Emergence of the marked: Vowel lengthening in Bangla

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1 Introduction

Bangla (Indo-Aryan) shows an unexpected pattern of vowel lengthening in focused forms despite the language lacking a phonemic vowel length contrast. Further, vowel lengthening is preferred to consonant gemination, even though there is contrastive consonant length, creating an apparent markedness paradox. This paper argues that Bangla vowel length under focus is the result of serial interleaving of morphology with phonology, with the requirement of incrementally improving harmony with every change. Focus is a non-segmental affix whose locus of realization is parasitic on the position of stress. Moreover, the position of vowel lengthening provides evidence for right-aligned quantity-sensitive stress, contra previous descriptions of the language. Bangla focus lengthening is a case of marked structure emerging due to obligatory expression of a morphological affix which the phonological grammar has no alternative way to realize.

2 The pattern: Vowel lengthening for focus

In Bangla, certain stem-internal vowels may optionally lengthen in a focused context (Table 1). Such lengthening often has an emphatic meaning but has other uses in combination with focus-sensitive operators. Vowel length is not contrastive in the language.

	Stem	Lengthening	Gloss
a.	moʈa	moʈa̲ː	‘fat’
b.	gɔrom	gɔro̲ːm	‘hot’
c.	lɔmba	lɔ̲ːmba	‘long’
d.	ʃundor	ʃundo̲ːr	‘beautiful’
e.	purono	purono̲ː	‘old’

Table 1: Vowel Lengthening in Bangla

Lengthening is quantity-sensitive: it targets the vowel in the rightmost closed syllable, and the final syllable if there are no closed syllables. Since CVC syllables pattern differently from CV syllables, I assume that consonantal codas are moraic. Table 2 recasts the pattern in terms of syllable weight.

	Without emphasis	With emphasis	Example
a.	**H**	**S**	ʤʰaːl ‘spicy’
b.	L**L**	L**H**	bɔɖoː ‘big’, moʈaː ‘fat’
c.	L**H**	L**S**	goroːm ‘hot’, biʃaːl ‘huge’
d.	**H**L	**S**L	lɔːmba ‘long’, loːkkʰi ‘well-behaved’
e.	H**H**	H**S**	ʃundoːr ‘beautiful’
f.	LL**L**	LL**H**	puronoː ‘old’, ʃaʤanoː ‘arranged’

Table 2: Bangla lengthening by syllable weight (S=superheavy trimoraic)

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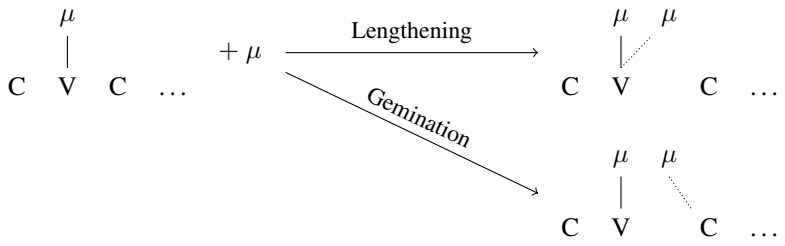
While focus generally induces vowel lengthening, there are a small number of functional items whose focused forms (Lahiri, 1998) show gemination of a stem-internal consonant (Table 3).

Stem	Gloss	Focus	Gloss
kɔto	'how much'	kɔtto	'just how much'
ɛk^{h}on	'now'	ekk^{h}un-i	'right now'
kɔk^{h}on	'when'	kɔkk^{h}on-o	'anytime'
kɔtok^{h}on	'how long'	kɔtokk^{h}on	'just how long'
ʃɔbaj	'everyone'	ʃɔbbaj	'absolutely everyone'

Table 3: Gemination under focus

Consonant gemination under focus is not productive and some of these focused forms also involve idiosyncratic vowel changes (ɛk^{h}on∼ekk^{h}un-i). Moreover, vowel lengthening can additionally apply to some of the geminate forms, as in *kɔtokk^{h}oːn.* Therefore it is likely that in the synchronic grammar, these forms are lexicalized stem allomorphs rather than the result of a gemination process. Nevertheless, the existence of both vowel lengthening and consonant gemination induced by focus suggests an analysis in terms of autosegmental mutation of a stem due to affixation of a mora (Wolf, 2008).



Outside of focused forms, Bangla has contrastive geminate consonants but no phonemic vowel length, which means long vowels are more marked than geminate consonants, with faithfulness ranked between the two markedness constraints (NoLongV >> Max, Dep >> $*\mu_C$). However, focus results in a long vowel rather than a geminate consonant, resulting in an apparent markedness paradox.

(1) Vowel length is not contrastive, but consonant length is contrastive

	*Append	NoLongV	Max	$*\mu_C$
a. /pa:ta/				
☞ pa.ta			*	
pa:.ta		*!	L	
b. /patta/				
☞ pat$_\mu$.ta				*
pa.ta			*!	L
pat.ta	*!			L

Given the constraint ranking above, affixation of a mora should not result in vowel lengthening. So why does focus result in the more marked structure (vowel length) instead of the apparently unmarked alternative (consonant gemination)?

3 Language background

Bangla, also called Bengali, is an Indo-Aryan language spoken in Bangladesh and India, and by diaspora around the world. There are about 242 million native speakers, with an additional 43 million second-language speakers.[1]

3.1 *Inventory and syllable structure* Bangla has the phonemic consonant inventory in Table 4 (Ferguson & Chowdhury, 1960; Dasgupta, 2003).

[1] https://www.ethnologue.com/language/ben/

	labial	dental	retroflex	palatal	velar	glottal
voiceless stop	p p^h	t t^h	ʈ $ʈ^h$	ʧ $ʧ^h$	k k^h	
voiced stop	b b^h	d d^h	ɖ $ɖ^h$	ʤ $ʤ^h$	g g^h	
fricatives				ʃ		h
nasals	m	n			ŋ	
flaps		r	ɽ			
lateral		l				
glide	w			j		

Table 4: Contrastive Consonants of Bangla

Apart from [ŋ], [h], [ɽ] and [r], all the other consonants display a geminate contrast. Geminates only occur in word-medial positions intervocalically and between vowels and liquids (Kar, 2008). Some examples of the geminate contrast are in Table 5.

Singleton	Gloss	Geminate	Gloss
[pata]	'leaf'	[patta]	'attention'
[baʧa]	'leftover'	[baʧʧa]	'child'
[bɔʃa]	'to sit'	[bɔʃʃa]	'rain'
[dibi]	'you will give'	[dibbi]	'quite'

Table 5: Geminates are contrastive

The vowel inventory is in Table 6. Length on vowels is not contrastive. The lax vowels [æ] and [ɔ] show a restricted distribution: they only occur in stressed and initial syllables. My account of stress in the language derives this restriction, as discussed in Section 5.

	front	back
high	i ĩ	u ũ
high-mid	e ẽ	o õ
low-mid	æ æ̃	ɔ ɔ̃
low	a ã	

Table 6: Contrastive Vowels in Bangla

The allowed syllable structure is (C)CVC. Except for sT clusters, complex onsets are only permitted when the second segment is [r]. Based on the lengthening pattern, I will assume consonantal codas contribute to syllable weight. I also assume that a single medial C is parsed as an onset whereas a medial CC is parsed as a coda followed by an onset. Geminates are assumed to be ambisyllabic (Hayes, 1989).

3.2 *Stress* Most previous studies on Bangla stress describe it as word-initial despite a lack of acoustic correlates (Chatterji, 1921; Ferguson & Chowdhury, 1960; Anderson, 1962; Hayes & Lahiri, 1991; Khan, 2008, 2014). In a phonetic study, Kawasaki & Shattuck-Hufnagel (1988) found no significant effect on f0 and intensity in initial position in Bangla. Shaw (1984) describes Bangla as a quantity-sensitive system where stress is on the second syllable if heavy, else on the first syllable.

Contra previous analyses, I propose that vowel lengthening in Bangla makes clear the position of stress, which shows a quantity-sensitive pattern: stress falls on the rightmost heavy syllable, else on the rightmost syllable. This is a 'right-aligned default-to-same' system, which has received various analyses in the literature (Kiparsky, 1973; Hayes, 1981, 1995; Prince, 1983, 1985; Walker, 1996). Similar stress patterns have been attested within the Indo-Aryan subgroup. Sindhi (Stowell, 1979) and Kelkar's Hindi (Kelkar, 1968; Prince & Smolensky, 1993) display a right-aligned default-to-same pattern with nonfinality. Kashmiri (Bhatt, 1989; Kenstowicz, 1993) shows a left-aligned default-to-same pattern with nonfinality. Bangla differs from these languages in not having nonfinality.

Since most previous studies looked at words in isolation, there could be additional domain-initial effects (Fougeron & Keating, 1997; Fougeron, 2001; Cho & Keating, 2001; Keating et al., 2009). This might explain

why prior research has classified Bangla stress as initial in the absence of phonetic evidence.

3.3 *Intonation and H tone* Although the existence and position of stress in Bangla is a matter of debate, the language has a well-described intonation system which interacts with the realization of focus. Focused phrases in Bangla have an L...H contour, with the L marking the left-edge of the focused constituent and the H being a high tone at the right edge (Hayes & Lahiri, 1991; Selkirk, 2007; Khan, 2008). However, not all previous studies agree that the high tone is anchored to the right edge. For instance, Chatterji (1921) notes the position of high tone may not be fully aligned to the right edge of the phrase.

Selkirk (2007) proposes the H tone comes from a tonal focus morpheme H[Foc] and aligns to the right edge of a Major Phrase (MaP). However, the data considered only use CVCV words under focus. When there is a nonfinal CVC syllable, preliminary recordings show the H tone is attracted away from the word edge. In other words, the H tone in focus phrases aligns to the position of stress.

Since both lengthening and high tone target the stressed syllable in focused phrases, I propose that the focus morpheme is a composite μ^H, which aligns to the position of stress. This is achieved by a slight modification of the alignment constraint proposed in Selkirk (2007).

(2) a. FOCUS $\rightsquigarrow \mu^H$
b. ALIGN(FOCUS, $\underline{\sigma}$): Assign a violation mark if the Focus morpheme is not aligned with the stressed syllable.

4 OT Analysis of Focus Lengthening

The analysis is based on Harmonic Serialism (McCarthy, 2000), a serial model of OT where only one change is allowed at a time and successive forms must increase in harmony relative to the constraint ranking. Further, it relies on the notion that morphological and phonological operations are interleaved (Wolf, 2008). In brief, focus lengthening is parasitic on the position of stress, and stress assignment must always take place first since it results in the greatest increase in harmony.

(3) a. MAXFLT: Floating morae must have an output correspondent.
b. *FLT: No floating morae.

(4) a. Good derivation: Root → Stress assignment (HAVESTRESS) → Focus lengthening (MAXFLT)
b. Bad derivation: Root ↛ Focus lengthening: improves MAXFLT, worsens Align-R(Focus,$\underline{\sigma}$)

▷ **Step 1** Stress assignment must take place first

Stress assignment must take place, since a and b are the only candidates one change away from the input that have less violations in the top tier. If focus lengthening were to take place first, this would produce candidate c. But this candidate does not produce harmonic improvement, since it improves on *FLT but additionally violates ALIGN(F,$\underline{\sigma}$), which is also in the top tier. Among the possible harmonically improving candidates a and b, the lower ranked ALIGNR selects candidate a as the winner.

/CV.CV/+μ_{Foc}	HAVESTR	MAXFLT	*FLT	ALIGN(F,$\underline{\sigma}$)	NOLONGV	SWP	*μ_C	ALIGNR
☞ a. CV.CV́+μ_F			*			*		
b. CV́.CV+μ_F			*			*		*!
c. CV**C**$_\mu$**.C**V	*!			*!			*	
d. CV.CV:	*!			*!	*			
e. CV.CV	*!	*!						

▷ **Step 2** Only harmonically improving option: Lengthen vowel in stressed syllable

Once stress assignment has taken place, the best available candidate (a) involves lengthening the vowel in the stressed syllable. Candidate c with consonant gemination has the focus morpheme attached to a different syllable. This removes a *FLT violation, but at the same time adds a violation of ALIGN(F,$\underline{\sigma}$), so harmony does not increase. For the affixal mora to result in consonant gemination with harmonic improvement, the position of stress would have to change to the first syllable. But this is impossible since only one change can occur at a time, so changing the position of stress cannot occur concurrently with docking the floating mora.

[CV.CV́]+μ_F	MAXFLT	*FLT	ALIGN(F,$\underline{\sigma}$)	NOLONGV	SWP	*μ_C	ALIGNR
a. ☞ CV.CV́:				*	*		
b. CV.CV́	*!			L	*		
c. CV**C**$_\mu$**.C**V́			*!			*	*
d. CV́.CV+μ_F		*!			*		

When the input contains a heavy (CVC) syllable, it will attract stress away from the right edge due to SWP, and this syllable will in turn also become the target for focus lengthening. Once again, the only way to increase harmony is to dock the floating mora and align it with the stressed syllable. Because in this case the target syllable is already CVC, consonant gemination is impossible and lengthening the vowel is the only way to attach the floating mora.

[CV́C$_\mu$.CV.CV]+μ_{Foc}	MAXFLT	*FLT	ALIGN(F,$\underline{\sigma}$)	NOLONGV	SWP	*μ_C	ALIGNR
☞ a. CV́:C$_\mu$.CV.CV				*		*	**
b. CV́C$_\mu$.CV**C**$_\mu$**.C**V			*!	L		**	
c. CVC$_\mu$.CV́.CV+μ_F		*!			*	*	*L

In summary, focus lengthening is parasitic on the position of stress, which falls on either a non-final closed syllable, or on a final syllable. In both these cases, the only way to add a mora to the syllable is by lengthening the vowel; gemination of the following onset is impossible, since either there is already a coda (non-final CVC), or the syllable is final.

Therefore, the reason focus lengthening creates a marked long vowel is because this is the only way to attach an additional mora to stressed syllables in the language, given the stress system.

5 Predictions

The proposal outlined in this paper makes some predictions regarding other areas of the grammar and the broader typological implications.

5.1 *Distribution of lax vowels* The revised analysis of stress as quantity-sensitive accounts for the restricted distribution of the lax vowels [æ, ɔ] in the language.

(5) Lax vowels only occur in stressed and initial syllables.

Earlier work on Bangla has used the distribution of lax vowels as evidence for initial stress (Khan, 2008). But lax vowels do occur in non-initial positions. In these words, the syllables with a non-initial lax vowel are heavy and therefore stressed under the current analysis.

Word	Gloss
[bi.b^h**ɔ**t.ʃo]	'terrible'
[ʃi.t**ɔ**l]	'cold'
[bi.r**ɔ**l]	'rare'
[ɔ.t**ɔ**l]	'deep'

Table 7: Non-initial lax vowels

Lax vowels are additionally allowed in initial syllables. This can be ascribed to the inherent prominence of initial positions, which there is cross-linguistic evidence for (Cho & Keating, 2001; Fougeron, 2001; Keating et al., 2009). The special privilege of initial and stressed positions in licensing the ATR contrast can then be analyzed in terms of positional faithfulness (Beckman, 1998) to ATR in these prominent (initial and stressed) positions.

(6) Lax vowels are preserved in stressed and initial syllables

/ɔ-tɔl/	IDENT-STRESS[ATR]	IDENT-INIT[ATR]	*[-ATR]	IDENT[ATR]
☞ a. (ɔ.tɔ́l)			**	
b. (o.tól)	*W	*W	L	**W
c. (ɔ.tól)	*W		*L	*W
d. (o.tɔ́l)		*W	*L	*W

On an initial-stress analysis, the stressed position is the same as the initial position. In that case, the two positional IDENT constraints would collapse into one. The predicted output candidate would neutralize [ATR] in the second syllable regardless of syllable weight, since it is non-initial and would therefore always be unstressed in an initial-stress system.

However, it is important to note that this does not entirely account for the distribution of lax vowels. For instance, lax vowels never occur word-finally, even though this is predicted to be the stressed syllable in a word with only light syllables. Further work is necessary to fully understand lax vowel licensing in Bangla.

5.2 *Monosyllabic lengthening* Monosyllabic stems in Bangla lengthen show vowel lengthening, which does not occur in the presence of a suffix (Dasgupta, 1984; Fitzpatrick-Cole, 1996).

Stem	Gloss	Suffixed	Gloss
raːg	'anger'	rag-i	'angry'
naːk	'nose'	nak-i	'nasal'
raːg	'anger'	rag-o	'you get angry'

Table 8: Lengthening with focus sensitive affixes

Monosyllabic lengthening is ascribed to a bimoraicity requirement on prosodic words. Fitzpatrick-Cole (1996) argues that consonantal codas are non-moraic, citing the presence of lengthening in CV and CVC monosyllabic stems, but not those with an offglide coda. Under the current analysis, consonantal codas are moraic and vowel lengthening is predicted to occur under focus for all stem shapes.

(7) Monosyllables lengthen under focus.

The prediction is that monosyllabic CVC words will not display lengthening in non-focus contexts, such as when another word bears focus (Question-Answer pairs, *only*). This is indeed the case.

(8) a. *ke* ***rag*** *kor-ʧʧ-e?*
who anger do-PROG-3
'Who is angry?'

b. *[Ram]$_F$* ***rag*** *kor-ʧʧ-e?*
Ram anger do-PROG-3
'Ram is angry.'

(9) *ʃud^{h}u [Ram]$_F$-i* ***rag*** *kor-l-o*
only Ram-SCAL anger do-PST-3
'Only Ram got angry.'

Further, unlike the derivational affixes in Table 8, the homophonous focus-sensitive morphemes *-i* and *-o* do occur with lengthened monosyllabic stems. Dasgupta (1984) proposes this is because the focus particles do not participate in lexical phonology and the stem must therefore lengthen to meet the bimoraic minimum. But there is an alternative explanation: given that these are focus particles, the stem is obligatorily focused, which results in focus lengthening on the stem.

Stem	Gloss	Focused	Gloss
raːg	'anger'	raːg-i	'only anger'
raːg	'anger'	raːg-o	'also anger'

Table 9: Lengthening with focus sensitive affixes

To summarize, under the current proposal, consonantal codas are moraic, so CVC stems do not need to lengthen to meet a bimoraic minimum. Rather, stems of all shapes lengthen under focus, and monosyllabic CVC stems are no exception. But in the absence of focus, CVC stems can occur without vowel lengthening. Note that this analysis does not make a prediction about monosyllabic CV stems. As they are monomoraic, CV stems may still show lengthening in non-focus contexts, if there is a bimoraicity requirement. But lengthening in CVC stems is not sufficient evidence for such a minimal word requirement.

5.3 *Typological space* Bangla makes use of vowel length to realize focus, despite the absence of a phonemic vowel length contrast. What other phonological properties can behave this way, *i.e.* produce non-structure-preserving changes? As predicted in Wolf (2008), any non-segmental features may behave this way, provided they are the sole realization of an affix. This is due to the nature of MAX-FLT, which requires that floating features have an output correspondent. For any feature [F], if MAX-FLT dominates the relevant markedness constraint against [F] in the language, featural affixation of [F] will result in exceptionally allowing this feature to surface.

There are several cross-linguistic patterns that seem to display similar behavior to the Bangla focus pattern. Cases of vowel length being conditionally utilized for emphasis have been reported in the literature, such as in Siwkolan Amis (Chang et al., 2019), Japanese (Kawahara & Braver, 2013), and English (Braver et al., 2016).

Tone is another non-segmental feature that can realize morphological changes. One such case appears to be absolutive case in Samoan, which is realized solely by a high tone, although the language is otherwise non-tonal (Yu, 2021).

Widening the scope further, this class of processes may extend to changes that may otherwise not be considered as being under the purview of the morpho-phonological grammar. For example, a featural affixation explanation could be proposed for sociolinguistic variables such as identity-indexing creaky voice in English (Hildebrand-Edgar, 2016), or nasality in Japanese, which indexes social meaning (Ikuta, 2013).

6 Conclusion

Realization of a morphosyntactic feature (focus) forces the creation of a marked structure (long vowels) in Bangla. This pattern shows that morphological considerations can override the language's default phonological grammar, resulting in the creation of marked structure. More generally, this supports the cognitive 'reality' of structurally marked candidates as viable alternatives despite being ordinarily unavailable in the surface data.

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