e $\|\underline{I}A\|$	ə $\|A\|$	o $\|AU\|$
ɛ $\|\underline{A}I\|$		
	a $\|AA\|$	

Figure 3: Representing Moksha vowel system with elements (first attempt)

There are, however, problems with representing light vowels as uniformly mono-elemental. First, when they are stressed, they should become bipositional for the generalisation about homorganic glide insertion to hold. Next, in the absence of stress, light vowels /u/ and /i/ can spread, that is, occupy two positions. Moreover, spreading of /u/ and /i/ in the case of glide insertion produces /uv/ and /ij/ respectively, which are sequences of two segments, not one. One element being interpretable both in the V and in the C-slot as two different segments is an undesirable result.

I propose to represent light vowels /u/ and /i/ as containing a floating element (see the revised vowel system in Figure 4). The floating element can only associate if a free skeletal slot is available. When a light vowel is stressed, the floating element can take up the free V-slot; if a V-slot is not available, as in the case of schwa-initial suffixes, the element can associate to a free C-slot and surface as a glide.

i $\|I<I>\|$		u $\|U<U>\|$
e $\|\underline{I}A\|$	ə $\|A<A>\|$	o $\|AU\|$
ɛ $\|\underline{A}I\|$		
	a $\|AA\|$	

Figure 4: Representing Moksha vowel system with elements (final version)

The phonological representations of two different bases – with a final light vowel and without a heavy vowel – are presented in (38) and (39) respectively.

(38) *kuvaka* [ku'vaka] 'long'

C V C V C V C V C V
k U v AA k AA

(39) *kijə* ['kijə] 'who'

C V C V C V
k I j A

The mechanism of glide insertion proceeds by associating the floating element of a light vowel in an unstressed final position to the initial empty C-slot of the suffix. When there is an empty V-slot provided by the stress CV, the floating element takes it up and glide insertion – spreading onto a C-slot – is not possible anymore (see example 40 for the derivation of *šin'* 'day.GEN'). When no V-slot is available, the floating element can spread and surface as a consonant, like in *t'ɛčijən'* 'today-GEN' (41).

(40) *ši* + *ən'* → *šin'* [šin']

C V C V – C V C V
š I A n'
I

(41) *t'ɛči* + *ən'* → *t'ɛčijən'* [t'ɛčijən']

C V C V C V – C V C V
t' A̲I č I A n'
I

In order to account for the lack of homorganic glide insertion in monosyllabic bases with final /u i/, their representations do not have to be different from those of the polysyllabic /u i/-final bases: the job is done by the stress algorithm, which can only lengthen the final vowel of a monosyllabic base.

3.1 Note on schwa and vowel deletion in hiatus

In the elemental representations of Moksha vowels that I propose, schwa has a floating element |A| as well, which needs to be addressed. The motivation behind including a floating |A| in the representation is that schwa can be stressed. Stressed schwa sounds close to /e/ after palatalised consonants and close to /a/ after non-palatalised consonants (Aasmäe et al. 2013). Therefore, it should be able to spread onto a neighbouring V-slot in order to create a vowel that would be phonetically interpreted similarly to /a/. The element |I| that would bring schwa close to /e/ in stressed positions after palatalised consonants may be inherited from the consonant. When it comes to homorganic glide epenthesis environments, I assume that |A| can take up a C-slot but it cannot be pronounced as a consonant in Moksha because it has no overt phonetic exponent.

Schwa also exhibits special behaviour in vowel hiatus. Schwa disappears before or after long vowels but stays after consonants, be it base-final consonants or glides that appear after spreading. The general rule of vowel deletion in hiatus can be tentatively formulated as follows: if association of a floating glide in between is not possible, delete the lighter vowel (**??**–**??**); in case of a tie, delete the first one (**??**).

(42) Vowel deletion as hiatus resolution

a. Schwa deletion:
/əa/ → /a/
vir'-sə + *an* → *vir'san* 'forest-IN-1SG' (Kozlov & Kozlov 2018: p. 40)
/aə/ → /a/
ava + *ən'* → *avan'* 'woman-GEN'

b. First vowel deletion:
/ɛa/ → /a/
at'ɛ + *an* → *at'an* '(I am) old man-1SG'
/aa/ → /a/
ava + *an* → *avan* '(I am) woman-1SG'

/əə/ → /ə/
kizə + ən' → *kizən'* 'year-GEN'

This rule is yet to be formalised in Strict CV terms; it constitutes a puzzle in itself, which is beyond the scope of this paper. I now turn to two other previously described phenomena: (a) the vowel-glide alternation in /u i/-suffixes; (b) /j/-insertion in between monosyllabic bases with a heavy syllable and an /a/-initial suffix.

3.2 /u i/-suffixes are mono-elemental

While /u/ and /i/ can spread onto neighbouring C-slots, producing a vowel-glide sequence, suffixes like *-i/j* 'NPST.3SG' and *-u/v/i* 'LAT' can surface either as a glide or as a vowel. I propose that those suffixes have only one element in their representation (see examples 43–44 for the suggested representations). This element has to be floating, since it can associate to different slots: either a V- or a C-slot.

A CV of its own has to be assumed for the floating element, since otherwise there would be no space for it to associate to after a vowel-final base. The association line of this element is directed: it associates to the leftmost available slot (see Yip 1988, Roca 1994 on parametrising the directionality of association in autosegmental phonology). If it finds a V-slot, like in example (43), it can associate and become a vowel; if the leftmost vacant slot is consonantal, like in example (44), the floating element associates there and surfaces as a glide.

(43) *šam-* + I → [šam-i] 'empty-3SG'

```
C V C V C V – C V
|  \_/    |   ↖
š AA      m      I
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(44) *jaka-* + I → [jaka-j] 'go-3SG'

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C V C V C V C V – C V
|  \_/  |  \_/      ↑
j AA    k AA        I
```

Since every word is at least one syllable long, the suffixes consisting of |U| or |I| can never be stressed – they will never occur in the first syllable. Hence, the mono-elemental representation is not in conflict with my analysis of stress as length: these suffixes cannot possibly be long vowels because they do not contain a second element, and they are not.

3.3 Floating segments are still necessary

The pattern of glide insertion cannot be accounted for in its entirety by vowel spreading only: we have another type of glide, which appears after all monosyllabic V-final bases before /a/-initial suffixes.

(45) *sa + an → sajan*
'come-1SG'
(Kozlov & Kozlov 2018: p. 57)

(46) *šna + an → šnajan*
'praise-1SG'

(47) *mu + an → mujan*
'find-1SG'

(48) *li + an → lijan*
'fly-1SG'

As previously demonstrated in Table 4, /u i/ spread before *-an* 'NPST.1SG' in polysyllabic bases, similarly to schwa-initial suffixes like *-ən'* 'GEN', whereas the /a/-final bases make the /a/ of the suffix coalesce with one of the base. All monosyllabic bases ending in vowels, however, share a strange pattern of /j/-insertion. If we take this common behaviour to be indicative of some shared property, this is different from the stress-conditioned pattern of homorganic glide insertion: stressed heavy vowels, like /a/ in *'šnajan* '(I) praise-1SG', would be grouped together with unstressed light ones, like /u/ in *mu'jan* '(I) find-1SG'.

I contend that the /j/ inserted in between heavy vowels has nothing to do with spreading or stress, nor is it the default strategy for hiatus resolution; rather, it should be encoded lexically. First, insertion of /j/ does not depend on stress placement. Final light vowels can only be long in monosyllabic bases with suffixes containing no heavy vowels – this is the only context where they can be stressed, lengthened and therefore non-spreading. In unstressed positions, light vowels can and do spread. With heavy vowels like /a/, on the other hand, the rule that singles out monosyllabic bases is not reducible to stress. Both mono- and polysyllabic bases can have a final stressed /a/: monosyllabic bases – by virtue of having just one syllable and the polysyllabic ones – if all vowels before the final /a/ are light. Consider the example of such a polysyllabic base, which a final stressed heavy vowel (49). No /j/-insertion occurs before *-an*. Still, after monosyllabic bases, the glide does appear (50).

(49) *juma + an → juman*
'(I am) lost-1SG'

(50) *šta + an → štajan*
'wash-1SG'

Since in some cases we see vowel coalescence (49) and in other cases there is glide epenthesis, /j/-insertion is not automatic. This process cannot be reduced to anything, hence it must be lexically conditioned. I argue that there is a floating glide in the representation of all monosyllabic bases. The glide is floating because it is lost before consonants (51), before schwa (52) and word-finally (53).

(51) *šta + s' → štas'*
'wash-PST.3SG'

(52) *sa + əl' → sal'*
'come-IPF'

(53) *iz' sa*
'NEG.PST.3SG come.CN'
(Kozlov & Kozlov 2018: p. 57)

Monosyllabic bases that end with /u/ and /i/ are subject to the exact same rules (54–56). The glide appears before /a/ and does not surface before consonants, schwa or in the rightmost position.

(54) *mu + s' → mus'*
'find-PST.3SG'

(55) *mu + l' → mul'*
'find-IPF'

(56) *iz' tu*
'NEG.PST.3SG go.CN'

Ultimately, the quest of reducing the syllable-counting rule has failed: since /j/-epenthesis affects /u i/-final bases as well, all monosyllabic bases have to be lexically marked as containing a floating glide. Nevertheless, an analysis of homorganic glides is still necessary. Recall that the homorganic glides can appear before any vowel, /a/ or schwa, whereas the floating /j/ can only associate before /a/. After monosyllabic /u i/-final bases, it still has to be explained, why the homorganic glides, which, unlike the floating /j/, should be able to associate before schwa, do not appear (57–58).

(57) *mu + at → mujat*
'find-2SG'

(58) *li + an → lijan*
'fly-1SG'

Here is where the analysis in terms of spreading provides a solution: only unstressed, i.e. mono-positional vowels can spread to create a glide.

One possible objection to the spreading analysis of homorganic glides is that the rule that inserts them, as already mentioned, is not productive. Hence, a more plausible solution could be to just endow any base that can participate glide insertion with a floating glide. First, this would be problematic because there would be two types of floating glides with divergent behaviour. Next, the stress rule, on which, as I have argued, the homorganic glide epenthesis depends, is not productive either. The interaction of the stress rule and the spreading rule must have been active during an earlier period in the history of Moksha, which, however, does not prevent me from finding a phonological rule where it can be found.

4 Conclusion

I have proposed a novel analysis of the glide insertion in Moksha – a phenomenon of homorganic glides appearing in between base-final /u i/ and schwa-initial suffixes, but only in polysyllabic bases. The rule that appears to be counting syllables, receives a local explanation under two assumptions. First, I suppose that heavy vowels that attract stress are underlyingly long, and so are all stressed vowels. Since stress falls on the leftmost syllable in the absence of heavy vowels, the only bases where final light vowels can be long are monosyllabic bases. Thus the bases that participate in glide insertion form a natural class – those are short base-final vowels. The second assumption is that /u i/ can spread onto neighbouring C- or V-slots, which is corroborated by another vowel-glide alternation that happens in /u i/-initial suffixes. Short base-final vowels can spread, whereas long vowels cannot. Additionally, I have reviewed a different case of epenthesis – a non-homorganic /j/, which sometimes appears before suffixes with initial heavy /a/. Eventually, all monosyllabic bases have to be endowed with floating /j/ and thus be lexically marked, which does not diminish the explanatory power of the analysis of homorganic glides, since the two glide insertion processes are different both in their distribution and in their source in the underlying form; homorganic glide epenthesis can be analysed without lexical specification of monosyllabic bases, whereas /j/-insertion cannot.

Appendix

IPA correspondence table

IPA	Transcription
m	m
n̪	n
n̪ʲ	n’
p	p
b	b
t̪	t
t̪ʲ	t’
d̪	d
d̪ʲ	d’
k	k
g	g
x	x
f (ɸ)	f

IPA	Transcription
v (β)	v
s̪	s
s̪ʲ	s’
z̪	z
z̪ʲ	z’
ʃ	š
ʃʲː (ʃt͡ʃ)	šč
ʒ	ž
t͡s̪	c
t͡s̪ʲ	c’
t͡ʃ	č
ç	j̊
j	j
ɾ̥	r̥

IPA	Transcription
ɾ̥ʲ	r̥’
ɾ	r
ɾʲ	r’
ɬ̪	l̥
ɬ̪ʲ	l̥’
l̪	l
lʲ	l’
i	i
u	u
e	e
ə	ə
o	o
ɛ	ɛ
a	a

List of glossing abbreviations

1 first person
2 second person
3 third person
CN connegative
GEN genitive
INF infinitive
IPF imperfective
LAT lative case
NEG negative
NPST non-past
PASS passive
PST past
SG singular

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