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A Critical Review of Some Contentious Issues in the Phonetics and Phonology of Ẹdo, Igbo, and Yoruba

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Abstract: Some contentious/controversial issues in the Phonetics/Phonologies of Ẹdo, Igbo, and Yoruba, (all members of the Kwa group of languages) are examined in this paper. This includes the appropriateness or otherwise of the use of the term "coalescence" in phonology based on available data in Ẹdo and Yoruba. The data from the Ẹdo language, and the reanalyzed Yoruba data do not seem to support the continued use of the term "coalescence" without any overt phonetic motivation as a tool for defining/describing what is actually vowel assimilation, vowel elision, and tone shift as a set of phonologically ordered processes. The second issue examined in this paper is the generally held view of the total assimilation of V_2 by V_3 across word boundary in a V_1CV_2 # V_3CV_4 collocation in Igbo. It is a known fact in languages that a more plausible (natural) assimilatory process involves a left to right movement not a right to left movement. It is argued that the so-called (total) vowel assimilation in Igbo V_1CV_2 # V_3CV_4 collocation is simply the case of the elision of V_2, and the re-association of the tone thereon with V_3, i. e., the first vowel of the second word. The autosegmental perspective is employed to elucidate this fact. In the third issue examined, it is argued that mutual exclusivity, used as the defining characteristic of languages that manifest vowel harmony, effectively excludes the Ẹdo and other Ẹdoid languages, in which there is free co-occurrence of vowels in any position of the word from being characterized as languages that manifest vowel harmony. The fourth issue examined is the manifestation of the downdrift and downstep phenomena. It is argued that the phenomena are language specific: non-phonemic in Ẹdo, involving a set of phonologically ordered rules whereas it is phonemic in Igbo. It is demonstrated that the only condition for obtaining a downstepped tone in Ẹdo is the presence of a H # L tone pattern across word boundary. The donwnstepped High tone in Igbo is phonemic irrespective of the nature (voice or voiceless) of the intervocalic consonants in VCV words.

Keywords: Assimilation, Deletion, Coalescence, Process, Vowel Harmony, Mutual Exclusivity, Downdrift, Downstep

1. Introduction

The concepts of "vowel coalescence", vowel elision, vowel harmony, downdrift and dowstep as phonetics/phonological phenomena in the languages identified are critically examined based on a clearer understanding of how they function in these languages. In particular, the appropriateness or otherwise of the use of the term "coalescence" in phonology is called to question based on available data in Ẹdo and Yoruba. The data from the Ẹdo language, and the reanalyzed Yoruba data in this paper based on Awobuluyi, [3] and Bamgbose Bamgbose, [4], do not seem to support the continued use of the term "coalescence" as a tool for defining/describing what is actually vowel assimilation, vowel elision, and tone shift as a set of phonologically ordered processes. If "coalescence", as defined by many authors, is the fusion of two contiguous sound segments to produce a third segment that shares some phonetic features with the two sounds the same way oxygen combines with hydrogen to form water, what the data in these languages reveal is certainly not "vowel coalescence". This work, therefore, is in agreement with Bamgbose [4] in his rejection of the concept of "vowel coalescence" without any overt phonetic motivation as a phonological process in Yoruba, and indeed in other natural languages.

Another issue examined in this paper is the generally held view of the total assimilation of V_2 by V_3 across word boundary in a V_1CV_2 # V_3CV_4 collocation in Igbo. It is a known fact in languages that a more plausible (natural) assimilatory process involves a left to right movement not a

right to left movement. It is argued that the so-called (total) vowel assimilation in Igbo V_1CV_2 # V_3CV_4 collocation is simply the case of the elision of V_2, and the re-association of the tone thereon with V_3, i. e., the first vowel of the second word. The autosegmental perspective is employed to elucidate this fact. In the third issue examined, mutual exclusivity, used as the defining characteristic of languages that manifest vowel harmony, effectively excludes the Ẹdo and other Ẹdoid languages, in which there is free co-occurrence of vowels in any position of the word from being characterized as languages that manifest vowel harmony. The manifestation of the downdrift and downstep phenomena is the fourth issue examined. It is argued that the phenomena are language specific: non-phonemic in Ẹdo whereas it is phonemic in Igbo. In Ẹdo, it involves a set of ordered phonological rules: (a) downdrift (b) vowel elision, and (c) tonal re-association in that order. It is demonstrated that the only condition for obtaining a downstepped tone in the language is the presence of a H # L tone pattern across word boundary. The donwnstepped High tone in Igbo contrasts with a High tone on V_2 in V_1CV_2 lexical items irrespective of the nature (voice or voiceless) of the intervocalic consonants.

It is our studied opinion that the lack of elaborate data in some of the previous studies could be one of the major reasons for the controversies that emanated from them.

2. The four Contentious Issues in the Phonetics and Phonology of of the Identified Languages

The four contentious issues examined in this study are (1) the so-called vowel coalescence which constitutes the focus of 2.1. Data from Yoruba and Ẹdo form the basis of the analysis. It is demonstrated in 2.2 that vowel elision and tone shift, not vowel assimilation, is what obtains in Igbo. In 2.3, it is shown that the use of the term "mutual exclusivity" as a defining characteristic effectively exclude the Ẹdoid languages as languages that manifest vowel harmony. Finally, it is demonstrated in 2.4 that the phenomena of downdrift and downstep is language specific.

2.1. "Vowel Coalescence" as the Combined Phonological Processes of Vowel Assimilation, Vowel Elision, and the Redundant Tone Shift"

The term "coalescence", as defined by many authorities, is "the waxing together in union, combination, …association…, etc." (Bantam New College German and English Dictionary [38]). Thus, "to coalesce is to come together and unite into one substance, group, etc." (The Oxford Advanced Learners Dictionary [34]). By extension, therefore, in the view of some scholars, "coalescence" as a phonological process could be defined as the fusion of two contiguous sound segments (across word boundary) to produce a third and new segment that has the features of the "coalesced" segments the same way oxygen combines with hydrogen to form water. Hence it is claimed that two phonetically different vowels having some common features coalesce across word boundary to form a third one Awobuluyi [3]; Oyebade [33]. According to Bamgbose [4] "Vowel coalescence as described in a wide range of languages, is accepted as involving two different vowels giving rise to a third.", similar to the claims in Kenstowicz and Kisserberth, [16]; Faraclas, [9] etc. It is pointed out in Kenstowicz and Kisserbert ([16]) that "the vowel that appears on the surface in such cases is not identical to either of the two original vowels but instead is a kind of compromise vowel." Thus, for Bamgbose [4], "the crucial factors in vowel coalescence are *differentiation* and *compromise*." It will be demonstrated in this paper that the so-called process of "Vowel coalescence" is, in fact, the combined phonological processes of vowel assimilation, vowel elision, and the expected tone shift" in that order (Ọmọzuwa [30]). We regrouped the data in Awobuluyi, ([3]); and Bamgbose, [4] into (1)-(4) below:

(1)
/dà # ìwé/ => [dìwé]
Buy book 'buy book'

In our opinion, (1) above can simply be characterized as a case of vowel elision where the vowel before the word boundary elides as seen in the Ẹdo examples in (11, (12), and (13), and as it is also manifested in some other Kwa languages.

The data in (2) and (3) are height/back/roundness assimilation preceding vowel elision:

(2) Height assimilation
(a) /bè # ùʤú/ => [bòʤú]
look for pounded yam 'look for pounded yam'
(b) /a # ri # ogbo/ => [arugbo]
agent see old age 'elderly person'
(3) Back/Roundness assimilation
(c) /o # mɔ # iwɛ/ => [omuwɛ]
Agent know bath 'swimmer'
(d) /gbɔ # iro / => [gburo]
Hear sound 'hear from someone'
(e) /ogu # edi/ => [ogodi]
Twenty two 'forty'
(f) /ogu # ɛʤɔ/ => [ɔgɔʤɔ]
Twenty eight 'hundred and sixty'
(e) /so # ikpa/ => [sokpa]/[sukpa]
Grow testes 'develop swollen testicles'

It could be seen in (2) and (3) that two phonological processes are at play, namely, (i). height/back/roundness assimilation, and (ii). vowel elision, where the vowel before the word boundary either raises or lowers or assimilates the back/roundness features of the first vowel of the following word before it elides as seen in the Ẹdo examples in (6), (7), and (8) later in this paper.

(4)
/ʤɛ # iba/ => [ʤuba]
Answer homage 'pay homage'
/kpa # irɔ/ => [kpurɔ]
Kill lie 'tell lies'
/wi # ire/ => [wure]
Say blessing 'Pronounce blessings'

/sa # ire/ => [sare]/[sure] 'run'

It would appear implausible to characterize the examples in (4) above as cases of vowel coalescence because the presumed "coalesced" vowel, [u] in this case, shares only the feature height with the vowels across word boundary in only one instance (/wi # ire/ => [wure]) and no common feature(s) in other cases, except that they are all vowels. They do not, therefore, fall within the strict definition of "vowel coalescence" as stated above even though Awobuluyi [3] used the roundness polarity to account for the assumed cases of vowel coalescence in Yoruba in (1) and (4) above. We are, therefore, in agreement with Bamgbose [4] in his rejection of the concept of "vowel coalescence" *without any overt phonetic motivation* (Ọmọzuwa, [30]) as a phonological process in Yoruba, and indeed in other natural languages. The processes in (2), and (3) above can be accounted for by the following rules:

(i). Vowel assimilation rule:

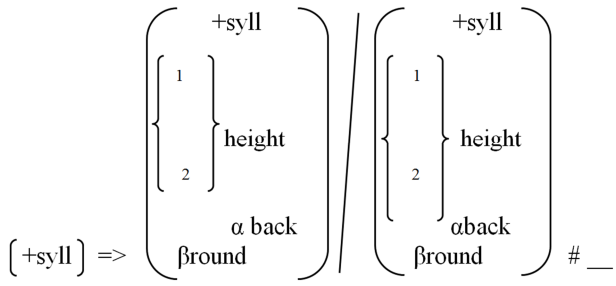

Figure 1. *Shows the vowel assimilation thaat applies before the vowel elision rule.*

and the vowel elision rule below for (1), (2), and (3).

(ii). Vowel elision rule:

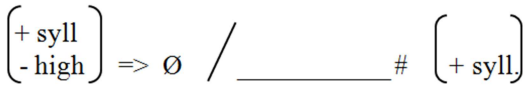

Figure 2. *Illustrates the vowel deletion.*

Omozuwa, [30], asserts that "a definition of vowel coalescence which presupposes that a segment replaces the initial two segments across word boundary with no overt reference to any influence of one segment on the other or with no reference to any overt phonetic motivation would appear inappropriate." The issue of the "fusion" of two vowels that share similar phonetic features to give a third vowel that has some of the features of the two "coalesced vowels" through some unexplained "compromise" arrangement does not even arise. The proponents of the "coalescence" theory ought to have gone a step further than considering it simply as a case of "differentiation" and "compromise" by taking into consideration the phonetic motivation as a precondition for obtaining the presumed cases of vowel coalescence.

It is argued in this paper, based on available data from Ẹdo, that the observed instances of "vowel coalescence" is not the consequence of "differentiation" and an unexplained "compromise" but the result of a set of phonetically motivated, ordered phonological processes: vowel assimilation (lowering or raising), elision of the assimilating vowel, and tone shift (or tonal re-association) in that order. In the language, these phonological processes: vowel assimilation, vowel elision, and tone shift, occur only in a verb-noun collocation involving mainly the mid vowels, in particular, [ɛ] and [ɔ], in which the tone of the verb is a Rising tone. Vowel assimilation in the language presents two possibilities:

(i). Vowel laxing: if the vowel of the verb is a Rising-toned [a] or [ã], the first vowel of the noun, usually the front, unrounded tense vowels either the vowel [i] or [e], is assimilated to the corresponding lax vowel [ɪ] and [ɛ], respectively. In such cases, elision of the vowel before the word boundary is blocked. The resultant two vowels across word boundary and the tones with which they are co-articulated, are realized phonetically as seen in the following examples:

(5)

/wǎ # èwá/ => [wǎɛ̀wá]
Spread mat "spread the mat"
/kp̄ă # èŋ́í/ => [kp̄ăɛ̀ŋ́í]
Lift something "lift something"
/kạ̃# ìsé/ => [kãὼsé]
Hit nail "drive the nail in…"
/sã̄ # ógbà/ => [sã᷅gbâ] => [sãgbâ]
Jump fence "jump the fence" (total assimilation in the last example).

(ii). The vowels [ɛ] and [ɔ] of a Rising-toned verb, assimilate (lower) the first vowel of the noun after the word boundary to their corresponding heights, and elide subsequently. The "floating" Rising tone co-articulated with the deleted vowel is subsequently re-associated with the said first vowel of the noun affected by the lowering to give the correct phonetic realization of the Verb-noun collocation. These are the cases commonly and wrongly referred to as cases of "vowel coalescence". Examples include:

(6)

/gwɛ̌# ùhű́ŋù/ => [gwɔ̌hű́ŋũ̀]
Offer prayer head "offer prayer to one's head"
/βwɛ̌# ùkp̄ɔ̄/ => [βwɔ̌kp̄ɔ̄̂]
Fold clothes "fold the clothe(s)"
/xɛ̌ # òwá/ => [xɔ̌!wá]
Look after house "look after the house"
/βɛ̌ # ógbà/ => [βɔ̌gbâ]
Widen arena "widen the arena"
/dwɛ̌# ìkù/ => [dwɛ̌kû]
Scatter refuse "scatter the refuse"
/ɻwɛ̌ # ìfí/ => [ɻwɛ̌fí]
Set trap "set trap"

The examples above are instances where the front, half-open/mid-low, unrounded vowel, [ɛ] assimilates (lowers) the first vowel of the noun (a close/high vowel) to the corresponding half-open/mid-low vowel and subsequently elides. The back, half-open/mid-low, rounded vowel, [ɔ], also operates in a similar manner, assimilating the first vowel of the noun (a close/high vowel) to the corresponding half-open/mid-low vowel before it elides as seen in the examples below:

(7)
/hɔ̰# ìkù/ => [hɛ̌kû]
Pack refuse "pack the refuse"
/hɔ̰ # ìsã̀/ => [hɛ̌sã̂]
Pack faeces "pack the faeces"
/nɔ̰# èdjɔ̃́/ => [nɛ̌!djɔ̃́]
Inquire elders "inquire from the elders"
/ɻɔ̰# égí!lɛ̀/ => [ɻɛ̌gí!lɛ̀]
Pick snail "pick up snails"
/hɔ̰# ùk͡pɔ̃́/ => [hɔ̌k͡pɔ̃̂]
Wash clothes "wash the clothes"
/sɔ̰# ùk͡pɔ̃́/ => [sɔ̌k͡pɔ̃̂]
Tear clothes "tear the clothes"
/gwɔ̰ # óbòbó/ => [gwɔ̌bồbó]
Mash yam and palm oil "mash boiled yam and palm oil"

Instances where the front, half-close/mid-high, unrounded vowel, [e] assimilates (lowers) the first vowel of the noun (a close/high, back, rounded vowel [u] (but not the close/high vowel [i]) to the corresponding half-close/mid-high, back, rounded vowel [o] and subsequently elides are also attested as evidenced in the examples below:

(8)
/k͡pɛ̰# ùɻù/ => [k͡pɔ̌ɻû]
Blow throat "preach"
/k͡Pɛ̰# ùhűŋù/ => [k͡pɔ̌hũ̄ŋũ̀]
Rattle head "split head" (from which [àk͡pòhũ̀ŋũ̀] 'splitting headache' derives).
/kɛ̌ # ùhűŋù/ => [kɔ̌hűŋũ̀]
Wedge head "wedge head" (from which [ùkòhũ̀ŋũ̀] 'pillow' derives).

However, it is observed that [e] in (9) below simply elides (following the normal pattern of eliding the vowel before the word boundary) without the expected lowering of the first vowel [u] of the following noun to [o]:

(9)
a) /ɣɛ̌ # ùk͡pɔ̃́/ => [ɣŭk͡pɔ̃̂]
Look cloth "look at the cloth"
b) /ɣɛ̌ # úkúsɛ̀/ => [ɣŭkúsɛ̂]
Look maracas "look at the maracas"
Look maracas "look at the maracas"

However, a cursory look at the examples in (10) a and b would reveal that assimilation did not take place in (9) a and b for the purpose of disambiguating the utterances in both sets.

(10)
a) /ɣɔ̌ # ùk͡pɔ̃́/ => [ɣɔ̌k͡pɔ̃̂]
Hawk clothes "hawk clothes"
b) /ɣɔ̌ # úkúsɛ̀/ => [ɣɔ̌kúsɛ̂]
Hawk maracas "hawk maracas"
Hawk maracas "hawk maracas"

The [o] before the word boundary in (10) a) assimilates the [u] in [ùk͡pɔ̃́] to [o] before it is, itself, deleted to disambiguate it from (9) a) as it is also the case in (9) b compared to (10) b. In other cases, [o] is simply deleted or realized as the glide [w] whereas the Rising tone co-articulated with it is re-associated with the first vowel of the noun after the word boundary as seen in the examples below:

(11)
/lɔ̌ # ùk͡pɔ̃́/ => [lŭk͡pɔ̃̂]
Use clothes "use clothes"
/kɔ̌ # ùk͡pɔ̃́/ => [kŭk͡pɔ̃̂]
Gather clothes "gather clothes together"
/lɔ̌ # íɣó/ => [lwĭɣó]
Spend money "spend money"

Where there is agreement of the feature "height", between the front, half-open unrounded vowel [ɛ] of the verb and its back, rounded counterpart [ɔ] of the noun (or vice versa) across word boundary, the normal pattern of eliding the vowel before the word boundary occurs as evidenced in the examples below:

(12)
/xɛ̰# ɔ̀mɔ́/ => [xɔ̌!mɔ̃́]
Look after child "look after a child"
/xwɛ̰# ɔ̀mɔ́/ => [xwɔ̌!mɔ̃́]
Bathe child "give the child a bath"
/kɔ̰# ɛ̀ŋɛ̀/ => [kɛ̆̌ŋɛ̆̂]
Watch speech "speak with caution"
/lɔ̰# ɛ́wù/ => [lɛ̆̌wû]
Iron shirt "iron the shirt"

See also the examples below illustrating the usual elision process/glide formation in the language:

(13)
/fì # úzò/ => [fjúzô]
Shoot antelope "shoot antelope"
/ɹù # èŋí/ => [ɹwèŋ́ĩ́]
Do something "do something"
/kpè # òbɔ́] => [k͡pòbɔ́]
Wash hand "wash hands"
/dɛ̀ # èbé/ => [dèbé]
Buy book "buy book"
/kɔ̀ # èŋí/ => [kèŋ́ĩ́]
Plant something "plant something"
/kà # èŋí/ => [kèŋ́ĩ́]
Count something "count something"

The two ordered rules below adequately account for the assimilation, elision and tone shift processes exemplified above:

(i). Vowel (height) assimilation rule:

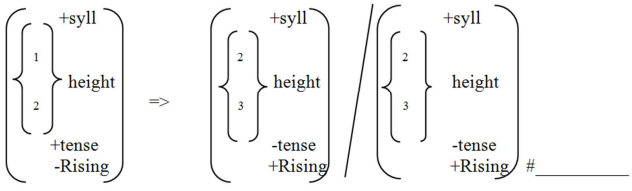

Figure 3. *Shows the rule of vowel assimilation in Ẹdo.*

(ii). Vowel elision rule:

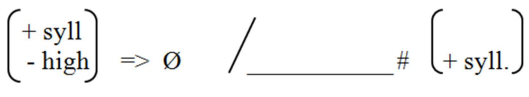

Figure 4. *Illustrates the rule of vowel elision in Ẹdo the same way it applies in Yoruba.*

Rule (i). above presupposes that the two vowels across word boundary have different features such that one or more of the features of one vowel is/are assimilated by those of the other whereas Rule (ii). simply deletes the (assimilating) vowel before the word boundary.

2.2. "Vowel Assimilation" in Igbo as Vowel Elision and Tone Shift

Another contentious issue is that of the claimed few cases or absence of vowel elision in Igbo. It is a known fact that vowel elision/deletion is a very common phonetic phenomenon in Kwa languages that are essentially open syllable languages. When two words are used sequentially in an utterance, therefore, two vowels meet across word boundary. In such cases, the last vowel of the first word, i.e., the vowel before the boundary is elided provided it is not the high vowel [i/e or u/o] in which case, it is realized as the corresponding glides, [j] and [w] respectively.

It is the general assumption in Igbo Phonology that "few cases of vowel elision exist" in the language (Emenanjo [8]: 26). According to him, "…while vowel assimilation is pronounced in Igbo, vowel elision is very limited in occurrence." Adopting the autosegmental perspective as an alternative analytical framework for a clearer explanation of the phenomenon, it is argued that the generally held assumption that the phenomenon be treated as the total assimilation of V_2 by V_3 in a V_1CV_2 # V_3CV_4 construction in previous studies (cf. Emenanjo [8]; Omozuwa [29]) would appear defective, and is better treated as vowel elision or glide formation (as the case may be) and tone shift in which V_2 elides in all cases (provided it is not a high vowel, in which case a glide results), and a rightward shift of the tone (and nasality when present) with which it is co-articulated, to give the correct phonetic output (Omozuwa [24, 31]). The tonal behavior in all instances of the deletion of V_2 in a V_1CV_2 # V_3CV_4 construction analyzed autosegmentally for the different tone patterns in the language reveals that vowel elision, and *not vowel assimilation*, is, indeed, what operates in Igbo as seen below:

2.2.1. HH # HH => HHH (Noun # Adjective) or HH!H (Noun # Noun or Genitival Constructions) in Igbo

(14)

/áká	#	ɔ́má/	=> [ákɔ́mā́]
Hand		good	'good hand'
/ákpá	#	ɔ́ʧá/	=> [ákpɔ̋ʧá]
eye		white	'white eye'
/ákpá	#	úkwú/	=> [ákpṹkwú]
eye		big	'big eye'

Using (/áká # ɔ́má/ => [ákɔ́mā́]) as example, the phonetic facts in (14) can be represented autosegmentally as:

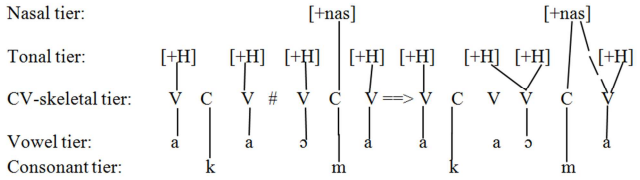

Figure 5. *Illustrates the autosegmental representation of /áká # ɔ́má/ => [ákɔ́mā́].*

It could be observed from the phonetic output of the autosegmental representation above that V_2 is not mapped onto the appropriate slot in the CV-skeletal tier because it is an elided segment.

2.2.2. HH # HL => HHL

A HH # HL tone pattern in Igbo V_1CV_2 # V_3CV_4 collocation yields a HHL tone pattern with the expected fusion of the High tone of the elided V_2 with that of V_3 as seen in (15) below:

(15)

/ónḗ	#	íʤè/	=>[ónḗíʤè]
'person'		'walk'	'traveller'
/ékɛ́	#	ɔ́gbà /	=>[ɛ́kɔ́̀gbà]
'python'		'big/bush	'python'
/áká	#	ígù /	=> [ákígù]
Hand		palm leaf	'palm frond'

The vowel elision process and the tone shift observed in (15) are represented autosegmentally using (/ónḗ # íʤè/ => [ónḗíʤè]) as example:

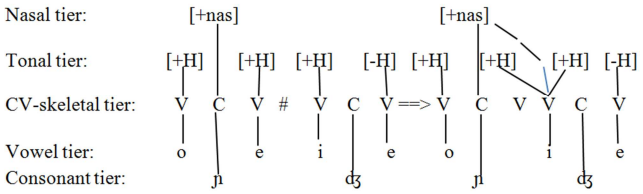

Figure 6. *Illustrates the autosegmental representation of (/ónḗ # íʤè/ => [ónḗíʤè]) as example.*

2.2.3. HH # LL => HFL

The data in (16) below, show that a HH # LL tone pattern on V_1CV_2 #V_3CV_4 collocation in Igbo yields a HF: L tone pattern after the elision of V_2 and the subsequent movement of the tone (and nasality where applicable) co-articulated with it to form a contour tone (a Falling tone in this case) on V_3 with the redundant lengthening of the latter (cf. Omozuwa [26] for experimental validation of similar redundant lengthening of a vowel bearing a contour tone in Ẹdo):

(16)

/ónḗ	#	ʊ̀ʧʊ̀/	=> [ónʊ̂:ʧʊ̀]
'person'		'taboo'	'destroyer'
/íkḗ	#	ɔ̀gʊ̀/	=> [íkɔ̂:gʊ̀]
'strength'		fight/war	'name of a person'
/íkpḗ	#	ɔ̀hà/	=> [íkpɔ̂:hà]
Judge		public	'name of a person'

(16) above are represented autosegmentally, using (/íkpḗ # ɔ̀hà/ => [íkpɔ̂:hà]) as example:

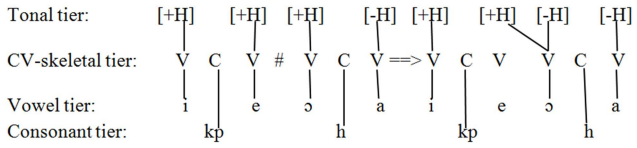

Figure 7. *Illustrates the autosegmental representation of /íkpé # ɔ̀hà/ => [íkpɔ̂ːhà].*

As seen above, the High tone co-articulated with the deleted [e] of [íkpé] merges with the Low tone co-articulated with [ɔ] of [ɔ̀hà] to form a Falling tone in the phonetic realization.

2.2.4. HL # HH => HRH

A HL # HH tonal collocation results in HRH in Igbo after the elision of the vowel before the word boundary, and the subsequent shift of the tone (and nasality where applicable), co-articulated with it as seen in the following examples:

(17)

/úʧè	#	ɔ́má/	=>	[úʧɔ̌ːmǎ]
Thought		good		'good thought'
/ ógè	#	ɔ́má /	=>	[ógɔ̌ːmǎ]
Time		good		'good time'
/ íkè	#	úkwú /	=>	[íkŭːkwú]
Buttocks		big		'big buttocks'

(17) above are represented autosegmentally, using (/íkè # úkwú/ => [íkŭːkwú]) as example:

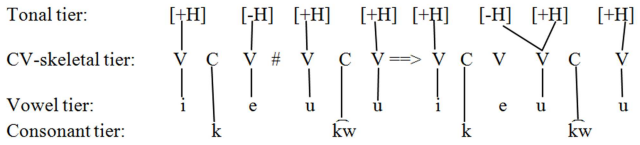

Figure 8. *Illustrates the autosegmental representation of íkè # úkwú/ => [íkŭːkwú].*

It would be observed that the Low tone co-articulated with the deleted [e] of [íkè] merges with the High tone co-articulated with [u] of [úkwú] to form a Rising tone in the surface form similar to what was observed in 1.2.3 above for the Falling tone.

2.2.5. HL # LL => HFL

As pointed out in Omozuwa [29], it would have been expected that this tone pattern gives rise to a HLL tone pattern after the elision of V_2 and the fusion of the Low tone co-articulated with the deleted vowel with the Low tone co-articulated with V_3 since they are like tones. Thus, the collocation /ókè # àlà/ ought to be *[ókàlà]. This would give a meaningless utterance in the language. However, the phonetic output of the tonal realization of the collocation is a HFL tone pattern as seen in (18) below:

(18)

/únè	#	ɔ̀gɔ̀/	=>	[únɔ̃̂ːgɔ̀]
Banana		Ọgọ		'Ọgọ's banana'
/ʊ́nɔ̀	#	àʤà/	=>	[únâːʤà]
House		sacrifice		'house of sacrifice' (shrine)
/ójè	#	àbà /	=>	[ójâːbà]
market day		Aba		'Aba market day'
/ókè	#	àlà /	=>	[ókâːlà]
Boundary		land		'land boundary'

Omozuwa [29] posited that a Low tone raising rule which raises the Low tone of the vowel before the boundary to a High tone in a sequence of Low tones across word boundary, prior to the deletion of the said vowel, operates in the language. The Low tone raising rule is repeated here for emphasis:

Rule iii: Low Tone Raising Rule:

[-H] => [+H] / { [+H] / [-H]… } _____# [-H]…

According to this rule, the Low immediately before a word boundary in a sequence of Lows (or when preceded by a High tone) is raised to a High tone. This adequately accounts for the surface Falling tone (resulting from the (now) High before the boundary and the Low tone co-articulated with the first vowel after the word boundary in the examples presented in (18) and (19).

The data in (18) above can be better represented autosegmentally, using (/únè # ɔ̀gɔ̀/ => [únɔ̃̂ːgɔ̀]) as a model as shown below:

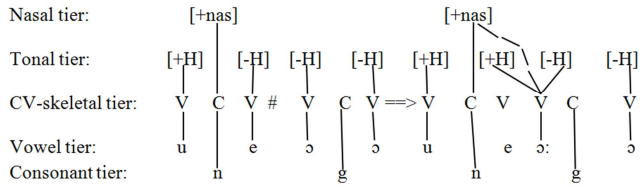

Figure 9. *Illustrates the autosegmental representation of /únè # ɔ̀gɔ̀/ => [únɔ̃̂ːgɔ̀].*

2.2.6. L L # LL => LFL

This tonal configuration gives rise to a Low-Falling-Low tone pattern as a result of the elision of V_2, and the resultant merging of the "floating" High tone of the 'fossilized' segments of the 'possessive marker' [ǹkè] (resulting from the Low tone raising rule mentioned earlier) with the Low tone of V_3 to form a Falling tone on the latter as seen (19) below:

(19)

/òkè	# (ǹkè)	# ɔ̀gɔ̀/	=>	[òkɔ̂ːgɔ̀]
share	PM	Ọgọ		'Ọgọ's share'
/àkpà	# (ǹkè)	# àgwà/	=>	[àkpâːgwà]
bag	PM/of	beans		'bag of beans'
/ìtè	# (ǹkè)	# àgwà/	=>	[ìtâːgwà]
pot	PM/of	beans		'pot of beans'

The observed phenomenon in (19) above is represented autosegmentally using (/òkè # (ǹkè) # ɔ̀gɔ̀/ => [òkɔ̂ːgɔ̀]) as example:

(a) Base form

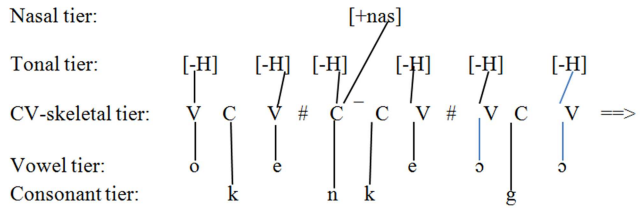

Figure 10 *Illustrates the autosegmental representation of the underlying form of /òkè # (ǹkè) # ɔ̀gɔ̀/ => [òkɔ̂ːgɔ̀].*

(b) surface (phonetic) realization

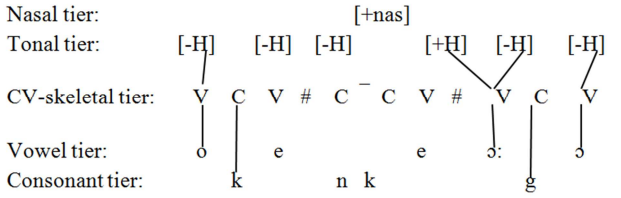

Figure 11. *Illustrates the autosegmental representation of /òkè # (ǹkè) # ɔ̀gɔ̀/ => [òkɔ̂:gɔ̀] at the (surface) phonetic level.*

2.2.7. LL # HL => LRL

In (20) below a Low Low # High Low tonal collocation results in a Low Rising Low after the elision of the vowel before the word boundary. In other words, the Low tone of the elided vowel then merges with the High tone on V_3, the vowel immediately following the boundary, resulting in a phonetic Rising tone and a redundant (predictable) lengthening of the vowel as seen below:

(20)

/ìtè # ázʊ̀/ => [ìtă:zʊ̀]
Pot fish 'pot of fish'
/àmà # ógè/ => [àmɔ̃̌:gè]
who knows time 'name of person'

The observed phenomenon in (20) is represented autosegmentally, using (/ìtè # ázʊ / => [ìtă:zʊ]) as a representative example:

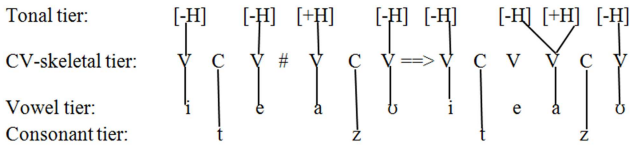

Figure 12. *Illustrates the autosegmental representation of /ìtè # ázʊ / => [ìtă:zʊ].*

2.2.8. LH # LL => LFL

It would be observed from the examples in (21) that a LH # LL results in a LFL tonal configuration as a result of the elision of the vowel with which the High tone before the word boundary is co-articulated.

(21)

/ùdé # ùgò/ => [ùdû:gò]
body cream name of person 'Ugo's body cream'
/àkwá # ùgò/ => [àkwû:gò]
egg eagle 'eagle's egg/name of person'
/ìkó # àʤà/ => [ìkâ: ʤà]
cup sacrifice 'cup used for sacrifice'

Autosegmentally, the facts in (21) above are represented below, using (/ùdé # ùgò/ =>[ùdû:gò]) as a model:

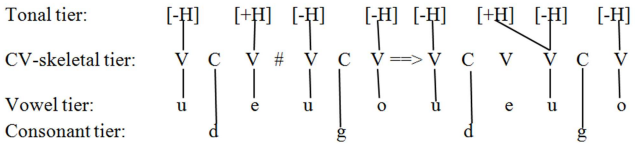

Figure 13. *Illustrates the autosegmental representation of /ùdé # ùgò/ =>[ùdû:gò].*

One interesting fact that emerges from the autosegmental analysis of all the examples above, irrespective of the vowel in V_2 position and the tone (and nasality where present) is the consistency with which V_2 is elided in all cases (indicated by the absence of an association line from the vowel tier to the appropriate V-slot on the CV-skeletal tier and the shift of whatever other autosegments, tone or nasality, is co-articulated with it (indicated by the association lines from such autosegments to the appropriate slot(s) on the CV-skeletal tier corresponding to V_3 position on the vowel tier).

2.2.9. Glide Formation and Tones in Igbo

The fact of glide formation is perhaps a further proof that the vowel in V_2 position is elided and not assimilated in an Igbo V_1CV_2 # V_3CV_4 construction. This is the process whereby a high vowel is de-syllabified to form the corresponding glide. It is a known fact that the tone (and nasality) co-articulated with such de-syllabified high vowel then shift(s) to the next available tone-bearing unit to the right (V_3 in this case) resulting in the redundant lengthening of the said vowel as seen in (22) below:

(22)

/éɲí # úkwú/ => [éɲjű̌kwú]
elephant big 'big elephant'
/ɔ́ʧí # áɣá/ => [ɔ́ʧjáɣá]
ruler war 'military ruler'
/ákp͡ʊ̀ # áká/ => [ákp͡wă:ká]
nut hand 'palm'
/èlù # ág͡wɔ́ / => [èlwă:!gwɔ́]
gland snake 'snake's gland'

It is observed that the result in all cases is a contour tone (Falling or Rising) co-articulated with the said tone bearing unit provided the tones that interact across word boundary are unlike tones otherwise there is tonal fusion if the tones across word boundary are like tones.

The argument, therefore, is that if there is any phonetic motivation in V_2 being totally assimilated by V_3 as Emenanjo [8] seems to suggest, the V_2 in the examples in (22) presented above ought to have been totally assimilated also rather than forming a glide. In other words, the [i] and [u] before the word boundary in (22) share the phonetic property of being high (i. e. close vowels) for either of them to have been able to assimilate the other yielding, for instance *[éɲűkwú] rather than [éɲjűkwú] as the phonetic realization. It, therefore, appears less plausible to imagine cases in which [ʊ/u] in V_2 position could have been totally assimilated by [a] in V_3 position in the V_1CV_2 # V_3CV_4 constructions in the language. There is, therefore, no phonetic motivation to account for such claim of total assimilation in the language. An analysis premised on the elision or the de-syllabification of V_2 (if it is a high vowel) appears, therefore, more logical in accounting for the phonetic realization of V_1CV_2 # V_3CV_4 constructions in Igbo. (22) can, therefore, be represented autosegmentally, using (/èlù # ág͡wɔ́ / => [èlwă:!g͡wɔ́]) as a model:

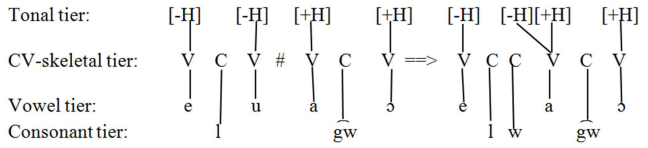

Figure 14. *Illustrates the autosegmental representation of /èlù # ágw̃ɔ́ / => [èlwǎ:!gw̃ɔ̌].*

The phenomenon observed in the examples above lends further support for the autosegmentalization of tone (and nasality) in the language since in all the cases, the tone (and nasality as the case may be) coarticulated with a deleted vowel is never lost but surfaces on the next available vowel (V_3 in this case) with a redundant lengthening of the said vowel.

2.3. Ẹdoid Languages Do Not Manifest Vowel Harmony

Vowel harmony is the phonetic phenomenon whereby the occurrence of vowels within the same lexical formative is sequentially constrained. This phonotactic constraint is imposed by the existence of two sets of vowels which are *mutually exclusive* in their distribution within the same formative in a language that manifests vowel harmony. Oyebade ([33]), says "Languages that attest this process impose the euphonic constraint of allowing vowels from a particular group to co-occur together in a well-defined domain to the exclusion of members of other group." Vowel harmony, in languages that attest this phenomenon, can either be complete or partial. The Igbo language is one of the languages that operate a complete vowel harmony system. Oyebade, ([33]) reports the existence of partial vowel harmony in Yoruba. Partial vowel harmony has also been reported in a number of other Nigerian Languages: Armstrong, [2] for the Idomoid languages; Kuhn and Dusu, [15] for Berom; Jenewari, [14] for Kalabari; Donwa-Ifode, [5] for Isoko; etc.).

Within the framework of the binary distinctive feature theory, vowel harmony "is always based on one phonetic feature or another…" the most common one in African Languages being "the ATR feature" (Oyebade, [33]). Members of one group made up usually of the lax vowels are characterized as [-ATR] (Advanced Tongue Root), whereas their tense counterparts are characterized as [+ATR]. The crucial factor in determining whether or not vowel harmony is attested in a language is the existence of two sets of vowels, characterized as having the features [+ATR] ([+tense]) and [-ATR] ([-tense]) respectively, or a set of half-open and half-close vowels (in the case of Yoruba) that are *mutually exclusive* in their distribution.

The nature and extent of the manifestation of the presumed vowel harmony in four Ẹdoid languages namely, Ẹdo, Esan, Emai and Okpẹ, are examined. It is argued that, going strictly by the definition of vowel harmony in languages in which it occurs such as Igbo (complete vowel harmony) and Yoruba (partial vowel harmony), the empirical data on the VCV(CV…) nouns in these Ẹdoid languages do not seem to qualify them as languages that manifest vowel harmony.

2.3.1. Vowel Harmony in Igbo

Igbo is one of the African Languages that manifest a complete vowel harmony system. The Language has eight vowels divided into two clear sets. The first set made up of [i, e, u, o] is characterized by the feature [+ATR] ([+tense]) whereas the second set made up of [ɪ, ʊ, ɔ, a] is characterized by the feature [-ATR] ([-tense]). In Igbo, therefore, wherever members of one set occur in a formative, members of the other set are excluded. Consider the following examples (cf. Oyebade, [33]):

(23)

Set A [i, e, u, o]	Set B [ɯ,ʊ,], a]
[òsísí] 'cooking	[ɔ́mɪ́mɪ́] 'sucking'
[òbìbì] 'living in'	[ɔ́hɪ́hɪ́] 'squeezing'
[òlùlù] 'throwing'	[ɔ́dɯ́dá] 'cutting'
[òxíxé] 'tying'	[ɔ́ɓʊɓá] 'peeling'
[òtító] 'growing'	[ɔ́sɪ́sɔ́] 'avoiding'

This phenomenon is also evident in disyllabic words as seen in the following examples:

(24)

[é!gó] 'money'	[á!gʊ́] 'tiger'
[í!gwé] 'sky'	[á!lʊ́] 'abomination'
[é!ró] 'mushroom'	[á!ɣɔ́] 'odour'
[ó!gwú] 'thorn'	[ʊ́!gʊ́] 'pumkin'
[ó! ʧé] 'chair'	[ɔ́!gʊ́] 'twenty'
[é!nṹ] 'height'	[ɔ́! ʤɪ́] 'kolanut'

It is observed in the examples in (23) and (24) above that the vowels of set A and those of set B are mutually exclusive in their distribution. In other words, the occurrence of the vowels of one set in a word excludes that of the other set. However, it would appear that this constraint no longer holds in a VCV # VCV (i.e., noun-noun or noun-adjective) construction after the elision of the second vowel of the first word before the word boundary (cf. Ọmọzuwa, [30]). Consider the following examples:

(25)

/áká	#	ɔ́má/	=> [ákɔ́mǎ]
hand		good	'name of person'
/ífé	#	ɔ́má/	=> [ífɔ́mǎ]
thing		good	'name of person'
/áŋá	#	úkú/	=> [áŋṹkú]
eye		big	'greed'
/áká	#	éwú/	=> [áké!wú]
hand		goat	'goat's hand'
/ìtè	#	ázʊ̀/	=> [ìtǎzʊ̀]
pot		fish	'pot of fish'

The examples in (23 and 24) above show complete vowel harmony in Igbo which is different from the partial vowel harmony system that operates in Yoruba as seen in (26) below:

2.3.2. Vowel Harmony in Yoruba

Oyebade ([33]), points out that Yoruba, like the Idomoid languages (Armstrong, [3]), operates a partial vowel harmony system. The language has seven oral vowels [i, e, ɛ, a, u, o, ɔ] as obtained in Ẹdo (cf. Omozuwa, [21, 28]). In VCV words, the vowel system in Yoruba falls into three

groups in terms of their distribution. "The first group contains *e, o*, the second group has *ɛ,* ɔ while the third group attests *i, u, a*" (Oyebade, [33]). According to him, "Members of the first group can co-occur with each other but cannot co-occur with the second group; likewise, members of the second group can co-occur with each other but cannot co-occur with the first group. Members of the third group can co-occur with each other and also with members of the first and second groups." (Oyebade, [33]).

It could be seen from the observations above that the mid vowels are mutually exclusive in Yoruba in terms of their distribution in VCV words. This distributional constraint is with respect to the half-close/mid-high – half-open/mid-low dichotomy. This is similar to the situation reported in Armstrong, ([3]) for the Idomoid languages. According to him, examples such as [ɛne] (Idoma pronunciation of "Native Authority": N. A.) where the front, half-open/mid-low vowel is made to co-occur with the front, half-close/mid-high vowel "… would violate vowel harmony" in this group of languages. Thus, in Yoruba, the half-close/mid-high, vowels can co-occur with each other to the exclusion of the half-open/mid-low, vowels as evidenced in the following examples (cf. Oyebade, [33]):

(26)

[owó] 'money'	[ɔwɔ́] 'hand'
[òwe] 'proverb'	[ɔsɛ] 'week'
[eʤò] 'snake'	[ɛʤɔ́] 'gossip, case'
[ewé] 'leaf'	[ɛʤɛ] 'blood'

However, these two groups of mutually exclusive vowels can co-occur freely with the vowels [i, u, a] as seen in (27) below:

(27)

[ìwo] 'horn'	[oʃù] 'month'
[ilé] 'house'	[ɔdṹ] 'year'
[ilè] 'ground'	[ɛwu] 'dress'
[itó] 'spittle'	[ɛdú] 'blackness'
[ìta] 'outside'	[iʃu] 'yam'
[ìlú] 'town'	[ìgì] ' tree'
[àwo] 'plate'	[aʃɛ] 'cloth'
[ate] 'broad-brimmed hat'	[ara] 'body'
[àʤɛ́] 'witch'	[ìgbá] 'calabash'

When the principle of mutual exclusivity is applied to the empirical data presented for Ẹdo, and three other Ẹdoid languages presented below, it would be observed that these languages cannot be categorized as languages that manifest vowel harmony since the vowels in the languages can co-occur freely with any other vowel in any position of the word. This means that *vowel harmony is not a defining characteristic of the Ẹdoid group of languages*.

2.3.3. Co-occurrence of Vowels in Ẹdo VCV(CV…) Formatives

Ẹdo has seven phonemic oral vowels and five phonemic nasal vowels. There is no restriction whatsoever regarding the occurrence of any of the oral vowels in Ẹdo VCV words. However, as pointed out in Omozuwa [22], a nasal vowel cannot begin Ẹdo words.

The examples in (28) below would give the impression that [+ATR] ([+tense]) vowels do not co-occur with [-ATR] ([-tense]) ones within the same VCV lexical item as seen earlier in the Igbo and (partially) in the Yoruba examples:

(28)

[ùsì] 'popularity'	[ɛ̀kɔ́] 'pap'
[èsì] 'pig'	[ɛ̀bɔ̀] ' deity'
[ìsì] 'name of a clan'	[ézɔ́] 'quarrel'
[òsé] 'beauty'	[ɔ̀wé] 'wealthy farmer'
[èsó] 'some'	[ɛ̀wɛ́] chest'
[ètó] 'hair'	[ɔ̀há] 'bride'

[íɣó] 'money' [ɔ̀gbá] 'tap'

The examples above are some of the ones that may easily be cited by analysts who may argue for the existence of vowel harmony in the language. However, a careful study of the occurrence of vowels in Ẹdo lexical items will reveal that any of the seven oral vowels can occur in any position of a word. Similarly, any of the inherent nasal vowels in the language can co-occur with any of the oral ones in a word except in absolute word initial position. In other words, an inherent nasal vowel can co-occur with any of the seven oral vowels, except in word initial position. The examples below serve to illustrate the free co-occurrence of the vowels in a word, in the language:

(i). Free co-occurrence of the Ẹdo Front, Half-close, and the Half-open Vowels

The examples in (29) below illustrate the free co-occurrence of the Ẹdo front, half-close and the half-open vowels in a formative contrary to the constraint imposed on such co-occurrence of the vowels in Igbo and Yoruba:

(29)

[èdé] 'grey hair'	[édé] 'crown'
[èmɛ̃́] 'monkey'	[ɛ̀wé] 'goat'
[èvɛ̃́] 'wrestling'	[ɛ̀sé] 'goodness'
[èŋ̀wɛ̃́] 'breast'	[égbê] 'a killer'
[èkɛ̃́] 'sand'	[ɛ̀fè] 'riches'

(ii). Free Co-occurrence of the Ẹdo Front, Half-close, and the Back, Half-open Vowels

(30)

[èhɔ́] 'ear'	[ɔ̀sè] 'friend'
[ègɔ̀] 'name of a quarter'	[ɔ̀ɹè] 'it is'
[èg͡bɔ́] 'felling trees'	[ɔ̀bè] 'name of person'
[èβɔ́] 'guinea worm infection'	[ɔ̀ɹwé] 'co-wife'
[èk͡pɔ́] 'being saucy'	[ɔ̀lèmã̀] 'a cook'

(iii). Free Co-occurrence of the Ẹdo Front, Half-open, and the Back, Half-close Vowels

(31)

[ɛ̀hó] 'neck'	[òwɛ̀] 'leg'
[ɛ̀dó] 'Edo Language'	[òɣɛ̀] 'flirtation'
[ég͡bó] 'forest'	[òg͡bɛ̀] 'family'
[ék͡pó] 'space'	[òvɛ̃̀] 'sun'
[ɛ̀bó] 'medicine'	[òré] 'pillar'

(iv). Free Co-occurrence of the Ẹdo Front, Close, and the Half-open Vowels

(32)

[ihé] 'load' [ɛ̀hì] 'angel'
[ítɛ̀] 'cemetery' [ɛ̀tî] 'thick undergrowth' (of forest)
[ìɲɛ̀] 'news' [ɛ̀ɲḯ] 'charcoal'
[ijɛ̀] 'parasite' [ɛ̀kì] 'market'
[ìmɛ̃̀] 'me' [ɛ́mḭ̃] 'thickness'

(v). Free Co-occurrence of the Ẹdo Front, Half-open, and the Back, Close, Rounded Vowels

(33)

[ɛ̀xù] 'door' [ùsé] 'poverty'
[ɛ̀tù] 'beard' [ùvɛ̀] 'bone'
[ɛ́wû] 'dress' [ùwɛ̀] 'you'
[ɛ́bú] 'crowd' [ùhɛ̀] 'Ẹdo name for Ife'
[ɛ́dṹ] 'bitter kola' [údɛ̃́] 'parafine'

As further evidence for the non-existence of any co-occurrence constraints on Ẹdo vowels in a word, consider the examples in (34) below:

(vi). Free Co-occurrence of Vowels in Ẹdo Polysyllabic Words

(34)

[ɛ̀ɹúβɔ̂] 'river tortoise' [ètébí!tɛ́] 'eternity'
[àtɔ̀rí] 'gonorrhoea' [ɛ́k͡pó!xùrɛ̀] 'bowel'
[ɛ̀k͡pé!ɹɛ̀] 'trumpet' [ùkɔ̃̀! ŋɡɛ̃̀] 'stupidity'
[òɹùxɔ̌] 'sin' [èzɔ́!tì] 'street in Benin City'
[ɛ̀ɻṳ̃ɻṳ̃] 'tail' [ɛ́ɹóxɪ̃] 'camelon'
[ɛ̀lùbɔ́] 'plantain paste' [ɛ̀zìzà] 'whirlwind'

Further evidence in support of the claim that vowel harmony is not a defining characteristic of Ẹdo as well as the other members of the Edoid group of languages are presented in 2.3.4 below:

2.3.4. Absence of vowel Harmony in Other Members of the Ẹdoid Group of Languages

(i). Absence of Co-occurrence Restriction of Vowels in Esan VCV(CV…) Formatives

The Esan language is classified as a North Central Ẹdoid language (Okojie and Ejele ([18]). Even though it is claimed in Okojie and Ejele ([18]) that "vowel harmony exists in Esan in very restricted environment …", it would be observed from their examples that, like Ẹdo, there is no co-occurrence constraint on vowels in the same lexical formative in the language as evidenced in the examples below:

(a). Free co-occurrence of [+tense] vowels in V_1 position and [-tense] vowels in V_2 position in the same V_1CV_2 lexical items.

(35)

[òdɛ̀] 'yesterday' [ófɛ̃̀] 'rat'
[ógbà] 'fence' [íhɛ̀] 'load'
[úẃɛ] 'you' [éhɔ̀] 'ear'
[évjɛ̃̀] 'cry' (noun) [èkɛ̃̀] 'sand'

(b). Free co-occurrence of [-tense] vowels in V_1 position and [+tense] vowels in V_2 position in the same V_1CV_2 lexical items.

(36)

[ébè] 'goat' [ɛ̀lò] 'eye'
[ɛ̀kì] 'market' [ésɪ̀] 'pepper'
[ɔ̀lè] 'that is…' [édɪ̀] 'palm nut'

(c). Free co-occurrence of [+tense] vowels in V_1 and V_2 positions in the same V_1CV_2 lexical items.

(37)

[étò] 'hair' [ójì] 'thief'
[ik͡pè] 'grave yard or cemetery' [údò] 'stone'
[úʧè] 'traditional knife' [óxwò] 'woman'
[ùdù] 'chest' [útṹ] 'mushroom'

(d). Free co-occurrence of [-tense] vowels in V_1 and V_2 positions in the same V_1CV_2 lexical items.

(38)

[àbá] 'father' [édɛ̀] 'river'
[ɔ̀gɔ́] 'bottle' [ɔ́ʃɔ̀] 'friend'
[ɔ̀k͡pà] 'cock' [ɔ́kà] 'corn'

(e). Free co-occurrence of Esan vowels in VCVCV… formatives.

(39)

[ɔ̀sódámɛ̃̀] 'a name' [òhɛ̃̄mɛ̃̀] 'hunger'
[ésɑ̃́ígɓɛ̀dó] 'a name' [èlàmɛ̃̀] 'animal'
[íkpɛ́dɪ̀] 'palm nuts' [òtɔ̀ídè] 'name of person'

(ii). Co-occurrence of Vowels in Emai VCV(CV…) Formatives

The Emai language is classified as a North Central Edoid language (Elugbe, [7]). It would be observed from the examples below drawn from Schaefer ([36]), that vowels in Emai, like Ẹdo, occur freely with other vowels in the same lexical formative:

(a). Free co-occurrence of [+tense] tense vowels in V_1 position and [-tense] vowels in V_2 position in the same V_1CV_2 lexical items.

(40)

[íbɛ̃̀] 'liver' [ìsɔ̃̀] 'excreta'
[èkɔ̀] 'temporary resting place for hunters' [èfɛ̃̀] 'side'
[ókɔ̀] 'canoe/boat' [ódɛ̀] 'network of roads'
[ùkɔ̀] 'servant/messenger' [ùtɛ̀] 'old (as of things)'

(b). Free co-occurrence of [-tense] vowels in V_1 position and [+tense] vowels in V_2 position in the same V_1CV_2 lexical items.

(41)

[ɛ̀fè] 'wealth' [ɛ̀kò] 'parcel/gift'
[ɛ̀hì] 'deity' [ɛ̀kù] 'type of tree'
[ɔ̀dù] 'bitter kola' [ɔ̀ɡ̀bè] 'dancer'

(c). Free co-occurrence of [+tense] vowels in V_1 and V_2 positions in the same V_1CV_2 lexical items.

(42)

[ébè] 'leaf' [édó] 'large termite'
[ùgbò] 'forest' [èhù] epidermis'
[ètì] 'spirit/soul' [éɣò] 'money'

(d). Free co-occurrence of [-tense] vowels in V_1 and V_2 positions in the same V_1CV_2 lexical items.

(43)

[ɛ̀dɛ̀] 'day' [ɛ̀k͡pɛ̃̀] 'leopard'
[ɛ̀fɔ̀] 'vegetables' [ɛ̀sɔ̃̀] 'poverty'
[ábɔ̀] 'arm' [ásɔ̃̀] 'night'
[àsɛ́] 'authority' [àxɔ̀] 'tomorrow'

(e). Free co-occurrence of Emai vowels in VCVCV…

formatives.

(44)

[ùkpàkɔ̀] 'object for cleaning teeth' [ùʃɔ̀mĩ̀] 'piece' (as of meat)
[òtɔ̀ì] 'ground' [ùɣɔ̀í] 'type of plant'
[ìzɔ́bò] 'traditional sacrifice object' [ìbɛ̀gũ̀] 'shin'
[ìdóbɔ̀] 'mistake/accident' [ɛ̀tɛ̀kũ̀] 'bow'
[ɛ̀k͡pètè] 'traditional bench/stool' [ɔ̀zèvà] 'second'

(iii). Co-occurrence of Vowels in Okpẹ VCV(CV…) Formatives

Okpẹ is classified in Elugbe ([7]) as a member of the south-western Ẹdoid languages. According to Omamor ([20]) "the restrictions on vowel co-occurrence in Okpẹ provide the first real indications of the existence of vowel harmony in the language". However, a careful study of her data presented therein would appear to suggest a free co-occurrence of vowels in the language.

(a). Free co-occurrence of [+tense] vowels in V_1 position and [-tense] vowels in V_2 position in the same V_1CV_2 lexical items in Okpẹ.

The examples below show the free co-occurrence of [+tense] vowels in V_1 position and [-tense] vowels in V_2 position in Okpẹ words:

(45)

[òkpɛ̀] 'a language' [òdɛ́] 'name of person'
[òn̰wɛ́] 'hunter' [òrɛ̀] 'festival'
[òn̰jɛ̃̀] 'judgement' [ògbɔ̀] 'felling trees prior to farming'
[òwɔ́] 'canoe/boat' [òcɔ̃̀] 'defense'
[òbɔ́] 'hand' [òdɔ̃̀] 'Christmas'
[ìfɔ́] 'greens/vegetables' [èkɔ̃̀] 'worldly goods in their entirety'
[èjɛ̃̀] 'egg' [èhɛ̃̀] 'mind'
[èmɔ̃̀] 'children' [élɛ̀] 'yams'
[èwɔ́] 'canoes/boats' [ú!rjɛ̃̀] 'muscle'

(b). Free co-occurrence of lax vowels in V_1 position and tense vowels in V_2 position in the same V_1CV_2 single lexical items in Okpẹ.

The examples below show the free co-occurrence of [-tense] vowels in V_1 position and [+tense] vowels in V_2 position in Okpẹ words:

(46)

[ɛ̀lù] 'a kind of cotton print wrapper' [ɛ̀ʤó] 'no!'
[ɪ́rù] 'louse/lice' [ɪ́tò] 'tiny snails'
[ɪ́!kó] 'cups' [ɪ́!ɣó] 'money'
[ɪ́tì] 'pigs' [ɪ́βrì] 'violent and endless argumentation'
[ɔ́rì] 'one that…' /ɔ̀rɪ́ # évà / => [ɔ̀révá] 'the second (one)'

(c). Free co-occurrence of [+tense] vowels in V_1 and V_2 positions in the same V_1CV_2 lexical items in Okpẹ.

(47)

[ùk͡pé] 'year' [órò] 'gold'
[ìrwó] 'work' [ìvjé] 'a particular kind of coral bead'
[ívì] 'palm kernels' [ùfĩ́] 'rope'

(d). Free co-occurrence of [-tense] vowels in V_1 and V_2 positions in the same V_1CV_2 lexical items in Okpẹ.

(48)

[ɛdɛ] 'day' [ɔvrɛ] 'slave'
[ɛβrʊ] 'kola nuts' [ɔrɪ] 'huge meal'
[ɔlɛ] 'yam' [ɔɣɔ] 'respect/virginity'

(e). Free co-occurrence of Okpẹ vowels in VCVCV… lexical items.

(49)

[òvɛlɛ] 'difference' [ùsáβɛ] 'key'
[ìkáwù] 'teeth' [ùɣɔjɔ] 'clock'

Examples in 45-49 above in which the vowels of Okpẹ co-occur freely provide enough evidence to support the claim that vowel harmony is not attested in VCV nouns in the language.

2.4. Tonal Behaviour: Downdrift and Downstep

Another contentious issue in phonology, especially of the Kwa languages, is the downdrift and downstep phenomena. Majority of Kwa languages, like Ẹdo and Igbo, have two distinctive tones whereas others, like Yoruba, have three distinctive tones.

The Ẹdo language presents an interesting study in terms of its tonal realizations. Two types of tonal processes, vertical and horizontal, occur in the language. Vertical tonal assimilation is a situation in which a Low tone immediately preceding a High tone in disyllabic words tends to "pull down" the contiguous High tone such that when compared to another High tone in the same position, i.e., HH, the F0 realization of the former is lower than that of the latter. However, a High tone is perceived in both cases. The second type of tonal assimilation, the horizontal tonal assimilation, involves the horizontal spread of a High tone on a following Low. The result is that the tone on the said syllable is acoustically and perceptually realized as a Falling tone. The reversed situation occurs in a language like Yoruba where a Low tone spreads onto the High tone on the following syllable resulting in a Rising tone.

2.4.1. Downdrift

When the vertical tonal assimilation, as described above, occurs in a sequence of Highs with intervening Lows, it leads to a successive lowering of the Highs after the Lows in contiguous syllables, a phenomenon referred to as "downdrift" also referred to as automatic downstep by some authors. In other words, the "downdrift" phenomenon involves an automatic lowering of a sequence of High tones with intervening Lows. The automatic lowering of a Low tone immediately after another Low is also attested in Ẹdo. This means, therefore, that the downdrift phenomenon occurs lexically and post-lexically in the language especially with regard to the Low tones. However, a sequence of High tones without intervening Lows remains on the same pitch level (Omozuwa, [21]). This is in contrast with Meyer's ([19]) observation for Hausa in which both the sequence of High tones without intervening Lows and the sequence of Low tones without intervening Highs drift down in pitch (see also Amayo [1]; Omozuwa [21]; etc.). Downdrift characterizes tonal languages of the terraced level type in the sense that the overall tonal contour of a sequence of High tones with intervening Lows is realized in the form of a flight of stairs.

It should be noted that the downdrift phenomenon is not

universal among tone languages. It is more frequent among languages that contrast two phonemic tones.

2.4.2. Downstep

Unlike downdrift which is a purely vertical tonal assimilation, *downstep in Edo is a combination of three phonological processes* the rules of which are strictly ordered to obtain the correct (surface) phonetic form. These processes are:

i. downdrift as discussed in 1.4.1 above
ii. vowel elision
iii. tone shift

in that order. Downstepping applies only to the VCV # (ɔ́ɣé) # VCV collocations in the language *provided that the tonal collocation across word boundary is High (H) # Low (L)*. Other tonal collocations across word boundary *cannot* lead to donwnsteping (cf. Omozuwa, [23] for a detailed analysis). Evidence that the *High (H) # Low (L)* precondition must be met before downstep is obtained in the language is presented in the examples below:

(50)
a. /úwú # òwá/ => [úwó!wá]
inside house "inside the house"
b. / úwú # áwá/ => [úwáwá]
inside stall "inside the stall"

(51)
a. /íɣó # òk͡pẹ̀=> [íɣó!k͡pè]
money palm wine tapper "money for a palm wine tapper"
b. /íɣó # ók͡pè/ => [íɣók͡pê]
money flute "money for flute"

(52)
a. /òβí # òg͡bè/ => [òβjó!g͡bè]
child novice "a novice's child"
b. /òβí # óg͡bè/ => [òβjóg͡bê]
child ogbe (quarters) " a child of ogbe quarters"

(53)
a. /úwú # ɛ́k͡pó/ => [úwɛ́k͡pó]
inside space "between spaces"
b. /úwú # ɛ́k͡pò/ => [úwɛ́k͡pô]
inside pocket/bag "inside pocket/bag"

In (50)a-(52)a, the precondition, i.e., a H # L tone sequence across word boundary, for obtaining a downstepped (dropped) tone on the last syllable of the utterance is met hence the downstepped High tone on the last syllable of (50)a, and a downstepped Low tone on the last syllable of (51)a and (52)a. However, the condition is not met in (50)b-(52)b and (53) a and b hence the absence of downstepped tone on the last syllable of each of these utterances. Note in particular the expected tone spreading of a High tone unto the Low tone on the following syllable in (51b)b-(53)b to form a Falling tone on the last syllable of the utterance.

Unlike Ẹdo, the downstep phenomenon occurs in Igbo VCV nominal and verbal classes. Thus, a downstepped High tone in the nominal class contrasts with a High tone on the second syllable of another nominal VCV lexical item as evidenced in the following examples:

(54)
/ámá/ => [ámā́] 'street/premises' versus /á!má/ => [ám!ā́] 'personal name'
/ɔ́gwá/ => [ɔ́gwá] 'raft' versus /ɔ́!gwá/ => [ɔ́!gwá] 'mixture'
/ʊ́gwǴ/ => [ʊ́gwǴ] 'hatred' versus /ɔ́!gwǴ/ => [ʊ́!gwɔ́] 'debt'

Other examples of words with a voiced intervocalic consonant and a downstepped High tone on the tone-bearing element of a VCV noun are:

(55)
/ég!ó/ => [é!gó] 'money'
/á!gʊ́/ => [á!gʊ́] 'tiger'
/í!gwé/ => [i!gwé] 'sky'
/é!ró/ => [é!ró] 'mushroom'
/ó!gwú/ => [ó!gwú] 'thorn'
/á!lʊ́/ => [á!lʊ́] 'abomination'
/á!ɣɔ́/ => [á!ɣɔ́] 'odour'

Similarly, a downstepped High tone in the verbal class in the Igbo language also contrasts with a High tone on the second syllable of a nominal VCV lexical item as evidenced in the following examples:

(56)
/ígwú/ => [ígwú] 'louse/lice' versus /í!gwú/ => [í!gwú] 'to dig'
/íkpé/ => [íkpé] 'judgment' versus /í!kpé/ => [í!kpé] 'to judge'
/íkpó/ => [íkpó] 'set' versus /í!kpó/ => [í!kpó] 'to gather'
/íké/ => [íké] 'strength' versus /íké/ => [í!ké] to tie'

Examples in (56) seem to invalidate the claim in Hyman and Schuh ([13]) that in Igbo "…all H-D nouns involve an intervocalic voiced consonant."

Other examples with voiceless intervocalic consonants are presented in (57):

(57)
/ ó!ʃí / => [ó!ʃí] 'robbery'
/ á!fá / => [á!fá] 'divination'
/ é!só / => [é!só] 'gum'
/ á!ʧí / => [á!ʧí] 'branch of tree'(specie)
/ ó!ʧé / => [ó!ʧé] 'chair'
/ é!pé / => [é!pé] 'orange'
/ ʊ́!tá / => [ʊ́!tá] 'blame/bow'
/ ʊ́!kpá / => [ʊ́!kpá] 'stingy'

It is clear from the examples above that the occurrence of a downstepped High tone on the second syllable of an Igbo VCV lexical item is phonemic since there is no evidence of any phonetic motivation to explain the phenomenon.

3. Conclusion

Copious data from selected Nigerian Languages were relied on to provide a better explanation and clarification for some contentious phonetic/phonological phenomena which include "vowel coalescence", vowel elision, vowel harmony, downdrift and downstep. The following facts emerged:

(i) the data from the Ẹdo language do not support the continued use of the term "coalescence" as a tool for defining/describing what is actually vowel assimilation, vowel elision, and tone shift as a set of phonologically ordered processes. If "coalescence", as defined by many authors, is the "…*fusion* of two contiguous sound segments to produce a third segment that shares some phonetic features with the two sounds the same way oxygen combines with hydrogen to form water, what the Ẹdo data reveal is certainly not "vowel coalescence" and, therefore, calls to question the appropriateness of the continued use of the term in phonological description.

(ii) the generally held view of the total assimilation of V_2 by V_3 across word boundary in a V_1CV_2 # V_3CV_4 collocation in Igbo is simply the case of the elision of V_2, and the re-association of the tone thereon with V_3, the first vowel of the second word. A more plausible (natural) assimilatory process in languages involves a left to right movement not a right to left movement.

(iii) using mutual exclusivity as the defining characteristic of languages that manifest vowel harmony, the Ẹdoid languages, in which there is free co-occurrence of vowels in any position of the word, cannot be characterized as languages that manifest vowel harmony.

(iv) the manifestation of the downdrift and downstep phenomena is language specific. In particular, the downstep phenomenon is non-phonemic in Ẹdo. It involves a set of ordered phonological rules: (a) downdrift (b) vowel elision, and (c) tonal re-association in that order. The only condition for obtaining a downstepped tone on V_4 in a V_1CV_2 # V_3CV_4 collocation in the language is the presence of a H # L tone pattern across word boundary. In other words, V_2 # V_3 must have a High and a Low tone, respectively, for there to be downstep High tone or Low tone on V_4.

(v) the donwnstepped High tone in Igbo is phonemic: a High tone and a downstepped High tone on V_2 in V_1CV_2 lexical items in the language can be minimally distinguished irrespective of the nature of the intervocalic consonants.

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