Locality of vowel harmony in Igbo

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Introduction & basic operations. The paper delves into the locality of vowel harmony (VH) and vowel coalescence (VC) in Igbo (Niger-Congo). Igbo has [+ATR] vowels [i, e, u, o] and [−ATR] vowels [ɪ, a, ʊ, ɔ], where each vowel has [+/−ATR] counterpart (Zsiga 1997). **(A)** ATR harmony takes place within a phonological phrase (=1), where the alternation between [+ATR] and [−ATR] among an intonational phrase (which is aligned with a sentence) is possible. **(B)** Vowel coalescence occurs in hiatus contexts where two vowels (V_1V_2) are assimilated into one. In Igbo, V_2 consistently wins out, if applicable (=2) (e.g., /ŋ**e.a**da/→[ŋ**e:**da] 'give Ada,' /eg**o.e**ze/→[eg**e:**ze] Eze's money). The operation is also domain-specific to a phonological phrase. **(C)** Interestingly, depending on speech speed, prosodic phrasing may alter, which comes with consequent vowel coalescence (=3). In normal speech, three phonological phrases comprise an intonational phrase; in fast speech, the number of phonological phrases is reduced, where Φ_2 forms a larger phonological phrase withΦ_1, [$\Phi_{1+2}\Phi_3$], in preference to Φ_3, *[$\Phi_1\Phi_{2+3}$].

(1) Domain-specific ATR harmony
((nwoke $_\Phi$)(afʊlʊg^{h}ɪ $_\Phi$) (osisi $_\Phi$)$_\iota$)
[+ATR] [−ATR] [+ATR]
'The man didn't see the tree.'

(2) Domain-specific vowel coalescence
((nwoke $_\Phi$) (ŋ**e.a**da $_\Phi$) (eg**o.e**ze $_\Phi$)$_\iota$) UR
((nwoke $_\Phi$) (ŋ**a:**da $_\Phi$) (eg**e:**ze $_\Phi$)$_\iota$) SR
'The man gave Ada Eze's money'

(3) Prosodic phrasing by speech speed
((nwoke $_\Phi$) (ŋ**a:**da $_\Phi$) (ego eze $_\Phi$)$_\iota$) [Normal: [$\Phi_1\Phi_2\Phi_3$]] (=2)
((nwokeŋ**a:**da $_\Phi$) (ege:ze $_\Phi$)$_\iota$) [Fast: [Φ_{1+2} Φ_3]]
*((nwoke $_\Phi$) (ŋa:de:ge:ze $_\Phi$)$_\iota$) [Fast: *[Φ_1 Φ_{2+3}]]

The interactions between the three operations contribute to an interesting pattern in (4). **ga** and **na** are future and present tense markers; **e-** and **a-** are prefixes to the verb roots. In normal speech, **ga/na** and **e-/a-** are not prosodically phrased together, while in fast speech, they are. The patterns give rise to two issues: First, when the left prosodic boundary of Φ_2 is open to the preceding phonological phrase (Φ_1), it is opaque whether vowel harmony plays a role in assimilating the preceding vowel or not (**VH+VC:** ga+e → ge+e → ge: vs. **VC only:** ga+e → ge:). Second, as shown in (1), vowels in the same phonological phrase typically share the same [ATR] feature, while it seems that the readjustment of the prosodic phrasing in fast speech does not (completely) trigger ATR harmony onto Φ_1, where at least the subject pronoun [ɔ] remains unchanged.

(4) Apparent opacity between vowel harmony and vowel coalescence

Verb inflection	SUBJ-TENSE-PFX-VERB IO DO[1]		*Gloss*
	Normal	Fast	
Future	(ɔ.ga) (e.ŋe) (me.go)	(ɔ.**ge:**.ŋe) (me.go)	He will give me money.
	(ɔ.ga) (a.zʊ.ŋe) (ma.kpa)	(ɔ.**ga:**.zʊ.ŋe) (ma.kpa)	He will buy me a bag
Present	(ɔ.na) (e.ŋe) (me.go)	(ɔ.**ne:**.ŋe) (me.go)	He is giving me money.
	(ɔ.na) (a.zʊ.ŋe) (ma.kpa)	(ɔ.**na:**.zʊ.ŋe) (ma.kpa)	He is buying me a bag

Analysis. Based on the observations, I argue that vowel harmony in Igbo is local and does not apply cyclically. In fast speech, the adjustment of prosodic phrasing does not trigger ATR harmony at all. The apparent opacity between vowel coalescence and harmony can be reduced to vowel coalescence only. I argue that the locality of vowel harmony can be explained if one considers cyclic spell-out and morpho-phonological conditioning by phase (Sande, Jenks & Inkelas 2020). Cyclic spell-out suggests phonological forms are cyclically determined by phase, where DP, vP, and CP are phases and spell-out domains. According to Match theory (Selkirk 2011), vP or smaller phrases are aligned with a phonological phrase, while CP is aligned with an intonational phrase; this is, the phonological operations involving vP (Φ) and CP (ι) are active at different times. This deduces the locality effect of vowel

[1] SUBJ=subject; PFX=verbal prefix; IO=indirect object; DO=direct object

harmony in Igbo (=1), where harmonization is valid within a ph(r)ase.

(5) Prosodic phrasing by phase

$[_{CP}\,[_{TP}$ ɔ.ga $[_{vP}$ e.ɲe $[_{VP}$ me.go]]]	
3SG.FUT PFX-give me money	'He will give me money'
((Φ_1) (Φ_2) ($\Phi_3)_\iota$)	[Normal speech: $[\Phi_1\Phi_2\Phi_3]$]
((Φ_{1+2}) ($\Phi_3)_\iota$)	[Fast speech: $[\Phi_{1+2}\,\Phi_3]$]

Consider (5), where vowel harmony is active and deactivated ph(r)ase by ph(r)ase. In fast speech, when vowel harmony has been done within vP phase (**e**.ɲe.mego vs. ***a**.ɲe.mego), it is thus not active again in CP phase ($[_{CP}$ **ɔ**.g**a**$[_{vP}$ **e**.ɲ**e**.m…]] vs. *$[_{CP}$ **o**.g**e**$[_{vP}$ **e**.ɲ**e**.m]]), even though they are in the same phonological phrase after readjustment for fast speech. In contrast, vowel coalescence does not show such locality restrictions, which is globally active and can be attributed to its higher constraint rankings.

Constraint rankings. I posit a set of constraints to capture the facts. First, ***V_1V_2** prohibits hiatus contexts (two different vowels adjoined), of which the repair is constrained by **ANCHOR-L(V)**, confining the winner vowel for hiatus resolution to the left-edged vowel of a prosodic domain (Φ_2), namely the right vowel between two (V_2). Second, ATR harmony takes place within a phonological phrase, constrained by **AGREE(ATR,Φ)**. **IDENT[ATR]**, on the other hand, prevents the change of [ATR] features from the input, which is violable in normal prosodic phrasing.

(6) Normal prosodic phrasing $[\Phi_1\Phi_2\Phi_3]$

(ɔ.na Φ_1) (**e**.ɲe Φ_2) (me.go Φ_3)[2]	*V_1V_2	ANCHOR-L(V)	AGREE(ATR,Φ)	IDENT[ATR]
→(ɔ.na Φ_1) (**e**.ɲe Φ_2) (me.go Φ_3)				
(ɔ.na Φ_1) (**a**.ɲe Φ_2) (me.go Φ_3)			*!	*

In the readjustment of prosodic phrasing, of which the input is based on (6), vowel harmony does not apply to the new phonological phrase, which can be captured by a subtle difference in constraint ranking, where IDENT[ATR] then overrides AGREE(ATR,Φ). In both (6) and (7), hiatus resolutions are always ensured to be active, overriding vowel harmony.

(7) Readjustment in fast speech $[\Phi_{1+2}\,\Phi_3]$

(ɔ.na Φ_1)(**e**.ɲe Φ_2) (me.go Φ_3)	*V_1V_2	ANCHOR-L(V)	IDENT[ATR]	AGREE(ATR,Φ)
(ɔ.n**e**:.ɲe Φ_{1+2}) (me.go Φ_3)			*!*	
→(ɔ.n**e**:.ɲe Φ_{1+2}) (me.go Φ_3)			*	*
(ɔ.n**a**.**e**.ɲe Φ_{1+2}) (me.go Φ_3)	*!			**
(ɔ.n**a**:.ɲe Φ_{1+2}) (me.go Φ_3)		*!		*!**

Conclusion. In Igbo, vowel harmony exhibits a locality effect on normal prosodic phrasing and applies phase by phase (domain by domain), while vowel coalescence cyclically takes place to resolve hiatus contexts. Igbo data supports the hypothesis that vowel harmony is local, bounded, and domain-specific (cf. Finley 2009; Walker 2005, 2012). Also, vowel harmony in Igbo is operated only within local phases, which supports the phase-based theory of morpho-phonological operations (Sande, Jenks & Inkelas 2020), showing a thought-provoking interaction between syntax-prosody mapping and the domain-specific applicability of vowel harmony.

References

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[2] Gray words indicate they are invisible to the ranking since they are not in the same operation domain/phase.