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Quantitative Analysis of Hausa Falling Tone in the Pronunciation of Disyllabic Hausa Words Among the Yorùbá-Hausa NCE 3 Students in Primary Education Studies

Sale Maikanti, PhD

Department of Linguistics & African Languages, Adeyemi Federal University of Education, Ondo

ABSTRACT: Hausa and Yorùbá languages shared two-level tones: high (´) and low (`), while a mid (-) and rising tones (∨) are peculiar to Yorùbá, with a falling tone (^) only related to Hausa. This study examines the production of Hausa falling tone among male and female NCE 3 Yorùbá-Hausa learners at the Primary Education Studies Department in Adeyemi Federal University of Education, Ondo. The study aims to investigate the accuracy and errors patterns in producing falling tones within the L2 context and their effects on language proficiency. Forty (40) participants, aged 18 years and above, participated in the study. In addition to the questionnaire, 50 carefully selected disyllabic Hausa words used for the construction of 50 simple declative Hausa sentences, with all containing either a high, low, or falling tone in their first syllables served as instruments. Every participant was asked to read aloud the sentences, while the researcher personally audio recorded the tasks, and then analysed them quantitatively, using SPSS Statistical tools. The selection criteria for the participants were based on purposive sampling, specifically targeting only individuals who were Yorùbá-Hausa learners and willing to participate in the study. An independent t-test was carried out to determine if there was a significant difference between the two groups in line with the predictions of Flege's (1995) Speech Learning Model. The results comparing the performance of males and females reveal that even though the p-value for the t-test is $p < .002$, yet male participants commit more errors on tone assignment in the first syllable than their female counterparts, while the results of the shared and unshared tone assignment in the first syllable appeared statistically non-significant ($p > .400$). Generally, both male and female participants replace Hausa falling tone with either Yorùbá mid-tones or low tones, resulting in mispronunciation and a change in meanings due to the assignment of incorrect tones. These insights contribute to the understanding of L2 tone acquisition with implications for language teaching and learning in a multi-lingual environment.

KEYWORDS: Yorùbá-Hausa, t-test, p-value, non-significant, mid-tones.

INTRODUCTION

Tone plays a central role in the phonological systems of many African languages, including Hausa and Yorùbá, where variations in pitch contour serve to distinguish lexical or grammatical meaning. Hausa, a Chadic language widely spoken in northern Nigeria and parts of West Africa, including the South-western part of Nigeria, exhibits a three-tone system: high, low, and falling, each contributing to semantic distinctions at the word level. The falling tone in Hausa is particularly significant because it functions as a complex contour tone, realized through pitch movement within a single syllable. For non-native speakers, especially those whose first language (L1) operates with a different tonal architecture, such as Yorùbá, acquiring the fine-grained tonal distinctions of Hausa poses perceptual and articulatory challenges. Yorùbá, which is also a tonal language, typically employs three-level tones (high, mid, and low) rather than contour tones, leading to potential cross-linguistic interference in the learning and production of Hausa tones. While Hausa on one hand, has [i], [e], [a], [o], [u] - as short, and [i:], [e:], [a:], [o:], [u:] - as long vowels, in addition to [ai], and [au] as diphthongs (Sani, 2005), Yorùbá on the other hand, has /i/[i], /e/[e], /ẹ/[ɛ], /a/[a], /o/[o], /ọ/[ɔ], /u/[u] - as oral, and <in>[ĩ], <ẹn>[ɛ̃], <an>[ã], <ọn>[ɔ̃], <un>[ũ] - as nasal vowels (Awobuluyi, 1967; Awobuluyi & Bamgbose, 1967; Bamgbose, 1967; Archangeli & Pulleyblank, 1994; Arokoyo, 2012; Allen, Pulleyblank, & Ọládiípọ̀, 2013; Akinola, 2014; Eme & Uba, 2016; Fiyinfolu, 2019). In second language (L2) phonology, Flege's (1995) Speech Learning Model (SLM) provides a theoretical framework for predicting how such difficulties in the production of sounds such as vowels and tones emerge. The SLM posits that L2 learners' ability to perceive and produce non-native sounds is shaped by the extent to which L2 categories are perceived as similar or dissimilar to L1 phonetic categories. When an L2 sound or prosodic feature (such as tone) is perceived as "similar" to an L1 category, learners are more likely to assimilate it to the existing L1 category, resulting in equivalence classification and thus reduced accuracy. Conversely, when the L2 feature is sufficiently distinct, learners are more likely to form a new phonetic category,

which enhances accurate perception and production. Applying this framework to the study of Hausa tone acquisition by Yorùbá learners, it can be predicted that the falling tone in Hausa, being structurally and acoustically different from the level tones of Yorùbá, may either be misperceived as a combination of level tones or be approximated through pitch patterns familiar from Yorùbá speech rhythm.

Statement of the Problem

Despite the long-standing contact between Yorùbá and Hausa speakers in Nigeria, tonal inaccuracies remain prevalent among Yorùbá learners of Hausa. Observations from classroom interactions and informal communication reveal that many Yorùbá speakers who were learning Hausa either as a second or even third language struggle with the accurate realization of the Hausa falling tone, often replacing it with level tones or producing incomplete pitch movements. These deviations result in semantic distortions, loss of intelligibility, and communication breakdowns in Hausa discourse. Existing research on Yorùbá learners of Hausa has largely concentrated on segmental phonology, particularly issues that have to do with the production and perception of vowels and consonants, while the supra-segmental domain, especially tone, has received limited empirical attention. Where tonal analysis exists, it tends to be more qualitative than quantitative, offering little insight into the acoustic correlates of tone production or the phonetic mechanisms underlying L2 tonal errors.

According to Flege's (1995) Speech Learning Model, successful L2 tone acquisition relies on the learner's ability to form a new phonetic category for the target tone. Since Hausa and Yorùbá share high-low tones but differ in Hausa's falling (^) tone and Yorùbá's mid (-) tone (Bello, 2017), it is important to examine how learners produce tones, especially when learning a language other than their mother tongue. It is unclear whether Yorùbá learners at the advanced NCE 3 level have developed this phonological differentiation for the Hausa falling tone or if they still assimilate it into Yorùbá tonal categories. This gap highlights the need for a quantitative study that empirically investigates how Yorùbá-Hausa learners produce the falling tone in disyllabic Hausa words and evaluates the level of L1 interference in line with SLM predictions.

Objectives of the Study

The main objective of this study is to evaluate and quantitatively analyze the production of the Hausa falling tone in disyllabic Hausa words among Yorùbá-Hausa NCE 3 students influenced by their L1 tonal system and the degree of phonetic category formation as predicted by Flege's (1995) Speech Learning Model. Specifically, the study is to examine the extent to which Yorùbá tonal influence affects the learners' realization of Hausa falling tones in disyllabic words, and also assess the level of errors committed by male and female learners, which reflect the equivalence classification with Yorùbá level tones, as predicted by the SLM.

Research Hypotheses

Based on the objectives and research questions, the following hypotheses to guide this study are formulated:

$H0_1$: There is no statistically significant difference between male and female participants in the pronunciation of Hausa falling tones by Yorùbá-Hausa NCE 3 students in the first syllable.

$H0_2$: There is no statistically significant difference between the performance of participants in the pronunciation of shared and unshared (Hausa & Yorùbá) tones among Yorùbá-Hausa NCE 3 students in the first syllable.

Significance of the Study

Within the context of NCE 3 (Nigerian Certificate in Education) students, who typically have sustained exposure to Hausa as a second language through academic and social interaction, the present study on tonal production will provide valuable insight into the developmental trajectory of L2 phonological competence, especially for the learners. Quantitative analysis of students' pronunciation performance on disyllabic Hausa words will no doubt offer an empirical basis for evaluating the extent to which learners have internalized the phonetic realization of the falling tone and whether their production aligns with native Hausa tonal patterns. Investigation of this nature will also enable the identification of systematic deviations, such as tone simplification, pitch flattening, or tone substitution, which may reflect the ongoing interlanguage processes predicted by Flege's (1995) model. The quantitative analysis of tone production offers an objective basis for assessing learners' mastery of Hausa tonal patterns. By measuring pitch contours and tonal alignment in the disyllabic Hausa words, researchers can determine whether the learners have developed accurate phonetic representations of the falling tone or continue to exhibit L1-induced deviations. Such findings may not only have implications for theories of L2 phonological acquisition, as predicted by Flege's SLM, but also for pedagogical practices in Hausa pronunciation teaching and learning within multilingual Nigerian contexts.

LITERATURE REVIEW

Even though African languages have received most of the attention in theoretical studies of tone, especially in the development of nonlinear phonology, many African languages have rich systems of morphophonemic tonal alternations (Odden, 1995). While it is true that African tone systems are better understood today than they used to be in the past, the vast majority of the languages spoken

in Africa are tonal (Bello, 2017). Therefore, a lot of work needs to be carried out to fully understand how tone works and the way it is represented in African languages. Studies on vowel and tone errors in Hausa language learning by Yorùbá speakers have become important in present times. This is because Hausa tones remain elusive to native Yorùbá speakers due to multiple linguistic and environmental obstacles, especially in the area of pronunciation. Various research studies combining quantitative and qualitative methods (mixed mode) (Sandelowski, 2000; Biesta, 2010; Obakhavbaye, 2024; Lewis & Anderson, 1976) confirmed that L2 learners have challenges in producing their intended sounds correctly due to interference from their native language. The phonemic variations between the first and second languages create substantial obstacles for learners who want to correctly produce targeted sounds such as tones. Yorùbá tone patterns dominate the process of learning Hausa tones, yet speakers mostly produce Hausa tones in error due to patterns from their native language. The Yorùbá speakers who transfer tonal rules to their Hausa-speaking counterparts bring about communication problems while using the language. This is because the way Yorùbá speakers acquire Hausa as their second language predicts elements of extensive linguistic interference.

Owolabi (2014), who examined Yorùbá speakers learning English as a second language, found that some vowels were recognized and produced as a result of inconsistencies between spelling and sounds in English, unlike in Yorùbá. It was an empirical study designed to identify the problems of these English-as-a-second-language learners after observing a similar group of students committing the same errors over time. In the study, forty out of fifty-seven respondents were randomly selected for a sandwich program. The data was collected in a serene and quiet language laboratory under the supervision of a language laboratory attendant. Each of the forty respondents was made to read a specially prepared passage with specific words to discover how they pronounce some vowel sounds in different-word environments in the English language. The speech production of each respondent was recorded personally by the researcher to discover how these sounds were pronounced. The results of the study reveal that the respondents, who were teacher trainees and expected to be models, cannot pronounce some of the sounds correctly, especially some words containing the letter 'i' in words like 'hide', 'ride', and 'rid'. This issue also affects words like 'kite' and 'kit', as well as 'bite' and 'bit' respectively. The same problem was also identified in the 'o' letter in 'woman' and 'women'. The study concludes that there is no one-to-one correspondence between letters and sounds in English, as is the case in the Yorùbá language. This was attributed to the transfer of the native language pronunciation in Yorùbá to the English language in some words, thus leading to inappropriate pronunciation.

The descriptive and acoustic work on Hausa recognizes high and low-level tones and a falling contour that often surfaces as an H+L sequence or as an integrated contour (analysis depends on prosodic/segmental context). Newman (1995) and other descriptive accounts discuss historical processes and the phonetic realization of falling tones, noting that the contour's realization can be sensitive to syllable structure and prosodic position (e.g., prepausal contexts). Quantitative acoustic descriptions of Hausa tone supply the benchmarks against which learner productions can be compared. Although often characterized as a three-level tone system (high, mid, low), Yorùbá shows dialectal variation and surface contour effects; some dialects and prosodic contexts produce derived contour surfaces. This complexity means that Yorùbá L1 speakers may bring a repertoire of tonal realizations to Hausa learning, including level tones and derived contour-like shapes, complicating simple predictions of transfer (Adeniyi, 2021). According to an empirical study on L2 tone acquisition, much L2 tone research has examined East Asian tone learning (e.g., Mandarin) by non-tonal L1 speakers (e.g., English) and, increasingly, comparisons involving tonal L1 groups (e.g., Thai, Yorùbá). Acoustic training studies show that exaggerated acoustic cues, multimodal input (visual/haptic), and music-based training can facilitate perception and production learning of tonal contrasts. These studies highlight that acoustic salience and multimodal cues can accelerate the formation of new tonal categories consistent with SLM in distinctiveness, and salient input will facilitate new category formation or provide multimodal feedback to improve perception/ production accuracy for tone learners (Cao et al., 2024). When L1 is tonal (but differs typologically from the target tone system), learners sometimes transfer L1 tonal realizations in ways that help or hinder acquisition. A recent cross-language study suggests transfer is complex and it depends on the match between contour vs level representations on the prosodic and segmental context. Findings also indicate that tonal L1s may have an advantage in perceiving pitch but may still struggle with contour vs level distinctions if their L1 lacks similar contour categories (Creel et al. 2023). Researchers typically quantify several F0 metrics: onset F0, offset F0, peak and valley F0, F0 slope (rise/fall), alignment of F0 targets relative to syllable landmarks, and duration. These metrics allow fine-grained comparisons between learner productions and native norms and can be used to test whether learners approximate native contours or instead produce flattened or levelized shapes consistent with L1 transfer. Ali (2013) researched pronunciation problems of English vowels produced by Sudanese learners of English to provide a piece of experimental evidence for certain linguistic causes of production errors in English spoken with a Sudanese Arabic accent. The respondents of the study were identified to have problems with the production of English vowels in both individual words and real communication. Ten (10) Sudanese University learners of English who primarily speak Arabic were purposefully selected for the study, using English vowels as data for the research. Based on the acoustic analysis of the English vowels spoken by both Sudanese and native speakers of RP English, the acoustic differences provided insight into the study. The results indicated that most of the differences appeared in the area of central and back vowels of English. Even though some English tense–lax vowels showed no serious challenges because there is correspondence between English and Arabic long/short vowels, the

production errors identified in the present study followed different directions that suggest that the Sudanese learners of English had difficulty learning English vowels, especially due to factors related to linguistics, mother-tongue interference, and lack of English background.

There is a growing literature examining tone effects in Nigerian languages and L2 interactions involving Hausa, Yorùbá, and Igbo. Recent studies have looked at the influence of L1 tone on the pronunciation of other languages (including Nigerian English), and localized studies have approached vowel and segmental transfer among Yorùbá-Hausa bilinguals (Farran & Morett, 2024). However, there remains a paucity of quantitative studies that directly measure Hausa contour tone production by Yorùbá L1 learners. A recent study by Maikanti (2025) quantified vowel production patterns among Yorùbá learners of Hausa and published the results within the context of Flege's (2020) Revised Speech Learning Model (SLM-r). The study, therefore, argued for extending such quantitative methods to supra-segmental features, such as tone. These regional studies highlight the need for further research on tone in the Yorùbá-Hausa learning context in the classroom to bridge both theoretical and pedagogical gaps.

Flege's SLM (1995) Theoretical framework with gaps in the present study

Flege's SLM (1995) established a widely used account of L2 phonetic category formation whereby learners perceive L2 sounds relative to their L1 inventory and either form new categories for sufficiently distinct L2 sounds or assimilate similar L2 sounds to L1 categories (equivalence classification), hindering accurate production. The model focuses on the perceived phonetic distance and the role of input/ exposure in category formation. With the advent of Flege's (2020) Revised Speech Learning Model (SLM-r), the theory incorporates individual differences, learning trajectories, and the role of L1/L2 interactions across the lifespan, but the core prediction is that the new categories form more readily when the L2 sounds are perceived as distinct, and remains central. This framework has been applied widely to vowels and consonants and increasingly to supra-segmental features (though empirical tests on tone remain fewer) (Flege, 1995). The SLM's logic applies to tones, indicating that L2 learners will form a distinct tonal category when the contour (e.g., falling tone) is perceived as sufficiently different from L1 tonemes. If learners assimilate the contour to L1-level tones or to sequences of level tones, equivalence classification will lead to persistent production differences. Therefore, from the theoretical and empirical literature, two key gaps motivate the present study: 1) most SLM research has centered on vowels and consonants; but systematic or quantitative tests of SLM predictions for tone (especially contour tones) are fewer, and 2) in the West African context, despite multilingual contact, there is a lack of quantitative work specifically on falling tone. The present study responds to these gaps by applying a quantitative analysis to disyllabic Hausa words among NCE 3 Yorùbá-Hausa learners, thereby offering a direct test of SLM predictions in a supra-segmental domain to generate pedagogically actionable evidence to serve as a reference material.

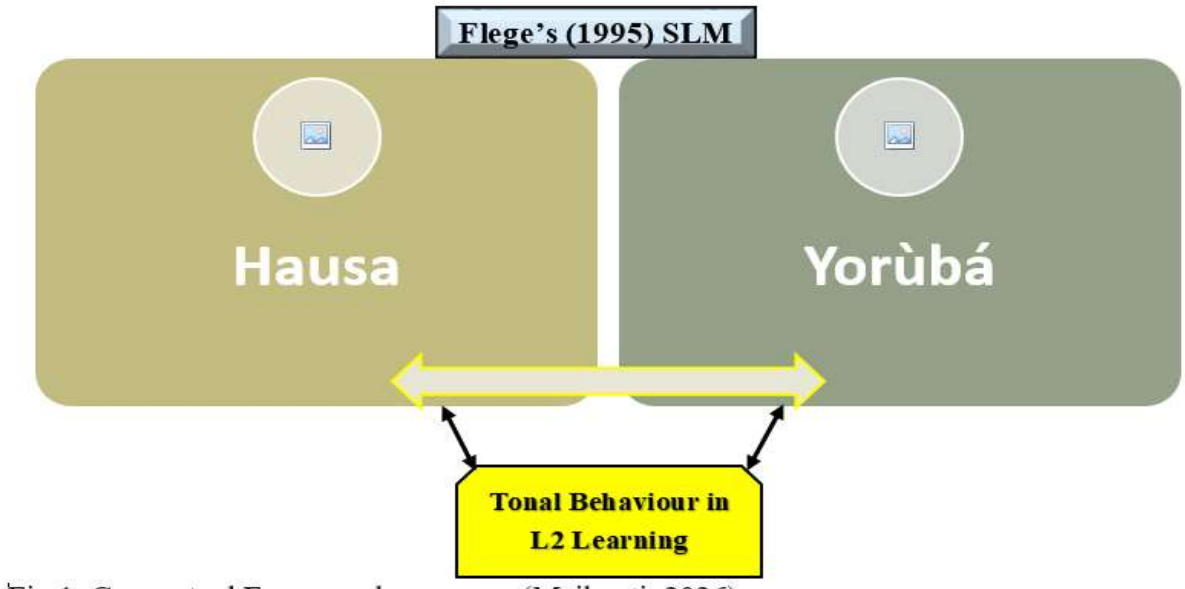

Fig 1. Conceptual Framework (Maikanti, 2026)

METHODOLOGY

Research Design

This study employed a qualitative research design aimed to examine the production of Hausa falling tone among the male and female participants who were NCE 3 Yorùbá-Hausa learners at the Primary Education Studies Department in Adeyemi Federal University of Education, Ondo.

Population and Sample Size

The population of NCE 3 Yorùbá-Hausa learners at the Primary Education Studies Department in Adeyemi Federal University of Education, Ondo, stands at 45 (forty-five) from different ethnic groups across the south-east and south-west, Nigeria. With this, the sample size for the present study is 40 (forty) participants (20 males and 20 females), aged 18 years and above were chosen based on purposive sampling. Even though the results of the present study were not to be generalised, choosing 40 participants as a sample size is in line with Krejcie and Morgan's (1970) Sample Size Table.

Research Instrument

In addition to the use of questionnaire to obtain more information from the participants for the success of the research, the research instrument for the present study comprising 50 (fifty) carefully selected disyllabic Hausa words used for the construction of 50 (fifty) different simple declarative Hausa sentences. These words are standard Hausa words extracted from Sanis's (2005) introductory phonology of Hausa (with exercises), and all the sentences contain either a high, low, or falling tone in their first syllables. The words are combinations of nouns, verbs, adjectives, and adverbs. To give every participant the opportunity to freely read the tasks aloud in a silent room, the wordlists were used to construct simple sentences, and this was also to ensure that the participants do not unnecessarily guess what the researcher was trying to identify. Some of the simple declarative sentences as highlighted, include:

(1) '*Ali ya kashe* ***kyânwa***' - (Ali killed a cat), '*Shehu ya tafi* ***Bida***' - (Shehu went to Bida), (2) '*Binta ta yi* ***lâifi***' - (Binta has committed an offense), '*Yaron ya* ***manta*** *da canjinshi*' - (The boy forgot his change), (3) '***Mânya****n duk sun halarta*' - (All the adults were in attendance), '***Gâgga****n sun ki zuwa*' - (The leaders refused to come), (4) '***Rânnan*** *mutumin ya zo*' - (The man came that day), and '***Yâuwa*** *abin ya yi daidai*' - (Really the thing is okay). All these represent a fairly and unbias data.

Method of Data Collection

The participants were asked to read aloud the 50 carefully selected disyllabic Hausa sentences in two paragraphs, containing falling tones in their first syllables, extracted from Sanis's (2005) Introductory phonology of Hausa (with exercises), while the researcher personally audio-recorded the tasks in a silent and serene environment, using an Android (Infinix Note 8i) handset. The data so far collected were later analysed quantitatively based on tonal accuracy and frequency counts. The selection criteria here, especially those who participated in the present study were based on purposive sampling, targeting only individuals who were in NCE 3, and are Yorùbá speakers learning Hausa as additional language (L2 or L3), particularly those who were willing to participate in the study, which was optional.

Method of Data Analysis

The data so far collected was transcribed, rated by two independent raters who are both linguists and Hausa experts that are teaching Hausa/Linguistics at the university, before subjecting them to quantitative analysis. To determine whether significant difference exist between the two groups (males & females) tested, the Mean scores, Std. D, and more particularly the p-value was calculated using an independent sample t-test. This was made possible with the help of SPSS version 23 Statistical tools.

RESULTS

In this section, attempt was made to present and discuss the research findings with Figures 1 and 2 showing the level of accuracy illustrating the level of error on individual vowel assigned to Hausa falling tone as pronounced among the participants in the first syllable, while Figures 1 to 4 reveal the performance index of the shared and unshared tones assigned to vowels as also pronounced by the participants in the first syllable. This, therefore, reflects the impact of L2 acquisition among the students of the Primary Education Studies Department. Below indicates the level of accuracy in the performance of the participants as compared between Figures 1 and 2 as illustrated below:

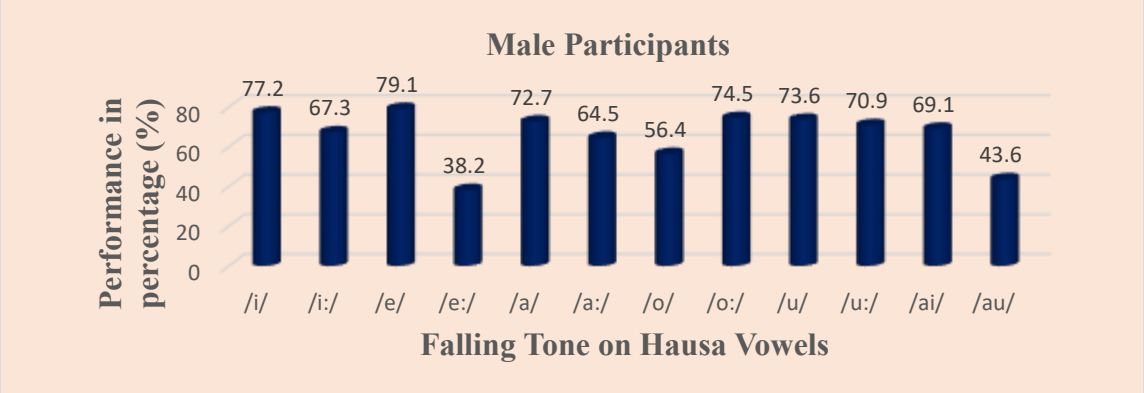

Fig 1. Shows the level of accuracy on falling tone in the first syllable

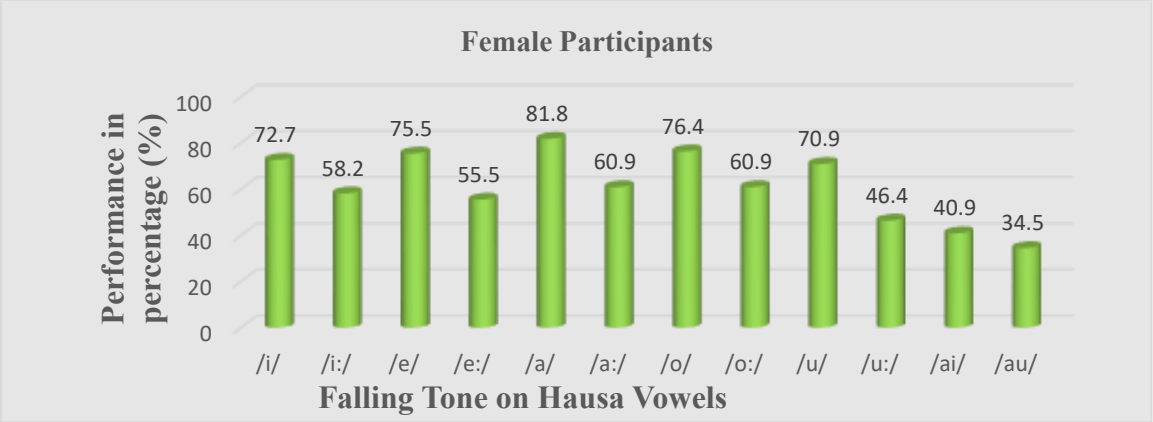

Fig 2. Shows the level of accuracy on falling tone in the first syllable

The performance of participants (Yorùbá speakers) on how falling tone assigned to Hausa vowels was measured and compared between the two groups (males & females) in Figures 1 and 2, as presented in the following order:

1) The tones assigned to the short front high vowel /i/, which appeared in the first syllable, scored 77.2%, while in the second syllable, the score was 72.7%, showing a moderate performance in each of the syllables. The tones used on long front high vowel /i:/ in the first syllable scored 67.3%, showing moderate performance, while in the second syllable, the score is 58.2%, representing weak performance. While the tones assigned to the short front mid vowel /e/have a score of 79.1% in the first syllable, which indicates moderate performance, in the second syllable, the score is 75.5% which also reflects moderate performance. As 38.2% appeared to be the score obtained for the tones placed on long front mid vowel /e:/ in the first syllable, which represents minimal performance, 55.5% was the score obtained in the second syllable, showing weak performance. Similarly, the tones assigned to short low central vowel /a/ scored 72.7% in the first syllable, showing moderate performance; the score obtained in the second syllable is 81.8%, reflecting strong performance. In addition, 64.5% is the score obtained for the tones on long central low vowel /a:/, particularly in the first syllable, showing moderate performance, as against a 60.9% score obtained in the second syllable, also reflecting moderate performance.
2) The tones placed on short mid back vowel /o/ in the first syllable scored 56.4%, showing weak performance; and 76.4% was obtained in the second syllable, representing moderate performance. A moderate performance with a score of 74.5% was recorded for tones on long mid back vowel /o:/ in the first syllable, while in the second syllable, 60.9% was obtained, with all of them showing moderate performance. As 73.6% representing moderate performance was found to be the score on tones assigned to short high back vowel /u/ in the first syllable, almost similar to 70.9% being recorded in the second syllable, with each of them reflecting moderate performance. The tones placed on the long high back vowel /u:/ in the first syllable scored 70.9%, showing moderate performance, contrary to what was obtained in the second syllable, as 46.4%, showing weak performance. While the tones placed on /ai/ (diphthongs) in the first syllable scored 69.1%, showing moderate performance, 40.9% was recorded in the second syllable, indicating weak performance. Similarly, 43.6% was the total score for tones assigned to /au/ (diphthongs) in the first syllable, reflecting weak performance, contrary to the 34.5% score obtained in the second syllable, representing the minimal performance by each participant.

i.) Descriptive Statistics

To determine if there is no statistically significant difference between male and female participants in the pronunciation of Hausa falling tones by Yorùbá-Hausa NCE 3 students in the first syllable, a descriptive statistic was carried out. This is to reveal the performance index of male and female participants, specifying their mean scores, standard deviation, and p-value on tone assignment in the first syllable. This can be illustrated in Table 1 below:

Table 1. Compares the performance of male and female participants on tones in the first syllable

Group 1 (males)	**Mean** 28.3	**Std D** (7.20069)	**t-statistics (df)**	***p-value***
Group 2 (females)	39.6	(8.51339)	21.411 (22)	.002

Results of independent t-test between males and females on tone in the first syllable

An independent sample t-test was conducted to compare how male and female Yorùbá-Hausa learners assign tones to disyllabic Hausa words in the production of Hausa vowels in the first syllable. Since Levene's test for equality of variances is non-significant (p=.475), we can assume that the variances of the two samples (groups) are equal. The results indicate that male participants (Yorùbá-Hausa learners) did not perform better in the first syllable (M = 28.3, SD = 7.2, N = 5) on Hausa vowels, compared to the female participants (M = 39.6, SD = 8.51, N = 7), t(22) =21.411, p <.002. Since the p-value for the t-test is less than 0.05, we reject the null hypothesis and accept the alternative hypothesis. Therefore, it can be concluded that in the first syllable, the male participants commit more errors on tone assignment to the Hausa vowels than their female counterparts.

Apart from the assessment of participants with respect to falling tone on individual vowels while trying to pronounce Hausa tones contained in Hausa paragraphs in the first syllable, the participants were also assessed generally based on how they assign tones to disyllabic Hausa words in relation to the falling tone in the first syllable. Figure 3 below illustrates the level of accuracy in the performance of the participants in the two groups, as indicated below:

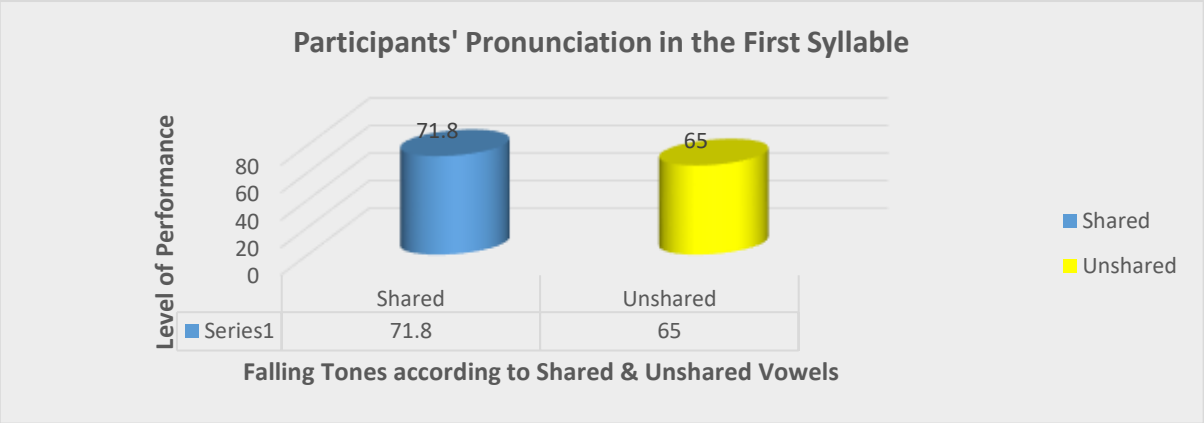

Fig 3. Shows tone placement according to shared and unshared vowels in the first syllable

ii.) Descriptive Statistics

To find out if there is no statistically significant difference between the performance of participants in the pronunciation of shared and unshared Hausa and Yorùbá tones among Yorùbá-Hausa NCE 3 students in the first syllable, a descriptive statistics was carried out to show the performance index of the shared and unshared tones, specifying the mean scores, standard deviation, and p-value on tone assignment to vowels for the two groups in the first syllable, as illustrated in Table 2 below:

Table 2. Shows the shared and unshared tones in the first syllable

Group 1	**Mean**	**Std D**	**t-statistics (df)**	***p-value***
(Shared tones)	71.8	(8.99528)		
Group 2				
(Unshared tones)	65.0	(17.26537)	9.392 (10)	.400

Independent sample t-test between the shared and unshared tones in the first syllable

An independent-samples t-test was conducted to determine how tones were assigned to disyllabic Hausa words by Yorùbá-Hausa learners in the production of Hausa vowels in the first syllable, based on Hausa and Yorùbá shared and unshared tones. Since the Levene's test for equality of variances is non-significant (p=.120), we can assume that the variances of the two samples (groups) are equal. The results reveal that Yorùbá-Hausa learners perform better in the first syllable on shared tones (M = 71.8, SD = 8.99528, N = 5) than in the tones that are not shared (M = 65.0, SD = 17.26537, N = 7), t(10) =9.392, p > .400. Since the p value for t-test is greater than 0.05, we reject the alternative hypothesis and accept the null hypothesis. Therefore, it can be established that Yorùbá-Hausa learners commit more errors based on the unshared Hausa falling tone in the disyllabic Hausa words, particularly in the first syllable.

DISCUSSIONS OF RESULTS

The current paper has discussed the assignment of tones by the Yorùbá-Hausa learners to disyllabic Hausa words with an emphasis on (i) gender variation in assigning tones to Hausa vowels to the first syllable and (ii) the effectiveness of learners when assigning tones that are shared between Yorùbá and Hausa and those that are not, including the Hausa falling tone. These findings show that

there was a statistically significant gender difference in the tone assignment case, where female learners showed better results through assigning the tones correctly (M = 39.6) as compared to male learners (M = 28.3), with the t-test showing that male learners exhibited more errors in tone assignment. This tendency is widely related to the research on second language phonology, which is gender- variant in terms of auditory sensitivity and the accuracy of speech production (Baker & Trofimovich, 2021; Gorjian & Sadeghi, 2019). It has also been found that female students tend to do better than their male counterparts in fine-grained phonetic activities, possibly since their perceptual abilities are more developed and their learning approach gives more attention to phonology (Kiss & Nikolov, 2005). According to the second portion of the analysis, Yorùbá-Hausa learners achieved higher scores on shared tones (M = 71.8) and lower scores on unshared tones (M = 65.0) though the difference was not significant (p >. 05). Even though the difference is not significant, the average scores indicate a pattern: the learners showed more difficulty in the production of the unshared Hausa falling tone. This result corresponds with the cross-linguistic literature on L2 tone acquisition, which proves that tones that are not available in the L1 of a speaker are more prone to the confusion of perception and misproduction (Hao, 2012; Lin & Li, 2023; Wang et al., 2022). The Hausa falling tone in Yorùbá speakers is a new phonological category that needs another perceptual reorganization and articulation training in the tonal system that does not possess a phonemic falling tone.

The results relate well to the assumptions of the Speech Learning Model (SLM) by Flege (1995). The SLM consists of the assumption of an influence of the perceived similarity of the L1 and L2 phonetic categories on L2 phonetic learning. Where L2 sounds are perceived to be similar, the learners will generalize the sounds into the already existing L1 categories, which can either facilitate or delay learning with respect to overlap. On the other hand, new sounds, e.g., sounds which do not correspond to L1 sounds, and in which new phonetic categories must be established, are cognitively focused and are generally accompanied by an increased number of errors. In the current research, the higher performance of the Yorùbá-Hausa learners in shared tones can be attributed to a prediction of SLM that phonological categories that are similar are found easier to learn. In the meantime, the increased challenge with the Hausa falling tone helps to confirm the model that suggests that learners with L2 have more problems working with non-native or unfamiliar categories. This falling tone substitution or misplacement by the learners could be reflective of the category assimilation to the nearest tone in Yorùbá, which would confirm the mechanisms of mapping of the equivalence proposed by SLM. The results concerning the gender aspect also fall within the general SLM definitions. Provided that perceptual acuity also plays a role in the process of generating or updating phonetic categories, the higher performance of female learners may indicate a more effective distinction between the categories of tones in both L1 and L2, thus making it possible to form categories more accurately. By and large, the results of the research support the cross-linguistic relevance of Flege SLM to the processes of tone-language acquisition and provide support through the results of the study to the African phonology literature, which is not well-investigated.

According to research on the perceptions and expectations of English as a foreign language (EFL) university students regarding the usage of information and communication technology (ICT) concerning English language learning by Al Arif, Armiwati, and Handayani (2023) involving 337 who responded online, and another 10 participants who were purposefully selected with a mixed-mode approach, this study examines the frequency of ICT use among EFL university students for both general and English learning purposes. With the descriptive analysis conducted, the participants' mean scores revealed that it was >3. The findings aligned with some of the results found in the present study, although not statistically significant, especially when the p-value is considered. Considering the teacher talk as the main input in English as a foreign language (EFL) classrooms, this descriptive study aimed to elucidate the beliefs and practices of Turkish EFL teachers regarding their use of a foreign language, namely English (L2), in their classrooms by taking into account school types, experience, and travelling abroad as variables. Accordingly, 308 EFL teachers from different regions of Turkey were given a questionnaire with two parts, firstly beliefs and then practices, to clarify this prominent issue. The results indicated a high level of teacher awareness about the necessity for using L2 for several reasons, but without dismissing the use of their native language, namely Turkish (L1). Conversely, the study highlighted the clashes between their espoused beliefs and practices. Furthermore, being more experienced teachers and working in primary or high schools were not reported as significant factors in teacher agency in making language choices to teach L2, whereas working in state or private schools and visiting English-speaking countries revealed significant differences in the beliefs and practices of the teachers about their use of L2 to teach L2. The results were discussed with suggestions to maximize L2 use in EFL classrooms.

Applying SLM to Hausa tone acquisition, the falling tone may be assimilated into Yorùbá learners' L1 tonal framework as a combination of high and low tones or as a pitch glide that lacks the precise contour movement required in native Hausa. This perceptual assimilation may hinder the formation of a new tonal category, leading to inaccuracies in tone production. Furthermore, the SLM suggests that phonetic learning remains possible across the lifespan, but accuracy is influenced by factors such as the quantity and quality of L2 exposure, age of acquisition, and phonetic similarity between L1 and L2 sounds. Among Yorùbá-Hausa NCE 3 students who are advanced in Hausa learning, examining the quantitative realization of the Hausa falling tone thus provides a window into how their tonal competence evolves and how far their productions have diverged from or converged with native norms. The results of the present research align with a study conducted by Thane et al. (2025), who examined the acquisition of Spanish nominal morphology in 116 children (4;0-6;11), even though SLM was not used for the comparative study, compared to

the present research. The research was divided into two groups based on their language ability (developmental language disorder [DLD] and typical development [TD]) and bilingualism (Spanish-English bilingual and Spanish monolingual). The monolinguals generated higher target-like articles and direct object clitics than bilinguals, with children with TD also generating more than those with DLD, using a multivariate analysis. The morphology of bilinguals with TD was more target-like compared to that of monolinguals with DLD, especially the clitics. Comparing children with DLD and those with TD showed that clitics were more omitted in the former than in the latter, whereas it was not the same for the bilinguals and the monolinguals. Children were able to come up with one default article in plural situations. However, the study observes that the clitics are superior to the articles because they can be used to identify DLD in a bilingual on a quantitative and qualitative basis.

The results of the current research enable the conclusions regarding the influence of L1 tonal experience on the acquisition of L2 tone categories, in particular, in the context of the Speech Learning Model (SLM) by Flege (1995). First, the researcher has observed that there were great gender variations in the accuracy of tone assignment among Yorùbá Hausa students, whereby the female students have a great deal of proficiency compared to the male students. Second, the accuracy appeared to be higher in shared tones (Yorùbá and Hausa), compared to the unshared Hausa falling tone, which has no linguistic equivalent in Yorùbá. Though none of these differences were statistically significant, the similar pattern highlights the predictability of L1 tonal inventories in determining L2 tone processing. These results are consistent with the central idea of SLM that L2 categories are learned in comparison to the existing L1 phonetic categories of the learner. SLM states that in cases where the L2 sound has a great level of phonetic resemblance with an existing L1 category, learners would tend to categorize this L2 sound as the same sound as the L1 category; this is called 'equivalence classification'. This is usually done to enhance perception and production. This principle is in line with the fact that the superior learner performance on tones that are common to Yorùbá and Hausa is that the tones fit more easily into already existing Yorùbá tonal categories, and thus are perceptually available. On the other hand, such perceptual transfer is not available to the Hausa falling tone that does not have a comparable tonal system in the Yorùbá. According to SLM, the learners have difficulties in creating a new phonetic category of sound that does not belong to their L1 tonal system, which makes them less accurate.

The findings of Wang et al. (2023) also present a critical parallel of perceptions that can support the interpretation of the current results. Their empirical research that investigated the influence of processing tone and intonation on the form and the function stage by cognitively competent autistic and non-autistic Mandarin-speaking children proved that extensive experience with a tone language enables efficient processing of tonal differences. More importantly, their findings revealed a high form-based and function-based tone processing correlation and that these skills were mostly normal even in autistic participants, although with autism symptom severity moderating the outcomes. However, there was variability associated with neurodevelopmental aspects; the existence of well-established categories of L1 tonal in Mandarin gave both groups a perceptual basis, which facilitated the processing of tone and intonation. Drawing parallels between the current research and that of Wang et al. (2023), the two studies intersect on the main argument of SLM, according to which the structure and strength of L1 phonetic categories play an overwhelming role in L2 phonetic learning and do not depend on the individual differences in gender, cognition, or developmental profile. In both studies, it is shown that in cases where the L1 has offers well-formed phonological templates of tone, processing becomes easier; and where the L1 does not have a corresponding category, learners have to create a new phonetic category, which is inevitably more challenging and allows more mistakes. This not only validates the SLM predictions but also increases its explanatory capacities to the special population groups like autistic learners whose cognitive profiles might have interacted, but not eliminated, the role of L1 phonological experience.

Furthermore, the gender differences that are witnessed in the current study draw a description of the significance of individual differences in SLM. Although the emphasis of SLM is on phonetics and perception determinants of L2 acquisition, the current results indicate that social, cognitive, or motivational determinants that are related to gender could affect the sensitivity of the learners to tone difference or their exposure to L2 input. This supports the necessity of an increased definition of SLM, which includes such variables of the learner as bridges of category-building and L2 phonetic growth. Overall, the current results and those of Wang et al. (2023) are a solid argument in favour of the claim of SLM that perceived phonetic similarity is the reason why the acquisition of L2 sounds is easier or more challenging. The evidence is that even in other linguistic settings, within age groups, and among cognitive profiles, L1 tonal categories create the source of perceptual anchoring where new tonal information is viewed. The general meaning is that effective acquisition of L2 tone should be taught using the instructional methodology that clearly addresses non-shared tone categories and offers learners the rich and highly variable input on which the new phonetic representations can be built. This pedagogical intervention would be especially beneficial in the tones such as Hausa falling tone, which is not perceptually supported by Yorùbá and thus would need explicit training to address the limitations of equivalence classification. In summary, this study investigates the quantitative realization of Hausa falling tones in the pronunciation of disyllabic Hausa words among Yorùbá-Hausa NCE 3 students, using the theoretical insights of Flege's Speech Learning Model (1995) to interpret the level of L1 influence, phonetic category formation, and interlanguage variation. By examining the tone production and their deviations from native norms of the languages investigated, the study revealed how cross-linguistic and phonological transfer contribute to ongoing research on tone learning in African multilingual contexts.

CONCLUSION

The study therefore observed that broader discussions in L2 prosody research, where tone, unlike segmental features such as vowels and consonants, have received relatively less empirical attention. Examining how Yorùbá speakers, learners of Hausa, face difficulties in the area of producing the Hausa falling tone not only enriches our understanding of L2 tone acquisition but also provides a practical foundation for improving phonetic instruction in Hausa language education. This study aligns with the pedagogical goal of developing intelligible and native-like pronunciation among L2 learners, a task that is inherently tied to the learner's capacity to restructure existing phonetic categories in line with SLM predictions. The study has also shown huge gender disparities in the accuracy of tone assignment in Yorùbá-Hausa learning, whereby female learners perform better than their male counterparts. Besides, learners showed better performance in Yorùbá-Hausa shared tones, but the performance is not statistically significant, especially in Hausa falling tone, which is not a shared tone with Yorùbá. These results confirm the role of L1 tonal determinants in L2 tonal acquisition and also offer additional empirical evidence to the Speech Learning Model developed by Flege, especially the importance of perceived phonetic similarity in determinants of tone acquisition.

RECOMMENDATIONS

The findings of this study underscore the need for Hausa language curricula designed for Yorùbá learners to incorporate explicit and structured modules targeting the identification and accurate production of the Hausa falling tone. Since this tone is absent in the Yorùbá tonal inventory, learners require focused instruction supported by perception-based training techniques. Activities such as tone discrimination exercises, tone identification tests, and guided listening tasks should precede production drills to help learners internalize the phonetic distinctions before attempting to carry out tone articulation. Through such pedagogically sequenced tasks, learners can gradually develop both auditory sensitivity and motor control necessary for accurate tone realization. Furthermore, the results suggest the importance of integrating gender-responsive pedagogical strategies into tone instruction, recognizing the differing learning patterns that may exist among male and female learners. Teachers should adopt teaching practices that address these learner-specific needs, ensuring that challenges faced by male learners who demonstrated lower tone-assignment accuracy are systematically addressed. In addition, comprehensive assessment techniques that evaluate both the perceptual and productive aspects of tone acquisition should be embedded into instructional practice. Such multidimensional assessment tools will allow instructors to obtain a more complete understanding of learners' tonal competence and provide targeted feedback that supports the development of accurate tone production.

Future studies should focus on larger and more heterogeneous sample sizes to further confirm the patterns in tone production according to gender that were found in the present study. An increased number of participants would make the findings more generalized and give a more rigorous statistical analysis. A longitudinal research design to follow the evolution of the Hausa tones mastery among learners throughout the time and provide information about the direction of the tone acquisition process and tone-related challenges could be employed in the subsequent research. Inclusion of the acoustic analyses in future studies would also give objective, measurable, and accurate contours of tones to serve as reference documents. Other studies should also be conducted on how the tone is acquired by Yorùbá-Hausa that are exposed to bilingual environments and different levels of proficiency. This kind of work would help to understand the use of language background and linguistic experience in promoting or inhibiting the acquisition of unfamiliar tonal patterns, including the Hausa falling tone. Theoretical studies that compare learners of other tone-language speakers in Nigeria, such as Igbo-Hausa bilinguals, would further expand the theoretical scope of cross-tone acquisition. Such comparative views would assist in determining whether the perceived difficulties are unique to Yorùbá-Hausa learners or are general trends among speakers of other languages.

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