

DOWNSTEP IN IGALA AND YALA (IKOM)

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Abstract

This article describes downstep in Igala and Yala (Ikom), two West Benue-Congo languages operating three-tone systems, with the aim of identifying how downstep in three-tone systems differs from that in two-tone systems. Downstep affects all the three tone levels of the languages studied, but high tone spreading and voiceless obstruents in syllable onset position block the phenomenon in the languages. Also, while the usual downstep trigger is floating low tones, downstepped high is also triggered by floating mid tones in Igala and Yala (Ikom). These add to the body of proof that terracing can, and does, operate in tone systems with three levels and that it interacts in obvious ways with other tonal and segmental phenomena. These facts therefore need to be included in the descriptions, typologies, and synthesising of three-tone languages.

0. Introduction¹

Downstep (DS) refers to the lowering of tone most often caused by non-initial low tones that are not phonetically realised. In this work, DS specifically refers to a situation where the trigger of the phonological lowering of tone is not phonetically realised (Elugbe 1985). There are however several questions regarding the nature of the phenomenon especially in three-tone languages. The long-standing consensus of floating low tone (L) being the trigger of DS, for instance, is challenged by evidence from many languages operating more than two tone levels, while fresh reports from three-tone systems raise issues of DS consistency (Adeniyi 2012; 2013; 2015). “Floating L” refers to a situation whereby the host tone-bearing-unit of an L is lost to vowel elision or glide formation (Paster and Kim 211) and the L remains unlinked to any segment throughout the derivation and onto the phonetic form. This is sometimes referred to as “lost L” (Elugbe 1985) or “deleted L” (Connell and Ladd (1990) in the literature.

Thus this paper addresses three key issues: the first relates to the factors that interact with DS in three-tone systems; the second addresses other triggers of DS besides non-initial floating L; and the third seeks insight into why DS in three-tone systems tends to be different from two-tone systems. The three-tone systems of Igala and Yala (Ikom) are studied and findings are used as the basis of inferences on the nature of DS in three-tone systems.

The remainder of this article is organised thus: DS in Igala and Yala (Ikom) is discussed in §1 and 2 respectively. The blocking effect of voiceless consonants on DS is

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discussed in §3 while the summary in §4 involves a pooling of findings on the two languages. The work is concluded in §5.

1. Downstep in Igala

Igala is a West Benue-Congo (WBC) language spoken by about 2,000, 000 speakers in central Nigeria (Omachonu 2012). It operates three tones H, M, and L as shown in the minimal set *bĩ* “give birth to,” *bĩ* “ask,” and *bĩ* “open/make way/separate.” The language has two contour tones: a falling tone which is an allotone of L after H and a rising tone which is the allotone of H after L (Akinkugbe 1978; Ejeba 2009). In addition, the M is positionally restricted such that it does not occur on the initial syllable of a disyllabic noun (Ejeba 2009). Further, there is downstep in Igala.

Downstep affects all the three tones of Igala, L, M, and H. This is frequently attested in verb phrases (1a–b, g–j; 2a–b; 3a), associative constructions (1c, i–j; 2c–f; 3b), numerals (1d, k; 2g), and reduplication (1e–f). While downstepped high (DSH) is often perceived more like raised M, downstepped mid (DSM) is also clearly lowered both perceptually and acoustically and often perceived as raised L. The difference between a L and a downstepped low (DSL) is however less significant; it is usually around 9Hz. Downstep in Igala is a juncture phenomenon owing largely to the loss of the tone-bearing unit of L during hiatus resolution. The reason for this is the open syllable structure of the language. Hiatus resolution in Igala generally requires the loss of V1 in a V1 # V2 configuration. This is achieved in either of two ways: V1 is converted to a glide when it is a high vowel /i/ or /u/ and it is followed by a vowel that is not identical to it (Examples 1b–c, e; 2e). The second option is outright elision of V1 once the structural condition for glide formation is not met (Examples 1d, f, h–i, k; 2a, g; 3a, c). Vowel elision however has a number of exemptions, one of which relates to the reversals of the vowel to be elided in associative constructions; it is V2 that is elided in this case.

A more general exemption to vowel elision relates to the close-mid and open-mid back vowels /o, ɔ/ that do not elide either as V1 or as V2 once the other vowel with which they form a hiatus is a front-vowel or /a/ (1g, j; 2b, d; 3b). In essence, the vowels /o, ɔ/ always dominate front vowels and /a/ when in a sequence. This is similar to the Avatime case where /a/ dominates /o/ as exemption to the general hiatus resolution rule (Schuh 1995:48-49).

It is instructive to note that initial Ls also trigger downstep in Igala. In example (1a), we see an instance of L-toned monosyllabic verb where the elision of the vowel sets the L floating during hiatus resolution, thereby triggering the downstepping of the initial H on the following noun. This is not in doubt as DSH in utterances like this is significantly lowered and perceived more like raised M (Fig. 2). A fact to note about Igala tonal behaviour at juncture is that H dominates M and L, but L dominates M; hence when the two contiguous tones are L and M, downstep may not arise because it is the higher tone that is set afloat in this environment. But when H is set afloat by the elision or gliding of its host, it re-links to the host of a non-H adjacent to it and it is then the non-H that is eventually set afloat. Usually, it is when the floating non-H is L that a DS arises. Thus as much as DSH arises when L is set afloat in a L-H sequence; it also arises in a non-final H-L sequence because the floating L lowers whatever tone follows it in this case.

1) **Downstepped high in Igala**

- a. gwè égbé → 'gwégbé
wash grass “wash the grass”
- b. lí òná égbé → lǝ'óná égbé
see dream grass “see the dream of grass”
- c. úkpásí èbjénē édúdú → úkpásjé'bjénēdúdú
gourd bad black “bad gourd is black”
- d. ègwá èlú → ègwé'lú
ten five “fifteen”
- e. èmí èmí → èmjé'mí
here here “right here/nearby”
- f. ègwá ègwá → ègwé'gwá
ten ten “groups of tens”
- g. ló àkó → ló'kó
bite bead “bite the bead”
- h. dǝó òpá → dǝó'pá
burn groundnut “burn the groundnut”
- i. ùtǝà áamá kéké → ùtǝ'ámákéké
pot clay small “a small clay pot”
- j. ɔdǝɔ̀ ìkólóbjà → ɔdǝɔ̀'kólóbjà
day young man “days of youthfulness”
- k. èlè ègwá → èlè'gwá
four ten “forty”

2) **Downstepped mid in Igala**

- a. kó òbē mé ègwá èdǝɔ̀ mì → kó'bē mé'gwé'dǝɔ̀ mì
pack knife pl. eighteen me “give me eighteen knives”
- b. tídó ùbjǝfù → tídó'bjǝfù
dance next month “dance next month”
- c. éfijá àpēlā → éfijá'pēlā
armpit horse “horse’s armpit”
- d. òná òdū → ònó'dū
dream night “night dream”
- e. úkpásí ègbē mé ètā → úkpásjé'gbē mé'tā
gourd dry pl. Three “three dry gourds”
- f. òdòdó òdū → òdòdó'dū

- flower night “flower night”
 g. $\text{ègwá} \text{ èdʒ̥} \rightarrow \text{ègwé} \text{ dʒ̥}$
 ten eight “eighteen”

3) Downstepped low in Igala

- a. $\text{òdùdè} \text{ là} \text{ àgèdè} \rightarrow \text{òdùdè} \text{ 'lògèdè}$
 bat buy banana “the bat bought banana”
 b. $\text{ìkpà} \text{ àgèdè} \rightarrow \text{ìkpà} \text{ 'gèdè}$
 bag banana “banana bag”
 c. $\text{ìtò} \text{ àbàlà} \rightarrow \text{ìtò} \text{ 'bàlà}$
 urine cat “cat’s urine”

The extent of lowering in these utterances is shown in the pitch tracks in Fig. (1-4). Fig. (1) contains one DSH and two DSM. Note that the first DSM sets a ceiling even for the H following it. The constrained H is then followed by DSH that is 18.9Hz lower than it, and it is directly followed by another DSM that is another 18.6Hz lower than the first DSM. The result is a gradient that typifies tone-terracing.

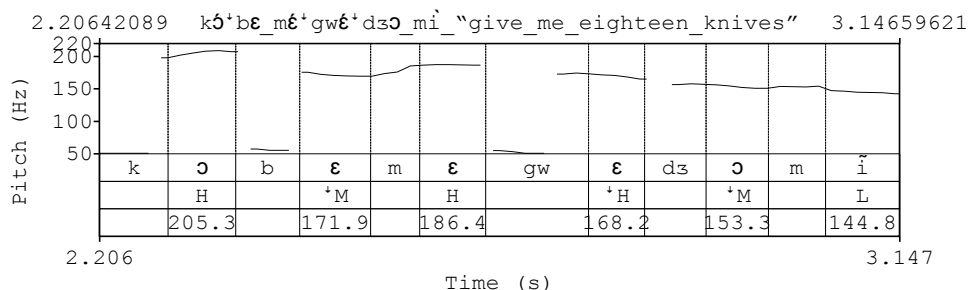


Fig. (1) Pitch track of $kɔ \text{ b} \text{ ɛ} \text{ m} \text{ ɛ} \text{ gw} \text{ ɛ} \text{ dʒ} \text{ ɔ} \text{ m} \text{ i}$ “give me 18 knives” showing terracing

In Fig. (2) we see an initial floating L downstepping a following H; although the H immediately following the DSH appears a little higher than it acoustically, it is clearly perceived around the level of the M.

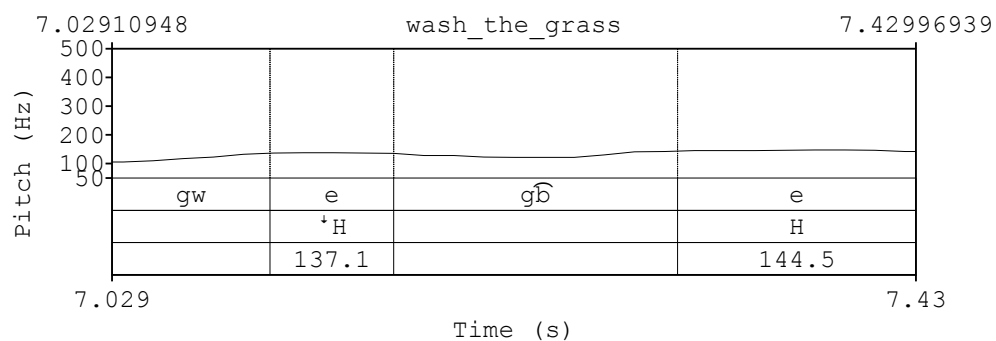


Fig. (2) Pitch track of $\uparrow gwégbé$ "wash the grass" showing DSH triggered by initial floating L

Fig. (3) is an all-L sequence. Notice that the pitch is steady on the first three Ls, but on the fourth L, which is downstepped, there is a drop of 9.8Hz, after which it becomes a little steadier again.

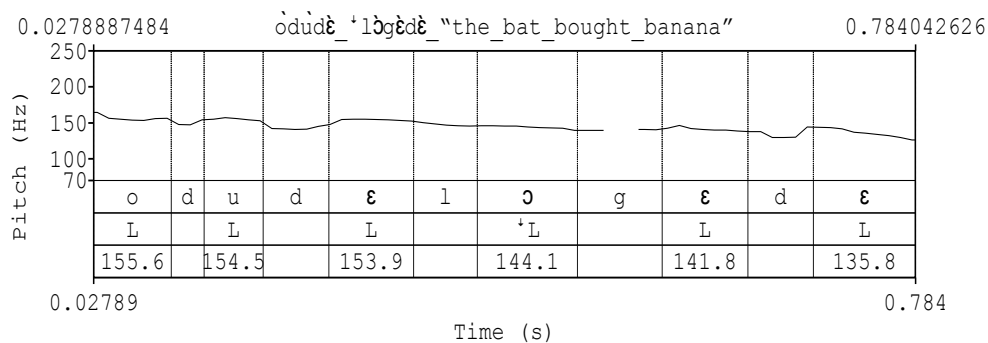
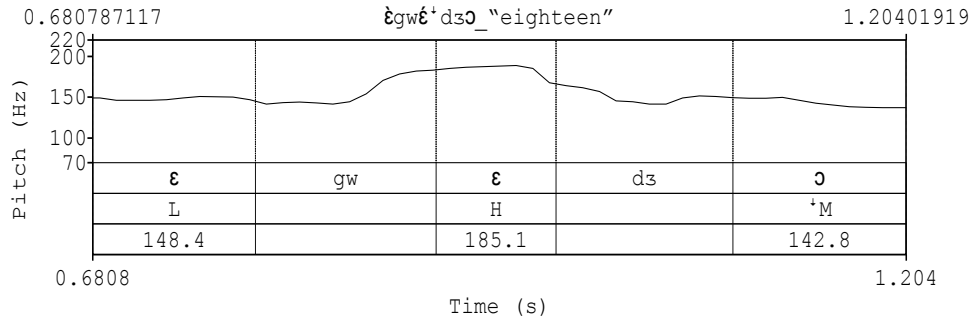
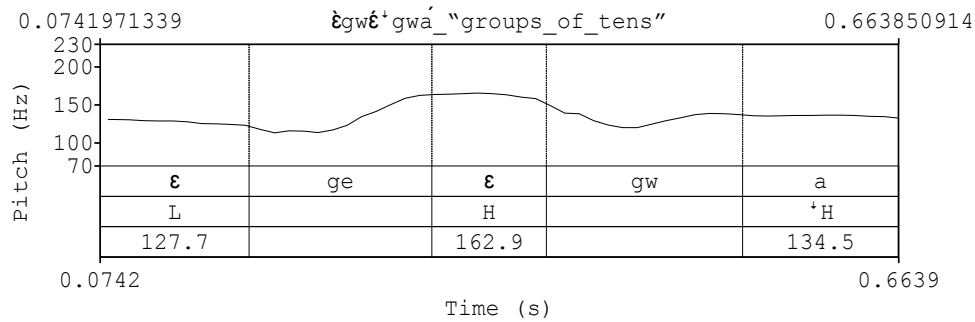


Fig. (3) Pitch track of $\uparrow \text{òdùdè} \uparrow \text{lògèdè}$ "the bat bought banana" showing DSL

In Fig. (4a) the pitch of DSM in utterance-final position is lower than that of the utterance-initial L. Finally, there is a difference of 28.4Hz between DSH and the H preceding it in Fig. (4b), and the DSH is perceived as raised M.

Fig. (4a) Pitch track of *ɛgwɛ¹ dzɔ* “eighteen” showing DSMFig. (4b) Pitch track of *ɛgwɛ¹ gwa¹* “groups of tens” showing DSH

The M also triggers DSH in Igala. Examples (4a-c) below show that just in the same manner that a floating L triggers the lowering of tones following it, floating M triggers the downstepping of H following it. This is because lowerings in these utterances as shown in Fig. (5a-c)) can only be attributable to the fact that the M that was present in the input was set floating in the derivation and never surfaces in the output.

- 4) M-triggered DSH in Igala
 - a. **ʃɛ ágbà → ¹ʃágbà**
make basket “make basket”
 - b. **ódzɪ du áɲédzɛ → ódzɪ¹dáɲédzɛ**
thief give tortoise “the thief gives tortoise”
 - c. **áɲédzɛ kpā ónú → áɲédzɛ¹kpónú**
tortoise kill chief “the tortoise killed chief”

In Fig. (5a), initial M is shown to trigger DSH when set afloat. While the clearest judgement of DS is by comparing the downstepped tone with an earlier tone within the same utterance, perception also remains a valid parametre and in the case of the utterance

represented in Fig. (5a) the initial tone of the output is perceived clearly as raised M and not close to H at all. Fig. (5b) is equally a clear-cut case of DSH. In Fig. (5c), DSH triggered by floating M is seen to be even lower than the M that immediately precedes it. As has been observed, DSH is not in any doubt in Igala because it is perceived like raised M and not at all close to H, and DSH triggered by floating M is not any different.

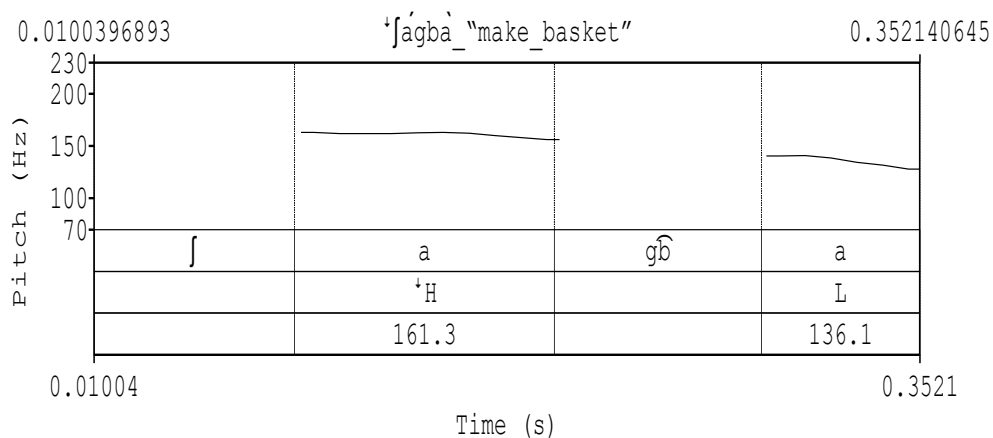


Fig. (5a) Pitch track of [↑]fágbà “make basket” showing DSH triggered by initial floating M in Igala

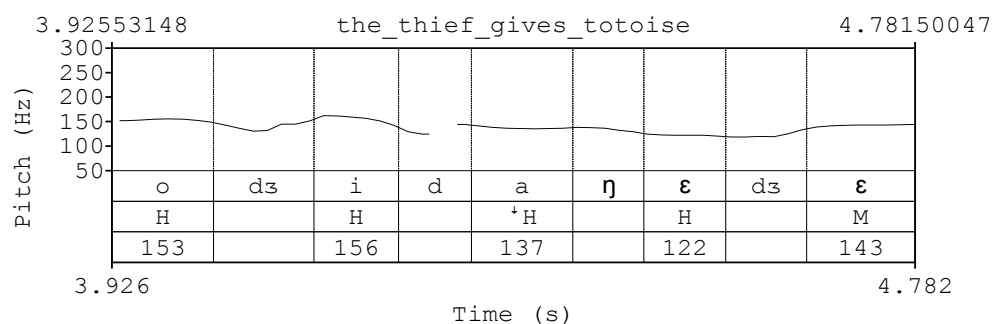


Fig. (5b) Pitch track of ódʒɪ́ dájédʒɛ “the thief gives tortoise” showing DSH triggered by floating M in Igala

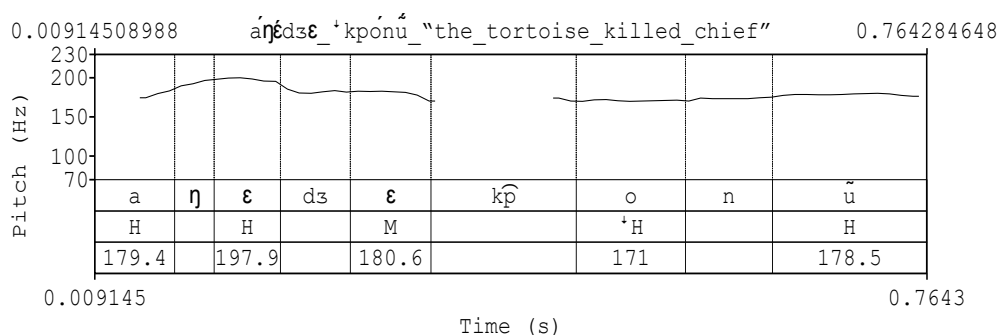


Fig. (5c) Pitch track of *áńédzε +kpónú* "the tortoise killed chief" showing DSH triggered by floating M in Igala

In spite of the clear downstepping of Igala tones, the phenomenon is not consistently realised by the speakers even when all the structural conditions are met. This means that Igala speakers are not consistent in their realisation of DS in their speech. A frequency count was therefore conducted to determine the extent of the inconsistency and to see whether it follows systematic patterns. Five competent speakers AM, IA, AIA, ARO, and MAI of average age of 32; 2 years old were recorded using 73 utterances for which tokens are available for at least two of the participants. Tokens with bloated F0 and those without the expected hiatus resolution were excluded, leaving us with a total of 545 usable tokens. The result (Table 1) shows that DSL occurred in 48 (35.6%) out of 135 tokens, DSM occurred in 74 out of 78 tokens (94.9%), and DSH occurred in 278 (83.7%) out of 332 tokens. Chi – square goodness of fit calculations on these results show that while DSM [$X^2(4)=11.333$, $p<.05$] and DSH [$X^2(9)=52.556$, $p<.05$] recorded significant p – values, DSL recorded a non-significant p – value of [$X^2(6)=3.250$, $p>.05$], indicating that DSL is not significantly realised in Igala.

Tone	Occurrence (%)	Occurrence per speaker (%)				
	All speakers	AM	MAI	ARO	IA	AIA
DSL	35.6	50	33.3	44.4	19.1	13.3
DSM	94.9	76.9	92.3	100	100	100
DSH	83.7	77.3	92.1	92.3	72.2	52

Table 1: Downstep occurrence in Igala

Closer analyses of the utterances used for this experiment point to the existence of patterns to the inconsistency of downstep in Igala. Out of 87 instances of DSL suspension, 32 (36.8%) were preceded by H, 11 (12.6%) were in voiceless obstruent-initial syllables, while another 29 (33.3%) combine these two factors. When seen together therefore, preceding H and voiceless obstruents account for 72 (82.8%) of the total DSL suspension in Igala. Somewhat fusing with this is the fact that 33 (37.9%) of all the instances of DSL suspension involve glide-formation.

Narrowing down to only utterances with the voiceless obstruent onsets affirms that DSL is truly blocked by voiceless obstruents with all the 5 participating speakers producing downstep in less than 50% of their measured utterances, and the combined frequency being only 34.8%. Likewise, narrowing the analyses down to only utterances with the H-spreading variable shows that DSL has only 27% occurrence overall.

A point to note from the speaker-based analysis in table (1) is that speakers differ in their implementation of the downstep phenomenon. This is more clearly seen in the rows for DSL and DSH where only speaker AM recorded up to 50% occurrence for DSL, but incidentally had the least occurrence for DSM and was just average for DSH. Considering DSH also, only speaker MAI and ARO recorded above 90%, while AM had only 77.3% and AIA had only 52%. All of these point to the fact that although, when taken as a whole, DSM and DSH are significantly realised, there are also indications of blocking in the speech of some speakers.

2. Downstep in Yala (Ikom)

The Ikom dialect of Yala is another WBC language spoken by about 10, 000 speakers in Cross River state of Nigeria (Adeniyi 2015). The language contrasts three tone levels H, M, and L. This is illustrated in the minimal set *ku* “bite,” *kū* “defecate,” and *ku* “run.” These tones exert syntagmatic effects on one another: L is raised in word-initial position before a higher tone and is falling after H. Further, H is downdrifted by L and M (Armstrong 1968).

Similar to Igala, downstep in Yala (Ikom) is a juncture phenomenon arising from hiatus resolution. All the three tones of Yala (Ikom) are affected by downstep (Armstrong 1968) and it is commonly attested in verb phrases (5a–b), associative constructions (5c–d; 6a–c), numerals, lexical items (5h –i; 6d –e), as well as in reduplication (5e–g; 6f–g). Usually when vowels form a hiatus in a V1 # V2 order across junctures, the language reduces the sequence in one of two ways; it turns V1 into a glide when it is either /i/ or /u/ and V2 is unidentical to it and is a non-high vowel (6a). Once the structural condition for gliding is not met, V1 simply gets elided (5a–d, h–i; 6b, d–e, h). Reduplication is however an exemption to this rule where it is rather V2 that gets elided (5e –g; 6f –g). Tonal behaviour following hiatus resolution is guided by higher tone superiority whereby if the vowel that loses its place happens to bear a higher tone than the surviving vowel, then there is an inversion of the tone to be set floating (5a –c, h –i; 6a, c, h) (Adeniyi 2015).

5) Downstepped high in Yala (Ikom)

- a. **wōlá àjédzì → wōlá'jédzì**
burn beans “burn the beans”
- b. **gwá òdžóré → gwó'džóré**
drink food “drink food”
- c. **òjé èbé là jēsī jà ēnì → òjé 'bé 'ljēsī jēnì**
small fish in pot of water “small fish in the water pot”
- d. **ēmī jà ádā mī → èmī 'jádámī**

feaces of father my “feaces of my father”

- e. òmá òmá → òmá'má
see see “seeing”
 - f. òdʒé òdʒé lípòtù → òdʒé'dʒé lípòtù
know know heart “knowing the heart”
 - g. òsé òsé wótákò → òsé'sé wótákò
cut cut thigh “cutting the thigh”
 - h. ìsó ìkpó → ìsí'kpó
things leg “shoe”
 - i. ùnú ùsí → ùnú'sí
made plank “stool”
- 6) Downstepped mid in Yala (Ikom)**
- a. èsí òmā lílípú lísí → èsjó'mā lílípúlísí
tree these inside market “these trees inside the market”
 - b. èbé jà ējǎ → èbé'jējǎ
fish of water “fish of water”
 - c. àjǐ èbé là ɔbā → àjé'bé 'lɔbā
children fish on mat “small fishes on the mat”
 - d. ũkpō jà ɔsí → ũkpō 'jōsí
seed of tree “fruit”
 - e. òjǐ jà ònā → òjǐ'jōnā
child the girl “daughter”
 - f. ɔ́nrò èdʒē èdʒē → ɔ́nrò 'dʒē'dʒē
man dance dance “the man dancing”
 - g. òkā òkā → òkā'kā
talk talk “talking”
 - h. ɔ́rɔkpá òkārá → ɔ́rɔkpó'kārá “mango”
bush mango white man “mango”
- 7) Downstepped low in Yala (Ikom)**
- a. wūlà jà ògàbō → wū là 'jògàbō
explain to chief “explain to the chief”
 - b. wòjǎ dʒè ògàbō → wòjǎ 'dʒògàbō
horse give chief “the horse gave the chief”
 - c. ògbò ònòbī → ò'gbònòbī
age mate black “black age mate”

- d. àgà lè àdʒè → àgà 'làdʒè
needle in sand “needle in the sand”

DS lowering in Yala (Ikom) are shown in the pitch tracks in Fig. (6-8). In Fig. (6a-b) DSH is 35Hz and 30Hz lower than the preceding Hs respectively.

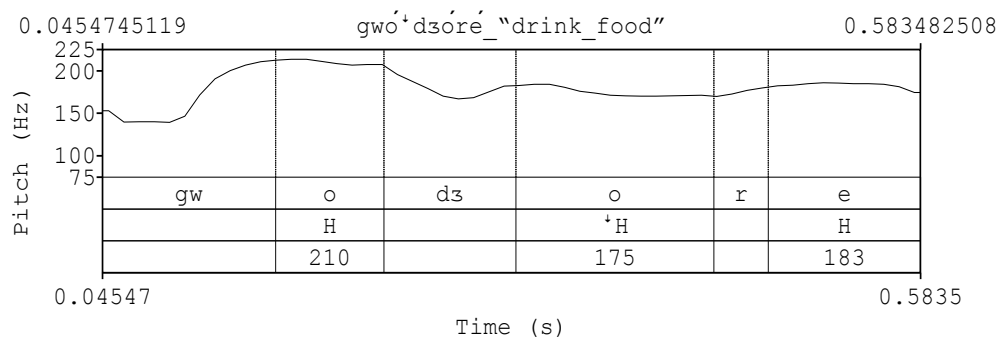


Fig. (6a) Pitch track of *gwó' dzóré* “drink food” showing DSH

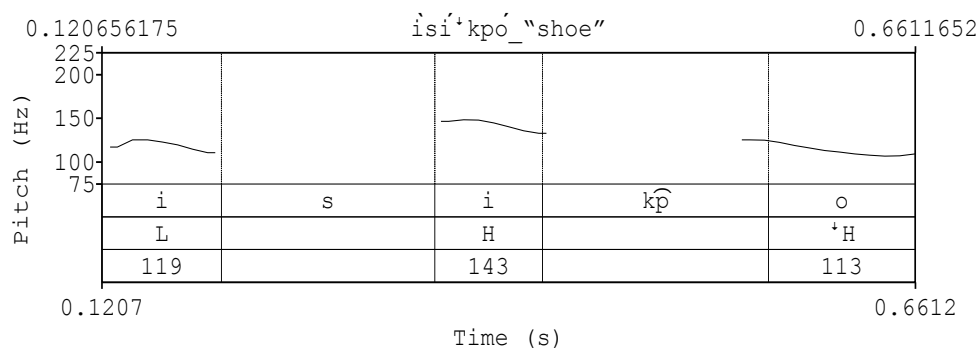


Fig. (6b) Pitch track of *ísí' kpó* “shoe” showing DSH

Fig. (7) illustrates iterative DS application in Yala (Ikom) with both DSH and DSM co-occurring in the same utterance. Notice especially that DSM is realised only a little higher than the utterance-initial L while the utterance-final M which is under the inhibition of the DSM is realised lower than the utterance-initial L.

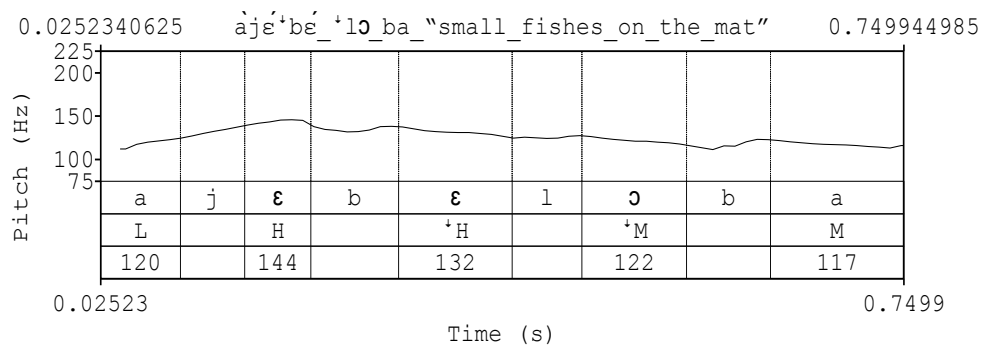


Fig. (7) Pitch track of àjɛ́bɛ́¹lɔ_ba_ "small fishes on the mat" showing DSH and DSM

In Fig. (8), DSH did not only set a ceiling for following Hs, it lowered the heights of all the tone levels. The DSH is then followed by two successive LH sequences that meant two successive downdrifts, and the final picture is that of a sentence-final H being acoustically 21Hz lower than sentence-initial L. Fig. (9) shows DSL.

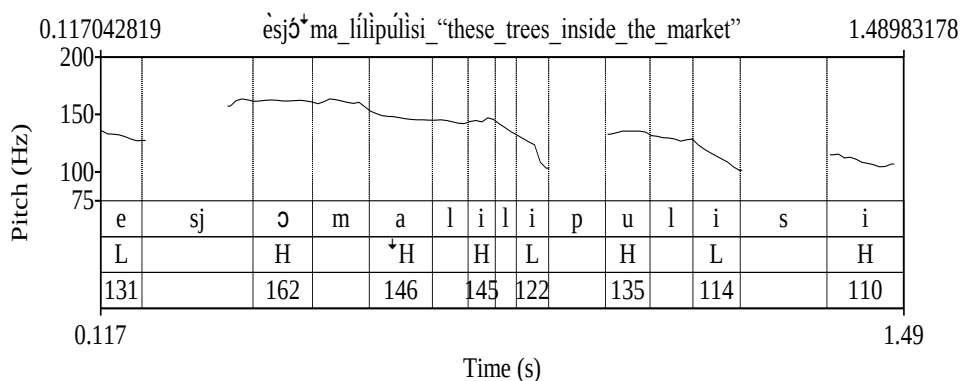


Fig. (8) Pitch track of èsjɔ́¹ma_lílípúlísí_ "these trees inside the market" showing DSH

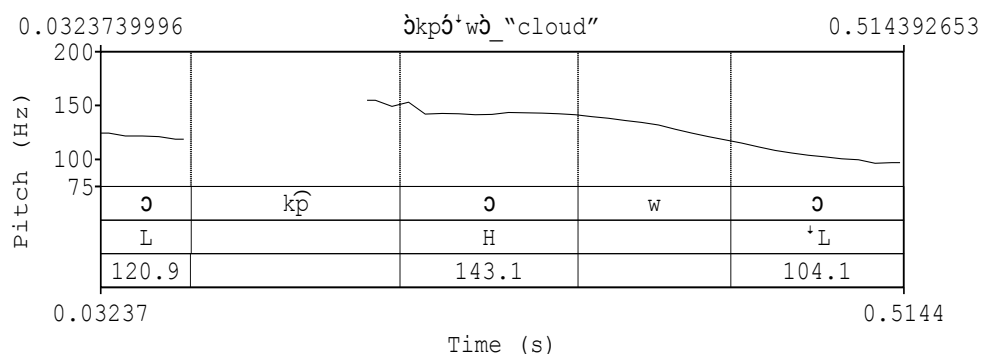


Fig. (9) Pitch track of ðkpó'wò "cloud" showing DSL

In a way similar to Igala, floating M also triggers DSH in Yala (Ikom). When the inputs in examples (8a–b) are compared with the outputs, it becomes clear that it is the floating M that triggers the downstepping in the utterances. Notice especially that example (8a), represented in Fig. (10), has no L in the input, but the DSH triggered by M is 26Hz lower than the immediately preceding H.

8) DSH triggered by floating mid in Yala (Ikom)

- a. rá léǵgbé ɔ́nípé → rá léǵgbó'nípé
buy kola nut fresh "buy fresh kola nuts"
- b. kó ɔ́ sé ɔ́sí lèḍḍā → kó'só'sí lèḍḍā
allow him cut that tree "let him cut that tree"

Fig. (10) is an all-H sequence clearly illustrating both DS lowering and level-setting.

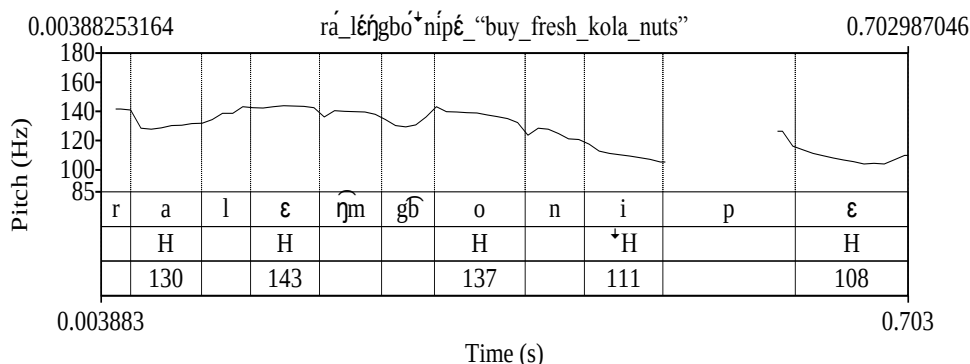


Fig.(10) Pitch track of rá léǵgbó'nípé "buy fresh kola nuts" showing DSH triggered by floating M

DS is however also not consistently realised in Yala (Ikom). Tokens from five speakers were studied, and they all fluctuated in their realisation of the phenomenon. A frequency count was conducted using 47 recorded utterances, which yielded 570 usable tokens in line with the method outlined for Igala in section 2. It was found that DSH and DSM recorded 96.6% (276 DSH out of 286 tokens) and 93.6% (162 DSM out of 173 tokens) occurrences respectively (Table 2). This translates to significant p-values of $[X^2(5)=27.000, p<.05]$ and $[X^2(4)=15.913, p<.05]$ for DSM and DSH respectively. This suggests that DSM and DSH are consistently realised in Yala (Ikom). DSL however presents a different picture; out of 111 tokens, DSL was realised only 45 times, which is 40.5%, and a non-significant p-value of $[X^2(5)=2.333, p>.05]$. A closer examination of this inconsistency yields the following: 27 occurred after M, and 12 after H, which combines as 59.1% of total DSL blocking possibly due to the spreading of preceding higher tones. The 15 (22.7%) cases of DSL blocking that were preceded by L happened to also be in syllables with voiceless obstruent onsets, which suggests a possible involvement of voicelessness of obstruents in the inconsistency of DSL in Yala (Ikom). The remaining 12 (18.2%) cases combined both voiceless obstruents and preceding H.

Tone	Occurrence (%)	Occurrence per speaker (%)				
	All speakers	EO	EA	GBO	AE	GE
L	40.5	55.6	33.3	29.6	40.7	83.3
M	93.6	100	100	82.1	90.9	100
H	96.6	95.7	93.7	95.2	100	100

Table 2: Downstep occurrence in Yala (Ikom)

While Armstrong (1968:1) already reported the raising of initial L before H and M, data used in this study show further that in addition L is raised after M. Also Armstrong (1968; 1972) argued that when there is a sequence of two Ls following a H, it is only the first that becomes a $\widehat{HL}$ falling tone and if it gets deleted, the following L, though now preceded by a H is not realised as a falling tone; rather it is realised as DSL. It is however found that in the speech of the five speakers that participated in this study, the second L becomes $\widehat{HL}$ falling once it becomes adjacent to a preceding H. This is because tone spreading is a phonetic effect and applies after all the phonological processes have been concluded. Further, the fall of the contour does not get to the level of the L, and this erases whatever degree of downstep lowering that might have occurred. The exemption to this is limited to slow deliberate speech in which the cautiousness of the speaking prevents the spreading of the preceding higher tones.

When utterances with the H-spreading variable are analysed in isolation, DSL recorded only 40% occurrence, which indeed shows that H-spreading is a genuine DS blocker in Yala (Ikom). Also studying only utterances with the voiceless obstruent variable in isolation yields only 30.8% occurrence for DSL.

3. Blocking of DS by voiceless obstruents

Reference has been made repeatedly to the blocking effect of voiceless obstruents on DS in Igala and Yala (Ikom); we now turn to a fuller discussion of this issue in this section. The blocking of DS by voiceless obstruents is evident in two ways: the resetting of F0 immediately after a voiceless obstruents first to follow the DS, and the often non-attestation of DS when the tone-bearing unit expected to be lowered is immediately preceded by a voiceless consonant.

In Igala, the span of terracing optionally ends just before the first voiceless obstruent on the right, after which tones are generally restored to their normal heights. To illustrate this in Igala, this is clearly seen in Fig. (11) [↓]*gwáǃíkù* “dig bone” where the first H is uncontestedly downstepped and is perceived as raised M. The H immediately following the DSH is however realised significantly higher than it. This is because the voiceless obstruent /f/ stops the progression of terracing such that tones following it are not subject to it.

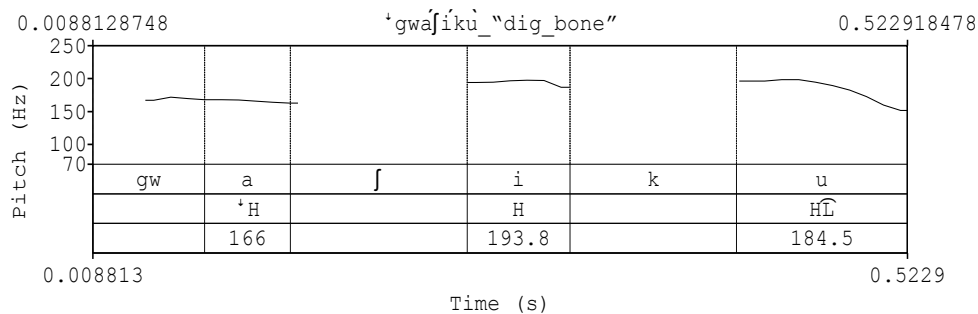


Fig. (11) Pitch track of [↓]*gwáǃíkù* “dig bone” showing interruption of terracing by voiceless obstruents in Igala

The second evidence of the blocking effect of voiceless obstruents on DS is the fact that the phenomenon is often not attested in utterances where the pre-vocalic consonant of its tone-bearing unit is voiceless. This is particularly related to DSL in both Igala and Yala (Ikom). Recall that in section 2, the low percentage of DSL was linked directly to consonant voicing. Specifically it was reported that when only utterances with voiceless consonants are considered the frequency of DSL in Igala is only 34.8 percent. Likewise, when only utterances with voiceless consonants were considered in Yala (Ikom) DSL recorded only 30.8 percent. Thus DSL occurrence is non-significant in this environment in both languages. To illustrate this with Igala, Fig. (12) shows the raising effect of the voiceless labiodental central fricative /f/. Notice that the supposed DSL in this utterance is only 1Hz lower than the L preceding it.

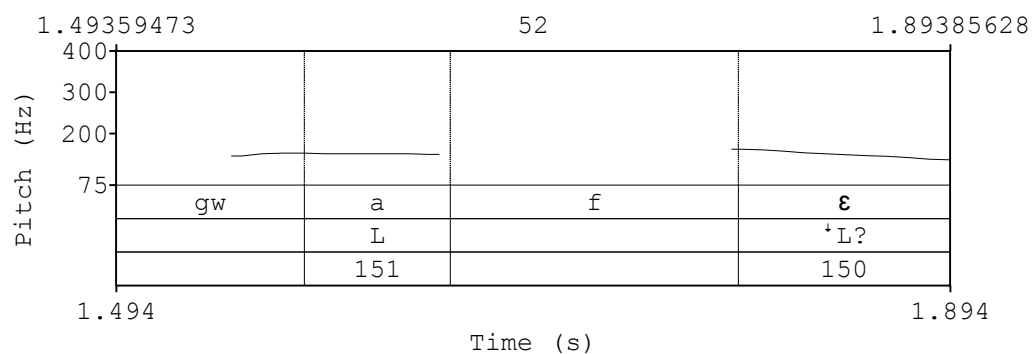


Fig. (12): Pitch track *gwā⁺ fɛ* “wash shirt” showing DSL blocking by voiceless consonant in Igala

Also in Yala (Ikom), Fig. (13) shows that DSL may not be attested when the prevocalic consonant is voiceless. Observe particularly that the DSL in this case is preceded by two consecutive Ls with which we can comparatively establish the non-lowering of DSL.

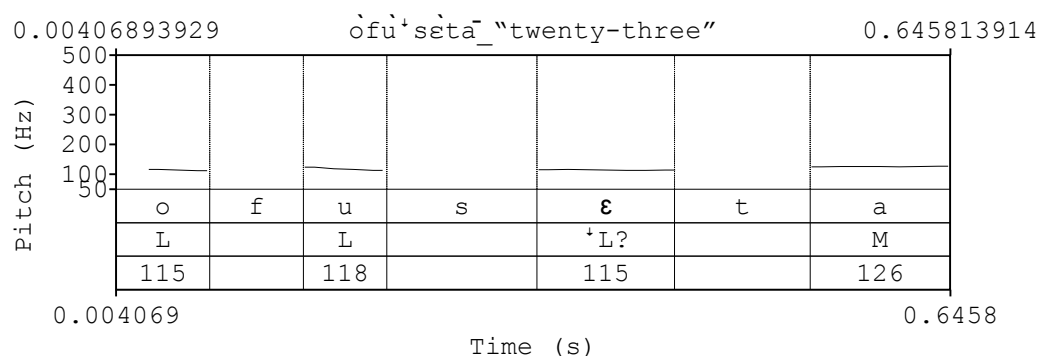


Fig. (13): Pitch track *òfù⁺ sètā̃* “twenty-three” showing DSL blocking by voiceless consonant in Yala (Ikom)

This is also observable in other DS types, though to a significantly less frequency and speaker variation. In Fig. (14); whereas DSH is usually realised somewhere close to the level of the M and is perceived as raised M, the tone on *só* in Fig. (14) is perceptually H and is also clearly higher than the M acoustically.

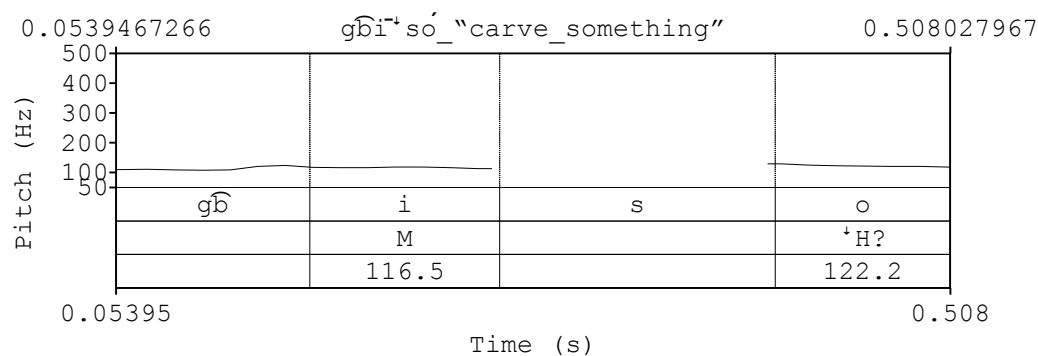


Fig. (14): Pitch track of *gbi⁺ sɔ́* “carve something” showing DSH blocking by voiceless obstruent in Yala (Ikom)

The raising effect of voiceless obstruents on F0 has been suggested to be the consequence of higher larynx in the production of voiceless obstruents and is most pronounced at the release phase of the consonants such that its effects carry over for more than 100 milliseconds into the production of following vowels (Ohala 1978; Gussenhoven 2004:7-8). The implication of the length of this effect on the discrimination of the following TBU is that by the time it wanes, the perceptual characteristics of its tone have already been altered (Ohala 1978). By this whatever lowering DS might have induced is effectively neutralise (Adeniyi 2015: 189). Note further that beyond voiceless obstruents patterning with higher a tone, which is a universal tendency, the blocking effect on downstep is particular to the languages studied in this work.

It is instructive to note also that while all the speakers that participated in this study show significant raising effect of voiceless obstruents on F0, the degrees of this effect vary from language to language as well as from one speaker to another. This indicates that languages and speakers deploy tone raising to different degrees.

Another possible explanation, especially for the resetting of pitch caused by voiceless obstruents after DS is that voicelessness of consonants implies the non-vibration of the vocal folds. A corollary of this is that once the vocal folds are not vibrating, pitch is also momentarily halted, and this means that the resumption of vibration afterward brings with it a fresh start of pitch which may not be subject to preceding effects, in this case terracing.

4. Summary

To now return to the questions raised at the beginning of this paper, the descriptions of Igala and Yala (Ikom) have so far revealed that H-spreading and consonant voicing are DS blockers. Apparently, the blocking brought about by H-spreading owes to natural tonal assimilation, whereby H spreads to a following L in the phonetics and consequently prevents that L from being realised as DSL. We note however that its blocking effect on DS is attested in the languages studied and is thus viewed as a possible cross-linguistic

nature of DS in three-tone systems. Already, Adeniyi (2015) has made similar findings for Ebira, Ghotuo, Gwari, and Nupe.

The perturbing interaction of consonant voicing with pitch is a language universal. It is however the voiced consonants that are more often said to interact with pitch by depressing it (Bradshaw, 1999; Tang, 2008). Thus the reports that voiceless obstruents raise pitch are of the less documented type. The nature of pitch transition after voiceless obstruents is however sufficient proof of this trend in the languages studied. Notice that in Fig. (5a; 6b; 8; 9) pitch habitually starts high after voiceless obstruents and then falls sharply afterwards. Notice that H starts significantly higher after both /s/ and /kʰ/ in Fig. (6b). The same is observable after /s/ in Fig. (7b), and after /kʰ/ in Fig. (8). Also in Fig. (9) H starts significantly raised after /p/. Added to this evidence is the closely-related blocking of downstep after voiceless obstruents. Downstep was frequently blocked by voiceless obstruent onsets in the speech of all of the speakers who participated in this study.

Another question raised at the beginning of this article relates to the trigger of downstep. The theoretical consensus is that the trigger of downstep is a non-initial floating L (Elugbe 1985, Paster and Kim 2001). While this is true, it does not completely account for our data in Igala and Yala (Ikom). Initial floating L also triggers downstep in Igala, while non-initial floating M triggers DSH in Yala (Ikom) and both initial and non-initial floating M trigger DSH in Igala. We will not go into the case of M triggering downstep in Yala (Ikom) since Armstrong (1968) sufficiently demonstrated it, but the case of Igala deserves some elaboration. As shown in Fig. (15-16), the H in Igala has a strong tendency to downdrift after M. This is more clearly observable when there is no intervening voiceless obstruent. While the downdrift is perceptually clear in Fig. (15-16), it is only in Fig. (15) that we have acoustically large amount of lowering. Notice that the utterance-initial H in Fig. (15) is realised at 179.6Hz whereas the utterance-final H is realised at 163.6 Hz which is 16Hz lower than the utterance-initial one. This is only attributable to the intervening M between them.

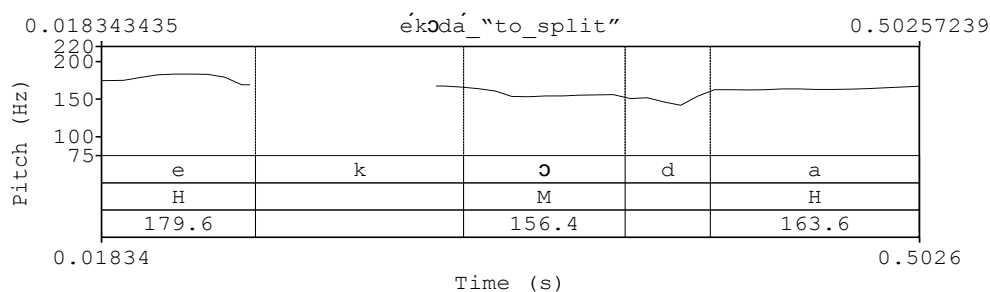


Fig. (15) Pitch track of *ékɔ́dǎ* “to split” showing the downdrifting of H after M in Igala

The intervening voiceless obstruent in Fig. (16) prevents a large amount of lowering, but observe that in spite of this, there is still a lowering of 6.5Hz between the utterance-initial H (realised at 171Hz) and the utterance-final H (realised at 164.5Hz) due

to the intervening M between them. Thus, the downdrifting of H after M supports the finding that DSH is triggered in Igala when the M preceding it is set afloat.

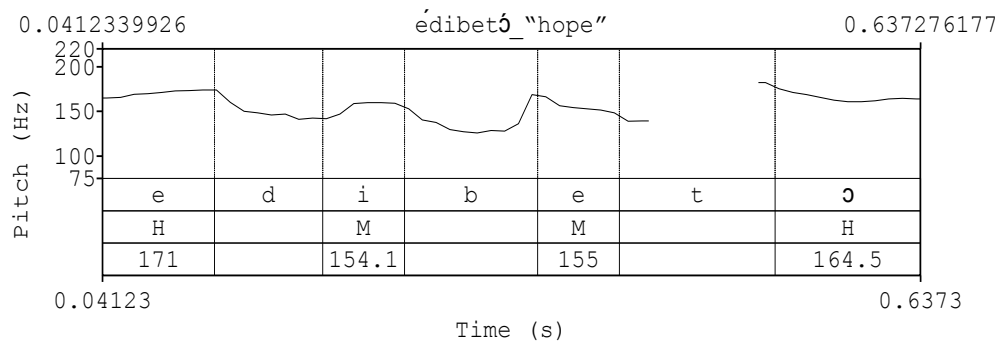


Fig. (16) Pitch track of *édibētó* “hope” showing downdrifting of H after M with intervening voiceless obstruent minimising the lowering in Igala

Some of these reports are not entirely uncommon. For instance, Wilson, (1968) reported that Temne has “a type of” terraced-level tone system. However findings that initial floating L triggers DSL, DSM, and DSH, while initial and non-initial floating M trigger DSH in Igala differ from popularly held views. Hence, they add fresh support to the belief that views on the tonology of African languages have been largely influenced by works on two-tone languages (Laniran and Clements 2003), and that theories founded on such works still need to be tested against careful studies on languages operating three or more tone levels.

4. Conclusion

It has been reported in this work that DS affects all the three tones of both Igala and Yala (Ikom). DS in the two languages is however blocked by two key segmental and tonal phenomena; voiceless obstruents and progressive spreading of H. These languages are therefore typologised as operating terraced-level tone systems, but with the caveat that their terracing is of a different type from that in two-tone systems.

In fact, it appears that voiceless obstruents have been found to block DS in every three-tone system where it has been investigated. For example, although there is DSM and DSH in Nupe, the phenomenon only occurs on TBUs preceded by voiced consonants. Adeniyi (2013) reports that voiceless obstruents raise tone in Nupe, and once tone-raising has occurred in a particular position, DS can no more be attested. According to Adeniyi, DS is attested in the utterances in (9) because it comes after voiced pre-vocalic consonants.

9) Downstep in Nupe (Adeniyi, 2013: 10-11)

- a. **Músá jí èdē** → **Muʃa si ʼdé** “Moses bought some cloth”
- b. **ētʃí èdzā** → **ētʃi ʼdzā** “drummer’s yam”

- c. **èfō èlě → èfó'lé** “past chance”
- d. **tú ègā → tú 'gā** “build a cage”

DS does not occur in (10) because the pre-vocalic consonants are voiceless.

10) Downstep blocking after voiceless onsets in Nupe (Adeniyi 2013: 10-11)

- a. **wá èkpō → wá èkpō** “want load”
- b. **tú èkpó → túkpó** “build a pole”
- c. **gí èfá → gífá** “spend the holiday”
- d. **tsúkù nā ēm̃ ètsú → tsúkù nā ēm̃ tsú** “this bone is smelling”

The same discovery has been made in Ebira, Gwari, and Ghotuo where H-spreading and voiceless obstruents block DSL, DSM and DSH in significant ways (Adeniyi 2015).

Finally, regarding the third question raised at the beginning of this paper as to why DS in three-tone systems is different from that in two-tone systems, the high number of contrastive tone levels is the obvious reason in the languages studied in this research. By this is meant that the tonal space in a three-tone language is concatenated into three, leaving smaller unused spaces between the three levels than what is available in a two-tone language. A further inference from this interpretation is the possibility that the tone-raising nature of voiceless obstruents is also present in two-tone languages, but that the wider distance between the two tones is sufficient to absorb the raising in such a way that it does not counteract downstep. There is then the need to experimentally investigate this in two-tone systems analysed as having the downstep phenomenon.

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