

A Comparative Phonological Analysis of Varieties of English Spoken by
Native Speakers of Nigerian Languages (Hausa, Igbo, Kanuri and Yoruba) for
the Determination of Speakers' Origins

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Abstract

Some people believe the assumption that individuals' speech is indicative of their place of origin. This notion motivated border agencies of several developed nations to use language analysis in the asylum process to distinguish fake asylum seekers from genuine ones. However, several linguists raised concerns over the lack of reliability in the language analysis. This concern motivated a debate over the required qualifications to conduct the analysis.

This study aims to provide empirically-based research contribution to the debate over the supervised native speaker approach versus the expert linguist-only approach in language analysis for the determination of speakers' origins.

The study comprises two phases: (i) provision of segmental description of four Nigerian English accents (Hausa, Igbo, Kanuri & Yoruba) (ii) accent classification experiments to assess the relative performance of four methods in classifying four Nigerian English accents. A corpus of the four Nigerian English accents was collected from 60 respondents, each accent represented by 15 respondents. The corpus was analysed impressionistically with some acoustic corroboration. The accent classification task involved 118 participants drawn from three human groups—80 Nigerian non-linguists (each L1 group represented by 20 respondents), 25 Nigerian linguists (6 Hausa, 9 Igbo, 5 Kanuri & 5 Yoruba), 13 UK-based phoneticians and an automatic accent recognition system, Y-ACCDIST.

The findings reveal that each of the four methods shows potential in accent recognition. However, overall results indicate that native speakers, regardless of linguistic background, were significantly more accurate in identifying speakers of their accent groups. The findings also reveal that the UK-based phoneticians and Y-ACCDIST were the most accurate in identifying Yoruba-English. Given that Yoruba-English speakers have stereotypes such as [h]-elision and [h]-epenthesis in their speech, it can be speculated that language analysis conducted by non-native speaker linguists can be more reliable if a language variety in question has some stereotypes.

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List of Abbreviations

Abbreviation	Explanation
NNSL	Nigerian non-linguists
NLS	Nigerian linguists
UKPHS	UK-based phoneticians
Hausa NNLS	Hausa non-linguists
Igbo NNLS	Igbo non-linguists
Igbo NLS	Igbo linguists
Kanuri NNLS	Kanuri non-linguists
Kanuri NLS	Kanuri linguists
Yoruba NNLS	Yoruba non-linguists
Yoruba NLS	Yoruba linguists
Y-ACCDIST table	York accent characterisation by comparison of distance in inter segment similarity table
NWS	North Wind and the Sun
PD	Picture description
RB	Rainbow passage
WL	Word list

Declaration

This is to declare that the contents of this PhD thesis have been originally produced by me. This work was never previously presented for a degree award at any university. All other sources that are not part of the original work have properly been acknowledged as references. A limited part of the work has been published in conference proceedings, and two other parts were presented as posters at two international conferences.

The second phase of the research four involved experiments: three human-based experiments and an automatic accent recognition system (Y-ACCDIST designed by Brown, 2014)). These experiments concerned classifying Nigerian English accents. The researcher took full responsibility for running the three human experiments by inviting, meeting, and recruiting the human listener participants.

However, Dr Georgina Brown took the responsibility of processing 60 selected speech samples from four accents of Nigerian English for training and classifying them in the automatic accent recognition system, Y-ACCDIST. The extracted results of the Y-ACCDIST classification were forwarded to the researcher for further analysis. Therefore, the researcher is responsible for the analysis, discussion and comparison of the Y-ACCDIST results with the human listener classification results.

Some contents of Chapter 4 have been published in the paper below, where I was the sole author

Muhammad-Gombe, U. (2020). A comparative analysis of standard Nigerian English spoken by L1 Hausa and Kanuri speakers. Proceedings of PARLAY: York papers in linguistics, York, UK, 20-27.

Elements of the findings are found in the following two posters:

- (1) Muhammad-Gombe, U., French, P., & Chodroff, E. (2021, February 4-5). *A comparative analysis of Nigerian linguist native speakers and untrained native speakers categorising four accents of Nigerian English*. Poster presented at the XVII AISV Conference of Speaker individuality in phonetics and speech sciences: Speech Technology and Forensic Applications, Zurich, Switzerland.
- (2) Muhammad-Gombe, U., French, P., Chodroff, E., & Brown, G. (2021, August 22-25). *A comparative analysis of Nigerian linguist native speakers and untrained native speakers, UK phoneticians and Y-ACCDIST (automatic accent recognition system) categorising four accents of Nigerian English*. Poster presented at the 29th Conference of International Association for Forensic Phonetics and Acoustics (IAFPA) 22-25 August 2021, Phillips-University, Marburg, Germany.

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Chapter 1

1.1 Introduction

This chapter provides the general background to the thesis. It is concerned with a brief account of the motivation of the study, a brief account of reasons for the linguistic scholars' debate on language analysis for the determination of speakers' origin (LADO), the rationale behind splitting the thesis into two phases. The chapter also involves a brief account of the emergence of forensic phonetics discipline and the subsequent emergence of its branch, LADO, as a result of the increasing rate of false asylum claimants in developed nations. It also provides the aim and objectives of the study and the thesis outline with brief information about twelve chapters of the thesis. In addition, it contains the reasons for the growing reliance of immigration authorities on LADO in asylum processes and the suitability of using second languages such as L2 English and L2 French in analysing languages of asylum seekers claiming to come from multilingual countries such as Nigeria. The last section of the chapter delves into the availability of reliable means for verifying claims or region of origin or socialisation and the political situation in Nigeria.

The motivation for this research is to assist personnel in language analysis for the determination of origin (LADO) or language analysis in the asylum process (LAAP) with the selection of methodologies for language analysis and provide an up-to-date segmental phonetic and phonological description of four varieties of Nigerian English according to speakers' L1: Hausa, Kanuri, Igbo and Yoruba.

The project comprises two phases. The first phase concerns establishing an up-to-date description of four accents of Nigerian English. The first three accents of English—Hausa, Igbo and Yoruba—have been studied by a number of scholars, while the fourth accent, Kanuri-English, has not been extensively published. The second phase concerns the main focus of the project, investigating accent identification performance between two major methods: manual human identification and automatic (machine) identification. Among the manual methods, the project additionally investigates three distinct groups that differ in exposure and training with respect to these accents. Overall, the following four groups are then compared: Nigerian linguists, Nigerian non-linguists, UK-based phoneticians and Y-ACCDIST, an automatic accent recognition system, (Brown, 2014). Within the Nigerian populations, the dissertation also provides an analysis of the effect of L1 on performance with the L1-accented English. The first phase of the dissertation provides the background on phonetic variation in Nigerian English to set up the second phase of the dissertation. For further detail regarding the description of Nigerian English, the reader is referred to more comprehensive analyses in Jibril

(1982) and Sogunro (2012). Those studies were carried out solely on sociophonetic or phonological analysis of variation in the accents of Nigerian English.

The second phase and primary focus of the project accomplishes the following goals:

These aims build on previous Language Analysis for the Determination of Origin/Language Analysis in the Asylum Process (LADO/LAAP), but extends previous work in the following dimensions.

- Testing the ability/performance of native speaker linguists in distinguishing fellow speakers of their accent from other speakers of L2.
- Testing the ability of native speaker linguists in distinguishing L2 speakers not just from nationality differences (as in the case of Wilson's 2009 work) but from their L1 differences.

The project extends previous work of Wilson (2009) by framing matrices of segmental features of four Nigerian English accents using the most current corpus of the English varieties. Wilson's matrices of Ghanaian English features were based on some published descriptions of the. These previous methods are described in further detail in the following paragraphs below.

A founding work in LADO/LAAP (Wilson, 2009) tested the abilities of untrained native speakers of Ghanaian English in distinguishing stimuli spoken by fellow speakers of their Ghanaian English from Nigerian English foils. In addition to native speakers of Ghanaian English, three other groups of participants: academic/postgraduate linguists, undergraduates of linguistics and LADO personnel were also involved in Wilson's study. While native speakers of Ghanaian English were asked to use their native intuition in doing the classification task, the three aforementioned non-native speakers of Ghanaian English were provided with a working material containing features of Ghanaian English in advance of the task.

To replicate this procedure employed by Wilson, there was a need to provide non-native speakers of Nigerian English with a similar working material. Considering the reality of language dynamism where languages and their varieties are prone to changes and modification with time, it may not be ideal to rely on the past literature of Nigerian English varieties for forming matrices of segmental features of such varieties. This, therefore, motivated the first phase of the research by embarking on fieldwork in four Nigerian regions (of the four languages in question) to collect a fresh corpus that can reliably represent the current trends in the four accents.

Aim and Objectives of the study:

The overall aim of the research is to provide an up-to-date segmental phonetic and phonological descriptions of the four accents of Nigerian English and to test and assess four different methods (3 human versus Y-ACCDIST) of language analysis for the determination of speakers' origins,

with a view of providing empirical basis for a reliable method or combination of methods. To achieve this, the overall aim is broken down into the following objectives.

- (1) Record speech samples of speakers of the four Nigerian English accents with a view of providing an up-to-date segmental phonetic and phonological description of such accents
- (2) Compare the current descriptions of the four accents to determine their similarities and differences
- (3) Compare the current descriptions of three of the four Nigerian English accents with past descriptions made by scholars such as Jibril (1982), Jowitt (1991) and Sogunro (2012)
- (4) Extract matrices of distinguishing features of the four accents (from descriptions of the accents) for human participants' access before taking part in the survey
- (5) Assess the performance of each of the four methods in classifying the accents of Nigerian English
- (6) Compare the performance of the four methods to determine which method and at which accent performs best.

1.2 Background

Various reasons exist why an individual may flee their home country to enter Europe, Australia, Canada, New Zealand and the UK. Most of the individuals claim to have fled their countries for the safety of their lives from the danger of crises such as war and persecution by governments of their countries. While some migrants have genuinely been affected by crisis or faced persecutions, others are considered economic migrants falsely claiming to have fled their countries to protect themselves from danger (Eades, 2009). The economic migrants usually come from a safe place and did not face any threat but decided to migrate to Europe to improve their livelihood (Eades, 2005). Many people from several linguistic backgrounds seek asylum in developed countries (Patrick, 2010 in Fraser, 2012). In many cases, economic migrants falsely claim an origin of a neighbouring region or country engulfed by civil war and other political or religious crises (Eades & Arends, 2004).

The United Nations General Assembly held in 1951 recognised the right of some people fleeing their countries (on the ground of well-founded fear of being persecuted for various reasons) to seek asylum (Patrick, 2019). Under the United Nations cover, many people suspected to be economic migrants from African and other nations falsely claimed the origins of African countries engulfed by civil war.

Several signatory countries of the 1951 United Nations' Geneva Convention are taking steps to ensure that asylum seekers are not making false claims about their national origin to qualify for refugee status (Eades and Arends, 2004, p. 180). As Hunter et al. cited in Fraser (2012, 2016) stated, the unfounded reasons for seeking residency might be personal advantage or terrorist intentions.

Cambier-Langeveld (2010a) reports that some false claimants had been confidently identified when some asylum seekers accepted to reveal their true origin (on the grounds of the Dutch Government's decision to grant them unconditional asylum regardless of whether they were genuine or false claimants). Similarly, the Australian Government suspected that most of the immigrants (from 1999-2002) from Asian countries to Australia were falsely claiming Afghanistani origin, rather than their true Pakistani origin (Eades, 2009), due to cross-border use of the Hazargi dialect of Dari (spoken in Afghanistan, Pakistan and Iran). It is this fact of economic migrants that necessitated exploring methods of distinguishing them from genuine migrants (see Chapter 5 for further details). Consequently, Language Analysis for the Determination of Origin/Language Analysis in the Asylum Process (LADO/LAAP) in the asylum-seeking application procedure was started to detect false claims made by economic migrants (see below for details).

Before the emergence of LADO as a branch of forensic linguistics, the application of phonetics to forensic matters was started in the early 1960s. This application was initially motivated for assisting courts in handling criminal cases. Lawyers and police officers sought the help of phoneticians for investigation and prosecution in the 1960s (French, 1994). This means the early forensic phonetics application specifically concerns speaker or voice identification but not accent identification in general. However, the work was further extended to the following:

- (1) Determination of unclear utterances (see French, 1990 for details)
- (2) Evaluation of speaker recognition given by lay witness (see Solan & Tiersma, 2003 for details)
- (3) Authenticity examinations of audio-recordings (see Koenig & Lacey, 2012; 2009 for details)
- (4) Speaker profiling (see POST, 2015; Watt, 2010; Jessen, 2008; Baugh, 2002 for details)

LAAP is a process of verifying the authenticity of a recording/speech concerning whether an asylum seeker truly speaks a speech variety, or he is faking a speech form of a particular place, region, or nation to impose the impression of originating/socialising from such a place (Eades, 2009). The motivation for LAAP is to discover whether or not the speech of an asylum seeker represents the region or country of origin claimed, and such a language analysis is carried out when such claims are considered doubtful (Wilson, 2016). The migrants into Europe initially are considered asylum seekers unless and until the immigration authorities of the new country approve their application for refugee status (Eades & Arends, 2004).

While genuine asylum seekers are highly likely to lose their identification documents owing to the destruction of their homes and unplanned migration, economic migrants are often suspected to deliberately dispose of their identification documents to conceal their true origin (Cambier-Langeveld, 2010). As reported by Cambier-Langeveld (2016), some people from Nigeria claimed the origins of

countries such as Liberia, Sierra Leone and South Sudan based on the types of asylum policies in the target countries.

In 1993, another branch of forensic linguistics called 'language analysis for the determination of origin, (LADO) emerged'. Linguistic analysis, as noted by Foulkes, French and Wilson (2019, p. 100), is used to "determine the authenticity of a claimed origin or provide an opinion about a subject's likely origin". Language analysis was first started in Sweden in 1993 by the Swedish Migration Board (Reath, 2004); Patrick, 2019). It is also used for verifying the authenticity of the asylum seekers' claimed origins through a detailed analysis of their language use (Cambier-Langeveld, 2016). This verification purpose resulted in a proposal of another related acronym LAAP (language analysis in the asylum procedures). The possible outcome of any conducted LAAP might be one of the following:

- (1) Confirmation of the claim made by an asylum seeker
- (2) Rejecting the claim directly due to failure to originate from the claimed speech community
- (3) Indirect rejection due to falling into a different speech community other than the claimed one (Cambier- Langeveld, 2016).

There are five firms, comprising both government-based and private ones that conduct language analysis for the determination of origin: De Taalstudio (Netherlands-private), IND (Netherlands-public), Lingua (Switzerland-public), Sprakab (Sweden-private) and Verified (Sweden-private).

Three surveys on language analysis identified five European countries where LADO is carried out: Belgium, Germany, Netherlands, Sweden and Switzerland. In addition, 10 other countries contract some of the language analysis firms that operate in the above five counties to conduct language analysis for them (Cambier-Langeveld, 2010a).

Turkey will soon begin to use language analysis for the determination of migrants' origin. In line with this plan, the Turkish Government has signed a deal with the European Union Commission (through the department for International Corporation and development) for enhancing Turkish-Europe border security to control massive migration through Turkey (Verified, 2018).

1.3 Issues in LADO/LAAP

1.3.1 Growing reliance on LADO/LAAP by border agencies around the world

Language analysis is not the only method of determining asylum seekers' origins and verifying claimed origins. Other types of evidence are also considered when deciding on the status of asylum applications. However, language analysis is officially accepted by many European nations, Australia and the UK. Some countries have established their independent language analysis agency by recruiting analysts even permanently.

Linguists have raised numerous concerns regarding the danger in some language analyses (see Chapter 5 for details). Despite such concerns, countries using LADO/LAAP have never excluded

LADO/LAAP in their asylum procedure. The use of LADO/LAAP continues even if decisions, whether to approve or reject the applications of asylum seekers, may not be based on a language analysis report. The countries that chose to contract private firms for analyses terminate their contracts when they identify a lack of professionalism, but they never stopped using LADO/LAAP altogether. For example, in 2014, the UK Home Office replaced Sprakab with Verified AB as its leading language analysis supplier. Sprakab was accused of recruiting questionable analysts such as drug smuggling convicts (Home Office, 2021).

1.3.2 Availability of reliable means for verifying claims of origin

Currently, LADO/LAAP is under-researched. Linguists are concerned with the reliability of methods of language analysis for the determination of origin. They unanimously, therefore, called for empirical research to determine a reliable method or combination of methods of language analysis (Eades et al., 2003). Regardless of the methodology applied in carrying out any analysis, linguists interested in LADO have resolved that any potential language analyst needs to secure practical skills for the analysis. The linguists unanimously believe that expertise in linguistics does not automatically qualify one to conduct a reliable analysis of spoken language (Cambier-Langeveld, 2010; Wilson, 2009; Foulkes, French and Wilson, 2019). They argue that testing and training language analysts are required to ensure the right selection of potential analysts that can reliably analyse asylum seekers' speech.

LADO/LAAP is either conducted in asylum seekers' L1s or a language other than their L1. The choice of using an L1 or an L2 of the asylum seekers in conducting language analysis is determined by the linguistic situation in the claimed country or region of socialisation. It is feasible to use L1 Arabic for monolingual or bilingual nations such as Syria, Egypt, Yemen and Iraq. The job of an analyst, in this case, might be to differentiate the variety of Arabic spoken by the asylum seeker concerned from other varieties within the claimed country or other countries. However, it may not be easy to use L1s for language analysis that concerns multilingual countries with a very complex linguistic structure. It is difficult to form a clear linguistic boundary among the several languages that co-exist in the same region. Nigeria is one of such multilingual countries with extreme linguistic complexities. In some states, including Germany, language analysis interviews are conducted in L2 English or L2 French, while countries such as Australia and the UK conduct interviews in the L1s of asylum seekers (Eades and Arends, 2004). The use of L2 in LADO/LAAP is further supported in the following paragraph.

1.3.3 The need to identify the L2 English accents in forensic recordings

One of the strategies embraced by the economic asylum seekers is to intentionally conceal their L1s to hide their original place of origin, place of socialisation or refuse to demonstrate their L1 linguistic competence/repertoire. When, for instance, an Igbo man originating from Nigeria, is falsely

seeking asylum in Germany, his firm belief is to hide his Igbo linguistic competence since the Igbo region in Nigeria is not in any political or other situations that meet the United Nations' condition for gaining asylum in other countries. Thus, such an Igbo man is already aware well in advance that his is not qualified to seek asylum even if he succeeds in crossing the border into the target country. This notion allows him to look for a false L1, usually an L1 from a country engulfed by religious or political crisis (e.g., the 1990s Civil War in Liberia). Such asylum seekers attempt to adopt and/or falsely speak another L1 to pave a way to obtain a refugee status. This attempt is usually made by those who genuinely come from multilingual nations, where L2 such as English and French are, by default, spoken as lingua franca. Given this circumstance and the awareness of possible differences of the spoken L2 in accordance with the speakers' ethnic or L1 differences, some government and private language agencies such as IND in the Netherlands and other agencies in Germany are forced to conduct language analysis using L2 English or L2 French, where applicable.

Second language learning research revealed the influence of learners' first languages in their L2 learning. There are several undocumented languages around the world, while other languages were partially described/documentated. Simo Bobda et al. (1999) argued that it is possible to reliably identify the regional, national or continental backgrounds of African English speakers from their L2 English. The identification clues mainly occur in the sound systems of the African L2 English speakers, and the sound systems are mainly influenced by the phonological systems of the speakers' native languages. Other aspects of varieties of L2 African English can also make the identification more reliable. Simo Bobda et al. (1999) argued that studies of varieties of English spoken in British and American colonies contained reliable clues that reveal the regional, national and continental origin of their speakers (of L2 English in such countries).

1.4 Political and linguistic situation in Nigeria

Nigeria is a product of 1914's amalgamation of northern and southern protectorates of Britain (before Nigeria's independence in 1960). Because of British colonialism and a lack of a common indigenous language used by most Nigerians, English has served as Nigeria's official language (Egbokhare, 2004). Standard Nigerian English is also used in government departments and other public institutions. On the other hand, Nigerian Pidgin English is used in unofficial domains in several cities, towns, markets and other social gatherings. Nigerian Pidgin has more than 40 million speakers, while two million (people of Niger-Delta of southern Nigeria) of this number speak it as their L1 (Faraclas 1996 cited in Egbokhare, 2004). The linguistic diversity of Nigeria is very complex compared to other African nations. As a multilingual country with over 400 languages, it is hard to have a complete description of each of the Nigerian languages in one comprehensive source. Some linguists have

worked on Nigerian English varieties, but the majority of the works centred on one or two varieties of Nigerian English (Igboanusi, 2006; Simo Bobda, 2007).

In the following sections, I discuss the current situation regarding migration from Nigeria and some of the dominant reasons for this migration. Then I discuss the linguistic situation of Nigeria in further detail and how this relates to LADO and LAAP for Nigerian migrants.

1.4.1 The status of Nigerian migration and its relation to Nigerian political situation

In the past several years, various countries in the EU and some developing African countries such as Libya and South Africa have had to depart native Nigerian individuals. In 2017, there were about 1,200 Nigerians seeking asylum in Germany alone and half of this number were seeking asylum in Switzerland (Oyebade, 2017). According to Uchekuku (2021), about eighteen thousand Nigerians applied asylum in the year 2020 alone. Of this total figure, France, Germany, Italy and the United States had the highest figures ranging from 2,114 to 4,001 asylum seekers, while only 3,678 of the total asylum applications were successful. In the UK, Nigeria is one of the top ten nations with cases of asylum and non-asylum-related enforced returns, voluntary returns and those refused entry at a port that led to their subsequent deportation in the most recent period (Home Office, 2021). The migrants are detained by the UK authorities in a detention estate for some time. Some of the migrants who might be economic migrants cannot withstand the hardship in the detention centres. As a result, they give up their asylum-seeking attempt and voluntarily request deportation. On the other hand, others will resist all challenging processes including hiring lawyers. They only accept enforced return if both their first asylum applications and appeals are rejected. In March 2021, 24 Nigerian asylum seekers were reported to have voluntarily accepted to return to Nigeria from the UK, while another group of four Nigerians were forcefully returned in the following year, March 2021 (UNHCR, UK, 2021).

The most common basis for seeking asylum by Nigerians in recent years is sexual orientation; however, the Nigerian government also currently faces a terrorist insurgency in its Northeast region. The UK Home Office reported that both male and female Nigerians claim asylum based on their sexual orientations. The majority of such claimants are being refused asylum by the UK Government (Bowcott, 2018).

The insurgency in Nigeria started in 2009 after the emergence of the religious group (Boko-Haram). As a result of the terrorist activities, thousands have died, and some millions have been internally displaced. The Borno State of the Northeast is considered the centre of the Boko-Haram where terrorist activities take place. The state neighbours three nations: Cameroon, Chad and Niger. A significant amount of the displaced people has found it easier to cross the border into one of these three neighbouring countries. Most of these people have now become refugees. As of November 2021, there are 324,553 Nigerian refugees in Cameroon, Chad and Niger (UNHCR, UK, 2021). Given

the unfortunate development, economic migrants from Nigeria have started exploiting this situation and claimed to have come from Borno or parts of Yobe State. According to Dabiri-Erewa, the Senior Special Assistant on Diaspora and Foreign Affairs to Nigerian President, some Nigerians (from East and West regions of Nigeria) seeking asylum in Germany claimed fleeing Boko-Haram terrorism (Campbell, 2018).

One primary key to verifying this claim, however, is that the dominant language in these affected regions is Kanuri, which within the whole country is a minority language. This point brings us to the next background section, in which the linguistic situation in Nigeria is discussed.

1.4.2 Linguistic situation in Nigeria: linguistic diversity and language policy in Nigeria

Three of the Nigerian indigenous languages (Hausa, Igbo and Yoruba) are considered the major languages of the country, and they were regarded as national languages by two versions of the Nigerian constitution (1979 and 1999). Each of these major languages had served as a lingua franca during the regional system of government before Nigeria's independence. Hausa was a major language widely spoken side-by-side with English in northern Nigerian official domains. Similarly, Igbo and Yoruba enjoyed the same role as major and official languages in Eastern and Western Nigeria. However, the abolition of the regional system and subsequent creation of more states along the ethnolinguistic lines provided a chance for both Nigerian English and Nigerian Pidgin to further flourish and acquire more speakers at the expense of these three major languages.

Similarly, the status of the three major Nigerian languages as national languages, as recognised by the Nigerian Federal Government, became unrealistic after creating more states, as stated above. On the other hand, the three major languages (by the then regional governments) lost their official status, as the new states (especially in the eastern and northern regions; see the map in the linguistic situation in Nigeria section of Chapter 2) started to develop and uplift the status of other minority languages that dominate the states as a mark of identity (Egbokhare, 2004). Consequently, several minority languages became dominant languages in various states. The development of languages such as Kanuri, Igala and Nufe was immediately started by their respective state governments.

Both Nigerian Standard English and Nigerian Pidgin have increasingly attracted the attention of more speakers due to Nigerians' strong loyalty to their native languages and ethnic groups. Most Nigerians alternatively prepare to speak Nigerian Pidgin or Nigerian Standard English to the detriment of other indigenous languages. Consequently, Nigerian Pidgin has taken over the lingua franca status, and both Nigerian English and Nigerian Pidgin have continued to acquire more L1 speakers (Egbokhare, 2004). Despite the official function of English, a significant number of Nigerians, especially in the northern region, do not speak it at all (Adegbite, 2004). These Nigerians are bilingual or

multilingual speakers of Nigerian indigenous languages, but could not learn English due to failure to attend formal schools for that purpose. It is common to hear Nigerian Pidgin in most of the southern cities and towns as well as Nigeria's capital, Abuja, while it is rarely spoken on the streets of northern states except for north-central states.

Despite numerous publications on features of Nigerian English, a well-codified standard Nigerian English that can serve as a reference work on the acceptable characteristics of the variety is still lacking (Adegbite, 2004). Adegbite (2004) suggested splitting the official status of English in Nigeria into two: primary and secondary. The language serves as the primary official language on a national level (at federal government institutions and houses of national assembly). It also serves as the secondary official language at the states' Houses of Assembly and other institutions, where indigenous languages hold the primary official status. English is the primary official language in multilingual states of three Nigerian regions: Middle-belt, South East and South-South, while it is the secondary official language in monolingual states of the other three regions: North-west, North-East and South-west (Adegbite, 2004).

Although Kanuri is not among the three major Nigerian languages, the current political situation and presence of terrorist activity in the Borno region justifies comparing the Kanuri-English accent against the other three accents of Nigerian English in this research. Thus, it is invaluable to document the Kanuri-English variety alongside the other three given the potential need in LADO/LAAP. The aim of this project is not just to help border agencies distinguish false claimants from genuine ones, but it is also aimed at ensuring that genuine asylum seekers are not denied their right of attaining the refugee status, as recognised by the United Nations.

Thesis Outline

The thesis comprises 12 chapters and brief information about each of these chapters is given below.

Chapter 2 firstly, provides an overview of the geographical and demographic distribution of Hausa, Igbo, Kanuri and Yoruba in Nigeria. It also comprises a brief account of the linguistic situation in Nigeria and the phonological accounts of the four Nigerian languages: Hausa, Igbo, Kanuri and Yoruba. It also provides up-to-date- segmental phonological descriptions of the English varieties spoken by native speakers of Hausa, Igbo, Kanuri and Yoruba. Such descriptions are based on the realisations of the English consonants and vowels as well as phonetic processes.

Chapter 3 is an account of the fieldwork that took place in four regions of Nigeria. It provides detailed information about the meeting, recruiting and recording the four accents of Nigerian English spoken by the participants in four universities and cities of the four Nigerian regions—North-East, North-West, South-East and South-West.

Chapter 4 describes the four Nigerian English accents based on the analysis of segmental features found in the recently collected corpus of this study. The current findings are discussed in comparison with a number of past findings.

Chapter 5 is a literature review concerning the LADO debate between proponents of the expert linguist approach and the supervised native speaker approach for language analysis for the determination of speakers' origins. It provides a brief introduction to the field, countries using it and methods of conducting language analysis. The main contribution of this chapter is compiling several views of linguists who recognise the involvement of an expert linguist only in language analysis and other linguists who recognise the significant relevance of non-linguist native speakers in analysing the speech of a fellow member of their L1.

Chapter 6 is an account of the classification fieldwork for recording English spoken by native speakers of the four Nigerian languages in the four Nigerian regions.

Chapter 7 presents the performance of Nigerian non-linguists in classifying the four accents of Nigerian English. The overall performance of the four sub-groups of the Nigerian non-linguists is further divided based on identifying a fellow speaker that shares the same accent group with listeners and classifying speakers of other accent groups.

Chapter 8 presents the performance of Nigerian linguists, as in the case of the Nigerian non-linguists stated above.

Chapter 9 presents the performance of the UK phoneticians in classifying the four accents of Nigerian English. Unlike the two Nigerian listener groups above, this group is not further split based on the native languages of listeners, as all UK phonetician participants belong to British English. Their performance is further divided based on whether a participant is a forensic or non-forensic phonetician.

Chapter 10 presents the performance of an automatic accent recognition system (Y-ACCDIST-Correlation, developed by Brown, 2014) in classifying the four accents of Nigerian English. Y-ACCDIST-Correlation was used due to the limitation of the sample size (60 samples, 15 from each of the accents). As Y-ACCDIST also does not belong to any of the 4 Nigerian L1s above, it has a unique procedure compared to the three human methods above. Only Y-ACCDIST's overall accuracy and accuracies of classifying each of the four Nigerian English accents are presented.

Chapter 11 compares the relative performance of the four methods that are separately presented in the previous four chapters. The chapter also compares the performance of the four methods in identifying each of the 18 samples. It also provides the accuracy rates of each of the four stimuli of the four accents. In addition, it compares the errors of confusing the accents, as some

misidentified speech samples were not confused with the same accent by different methods. Finally, speculations on correlations between accuracy and density of cues in the speech samples are made.

Chapter 12 discusses the findings of both phases of the study overall, draws a conclusion and a set of recommendations for consideration by border agencies and governmental bodies intending to employ personnel in LADO/LAAP casework. It also includes suggestions for future research developments in the field.

In the remainder of this chapter, I provide the background to the research questions. This chapter is organised in the following fashion: I first present a high-level overview to the need for LADO and LAAP techniques, along with how are they generally implemented. I then highlight relevant issues with LADO/LAAP. Finally, I provide some background to the political and linguistic situation in Nigeria and the particular issues individuals from this country face in the LADO/LAAP processes.

Having introduced the thesis, the next chapter concerns geographical, linguistic and phonological accounts of the four Nigerian languages.

Chapter 2

Geographic and Linguistic Situation in Nigeria and Phonological Accounts of Nigerian Native Languages (Hausa, Igbo, Kanuri & Yoruba)

2.0 Introduction

This chapter has two broad sections. The first section presents a brief account of the linguistic and sociolinguistic situation in Nigeria (regarding the speakers, location and linguistic status of the Hausa, Igbo, Kanuri, Yoruba languages). The second section provides phonological accounts of the four languages in comparison with English, and discusses consonants, vowels and phonological processes of the four languages.

2.1 Sociolinguistic situation in Nigeria

Nigeria, as one unified nation, was formed as a result of the amalgamation of southern and northern protectorates of the British colony in 1914. This was achieved during the administration of the then Nigerian Governor, Lord Frederick Lugard (Simpson & Oyetade, 2008). Nigeria today is said to have over 400 languages. Speakers of Hausa, Igbo and Yoruba alone form about 30% of the country's population. According to recent estimates conducted by the National Population Commission and National Bureau of Statistics (2016), about 200 million people reside in the country. The complex linguistic nature of Nigeria resulted in the selection of English as its official language after independence in 1960 (Simpson & Oyetade 2008).

The Nigerian languages are chiefly found in the country's thirty-six states, while the three aforementioned major languages have more than twenty million speakers each. Another ten languages have speakers ranging from one to ten million. Hausa is said to be the most populous language in the country dominating the whole of Northern Nigeria. Out of the entire Nigerian population, Simpson & Oyetade (2008) provide the proportions of major Nigerian languages, as shown in Table 2.1, while Fig 2.1 below contains a map showing the location of the four languages, as well as other Nigerian languages.

Table 2.1: The four Nigerian languages and the proportion of their speakers' out of the population

No.	Language	Region	Percentage of speakers
1	Hausa	Northern Nigeria	29.5%
2	Igbo	South-eastern Nigeria	16.6%
3	Kanuri	North-eastern Nigeria	4.1%
4	Yoruba	South-western Nigeria	20.3%

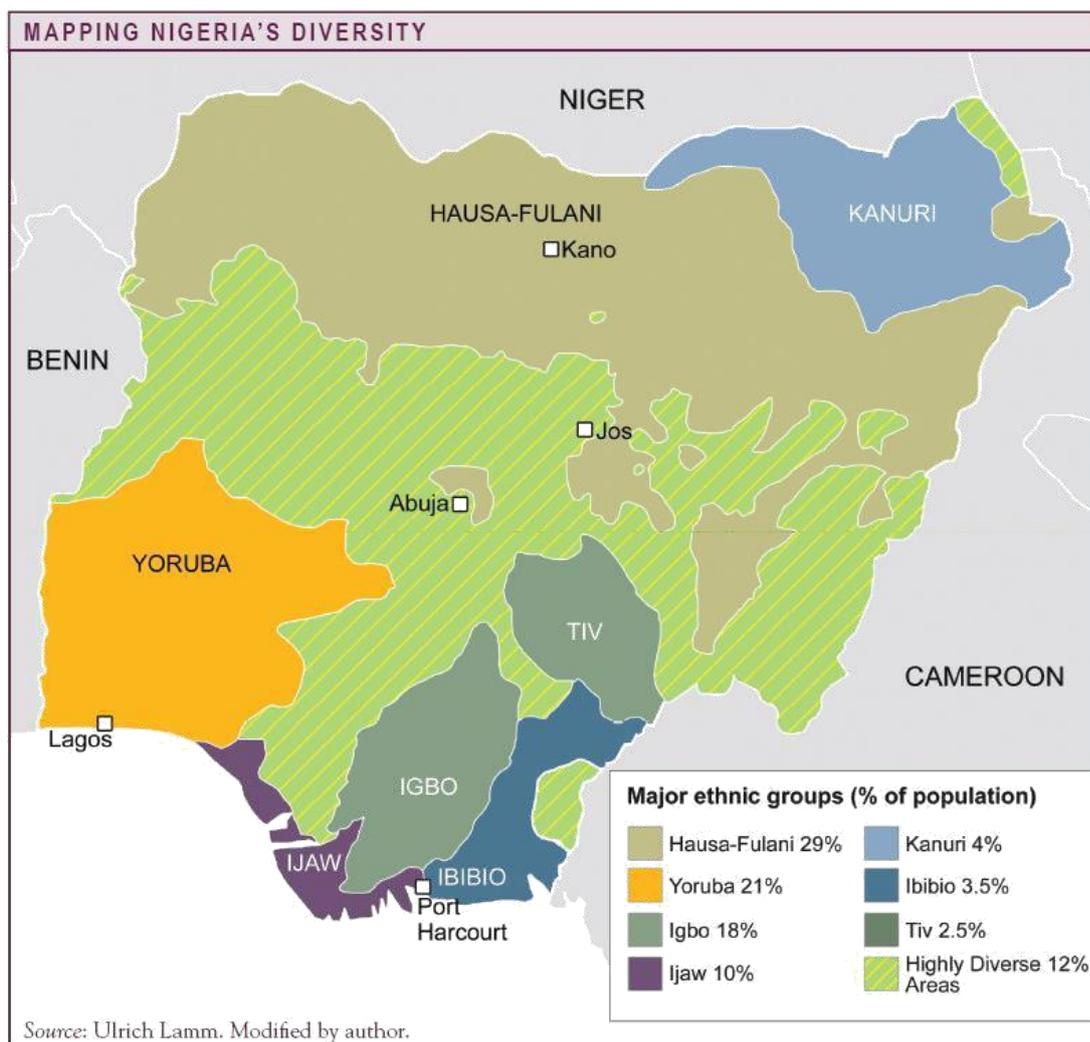


Figure 2.1: Nigeria map showing Nigerian regions and languages spoken in the regions
(Adapted from Went, 2014)

Nigerian Pidgin English

Nigerian Pidgin is a contact language that originated between sixteenth and nineteenth centuries, and its vocabulary is substantially derived from English with some common words such as dash, palaver and sabby originating from Portuguese, and it is extensively dependent on languages of Southern Nigeria. At the onset, Pidgin served as a means of communication for trade purposes between Nigerians living along the Nigerian coast and Englishmen (Jowitt, 1991).

Nigerian Pidgin is now getting native speakers in the south. Children of less educated parents learn Pidgin after acquiring their first languages and prior to learning Standard English at school. It is used by such children—especially those who do not share the same first languages—at both primary and secondary schools (Jowitt, 1991). It is not officially used in public domains but informally among people. Given that it is informally spoken by several people in the south, some states in the north

central region and Abuja, the Nigeria's capital city, it is now aired on media—both radio and television services as well as in advertisements.

Many Nigerians are fluently bilinguals, albeit this bilingualism is different in the two major Nigerian regions: the north and the south. While Hausa serves as the lingua franca in the north where most native speakers of minority languages speak it in addition to their native languages, Nigerian Pidgin plays a similar role in the south where several indigenous languages are spoken alongside Pidgin. While Nigerian Pidgin dominates the informal communications in the south, Hausa plays a similar role in the north. Many Nigerians in the north-eastern and north-western regions do not speak Nigerian Pidgin, including the researcher.

When the Europeans started penetrating into different regions of Nigeria for religious and political reasons, Pidgin continued to enjoy the status of being the important means of communication between Nigerians and the intruders. However, when the western-based educated Nigerian class emerged, the priority was transferred to Standard English, and this resulted in considering Pidgin as stigmatised form of English, albeit it continued to flourish and gain a lingua franca status especially in Southern Nigeria in spite of the stigmatisation. The lingua franca role is more or less observed among the less educated people in the south, albeit it is used even among the undergraduates at universities and the highly educated people in informal communications. Despite its diminishing role in formal setting, the number of its speakers is significant for some states to offer broadcasting services in it.

Standard Nigerian English

Standard English (a high variety of a language with functions that are generally formal, correct and it enjoys greater prestige over the low variety (Jowitt, 1991)) in Nigeria started to play a vital role in the nineteenth century at the time of massive arrival of missionaries, soldiers and Government officials sent by the British Government for colonisation. The presence of such people facilitated the replacement of Pidgin with Standard English which also imposed predominance and prestige for Standard English over Pidgin. This situation marked a clear division between Standard English and Pidgin, where the former serves as the language of the Government and the later serves as informal language used by the low-class people who were not usually working in Government. Consequently, the prestige attached to Standard English compelled Nigerians to emulate it in order to succeed in securing admission for studies and in obtaining posts in Government service.

The difference among varieties of languages could mainly be at the level of numerous branches of linguistics, but some differences are restricted to phonology (i.e., difference in spoken forms of languages). According to Jowitt (1991, p.38), the apparent parameter for determining Nigerian English varieties is the ethnic one where the varieties are distinguishable based on the

interference from native languages of their speakers (e.g., Hausa-English, Igbo-English or Yoruba-English), albeit much investigation has not been carried out on the ethnic varieties.

The question of which variety of Nigerian English is prestigious over the others is hardly determined by the differences along the ethnic line (as in the case of Hausa-English or Yoruba-English) but the level of educational attainment by Nigerians. It is worth noting that the stereotypes especially based on the L1 consonantal phonemic interference in Hausa-based English or Yoruba-based English is subjected to nothing but stigma. Thus, high class Nigerians always struggle to eliminate such stereotypes from their spoken English.

This level of education parameter is categorised by scholars such as Banjo (1996) into four different varieties. Variety 1 is placed at the primary school level which is full of L1 interferences from stereotypes of L1 phonology to syntax and semantic deviations. Variety 4, on the other hand, is highly refined with a lot of similarity with RP in phonology, syntax and semantics. Speakers of this variety are not simply identified with shibboleths from their L1s, as their L1 features are completely taken away or substantially reduced from their L2 English. Going by the early arrival of missionary activities and colonial masters in the south, English existed for a long time before taking the language to the north.

The early missionary school's establishment offered an advantage for southern people to dominate the public service and trading activities with Europe. Specifically, Yoruba people hugely benefited from the missionary education system which offered them the opportunity to have extensive number of English speakers that resulted in having the highest representation in the public service, including the Nigerian media and teaching jobs, though this does not denote any prestigious status for Yoruba-English accent over the other varieties. Although southerners generally dominate the national media, newscasters of the national media such as the Nigerian Television Authority (NTA), and the Federal Radio Corporation of Nigeria (FRCN) are expected to speak the Standard form of Nigerian English. So, it is hard to make a claim that any of the ethnic-based Nigerian English accent is considered prestigious over another in the media or any other official domains. Such prestigious status is usually emphasised in grammar and other aspects of language but not pronunciation.

However, Banjo (1996) argues that Hausa-English accent is more prestigious than Igbo-English or Yoruba-English. According to Banjo (1996), the English spoken in the north is considered as 'superior' to the English spoken in the south due to the following reasons: the influence of Hausa language and how English was taught and used in the north. Based on Dunstan's (1969) study, a comparative analysis of English and twelve Nigerian languages, Banjo observes that Hausa shares more phonemic features with English than Igbo and Yoruba languages. Also, Hausa has both tone and stress, while Igbo and Yoruba are tone-based only. This offered Hausa an advantage over the other varieties in the pronunciation. Hausa-English speakers have better command of idiomatic expression

than southern speakers for the following reasons. (1) There were few British-based schools in the first half of the twentieth century, and this made it possible to run them properly or more efficiently than in the south. (2) English was taught in northern schools by the native speakers when the teaching had already been taken over from southern Nigerian native teachers. This development discontinued the pupils' direct exposure to English native speakers. (3) Teachers in the north were able to give more attention to individual pupils due to smaller number of enrolments than in the south. Thus, northerners have had higher proficiency in the spoken English than southerners.

I, the researcher, natively speak Hausa and Kanuri, both spoken in the north. As someone from a mixed family background, I grew up speaking the two languages (Kanuri of my mother and Hausa adopted by my family). As I belong to a polygamous family with co-wives from different linguistic backgrounds, Hausa eventually became the general language of the family, while I learned English at school. However, based on people's observation, my English accent neither sounds Kanuri-based nor Hausa-based, as my linguistic expertise has influenced my spoken English. My English accent is modified, having studied BA in Linguistics/English and enrolled for MA in Applied Linguistics at the University of Bedfordshire. I did not explore via any formal testing whether this background might have influenced any of the recordings or speaker behaviour during the recording fieldwork in the Nigerian's four cities (Kano, Ibadan, Nsukka & Maiduguri).

Some brief background information of the four languages—Hausa, Igbo, Kanuri and Yoruba is given below.

2.1.1 Hausa

Hausa is predominantly spoken in most parts of northern Nigeria and plays a vital role as a lingua franca in the region. It is spoken in some parts of other West African states which include Niger Republic, Cameroon, Ghana and Chad. Minority tribes in the region use it as a link language to communicate in social activities. According to Newman (2000), it is spoken in the northern region of Nigeria and southern region of Niger Republic. Greenberg (1963) classifies the language as a member of the Chadic family of the Afro-Asiatic phylum of African languages. Hausa is also a tonal language with lexical and syntactic tonal aspects. It has a Subject-Verb-Object (SVO) word order (Newman, 2000). The language has more speakers than any other language in Sub-Saharan Africa. It has about thirty million native speakers in northern Nigeria (Newman, 1996). It plays other roles in official domains such as government, educational institutions, commerce (trade) as well as mass media stations such as Nigerian Television Authority (NTA), Federal Radio Corporation, states' own radio and television houses and international ones such as the British Broadcasting Corporation (BBC), Voice of America VOA, Radio Deutsche Welle and Radio Moscow (Jaggard, 2001; Newman, 1996). The Hausa

writing system, Ajami, was established two centuries prior to the arrival of British colonial rulers. Ajami uses the Arabic alphabet to represent Hausa words, structures and discourse (Bomgbose, 2001).

2.1.2 Igbo

Igbo is the third largest language in Nigeria and is spoken in south-eastern Nigeria, but with less linguistic dominance as a political language than Hausa or Yoruba. It is a member of the Niger-Congo phylum of African languages (Greenberg 1963). The language has dozens of dialects. These dialects were promoted due to the dispersed nature of the Igbo people who live in several towns, villages and cities which are separated by large bush (Ohadike, 1996). As reported by Ohadike, there were over 200 Igbo independent groups prior to the 20th century. Archaeological evidence revealed that the Igbo people have lived around the same region for over 2,000 years. Contrary to the other three groups, the Igbo people lack a centralised government or an organised political or administrative structure. Each of their towns and villages is independently ruled by its council of elders. Ikekeonwu (1986, cited in Clara 2013, p.579) reported five Igbo dialect groups: Niger Igbo, Inland Igbo, Northern or Wawa Igbo, Riverine Igbo and Inland-East Igbo. Iweadighi (2013) asserts that the origin of both the term Igbo and the Igbo people remain unknown, and it is a speculative and inconclusive topic of concern debated by several schools of thought and oral traditions.

2.1.3 Kanuri

According to Bulakarima & Shettima (2012), Kanuri is estimated to have over three million native speakers (representing 4.1% of the total Nigerian population) who are predominantly found in the north-eastern part of the country. The language comprises speakers from several ethnic groups which developed as a result of its geographical diversity and political influences (Bulakarima & Shettima, 2012). It has six major dialects: Yerwa, Bilma, Mowar, Suwurti and Manga. Alkali (1978) and Tijjani (1980) as cited by Bulakarima (2001), reported that Kanuri developed as a result of the emergence of the Magumi ethnic group as rulers of Kanem. The Magumi ethnic group started the process of unification and absorption of other small ethnic groups living in the region. The speakers of the Kanuri language currently live in the four countries surrounding the Lake Chad region; these include Cameroon, Chad, Niger and Nigeria. A large proportion of its speakers are found in Borno and Yobe States of the north-eastern region of Nigeria.

2.1.4 Yoruba

Yoruba is the second largest language spoken natively in South-Western Nigeria. The language belongs to the Niger-Congo phylum of African languages (Greenberg, 1963). The history of the Yoruba people reveals that they have lived for centuries in sub-groups rather than a unified common entity. At present, small Yoruba groups are found in other neighbouring countries such as Benin, Togo, Ghana,

Ivory-Coast and Senegal. About 20 million people speak the language as either their native language or an additional language (Ayeomoni, 2011). Ayeomoni reports 18 dialects of Yoruba: Oyo, Ijesa, Ekiti, Owo, Akure, Ondo, Ife, Igbomina, Ilorin, Yagba, Ibunu, Egba Ilaje, Ikale, Egun, Akoko, Owe (Benin Republic), Sabee (Togo) and Popo (Togo). Other scholars have reported different numbers of Yoruba dialects. According to Dingemans (2006), the varieties are further categorised into three major groups—NorthWest (Abeokuta, Ibadan, Oyo, Osun and Lagos areas), Central Yoruba (Igbonna, Ife, Ekiti, Akure, Efon and Ijesa areas) and South-East Yoruba (Okitipupa, Ondo, Owo, Sagamu and parts of Ijebu). Yoruba to some extent has been the lingua-franca in only some parts of Southern Nigeria, unlike Hausa in the north. This is due to the emergence of other competing languages such as Ijaw in the South-Southern sub-region and Nigerian Pidgin English. It is aired on the local media (both radio and televisions) in all the six states of the south-western region of Nigeria.

2.2 Description of Hausa, Igbo, Kanuri and Yoruba sound systems

This section concerns the phonological accounts of Hausa, Igbo, Kanuri and Yoruba languages. It specifically focuses on the segmental features (consonants & vowels) and the main phonological processes in the languages. In addition, it provides an overview of English spoken by the speakers of the four languages to establish any linguistic evidence of L1 interference from Hausa, Igbo, Kanuri and Yoruba systems. All examples in this section were drawn from published sources.

2.2.1 Description of Hausa Phonology

2.2.1.1 Hausa consonants

The number of Hausa consonants varies according to different scholars. Jibril (1982) reports 30 consonants. By contrast, Newman (1996) reports a different consonant phonemic inventory in which four additional consonants occur. These consonants are the alveolar ejective /t'/, palatalised labio-dental /fj/, apical tap or roll /r̄/ and glottalised approximant /hw/. Sani (2005), however, identified 31 consonants in Hausa, as shown in Table 2.2 below. While the most recent chart proposed by Sani (2005) classified the /r/ phoneme as trill/roll, it is classified as tap in the Hausa consonantal chart of Jibril (1982). Neither Jibril nor Newman reported the existence of the bilabial fricative /ɸ/ as an independent contrastive phoneme as evident in Sani's (2005) chart.

Table 2.2: Hausa consonantal chart Adapted from Sani (2005, p. 19)

	Bilabial	Palatalised Bilabial	Alveolar	Retroflex	Post-alveolar	Palatal	Velar	Labio-velar	Labialised velar	Palatalised velar	Glottal	Palatalised Glottal
Stop	b		t d				k g		k ^w g ^w	k ⁱ g ⁱ	ʔ	ʔ ⁱ
Implosive	ɓ			ɗ								
Ejective			s'				k'		k ^w	k ⁱ		
Nasal	m		n									
Fricative	ɸ	ɸ ⁱ	s z		ʃ						h	
Affricate					tʃ dʒ							
Lateral			l									
Trill/roll			r									
Flap			ɾ									
Approximant						j		w				

2.2.1.2 Hausa vowels

Hausa has twelve vowels which are composed of five short monophthongs, their five long counterparts as well as two diphthongs: /a, ɪ, o, u, e, a: ɪ:, o:, u:, e:, aɪ, au/ (Newman, 1996). In addition, Sani (2005) identified one more diphthong /ui/, bringing the number to thirteen.

2.2.1.3 Hausa tones

There are two level (high and low) tones in the language, as reported by Newman (2000). In addition, there is a falling tone which begins with a high tone and ends with a low tone, as shown in Table 2.3.

Table 2.3: Some examples of Hausa tones

raánà (HL tone) 'sun'	zaánà (HL tone) 'woven thatch'
jaârá (H-LH) 'infants'	jaârá (H-LH) 'waste'

2.2.1.4 Syllable structure in Hausa

Hausa has three distinct types of syllable: CV, CVV and CVC structures (Newman, 1996). This shows that Hausa syllables do not begin with a vowel. However, Newman reports permissible occurrence of syllabic nasal. The alveolar nasal /n/ may sometimes function as the only item forming a syllable. For example: nzoo (should I come?), ngulu (vulture). In the case of words beginning with vowels, such vowels are preceded by a glottal stop (articulated word or syllable-initially). For example: aure (marriage), ango (groom), amarya (bride). Thus, Hausa does not permit consonant clusters. All consonants are either preceded or followed by vowels (Newman, 1996).

2.2.1.5 Phonological processes in Hausa

There are various kinds of phonological processes in Hausa. But only the main ones are discussed here: assimilation (simple assimilation, voicing assimilation and nasal assimilation), labialisation, palatalisation, glottalisation, neutralisation, syllable-final labials and gemination.

Simple assimilation: This is a process whereby a sound becomes exactly like a neighbouring sound. For example: /bart̪i/ → [bat̪t̪i] (to sleep), /wanda/ → [wadda] (that), /motarsa/ → [motassa] (his car)

Voicing assimilation: This is a process whereby two consonants (fricative and stop) neighbouring each other share the same voicing feature. For example: /tʃasbi/ → [tʃazbi] (rosary), /kazka/ → [kaska] (tick 'insect')

Nasal assimilation: This is a process whereby a non-nasal consonant influences a neighbouring nasal sound to share the same place of articulation. The process only affects the place of articulation of the underlying /n/. For example: /tanbaya/ → [tambaja] (question), /gungu/ → [gungu] (gang), /runfa/ → [rumfa] (stall)

Labialisation: This is a process whereby velar sounds labialise when followed by a back vowel. This effect is usually seen when nouns and adjectives take a referential suffix -n, thereby turning the final syllable a closed one. For example: /bango/ → [bangwan] (wall-the wall), /dogo/ → [dogwajan] (tall-tall-plural)

Palatalisation: This is a process whereby alveolar and velar consonants palatalise when followed by either front vowel /i/ or /e/. For example: /kasase/ → [kasaʃe] (country-countries), /wake/ → [wakʲan] (beans-the beans), /bakake/ → [bakakʲan] (black-black plural)

Glottalisation: This is a process whereby a final open syllable of a word ending with a short vowel is accompanied by a glottal stop. However, the glottal stop disappears when the final syllable changes to have a long vowel in the same position. Exceptions of this process are: -o ending verbs, monosyllabic verbs, monosyllabic verbs and the first-person possessive pronouns. For example: /s'ani/ → [s'aniʔ] (elevator), /wanki/ → [wanʃkiʔ] (washing)

Neutralisation: This is a conditioned process in which two phonemes transform into another distinct phoneme.

(1) In partial reduplication, /k/ and /d/ neutralise to /r/ (Sani, 2005, p. 47), as in /hakahaka/ → [harhaka] (to dig repeatedly) or /katakada/ → [karkada] (to shake repeatedly).

(2) Phonemes /e/ and /o/ neutralise to /a/ in a closed syllable when followed by a referential suffix -n. For example: /dare/ → [daran] (night), /gado/ → [gadan] (bed)

(3) Phonemes /ai/ and /au/ neutralise to /a/ in a closed final syllable when followed by a referential suffix (n). For example: /taburmai/ → [taburman] (mat), /matʃizai/ → [matʃizan] (snakes), /bayanau/ → [bayan] (the adjective)

Syllable-final labials: This is a process whereby syllable-final labials weaken to /u/ in standard Hausa. For example: /sapka/ → [sauka] (get down), /abdu/ → [audu] (a proper name)

Gemination: This is a process whereby consonants in syllable coda position change to resemble the following consonants in reduplicative constructions from verbs or adjectives derived from nouns. For example: /ruferufe/ → [rurrufe] (to close repeatedly), /karfi/ → [kakkarfa] (strong-stronger)

2.2.2 Description of Igbo Phonology

2.2.2.1 Igbo consonants

Eme & Odiye (2008) assert that standard Igbo has 28 consonant phonemes, as Table 2.4 shows.

Table 2.4: Igbo Consonantal Chart (adapted from Eme & Odiye 2008, p. 28)

	Bilabial	Labio dental	alveolar	Post alveolar	Palatal	Velar	Labial Velar	Labialised-velar	glottal
Plosive	p b		t d			k g	kp gb	kw gw	
Nasal	m		n		ɲ	ŋ		ŋw	
Fricative		f v	s z	ʃ ʒ		ɣ			h
Affricate				tʃ dʒ					
Lateral			l						
Trill			r						
Approximant					j			w	

2.2.2.2 Igbo vowels

There are nine vowel phonemes in Igbo. Apart from the /a/ vowel, the other eight are equally divided into pharyngealised and non-pharyngealised sets (Mbah and Mbah, 2000). The root of the tongue retracts to approach the pharyngeal wall for the articulation of the pharyngealised vowels, while the tongue does not retract in the articulation of the other set. The pharyngealised vowels are: /ɛ, ɪ, ɔ, ʊ/, while the non-pharyngealised are: /e, i, o, u/.

2.2.2.3 Igbo tone system

Igbo is another African language that uses tone in distinguishing lexical items with the same segmental pronunciations. Three types of tone are evident in the language. These are: high, low and downstep tones (Eme and Uba, 2016). Igbo words always carry the following tone patterns: HH, HL, LL, LH or HS. The last letter 'S' stands for down step tone (a reduced high tone marked with a raised macron over the letter). For example:

Tone patterns	Examples
HH-	áká (hand) ísí (head)
HL-	úkà (worship) ákwà (cry)
LL-	àlà (land) òkè (share)
HS-	égō (money) élū (top)

2.2.2.4 Igbo syllable structure

Obimma (1998, cited in Eme & Uba 2016) asserts that Igbo syllabic structure does not possess closed syllables and consonant clusters. Thus, all syllables end in vowels and there is no evidence of two or more consonants coming together without an intervening vowel. Igbo also has a syllabic nasal as reported by Jibril (1982).

2.2.2.5 Phonological processes in Igbo

There are several phonological processes in Igbo, but the main ones discussed here are: labialisation, palatalisation, pharyngealisation, assimilation (progressive, regressive, coalescent), deletion and vowel harmony.

Labialisation: This is a process of superimposing lip rounding on the main place of articulation. It is evident in Igbo, as exemplified in Mbah & Mbah (2000): /àb^wá/ (two), /àg^wà/ (bean)

Palatalisation: This is also a process of superimposition of the palatal /j/ feature against the main place of articulation of certain phonemes. For example: /p^já/ (flog), /h^já/ (twist)

Assimilation: There are two types of assimilation in Igbo as reported by Mba & Mba (2000): progressive assimilation and regressive assimilation.

Progressive assimilation: This is a process whereby a preceding sound imposes its feature on the following sound. In Igbo, this usually takes place after deleting an intervening sound. For example: /egog^j/ → [egoi] (your money), /ɔbɔ/ → [ɔ] (it is) (adapted from Mbah & Mbah 2000). The vowel /ɪ/ in the pronoun g^j which is pharyngealised is now replaced by a non-pharyngealised one /i/ due to close contact with another pharyngealised vowel /o/ in the word ego (money).

Regressive assimilation: This is a process where a sound imposes its feature against a preceding sound. For example: /ólò élú/ → [ólē élú] (a building with multiple floors), /ódzízóbò/ → [ódzózóbò] (palm Kola nut)

Consonant elision: This is also a process of deleting a consonant in a rapid speech in Igbo. For example: /ádzòdzó/ → [áòdzó] (question), /ákpókó/ → [áókó] (leather)

Vowel harmony: This is a process whereby vowels are grouped into distinct sets and only members of the same group can occur within the same word. In Igbo, pharyngealised vowels will not occur with non-pharyngealised ones in the same word, for example, the following are non-pharyngealised vowels: /ógù/ (lot), /ézè/ (king), /ókó/ (itch).

2.2.3 Description of Kanuri phonology

2.2.3.1 Kanuri consonants

There are 18 contrastive consonant phonemes in Kanuri (Bulakarima & Shettima, 2012), as revealed in Table 2.5. In addition, a voiceless bilabial stop [p] and a voiceless postalveolar fricative [ʃ] exist as variants of the voiced bilabial stop /b/ and the voiceless alveolar fricative /s/.

Table 2.5: Kanuri Consonantal Chart (adapted from Bulakarima & Shettima, 2012)

	Bilabial	Labiodental	Dental	Alveolar alveolar	Palatal palatal	Velar	Pharyngeal	Glottal
Plosive	b [p]		t d			k g		ʔ
Affricate				tʃ dʒ				
Fricative		f	s z		[ʃ]		ħ	
Nasal	m		n			ŋ		
Lateral			l					
Trill			r					
Approximant	w				j			

2.2.3.2 Kanuri vowels

Kanuri has six vowels: /i, e, ə, a, u, o/, and all of them are short monophthongs. In addition, the /a/ vowel has one more variant [ʌ].

2.2.3.3 Kanuri tones

Kanuri is also a tone language. It possesses high and low underlying tones. Falling and rising tones are formed from these two underlying tones in Kanuri syllables. Mid-tone is also evident in rare cases (Bulakarima & Shettima, 2012), as exemplified in Table 2.6.

Table 2.6: Some examples of Kanuri tones

High tone	Low tone	Rising tone	Falling tone	Mid tone
Kóró 'donkey'	kòrò 'question'	kaǐwù 'coward'	fêr 'horse'	āmūsū 'cold'

2.2.3.4 Kanuri syllable structure

As observed by Bulakarima & Shettima (2012), Kanuri has two distinct kinds of syllable: CV and CVC. The language does not permit consonant clusters at all. Its words also do not begin with a vowel, but they can end with either a vowel or a consonant. Long vowels and diphthongs are not evident in the language. Any word beginning with a vowel is realised with an initial glottal stop

(Bulakarima & Shettima, 2012). Kanuri syllable pattern has four distinct structures: monosyllabic words, disyllabic pattern, trisyllabic pattern and quadrisyllabic pattern. The maximum number of syllables in Kanuri words is four. Such a pattern may take a combination of both open and closed syllables, as some examples in Table 2.7 show.

Table 2.7: Some examples of Kanuri syllable structure

Monosyllabic words	Disyllabic words	Trisyllabic words	Quadrisyllabic words
de (empty)	koro (donkey)	kəndondi (illness)	lenəm are (to and from)
ka (stick)	bərin (new)	Kasuwu (market)	matafəram (local medicine)
fər (horse)	Ngodo(begging)	Kawudi (perfume)	kərməsələm (Islam)

2.2.3.5 Kanuri phonological processes

There are six principal phonological processes in Kanuri: assimilation, palatalisation, sonorisation, deletion, voiced stop spirantisation and compensatory lengthening. Each of these is discussed below.

Assimilation: Both Kanuri consonants and vowels are influenced to sound like a neighbouring sound, but consonants are frequently affected. Regressive assimilation is frequently observed in Kanuri, while the vowel assimilation is considered as consonant weakening (Bulakarima & Shettima, 2012). For example: /musko/ → [mukko] (hand), /biska/ → [bikka] (yesterday), /katkadə/ → [kakkadə] (book)

Sonorisation: This is the second type of consonant weakening constantly used in Kanuri. It is called sonorisation due to the alteration of some consonants to only a bilabial approximant /w/, which also belongs to [sonorant] distinctive feature. Consonants such as /b/, /k/, /g/, /f/ are realised as [w] constantly in intervocalic environments or after liquid consonants /l/, /r/ and before a vowel. For example: /katibu/ → [katiwu] (scribe), /kurgun/ → [kurwun] (medicine), /kulgu/ → [kulwu] (gown)

Deletion: Consonants are frequently elided in Kanuri. Both voiceless and voiced velar stop /k/ and /g/ occurring between two identical vowels are normally elided in Kanuri words. For example: /karaga/ → [karaa] (bush), /mogoram/ → [mooram] (a traditional title), /dogoma/ → [dooma] (a traditional title)

Voicing: a voiceless alveolar stop /t/ becomes voiced intervocalically. For example: /fato/ → [fado] (house), /atə/ → [adə] (this), /watə/ → [wadə] (promise)

However, both the voiceless /t/ and voiced /d/ are used by Kanuri native speakers. Sometimes, variation in the use of /t/ or /d/ indicates a dialectal variation, but both phonemes are sometimes interchangeably used within the same dialect of Kanuri.

Spirantisation: Some non-fricative consonants metamorphose to fricatives in Kanuri. This process affects a voiced velar stop /g/ where it becomes a voiced velar fricative [ɣ] when it precedes a mid-central vowel /ə/, or occurs in between mid-central vowels. For example: /karəgə/ → [karəɣə] (heart), /dagəra/ → [dayəra] (a Kanuri ethnic group), /tʃigə/ → [tʃiyə] (flies)

Compensatory lengthening: This is a process of consonant weakening whereby elision of some phonemes necessitates their replacement by lengthening a neighbouring sound. For example: /kulwu/ → [kullu] → [kuluu] (gown), /kurwum/ → [kurrum] → [kuruum] (yellowish)

2.2.4 Description of Yoruba phonology

2.2.4.1 Yoruba consonants

Yoruba has 18 consonant sounds. Table 2.8 comprises six Yoruba distinct places of articulation. Akinlabi (1994) had noted on his Yoruba consonant chart that older literature available did not capture the [f] sound in their chart. Akinlabi reported that Bamgbose (1971) had argued that variations among speakers exist regarding the pronunciation of the sound in question. Some pronounce it with a complete closure of airstream, while other speakers differently pronounce it with a free flow of air (fricative).

Table 2.8: Yoruba Consonantal Chart (adapted from Oyebade, 1991)

	Bilabial	Labio dental	Alveolar	Palato Alveolar	Palatal	Velar	Labiovelar	Glottal
Plosive	b		t d			k g	kp gb	
Fricative		f	s	ʃ				h
Affricate				ɟʒ				
Nasal	m		n					
Tap			r					
Lateral			l					
Approximant					j		w	

2.2.4.2 Yoruba vowels

Yoruba possesses seven distinct contrastive vowels in its phonemic inventory: /a, e, ɛ, ɪ, o, ɔ, u/. Such vowel phonemes are orthographically represented by the same number of vowel letters: <a, e, ɛ, ɪ, o, ɔ, u>. Apart from the seven pure vowels given above, Yoruba possesses five more nasal vowels: /ĩ, ẽ, ã, õ, ü/. These are orthographically represented as: <in, en, an, on, un> (Eme and Uba 2016). Fresco (1970) revealed that six different dialects of Yoruba have seven oral vowels in their sound systems. Such vowels are exactly the ones given above. His Yoruba dialects study covered eight dialects as follows: Common Yoruba, Ketu, Ondo, Ifaki, Okiti-Kpukpa, Akuri, Owo and Oba. However,

the seven vowels identified belong to only six of the eight dialects covered in the study, excluding Ifaki and Akuri dialects.

2.2.4.3 Yoruba tones

Yoruba is another tone-based language. It has three types of tone: low, mid and high tones. Some Yoruba linguists assign native names to such Yoruba tones as *do* (low), *re* (mid) and *mi* (high) in Yoruba. Possible combinations of tones in the Yoruba words are shown in Table 2.9.

Table 2.9: Some examples of tone combinations in Yoruba words (adapted from Akinlabi, 2004)

Low	kò (reject)	Mid	kō (sing)	High	kó (build)
Low-low	ìlù (drum)	Mid-low	ōkò (vehicle)	High-low	pákō (chewing stick)
Low-mid	ìlū (opener)	Mid-mid	ōkō (husband)	High-mid	késē (a place name)
Low-high	ìlú (town)	Mid-high	ōkó (hoe)	High-high	pákó (plank)

Each of the three tones is sub-categorised into three sub-groups. Akinlabi (2004) observes that apart from the high tone, which only occurs syllable-initially, all other types of tone are found in different positions of words.

2.2.4.4 Yoruba syllable structure

Yoruba has a syllable structure which is similar to those of other African languages. It is of note that Yoruba does not permit consonant clusters in its syllabic structure. Thus, all syllables consist of single vowels and consonants only. Akinlabi (2004) clarified that Yoruba syllabic structure is always either a vowel (V) only or a combination of a consonant and a vowel (CV) only. Yoruba is further known as having a definite distribution of syllable patterns. Nouns always have VCV syllable structure; i.e. they begin with a vowel followed by a consonant and a vowel. On the other hand, all verbs always begin with consonants. Yoruba also has a syllabic nasal, as reported by Jibril (1982).

2.2.4.5 Yoruba phonological processes

Akinlabi (2004) asserts that there are several phonological processes in Yoruba, but he only discussed four main ones: vowel harmony, vowel assimilation, vowel deletion and consonant deletion.

Vowel harmony: This is a linguistic phenomenon in which some languages' sound systems restrict a vowel's occurrence in words. In other words, languages tend to have distinct classes of vowel phonemes; words can only have vowels from the same class. For instance, a mixture of class A and B vowels is not permissible within the same word. Yoruba happens to be one of such languages. Akinlabi (2004) noted that the seven Yoruba vowels discussed earlier (see Yoruba vowels section above) are divided into two classes. Class 1 consists of four vowels /i, e, o, u/; they belong to the same class based on sharing the feature advanced tongue root (ATR); i.e. the tongue root of the speaker is moved

forward to enlarge the pharynx. The other three /a, e, o/ belong to class 2 (non-advanced tongue root). However, high vowels /i, u/ are not exempt from the harmony. The last vowel determines the occurrence of vowels within the Yoruba simple (mono-morphemic) words. Thus, if the last vowel belongs to the advanced tongue root class, all the preceding vowels will also be members of the same advanced tongue root class.

Vowel assimilation: This is the process whereby a vowel influences another neighbouring vowel so that they become alike. Unlike vowel harmony, where an intervening consonant separates the vowels, the case in assimilation is that the two participating elements must occur side by side. This assimilation is often noticeable in Yoruba at a word boundary (where two nouns occur side by side). Either the last vowel of the first word assimilates the first vowel of the second word or vice versa. This is as the result of the definite rule that all Yoruba words end in vowels, and all nouns begin with vowels.

Vowel deletion: As noted by Akinlabi (2004), there is vowel elision in Yoruba. It is usually evident in fluent speech (connected speech). This is observed at a boundary between two neighbouring words; either a vowel at the end of the first word or another vowel at the initial position of the second word is dropped. Vowel deletion is mostly evident either in compound nouns or in between nouns and verbs occurring side by side. Concerning the noun-noun deletion, the second vowel in the sequence is deleted. For the verb-noun deletion, any vowel, either the first or second in the sequence, can be deleted; there is no strict rule of which vowel is to drop. However, high vowels in noun-noun are often dropped irrespective of their position in a particular sequence. Table 2.10 shows some examples of both cases.

Table 2.10: Some examples of vowel deletion in Yoruba

Noun-noun		
ewe	oko	eweko
(leaf)	(farm)	(leaf)
ori	oke	oroke
(top)	(hill)	(top of the mountain)
Verb-noun		
kaiwe		kawe
(read)	(book)	(be educated)
waowo		wawo
(look for)	(vehicle)	(look for money)

Consonant deletion: Consonants at times are deleted in connected speech. The most predictable types of consonant deletion were discussed by Akinlabi (2004) as follows:

(a) Consonants are deleted when a particular consonant is identical to a following or preceding one, for example, /otito/ becomes [ooto] (truth). In this example, the first /t/ is dropped, while the /i/ vowel is assimilated to /o/.

(b) In the second context, /w/ and /j/ may be dropped between two vowels and when followed by vowels with a similar place of articulation. In this case, it means /w/ is dropped if it precedes back vowels /u, o, ɔ/. For example: /awujo/ → [aujo], (assembly of persons), /perewu/ → [pereu] (doggedly), /jowo/ → [joo] (please)

In the case of /j/ deletion, it is dropped when followed by front vowels /i, e, ε/. For example: /iwoji/ → [iwoi] (at this time), /laje/ → [lae] (forever), /adije/ → [adie] (chicken)

(c) /r/ is also dropped under two conditions: If it occurs between two identical vowels or if it occurs before or after a high vowel. For example:

Occurrence between identical vowels: /warapa/ → [waapa] (epilepsy)

Occurrence before and after high vowels: /orisa/ → [oosa] (god), /ikire/ → [ikie] (a Yoruba town)

2.3 Summary and Conclusion

In this chapter, geographical and linguistic situations about the four Nigerian languages have been presented and discussed using published materials only. Segmental features and phonological processes in the four languages have also been presented and discussed with supporting examples. It is observed that all four languages are tone-based, but they have different tone patterns, as shown above. None of the languages allows consonant clusters to operate in its sound system. Thus, consonants and vowels occur side by side in all words belonging to the four languages. Table 2.11 provides a summary of the key similarities and differences of the four languages' features.

Hausa has seven major phonological processes. Igbo has six major phonological processes. Kanuri has six, and Yoruba has four major phonological processes. Hausa has 30 consonants, while Standard Igbo has 28 consonants. Kanuri and Yoruba have 18 consonants respectively. Hausa and Yoruba have 12 vowels, respectively. While the Hausa vowel system is divided in accordance with the length of the vowels (5 short and 5 long) and 2 diphthongs, the Yoruba vowel system is divided in terms of being nasal or non-nasal vowels. Igbo vowel system is divided in terms of being + pharyngeal or - pharyngeal. Kanuri has only six vowels, and all of them are short.

Table 2.11: Summary of key similarities and differences of the four Nigerian languages' features

	Hausa-English	Igbo-English	Kanuri-English	Yoruba-English
Similar consonants	30 consonants /b, k, g, t, d, s, z, n, r, l, m, h, j, ɗ, ɲ, ʦ, w, ʃ/	28 consonants b, k, g, t, d, s, z, n, r, l, m, h, j, ɗ, ɲ, ʦ, w, ʃ, ,f, p/	18 consonants b, k, g, t, d, s, z, n, r, l, m, h, j, ɗ, ɲ, ʦ, w, ʃ, f/ [p]	18 consonants b, k, g, t, d, s, z, n, r, l, m, h, j, ɗ, ɲ, ʦ, w, ʃ, f/
Different consonants	/ɸ, ɸ', s', d, r, k', k ^w , g ^w , k ^j , g ^j , k ^j , ʔ, ʔ ^j , ʔ ^w	/kp, gp, kw, gw, ɲw, ʎ, ɲ, v /	/ŋ, ʔ,	/kp, gp/
Similar Vowels	/a, i, o, u, e/	/e, i, o, u/ non-pharyngealised)	i, e, a, u, o/	/ a, e, i, o, u/
Different Vowels	/a: ɪ, o:, u:, e:/ aɪ, au	/ɛ, ɪ, ɔ, ɔ/ pharyngealised	/ə/ [ʌ]	/ɛ, ɔ/ /ĩ, ẽ, ã, õ, ü/ Nasal vowels
Similar Tones	High, low, falling	High, low	High, low, mid falling	High, low, mid
Different tones	_____	down-step	rising	_____
Similar syllable structure	CV, & CVC	CV	CV & CVC	CV
Different syllable-structure	CVV	_____	_____	V, VCV
Phonological processes	Assimilation: Simple voicing nasal labialisation palatalisation glottalization, neutralisation, syllable-final labials gemination	Labialisation palatalisation assimilation (progressive & regressive) consonant elision vowel harmony	Assimilation sonorisation deletion voicing spirantisation compensatory lengthening	consonant deletion vowel assimilation vowel deletion vowel harmony

Having summarised the phonological accounts of the four languages, it is anticipated that the differences between the segmental phonologies of the L1 Hausa, Igbo, Kanuri and Yoruba will be significantly reflected in L2 Hausa-English, Igbo-English, Kanuri-English and Yoruba-English. Whether this prediction is valid or not is discussed in Chapter 4. The following are the research questions and hypotheses guiding the next two chapters: Chapter 3 (production fieldwork for collecting a corpus of current trends in the four accents of Nigerian English) and Chapter 4 (description of segmental

features of current Hausa-English, Igbo-English, Kanuri-English and Yoruba-English based on some selected phonemes from the corpus).

2.4 Research questions and hypotheses

As the project is aimed at providing an up-to-date description of the four Nigerian English accents: Hausa-English, Igbo-English, Kanuri-English and Yoruba-English, the following research questions were formulated to guide the next stage—fieldwork in Nigeria for collecting a fresh corpus of the four accents to answer these questions and hypotheses.

2.4.1 Phase 1: Description of Hausa-English, Igbo-English, Kanuri-English and Yoruba-English accents

Three research questions were formulated to guide the project in establishing a thorough description of the four Nigerian English accents. The following are the hypotheses guiding the project.

2.4.1.1 Research Questions:

This phase aims to answer the following questions:

- (1) In what ways do the four Nigerian English accents spoken by L1 Hausa, Igbo, Kanuri and Yoruba speakers differ from one another?
- (2) Can the differences between the four types of Nigerian English be accounted for by reference to the different L1 phonological systems?
- (3) Are there any differences between the four current accents of Nigerian English and their past descriptions by scholars such as Dunstan (1969), Jibrin (1982), Jowitt (1991) and Sogunro (2012)?

2.4.1.2 Research Hypotheses

To answer the research questions, it is hypothesised that the Hausa-English, Igbo-English, Kanuri-English and Yoruba-English varieties are distinguishable, and that major disparities between them will be attributable to L1 interference and apparent in their segmental phonological and phonetic features.

It is also anticipated that the research might show at least some segmental features at variance with earlier descriptions owing to natural sociophonetic processes of evolution, mutation and change.

Chapter 3

Recording fieldwork and methodology

3.0 Introduction

This chapter concerns the stages and methods of collecting and analysing the data of the study. The chapter includes the following: ethical considerations, sample size, sampling technique employed, instruments (recorder, questionnaire) used for data collection in Nigeria, profiles of the participants. The chapter also provides details about research design, the population of the study area, methods employed for analysis using software such as Praat, Audacity and Sound Forge.

Conducting fieldwork in Nigeria is quite distinct from more developed countries. It might be of interest to give an account of certain difficulties and challenges encountered because it was not possible to exert the same controls over the recording process done in many other countries. Thus, this chapter includes an overall flavour of Nigerian culture and fieldwork experience, as shown in each of the four sections of fieldwork in Nigeria.

3.1 Ethical consideration

Permission to conduct the fieldwork was granted by the University of York Department of Language and Linguistic Science Ethics Committee. The ethics approval procedure was duly followed before the collection of data. The relevant information sheet and consent form appear in Appendix A. These consent forms and information sheets were initially given to the participants. They read and understood the contents before accepting to take part. All data protection guidelines were strictly adhered to during and after the collection of data. Informed consent forms were taken along with the reading excerpts to the informants for accepting to take part in the study. The informants were informed that their participation in the study was voluntary; they could withdraw from the research at any point. The information will remain confidential and their identities anonymous.

3.2 Recording Fieldwork in Nigeria

The production fieldwork took place in four Nigerian universities and cities hosting them. These are as follows:

- (1) Bayero University Kano and Kano City, North West Nigeria (Hausa)
- (2) University of Nigeria Nsukka and Nsukka City, South East Nigeria (Igbo)
- (3) University of Maiduguri and Maiduguri City, North East Nigeria (Kanuri)
- (4) University of Ibadan and Ibadan City, South West Nigeria (Yoruba)

The participant speakers selected were non-academic staff, students (both undergraduates and postgraduates) of the universities, some people who sell stationery and food in canteens and other educated native speakers in the four cities. Sixty male participants of Hausa, Igbo, Kanuri and Yoruba

(15 from each of the four accent groups) were recorded while speaking in both English and their native languages. Their ages ranged from 18 to 40 years (mean age = 27, SD = 5). To capture each of the four target accents, typical native communities of those ethnic groups were selected. Four of the six geographical zones of Nigeria—North-West, North-East, South-East and South-West covered the area of the study.

The four universities were selected for their having native speakers of Standard varieties of the four Nigerian languages. As some other neighbouring states were considered appropriate to draw participants from, some participants came from states other than those in which the universities are located. For the Hausa group, participants were selected only if they were from Kano, Jigawa and Katsina States of the North-West Nigeria. For the Igbo group, participants were selected only if they were from one of the five states (Abia, Anambra, Ebonyi, Enugu, and Imo) of the South-Eastern Nigeria (Igbo region). For the Kanuri group, participants were selected only if they were from Borno or Yobe States of the North-East Nigeria. For Yoruba, participants qualifying for recruitment were those from six Yoruba-speaking states: Ekiti, Lagos, Ogun, Ondo, Osun, and Oyo States of the South-West Nigeria (Yoruba region). Before fieldwork began, the researcher sought confirmation from potential participants that they were Yoruba native speakers from one of the six Yoruba States. Those who confirmed that they were Yoruba native speakers were selected. This procedure was repeated in Kano, Maiduguri and Nsukka.

3.2.1 Sample size

An overall sample population of sixty people participated, where fifteen male participants aged 18-40 (mean age = 27, SD = 5) years represented each L1 group. The participants were recruited between January and February 2019.

3.2.2 Sampling technique

The participants were selected under the following criteria:

- (1) Speaking one of the four Nigerian languages natively regardless of dialectal differences
- (2) Currently in the second year of undergraduate studies or above
- (3) Aged between 18 and 40
- (4) Apart from English, learned only his mother-tongue from infancy

Based on these criteria, the participants were randomly selected and recruited. Thus, there was no decision on equal representation among undergraduates, postgraduates, non-academic staff and, say, people who sell stationery or food in the university or city cafes and canteens. As these variables were not controlled for, there is variation within and across groups in terms of composition.

3.2.3 Procedure

Before the recording started, they were informed that their speech was going to be recorded for further analysis. Information sheets and consent forms were circulated among the participants. They were individually invited into the laboratory. They were first recorded while speaking freely, then when reading two passages (the North Wind and the Sun & the Rainbow Passage), a word list and describing pictures. They produced an average of 15 – 30 minutes of speech in all four conditions combined. While English was used in all the four speech styles, Hausa Igbo, Kanuri and Yoruba were only used in free speech. Thus, the portions spoken in English were longer.

The language background questionnaire was filled in after each participant completed his set of recordings. In order to avoid participants including clues to their backgrounds that might have been used by those taking part in the subsequent perception and classification experiments, they were asked not to mention their names, schools and places of birth. Where such clues crept into their speech, they were removed from the recorded material used in the perception experiment.

3.1.6 Tasks

The fieldwork served to secure the primary data of the study. Four accents of Nigerian English were all collected in the same four conditions:

- (1) Reading a word list (single words and few compound words containing all English phonemes abbreviated as WL in Chapter 4)
- (2) Engaging in picture description tasks (abbreviated as PD in subsequent Chapter 4; drawn from the Cambridge Projects and other African settings taken from the internet, as shown in Appendix C)
- (3) Reading two phonetically balanced passages (The North Wind and the Sun, The Rainbow passage; abbreviated as NWS & RB in Chapter 4)
- (4) Engaging in unscripted conversation in both their native languages and in English (abbreviated as FS in Chapter 4)

For the collection of the participants' metadata, including education background and level of their language proficiency, a language background questionnaire was included during the data collection (see Appendix A).

3.2.5 Recording

For the recording, an audio recorder and a structured questionnaire were employed.

3.2.5.1 Audio recording

A ZOOM H4n Pro Handy recorder and external microphone were used. The recordings were in .wav format at 44.1 kHz sampling rate and 16-bit resolution. The recording sessions mainly took place in language laboratories of the four universities.

3.2.5.2 Questionnaire

A structured questionnaire was used to document the language background information of each of the participants in the study. The questionnaire is divided into two parts, as detailed below.

Part A

In this part, the participants were required to provide their educational background information (including primary, secondary and tertiary institutions attended), their birthplaces, their travel history within Nigeria, and other languages they speak. The last question required them to state whether they had more than one native language, excluding English. For this question, they were required to make a self-assessment of learning other native languages on three levels of proficiency (basic, intermediate and advanced).

Part B

In this part, the participants were asked to rate their level of proficiency in speaking Standard Nigerian English on three levels (basic, intermediate, advanced). They were also asked to state whether they could speak Pidgin English, as not all Nigerians use Pidgin English. Besides these pieces of information, participants were required to rate their loyalty to both their tribe and native language on a scale of 0-100, where 0 stands for no particular loyalty and 100 stands for extreme loyalty. For finding out the linguistic diversity of their homes, the participants were required to state the number of languages they use at home. For determining the basis of fluency in English, they were asked to state whom they speak English with (whether parents, siblings, teachers, friends, colleagues or others). The participants were required to state how their English learning was achieved (whether mainly through formal classroom instruction, through informally interacting with people or a mixture of both formal and informal means).

On a percentage basis, they were asked to estimate their use of native languages and English per day (in all daily activities combined). Similarly, they were asked to specify their language preference (between English and a native language) in four different conditions: at home, at work, at a party or other social gatherings and in general. For determining whether their English teachers might have influenced their English accents (by providing pronunciation models for their students), they were required to state their both primary and secondary school level English teachers' nationality and ethnic group. They were also required to state the age at which they started learning English. Finally, they were asked to state whether they had ever been to any country where English is a native language

(including duration and purpose of stay). A detailed description of how the fieldwork took place is given under four separate sub-headings based on the four groups as follows:

3.2.6 Igbo-English data (University of Nigeria, Nsukka)

The fieldwork started with the Igbo group. On the day after my arrival at the University of Nigeria, Nsukka on the 22nd January 2019, my host (Prof Daniel Opatta) took me to the Department of English and Literary Studies and the Department of Linguistics, Igbo and other African Languages to meet the target participants. He introduced me to some of his colleagues before he linked me up with the Head of the English Department and other young lecturers in the department. The young lecturers coordinated both the meeting and recruiting participants. Mr. Emeka, an assistant lecturer of Literature in English, took me around the English Department. I was introduced to both staff and students. We then started to invite undergraduate and postgraduate students to participate in the study. They were told to speak in both their Igbo language and English. Eighteen participants participated in the Igbo groups. Most of these participants only speak their first (Igbo) language and English fluently; a few of them speak basic French.

Recording rooms

The language laboratory in the Department of English and Literary Studies was used. A conference room and my bedroom in the University's guest house were also used. Eight of the participants were recorded on the first day in the language laboratory.

Some challenges during the recording process

While staying in my accommodation, some participants were recruited and recorded at night. There were fewer external interruptions than in the language laboratory. Similarly, the "pause and resume strategy" was used due to the echoing of noise from elsewhere in the building. Initially, the recording started with the electric power supply. However, the recording was interrupted by a power outage. The Zoom recorder does not save the recording when the recording device switches itself off due to the power outage. Consequently, I lost the data. Thus, I had to switch to using battery throughout the recording process.

The language laboratory was in the midst of other buildings. Some external noise from the other buildings interfered in the recording. Both sides of the building (comprising ground, first and second floors) had car parks. External noise of cars and motorcycles driving out of the parks interfered in the recording on several occasions. I adopted a "pause and resume" strategy. Speaking participants were asked to pause whenever there was external machine noise. They continued when the noise had subsided. All the doors and windows of the room were shut, but passers-by sometimes would talk near the entrance. The noise would still intrude. My research assistant had to remain in the corridor to ask those passing by the door to be silent. Thus, we asked the participants to pause and resume when the noise stopped.

3.2.7 Yoruba-English data (University of Ibadan)

A retired professor of Yoruba syntax (who is currently running an NGO working on the revival of Yoruba cultures) was initially contacted by my former lecturer in December 2019 before my journey to Nigeria. The Yoruba professor agreed to help me during the fieldwork. Upon my arrival in Ibadan on the 28th of January 2019, he linked me up with the Head of the Department of Linguistics, University of Ibadan. Similarly, a young lecturer who had just completed his Ph.D. assisted me throughout the data collection in Ibadan. Twenty-two Yoruba English speakers participated in this group. They were from different departments and disciplines. While most of the Yoruba participants speak only their first language and English fluently, a few of them speak basic French or Arabic.

Recording rooms

I used both my research assistant's office and the language laboratory (used by both the Departments of English and Linguistics) to record the participants. The participants were asked to pause whenever external noise interrupted.

Some challenges during the recording process

Non-verbal communication (raising hand) was applied to pause them until the noise had passed. This reduced the background noise such as moving chairs, tables and reading papers. We used non-verbal demonstrations and writing on paper to remind the Yoruba participants of the next step to take during the recordings. Some could hardly recall the instructions (which I told them initially) before commencing the recording. External noise (from cars and construction machines) interfered on several occasions. I had to pause and continue after the noise had stopped. There was a small studio in the laboratory, which was subsequently used. The affected audio clips were discarded, and I started afresh. Sometimes the memory card filled up before the participant had completed the task, in which case the participants were asked to repeat the task.

3.2.8 Hausa-English data (Bayero University and Kano City)

It took me a long time to meet the target number of participants initially at Bayero University due to a nationwide strike embarked upon by the Academic Staff Union of Universities (ASUU). Very few students and staff of the university were on campus. I met the majority of Hausa participants in the city, instead. The meeting points were two locations in Kano City: Sharada and Janbulo. I followed up with some of the participants who did not initially sign the consent form on the following day. Most of the Hausa speakers speak Hausa and English fluently, but some of them speak basic Fulfulde and Arabic as well. While only five of the Hausa participants said they spoke basic Arabic, one participant speaks basic Fulfulde and Kanuri. Another one speaks basic Yoruba. All the other participants, representing 65% of the total, only speak Hausa and English. Seventy percent of the Hausa participants attended public primary and high schools. While 16% attended private primary and high schools, 14%

went to both private and public schools. Only 50% of the Hausa participants said they speak Pidgin English at a basic, intermediate or advanced level, but the advanced level has the lowest representation of only 15%.

Recording rooms

The rooms used for the recording of the Hausa data were the conference rooms of the Physical Planning Unit and the Department of Linguistics and Foreign Languages of Bayero University, Kano. Another room at a private school located in the Yan awaki area of Kano was also used.

Some challenges during the recording

Most of the buildings were connected. The complexity of the buildings had resulted in a lot of echoing of distant talks, which affected the recordings. Thus, we had multiple pauses along the line. I initially experienced a frequent power outage while using the Zoom H4N recorder. Thus, it necessitated the use of batteries to power the Zoom recorder. The speech was only saved when the recording session had completed.

3.2.9 Kanuri-English data (University of Maiduguri and Maiduguri metropolis)

Twenty-one Kanuri participants were recruited at the University of Maiduguri and other locations in the City of Maiduguri. The areas visited were Buddum, Shehuri North, Old GRA, Lagos Street, Damboa Road and Pompomari. The target participants were met in these specific locations. Currently, many people in the Kanuri-speaking communities speak both Hausa and Kanuri as L1s. Thus, I restricted our target participants to only strict Kanuri-speaking areas (where Hausa is not significantly used). This was to ensure the collection of data from typical Kanuri native speakers (who only speak Kanuri as their mother tongue before learning English in class). Presently, Hausa is spreading throughout Maiduguri City.

However, Kanuri is still dominant in some of the communities. Some Kanuri people still maintain the language as the only L1 of their communities. The Kanuri dominant communities include Shehuri South, Shehuri North, Bulabulin, Budum and Pole Wire Biyu. Thus, I met the Kanuri English-speaking people in these areas to collect data that produce a real representation of English spoken by the L1 Kanuri speakers. Many of the Kanuri participants speak English, Kanuri and Hausa fluently, but their Kanuri markers are evident in their Hausa conversations.

Bama is a Kanuri-majority town in Borno State where Kanuri remains the only dominant language. The inhabitants of Bama only learn English at schools. Thus, any external linguistic influence on English is presumed to be from L1 Kanuri. Most of the Bama people currently reside in Maiduguri due to the insecurity caused by the Boko-Haram insurgency. Seventy-one percent of the Kanuri participants attended public schools. While 19% attended private schools, 10% attended private primary schools and public secondary schools. In terms of speaking Pidgin English, 33% said they do not speak Pidgin

English at all. While 24% spoke basic Pidgin English, 43% rated themselves as intermediate Pidgin English speakers. While 100% of the participants use Hausa at different levels, 10% spoke basic Arabic. Only 5% speak Yoruba. Ninety-five percent of the participants said the first language of their primary school English teachers was Kanuri. Five percent said their secondary school English teacher's first language was Igbo. Both L1 Gwoza and Bura have 5% representation among secondary school English teachers.

Recording rooms

The rooms used for the recording of the Kanuri data were a conference room of the Department of Languages and Linguistics of the University of Maiduguri, quiet rooms in four houses in four locations: Damboa road, Pompomari, Lagos Street and Old GRA Maiduguri.

Some challenges during the recording

The biggest challenge faced in Maiduguri was locating the participants. Accessing the target participants (who only learned Kanuri as their L1 before learning English at school) was difficult as they were spread across different locations. Some of the participants were not available when I arrived in their areas. I had to wait for quite a long time. They were busy with other activities. The power outage was also a challenge in Maiduguri. Also, my research assistant had to remain in the corridor to ask the people passing by the door to be silent during the recording sessions.

3.3 Research design

Phase 1 of the study is based on a comparative empirical survey of four varieties of Nigerian English.

3.4 Data Analysis Procedure

The findings of the study were analysed in two ways: impressionistic analysis with some informal acoustic corroboration.

3.4.1 Method of Perception/impressionistic analysis

To analyse the recordings of the first phase of the research, the speech samples of the 60 respondents were transferred from the recorder to the researcher's computer. Each of the accents was given an independent folder bearing the name of the accent. The samples were numbered according to the order of the recording time, as the recorder automatically assigned a number to every recording. The researcher carefully listened to the speech samples in a quiet forensic laboratory at the Department of Language and Linguistic Science of the University of York and sometimes at home. After listening, five of the speech samples were selected from each of the accent groups for a narrow transcription.

3.4.1.1 Transcription

Narrow phonetic transcription was used for representing the speech samples. The data used comprised spontaneous speech, describing pictures and three types of read speech: The North Wind and the Sun, The Rainbow passage and a list of words. All of these were carefully listened to, and examples were randomly extracted from them. Analysis of the transcribed data paid more attention to only English consonant and vowel phonemes that were differently realised in all or any of the four Nigerian English accents. For examples, dental fricatives, labio-dental fricatives, postalveolar and glottal fricatives in the case of Yoruba-English, were mainly involved. All perceived non-native English phonological processes such as consonants and vowel epenthesis, elision, merger and gemination are also transcribed and supported with examples from the data. All realisations of the selected English phonemes and phonetic processes identified in the four accents are presented and lined up in tables alongside the environments, examples of words and the speech styles in which they occur.

3.4.2 Method of Acoustic analysis

For the acoustic analysis of some phonemes selected from the recorded speech samples, Praat was employed, while Audacity and Sound Forge were used for normalising the samples and extracting unwanted external noises and longer pauses or spaces from the speech samples. On the other hand, acoustic measurements of vowels were generated in Praat (Boersma & Weenink, 2021). The midpoint formant (F1 & F2) measurements of seven English vowels (articulated by five selected participants of all four accents): STRUT, NURSE, KIT, DRESS, TRAP, LOT and FOOT were extracted. The F1 and F2 values were then transferred to Microsoft excel for generating scatter plots. The individual values of each of the seven vowels for every participant in each of the accents were plotted in the accent chart. The averaged value of each of the vowels produced by members of the same accent group was also taken and plotted. The individual and averaged values of the participants of the four accents were compared separately within the same charts.

This chapter has provided a detailed description of the production fieldwork procedure in Nigeria and method of analysing the data obtained from the current corpus of Hausa-English, Igbo-English, Kanuri-English and Yoruba-English. The next chapter concerns the analysis and discussion of the findings obtained from the current corpus.

Chapter 4

Description of Hausa-English, Igbo-English, Kanuri-English and Yoruba-English accents

4.0 Introduction

This chapter concerns the analysis of recordings of four styles of English speech produced by speakers of four accents of Nigerian English. The chapter presents the findings obtained in the corpus of the four accents: Hausa-English, Igbo-English, Kanuri-English and Yoruba-English, in comparison with their findings in some past studies. In other words, the discussions of segmental phonetic and phonological patterns of the accents as obtained in the corpus are compared with the patterns previously reported by other scholars.

The lexical sets developed by Wells (1982) are used to provide the segmental description of the four Nigerian English. The use of Wells lexical sets does not denote that these varieties are regarded as 'deviations' from, or imperfect attempts to emulate, RP, from which the lexical sets derive, but the Wells scheme is simply used as an accepted descriptive framework for reference. The four Nigerian English accents are regarded as separate varieties in their own right; each constituting its own system, with independent phonological rules.

The realisations of each of the English phonemes were extracted from data collected for this study in four conditions: reading two phonetically balanced passages (The Rainbow Passage and The North Wind and the Sun; RB and NWS, respectively), reading a word list (WL), describing pictures (PD), and speaking freely (FS). These will, henceforth, be referred to as RB, NWS, WL, PD and FS in tables. The English phonemes are described based on their primary and secondary realisations in each of the four Nigerian English varieties. Tables showing some selected phonemes with their possible realisations along with examples of words and their phonetic transcriptions are provided. Several phonetic processes observed in each of the four accents have separate sub-headings under the four groups. The phonetic processes observed are vowel epenthesis, vowel deletion, consonant epenthesis, consonant deletion, devoicing and gemination. There are fewer processes observed in Igbo-English than in Hausa-English, Kanuri-English or Yoruba-English.

Given that Nigeria was one of the British colonies, the amalgamation of northern and southern protectorates in 1914 paved a way for English to play vital roles in the country. The roles include the official language of the government, a medium of instruction in schools, colleges and universities as well as a lingua franca. Consequently, the use of British English in such domains lasted throughout the colonial period (1914-1960) and continued to enjoy the same status even after Nigerian independence on 1st October 1960. In addition, British English is regarded as a superior variety in Nigeria for different reasons such as speakers' desire to be in high social class, political issues and language barriers among

the hundreds of speakers of different indigenous languages. Thus, Received Pronunciation is chosen just as a reference accent (not a target accent for comparing and contrasting the four varieties of Nigerian English).

This section discusses the realisations of selected English consonants and vowels in the four accents of Nigerian English. For the purpose of providing an up-to-date description of the four Nigerian English varieties based on their English segmental differences, speech samples of 60 participants (15 for each of the accent groups) were initially collected in the first quarter of 2019 in Nigeria (see Chapter 3 for further details). While the consonants of the four English accents are separately presented under each of the four groups, vowels are generally presented based on the differences between the northern and southern regions of Nigeria. Thus, Hausa-English and Kanuri-English vowels are merged under the same section and Igbo-English and Yoruba-English are merged under the same section. Slight differences between Hausa and Kanuri or Igbo and Yoruba are presented in matrices at the end of each of the sub-sections.

4.1 Hausa-English sound system

Of the twenty-four English phonemes, sixteen similar phonemes exist in Hausa: /b, t, d, k, g, s, z, l, h, m, n, w, j, ʃ, tʃ, dʒ/. Such phonemes are pronounced in the native English way by the native speakers of Hausa. Thus, only the remaining seven English phonemes, /p, θ, ð, f, v, ʒ, ɲ/, have been selected for further study regarding their realisations in Hausa English.

4.1.1 Hausa-English consonant system

There are some English consonant phonemes which are pronounced differently by native speakers of Hausa. The equivalents of such English phonemes do not exist in the Hausa sound system (see the Hausa consonantal chart in Chapter 2). The findings of this study revealed that the English phonemes /p, f, v, θ, ð, ʒ, ɲ/ are substituted in most cases by the native speakers of Hausa. Instead, they are invariably realised as a different sound, or variably substituted with multiple sounds. The labialised velar /k^w/ of Hausa occurs in some English words used by the Hausa-English speakers. For example: 'considered', 'comma' and 'confess'. Initial /k/ in these words was labialised as [k^w] by some of the speakers. This labialisation was also reported by Jibiril (1982). The voiceless velar stop /k/ has a fricative release [k^x] word-finally, as evident in words such as 'cloak', 'crank' and 'pathetic'. This is also captured in Jibril's (1982) work, although Jibril did not specify the environment of the realisation in English words. Hausa has extensively borrowed words from Arabic (Danzaki, 2015). As Arabic is the language of Islam, and the Islamic religion dominates most of the Hausa native speakers, Arabic has a great influence on the Hausa people (Yalwa, 1992).

Consequently, the frequent occurrence of velar fricative [k^x] in the Hausa words is suspected to be an influence of the Arabic language. /t/ has fricative release [t^h] word-finally, as evident in words such as ‘kit’ and ‘foot’ of the word list data. The seven selected phonemes /p, f, v, θ, ð, ʒ, ŋ/ are discussed below.

4.1.1.1 Voiced labio-dental fricative /v/ → [b] / #_ , → [ɸ] / _#

The voiced labio-dental fricative /v/ is realised as a voiced bilabial plosive [b] in onset position, as exemplified in Table 4.1, and a spectrogram of the word never is shown in Fig 4.1. However, it is realised as [ɸ] in syllable coda position by Hausa speakers. The marked section in Fig 4.1 contains low frequency energy for voicing, and a clear ‘stop gap’ and release burst.

Table 4.1: Examples of the three realisations of the voiced labiodental fricative /v/ in Hausa-English

Environment	Realisation	Words	Transcription	Style
#_	[b]	various	[berɪjɒs]	RB
_#	[m]	government	[gamman]	FS
_#	[ɸ]	have	[haɸ]	RB

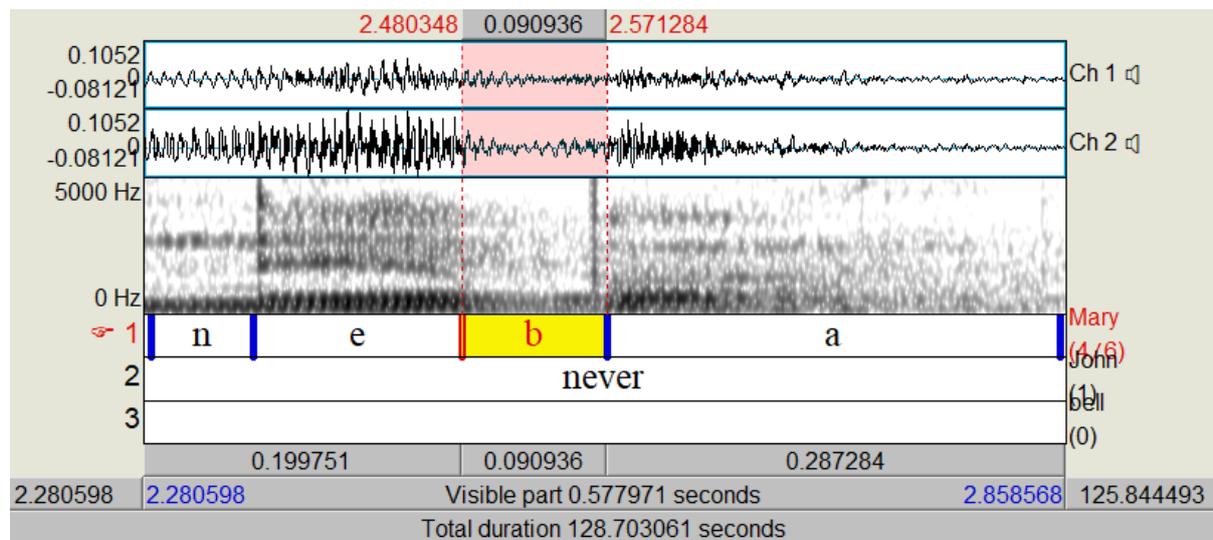


Figure 4.1: Hausa-English spectrogram for the realisation of the word never (Hausa speaker 007)

4.1.1.2 Voiceless labio-dental fricative /f/ → [ɸ]

The voiceless labio-dental fricative /f/ is realised as a voiceless bilabial fricative [ɸ] in both syllable onset and coda positions, as shown in Table 4.2. Thus, /v/ and /f/ are merged as [ɸ] word-finally or in syllable coda position in Hausa-English.

Table 4.2: Examples of the realisations of the English voiceless labiodental fricative /f/ in Hausa-English

Environment	Realisation	Words	Transcription	Style
#_	[ɸ]	friend	[ɸren]	RB
σ_	[ɸ]	unfortunate	[ɒnɸɔtʃunet]	PD
V_V	[ɸ]	effect	[eɸekt]	RB
_#	[ɸ]	off	[ɒɸ]	RB

4.1.1.3 Voiced dental fricative /ð/ → [z] [d]

The voiced dental fricative /ð/ is mainly realised as a voiced alveolar fricative [z] syllable-initially, but is occasionally articulated as alveolar plosive [d] in free speech, as show in Table 4.3.

Table 4.3: Examples of the two realisations of the English voiced dental fricative /ð/ in Hausa-English

Environment	Realisation	Words	Transcription	Style
#_	[z]	there	[zeja]	RB
#_	[d]	themselves	[demselfs]	FS
V_V	[z]	within	[wɪzɪn]	WL
V_V	[d]	another	[anada:]	FS

The Hausa realisation of /ð/ as [z] is mainly observed in the reading tasks. The speakers attempted to articulate the native form [ð] by observing the orthographic symbols. However, the speakers produced alveolar fricative [z], instead. It seems the Hausa-English speakers prefer [z] for its greater similarity with /ð/ than /d/. The two realisations have been observed in syllable onset position. Since L1 Hausa has both /d/ and /z/ as contrastive phonemes, such a difference may not be attributed to the L1 Hausa. Although both realisations may originate from the influence of the language, the [z] realisation by Hausa speakers remains unexplained. In addition, Hausa speakers mainly pronounce the definite article <the> with an [a] vowel as either [za] or [da] across all speech conditions. This realisation distinguishes Hausa-English from the other three Nigerian English accents in which 'the' is always realised as [di].

There is also some evidence of interspeaker variation in Hausa-English. A few participants who attended a private high school in Kano City and had their undergraduate or postgraduate studies abroad prefer using [d] for /ð/ rather than [z]. Their realisation is more categorical compared to other Hausa participants who variably realise it as [z] while reading and sometimes [d] in free speech.

4.1.1.4 Voiceless dental fricative /θ/ → [t] [s]

The voiceless dental fricative is realised as a voiceless alveolar plosive [t] word-initially or word-finally. It is also occasionally realised as a voiceless alveolar fricative [s] word-initially or finally, as is evident in Table 4.4.

Table 4.4: Examples of realisations of the English voiceless dental fricative in Hausa-English

Environment	Realisation	Words	Transcription	Style
#_	[t]	thought	[tɒt]	RB
	[s]	throughout	[suruawut]	RB
_#	[t]	north	[nɒt]	WL
	[s]	earth	[as]	RB

Such realisations are possible in both free speech and reading. However, highly educated Hausa speakers, especially those who had a part of their education abroad, mainly realise /θ/ as [t] and sometimes pronounce it as in Received Pronunciation.

4.1.1.5 Voiced post-alveolar fricative /ʒ/ → [ʒ] [dʒ]

The voiced postalveolar fricative /ʒ/ is substituted with a voiced postalveolar affricate [dʒ] or a voiceless postalveolar fricative [ʃ] in onset position of the second syllable of words in Hausa English. It is only realised as [ʃ] in onset position of a closed syllable in Hausa-English. A good example is the word 'division'. As an onset consonant, the sound [dʒ] mainly substitutes /ʒ/ in onset position of an open syllable as in 'measure'. The voiceless postalveolar fricative /ʃ/ frequently occurs in Hausa words. Thus, the frequent substitution of /ʒ/ with [ʃ] in Hausa-English is attributed to its distribution in Hausa phonology. Unlike what Jibril (1982) reported, the voiced postalveolar /ʒ/ is not invariably realised as [dʒ] in Hausa English, but it is now realised in both ways by the native speakers of Hausa. While [dʒ] is usually realised when /ʒ/ occurs syllable-initially in an open syllable, the voiceless postalveolar fricative [ʃ] is mainly realised syllable-initially in closed syllables, as is exemplified in Table 4.5. Fig 4.2 is a spectrogram showing the region where [dʒ] is realised for /ʒ/ in Hausa-English. The marked sections contain low frequency energy for voicing, and a clear 'stop gap' and release burst.

Table 4.5: Examples of Hausa-English realisations of the voiced post-alveolar fricative

Environment	Realisation	Words	Transcription	Style
_V	[dʒ]	measure	[medʒa]	WL
_VC	[ʃ]	division	[dɪvɪʃn]	WL

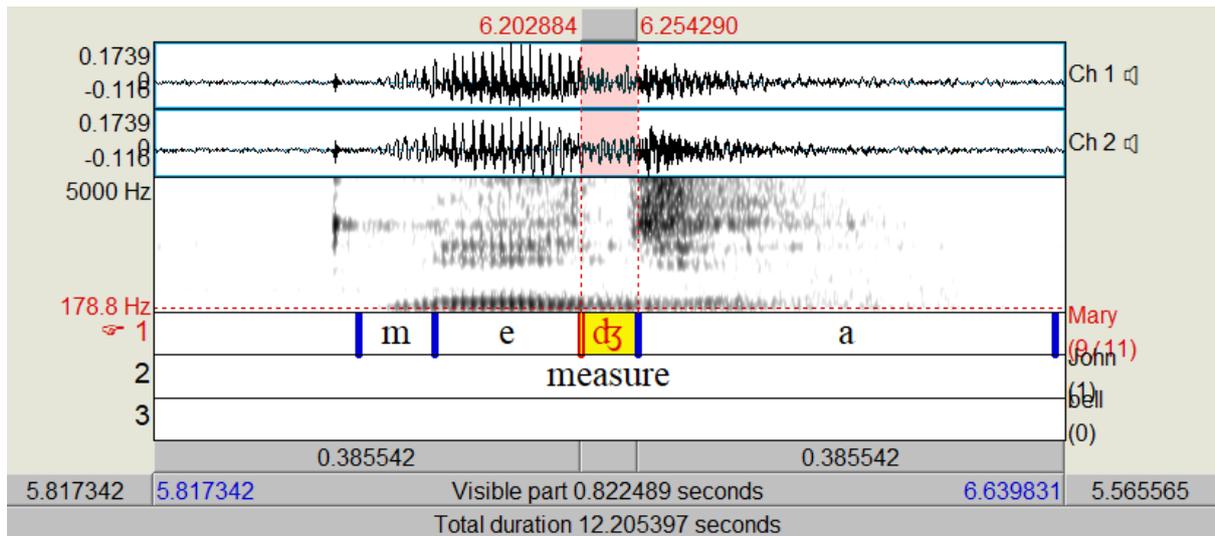


Figure 4.2: Hausa-English spectrogram for the realisation of the word measure (Hausa speaker 016)

4.1.1.6 Velar nasal /ŋ/ → [n] [ŋ]

The velar nasal is mainly realised as [n]. It is occasionally realised as a velar nasal [ŋ] at a word boundary, as is evident in Table 4.6.

Table 4.6: Examples of Hausa-English realisations of the velar nasal /ŋ/

Environment	Realisation	Words	Transcription	Style
_#	[ŋ]	long	[lɔŋ]	RB

This realisation could be argued to be the influence of a similar structure in the Hausa sound system. The velar nasal [ŋ] is realised as an allophone of alveolar nasal /n/ word-finally in Hausa. Thus, the realisation of /ŋ/ word-finally in Hausa-English is influenced by L1 Hausa since it is distributed word-finally in Hausa words. As reported by Jibril (1982), this is only occasional in Hausa-English. The voiced velar nasal is mostly realised as alveolar nasal word-finally in this study. A case of hyper-correction is also observed: The Hausa rule (realisation of alveolar nasal as velar nasal word-finally, see the Hausa phonology section in Chapter 2 above) is applied against the English words such as ‘beyond’ [bɪjɔŋ], as observed in the speech of some of the participants.

4.1.2 Phonetic processes in Hausa-English

There are a few phonological processes observed in Hausa-English that affect both consonants and vowels. While vowels often separate consonant clusters in Hausa-English, it is rare to delete a vowel in English words in Hausa-English, but vowels can have different realisations. On the other hand, consonants undergo both deletion and epenthesis processes. These processes mainly reflect the influence of the Hausa phonological system on the Hausa-English accent, as discussed

below. The processes observed in the current corpus are consonant epenthesis, consonant elision, vowel epenthesis and a few instances of consonant gemination. Each of these is discussed below.

4.1.2.1 Consonant epenthesis in Hausa-English

Consonants are sometimes inserted between the nucleus and offglide of diphthongs. It mainly affects PRICE, MOUTH, SQUARE, NEAR and CURE diphthongs. The first part of the PRICE and MOUTH vowels are sometimes lengthened before palatal or labiovelar approximants are introduced, as exemplified in Table 4.7.

Table 4.7: Some examples of consonant epenthesis in Hausa-English

Environment	Realisation	Words	Transcription	Style
/aɪ/	[a:jɪ]	behind	[bɪha:jɪn]	PD
/ʊə/	[uwa]	poor	[ɸuwa]	WL

4.1.2.2 Consonant deletion in Hausa-English

Hausa-English speakers habitually drop a consonant in consonant clusters at a word boundary. The past tense morpheme <ed> is mainly not pronounced in Hausa-English. This is because final /d/ in words such as 'find' and 'kind' is mainly dropped in Hausa-English. All the three conditions are syllable coda conditioned. The syllable structures of Hausa are CV, CVV and CVC (see Sani, 2005). Thus, Hausa does not allow a sequence of two or more consonants without an intervening vowel. It is, therefore, presumed that the speakers of Hausa might either break the consonant clusters or drop the syllable-final consonants. Table 4.8 shows some examples of consonant reduction in Hausa-English. The cluster deletion is mainly observed in free speech. Many of the participants pronounced each of the sounds in the written texts (i.e. spelling pronunciation). There is evidence of final consonant deletion in syllable coda position, as observed in the read speech.

Table 4.8: Some examples of consonant deletion in Hausa-English

Environment	Realisation	Words	Transcription	Style
/nd/	[n]	explained	[esple:n]	RB
/nd/	[n]	find	[faɪn]	RB
/sd/	[s]	caused	[kɔ:s]	RB
/nt/	[n]	student	[studen]	FS
/ks/	[s]	explain	[esple:n]	RB

4.1.2.3 Vowel epenthesis in Hausa-English

A vowel is inserted in between two consonants in consonant clusters, as evident in Table 4.9. While vowels occur in consonant clusters in Hausa-English, KIT, FOOT and schwa vowels mainly break consonant clusters in both syllable onset and coda positions of the Hausa-English. This finding was also reported in Simo Bobda’s (2007) work. Fig 4.3 contains a spectrogram showing the region where the epenthetic [ɪ] is evident. The marked sections contain evidence of vowel formant structure which is indicative of vowel epenthesis, and this is followed by transient burst spike indicating release of the lateral alveolar /l/.

Table 4.9: Some examples of vowel epenthesis in Hausa-English

Environment	Realisation	Words	Transcription	Style
/fl/	[fɪl]	floor	[ɸɪɫ:]	PD
/lp/	[ləɸ]	help	[heləɸ]	FS

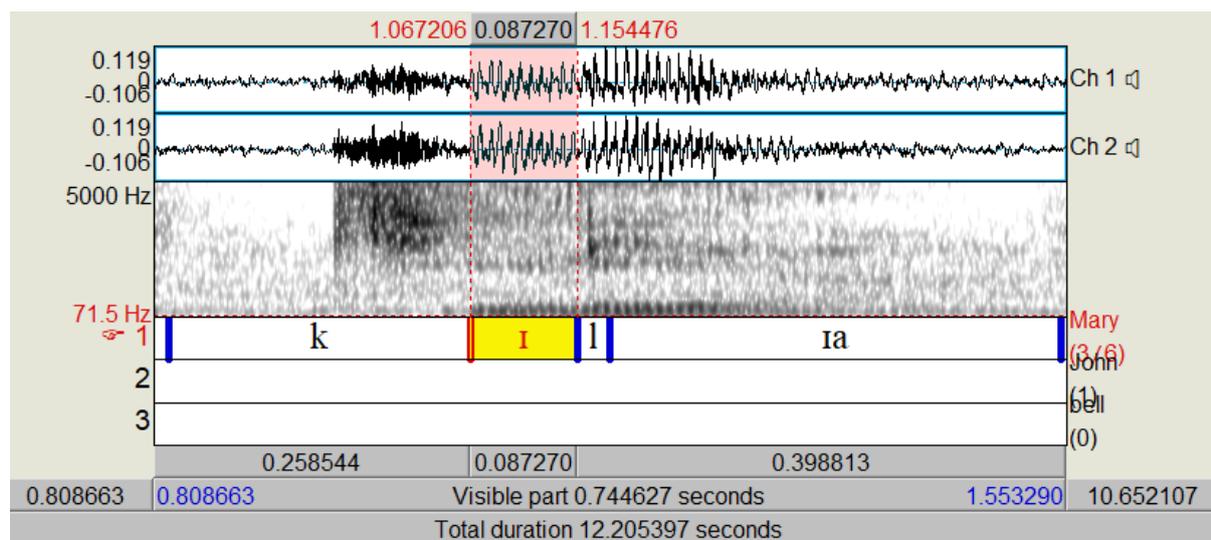


Figure 4.3: Hausa-English realisation of the word clear with an epenthetic KIT vowel (speaker 016)

4.1.2.4 Gemination in Hausa-English

A few examples of gemination are evident in Hausa-English. As already discussed in Chapter 2 (see description of Hausa phonology), there are some double-articulated consonants in Hausa-English. This reflects the influence of gemination process of L1 Hausa on some of the English words. Table 4.10 shows how Hausa-English speakers pronounce the word ‘government’ and the phrase ‘with the’. In some cases, the whole [və] syllable is elided and replaced by [m] in gemination process which is suspected to be the effect of Hausa phonology. The word ‘government’ is realised as [gamman] in

Hausa-English. This realisation resembles geminate consonants in several Hausa words (Sani, 2005; Jibril, 1982), for example, /sallah/ [salla] ‘prayer’ and /mayya/ [majja] ‘a female witch’.

Table 4.10: Some examples of consonant gemination in Hausa-English

Environment	Realisation	Words	Transcription	Styles
/və/	[m] / - /m/	government	[gammant]	FS
/ð/	[d] / - [d]	with the	[widda]	FS

4.1.2.5 Vowel lengthening in word medial positions

Word-medial schwa vowel is often lengthened in Hausa-English. For example, ‘afterwards’ is pronounced as [afta:wɔts] by Hausa-English speakers.

In summary, Table 4.11 provides all possible realisations of the English phonemes in Hausa-English.

Table 4.11: Some realisations of seven selected English consonants in Hausa-English

Phonemes	Realisations in Hausa English	
	Main realisation	Occasional realisation
/p/	[ɸ]	[p]
/f/	[ɸ]	[p] for hypercorrection
/v/	[b] syllable-initially	[ɸ] [p]
/θ/	[s]	[t]
/ð/	[z]	[d]
/ʒ/	[ʃ] in closed syllables	[dʒ] in open syllables
/n/	[n]	[ŋ] word-finally

4.2 Igbo-English sound system

Among the four Nigerian languages, Igbo has most English consonant phonemes in its phonemic inventory. Of the twenty-four English phonemes, only four consonant phonemes do not exist as contrastive phonemes in Igbo: /θ, ð, r, ʒ/.

4.2.1 Igbo-English consonant system

Pioneering studies such as Jibril (1982) argue that Igbo-English does not have shibboleths owing to its large phonemic inventory that includes most English consonants (except dental fricatives). For these reasons, it is argued that Igbo speakers of English realise all English consonants except for dental fricatives. However, the current corpus reveals that Igbo speakers also variably realise the voiced labiodental fricative, voiced postalveolar fricative and bilabial approximant. This sub-section only treats three of the four non-existing English phonemes: /ð, θ, ʒ/. Also, three more phonemes: /w,

v, ŋ/ are included for having some variants in Igbo-English. The phonemes and their realisations are discussed as follows:

4.2.1.1 Voiced dental fricative /ð/ → [d]

The majority of the Igbo speakers realise English /ð/ as [d], while a few others realise it faithfully, as shown in Table 4.12. On the other hand, it is realised as [t] in the following words: ‘with’, ‘within’, ‘northern’ and ‘without’. Almost all the Igbo participants who used such words realised the medial voiced dental fricative as voiceless alveolar plosive [t].

Table 4.12: Some realisations of the English voiced dental fricative /ð/ in Igbo-English

Environment	Realisation	Words	Transcription	Styles
#_	[d]	there	[deja]	PD
#_	[ð]	these	[ðɪ:s]	RB
V_V	[t]	northern	[notan]	PD

4.2.1.2 Voiceless dental fricative /θ/ → [t]

The voiceless dental fricative /θ/ is realised as voiceless alveolar stop [t] by the Igbo speakers, particularly in free speech, as observed by Jibril (1982). But some highly educated speakers realise it as in Received Pronunciation [θ], although its proportion of occurrence is low, and it is mainly observed in the read speech. Table 4.13 shows some examples. The same participants who realised it as the native [θ] reverted to [t] realisation in free speech.

Table 4.13: Examples of realisations of the English voiceless labio-dental fricative /θ/ in Igbo-English

Environment	Realisation	Words	Transcription	Styles
#_	[t]	thousand	[tauzan]	FS
_#	[θ]	north	[nɔθ]	WL

4.2.1.3 Voiced post-alveolar fricative /ʒ/ → [ʃ] [ʒ]

The voiced post-alveolar fricative /ʒ/ is mainly devoiced in Igbo-English. The realisation of [ʒ] is restricted in Igbo. Williamson (1969, cited in Jibril 1982) reported that the voiced postalveolar fricative [ʒ] is only realised as an allophone of /z/ before a front closed vowel in Igbo. Jibril (1982) observed that English /ʒ/ is variably realised as [ʒ], [dʒ] or [ʃ]. Contrary to his findings, the current corpus shows that the phoneme is mainly realised as [ʃ] and occasionally as [ʒ], as shown in Table 4.14.

However, there is an overlap between [w] and [ɱ]. Some of these participants realised it as [w] in the Rainbow passage data. On the other hand, participants (3) and (12) realised it as a labialised pharyngeal [ħ^w]. The word ‘which’ is realised as [ħ^wɪt] by both participants. Although this realisation was reported by Jibril (1982), it is only observed in the word ‘which’ in the current corpus. It is, therefore, not generalised across all wh-words. While other wh-words have retained their appropriate realisations, the glottal fricative /h/ is realised as [w] in some wh-words; for example, the participant (7) realised the word ‘whole’ as [wɔl]. Also, two different realisations are interchangeably used by participant (3). He variably realised ‘which’ as [ɱɪt] or [ħ^wɪt].

4.2.1.5 Voiced labio-dental fricative /v/ → [v] [b] [p]

The voiced labio-dental fricative /v/ is variably realised as [v] and [b] in all the five speech styles. It is mainly realised as [v] syllable-initially. On the other hand, it is occasionally realised as a voiced or voiceless bilabial plosive [b] and [f] before another consonant in a closed syllable, as shown in Table 4.16.

Table 4.16: Examples of the three realisations of voiced labiodental fricative in Igbo-English

Environment	Realisation	Words	Transcription	Styles
#_	[v]	evacuate	[ɪvakujet]	PD
V_C	[b]	observed	[ɔbza:bt]	RB
V_	[f]	observed	[ɔbza:f]	RB

While /v/ is realised as [b] by all the Igbo participants in the word ‘traveller’ of the North Wind and the Sun data, it is realised as [b] or [f] in the word ‘observed’ of the Rainbow passage data. It is realised as [f] when the past tense marker /d/ is dropped, as in ‘observed’ [ɔbza:f]. Also, it is realised as [b] when the speakers attempt to articulate the final /d/, as in [ɔbza:bt].

4.2.1.6 Voiceless post-alveolar fricative /ʃ/

The voiceless postalveolar fricative /ʃ/ is not realised as [s] throughout by all the Igbo participants. The absence of [s] realisation refutes the prediction of Jowitt (1991) that Igbo-English speakers may pronounce [s] for /ʃ/ because most of the Igbo dialects do not have the voiceless postalveolar fricative /ʃ/. Although Igbo literature such as Eme & Odinye (2008 p. 28) and Eme & Uba (2016) did not report similar information, the phoneme occurs in the Igbo consonant chart, as one of many other contrastive phonemes. However, an overlapping realisation is observed in the speech of participant (3), as he realised the word ‘showing’ as [tʃɔwɪn].

4.2.2 Phonetic processes in Igbo-English

Four phonetic processes occur in Igbo-English. These are consonant epenthesis, consonant deletion, vowel epenthesis and devoicing of alveolar plosive /d/.

4.2.2.1 Consonant epenthesis in Igbo-English

The only most common consonant epenthesis in Igbo-English is the occurrence of [k] at word boundary in words such as ‘sing’, ‘spring’ and ‘long’. The realisation is more prominent in southern Nigeria.

4.2.2.2 Consonant elision in Igbo-English

The alveolar plosive /d/ is deleted before a voiceless alveolar fricative /s/ in coda position of words. Deletion of /d/ usually results in lengthening the neighbouring vowels. For example, ‘gods’ is realised as [gɔ:s]. Table 4.17 shows more examples of consonant elision in Igbo-English.

Table 4.17: Examples of consonant elision at a word boundary in Igbo-English

Environment	Realisation	Words	Transcription	Style
V-C_# /d/	[∅]	gods	[gɔ:s]	RB
C_C /d/	[∅]	ends	[ens]	RB
V-C /l/	[∅]	old	[ɔ:t]	WL

4.2.2.3 Vocalisation in Igbo-English

The close back vowel [u] substitutes /l/ in consonant clusters, usually in coda position. Final /l/ in consonant clusters are substituted with the [u] vowel, as shown in Table 4.18.

Table 4.18: Some examples of vowel epenthesis in Igbo-English

Environment	Realisation	Words	Transcription	Style
C_C_# /l/→	[u]	little	[litu]	RB
	[u]	treacle	[triɪku]	WL

4.2.2.4 Devoicing of alveolar plosive /d/

The alveolar plosive is devoiced as [t] at a word boundary. This affects both the past tense morpheme and non-morphemic /d/, as shown in Table 4.19.

Table 4. 19: Examples of devoicing of alveolar plosive /d/ in Igbo-English

Environment	Realisation	Words	Transcription	Style
V_C_#	[t]	wind	[wint]	WL
C_V_#	[t]	coloured	[kɔlət]	RB

In summary, Table 4.20 provides possible main and occasional realisations of the selected English consonant phonemes in Igbo-English.

Table 4.20: Selected English consonants and their realisations in Igbo-English

Phonemes	Realisations in Igbo-English	
	Main realisation	Occasional realisation
/ð/	[d]	[ð] [t]
/θ/	[t]	[θ] mainly for reading
/ʒ/	[ʃ] in closed syllables	[ʒ] in open syllables
/v/	[v]	[b] [f] before another consonant in a closed syllable

4.3 Kanuri-English sound system

Of the twenty-four English phonemes, sixteen phonemes: /b, t, d, k, g, s, z, l, h, m, n, w, j, ʃ, tʃ, dʒ/ exist in Kanuri. Such phonemes are also realised in the English spoken by native speakers of Kanuri. Only these seven English phonemes: /p, θ, ð, f, v, ʒ, r/ are selected for an in-depth discussion regarding their realisations in Kanuri English, as such consonant phonemes are variably realised in Kanuri-English.

4.3.1 Kanuri-English consonant system

Kanuri does not have equivalents of the five English phonemes: /θ, ð, v, ʒ, r/. The English sounds [p] and [ʃ] only exist as allophones of Kanuri phonemes with a restricted distribution in the Kanuri words. These English phonemes have several realisations in Kanuri-English, as each of them is discussed below.

4.3.1.1 Voiced labio-dental fricative /v/ → [b] [p]

While /v/ is mainly realised as [b] in onset position, it is variably realised as [p] by Kanuri speakers, as shown in Table 4.21. The voiceless bilabial stop [p] occurs as an allophone of /b/ in syllable coda position of some of the Kanuri words.

Table 4.21: Examples of the two realisations of voiced labiodental fricative in Kanuri-English

Environment	Realisation	Words	Transcription	Style
#_	[b]	vegetable	[bedʒɪtɒbl]	PD
V_V	[b]	division	[dɪvɪdʒɪn]	RB
_ #	[p]	gave	[gɛp]	NWS

4.3.1.2 Voiceless labio-dental fricative [f] → [ɸ] [p]

The voiceless labiodental fricative /f/ is realised as a voiceless bilabial fricative [ɸ] syllable-

initially. /f/ is also realised as [p] syllable-finally by Kanuri speakers. Thus, the distinction of /v/ and /f/ is neutralised in syllable coda positions, as shown in Table 4.22.

Table 4.22: Examples of the realisations of the English voiceless labiodental fricative in Kanuri-English

Environment	Realisation	Words	Transcription	Style
#_	[ɸ]	farmers	[ɸa:mas]	PD
V_V	[ɸ]	information	[ɪnɸɔ:meɪn]	FS
_V	[ɸ]	effect	[eɸekt]	RB
_#	[ɸ]	myself	[maɪself]	FS

4.3.1.3 Voiced dental fricative /ð/ → [d]

The voiced dental fricative /ð/ is realised as a voiced alveolar plosive [d] in Kanuri-English, as shown in Table 4.23.

Table 4.23: Examples of the realisation of the English voiced dental fricative in Kanuri-English

Environment	Realisation	Words	Transcription	Style
#_	[d]	there	[deja]	RB
V_V	[d]	other	[ɔda:]	NWS

Kanuri speakers unconditionally (in both free speech and read speech) articulate /ð/ as [d]. Kanuri speakers mainly realise the definite article <the> as [dɪ] regardless of which sound precedes or follows it. Similarly, a few Kanuri-English speakers have shifted from the typical Kanuri-English accent. One of the Kanuri participants does not sound like the others. He had his primary education in his Kanuri community before moving to Katsina State (of North West Nigeria) for higher education. He also obtained a Master's degree from the University of Maiduguri.

4.3.1.4 Voiceless dental fricative /θ/ → [t] [s]

The voiceless dental fricative /θ/ is realised as a voiceless alveolar plosive [t] word-initially and word-finally. It is also occasionally pronounced as a voiceless alveolar fricative [s] word-initially and word-finally as evident in Table 4.24.

Table 4. 24: Examples of the realisations of the English voiceless dental fricative in Kanuri-English

Environment	Realisation	Words	Transcription	Style
#_	[t]	thought	[tɔt]	WL
_#	[t]	north	[nɔt]	WL
_#	[s]	mouth	[maus]	WL

4.3.1.5 Voiced postalveolar fricative /ʒ/ → [dʒ]

The voiced postalveolar fricative /ʒ/ is mainly realised as a voiced postalveolar affricate [dʒ] in syllable onset position of the second syllable of words. It is mainly pronounced as [dʒ] in onset position of both open and closed syllables in Kanuri-English. The sound [dʒ] mainly substitutes /ʒ/ in onset position of both open and closed syllables of Kanuri-English, as shown in Table 4.25. As explained in the Hausa and Igbo sections above, Fig 4.5 shows spectrogram of the region where [dʒ] is realised.

Table 4. 25: Examples of the realisation of the English voiced postalveolar fricative in Kanuri-English

Environment	Realisation	Words	Transcription	Style
V_V	[dʒ]	measure	[medʒa]	WL
V_VC	[dʒ]	division	[dɪbɪdʒɪn]	RB

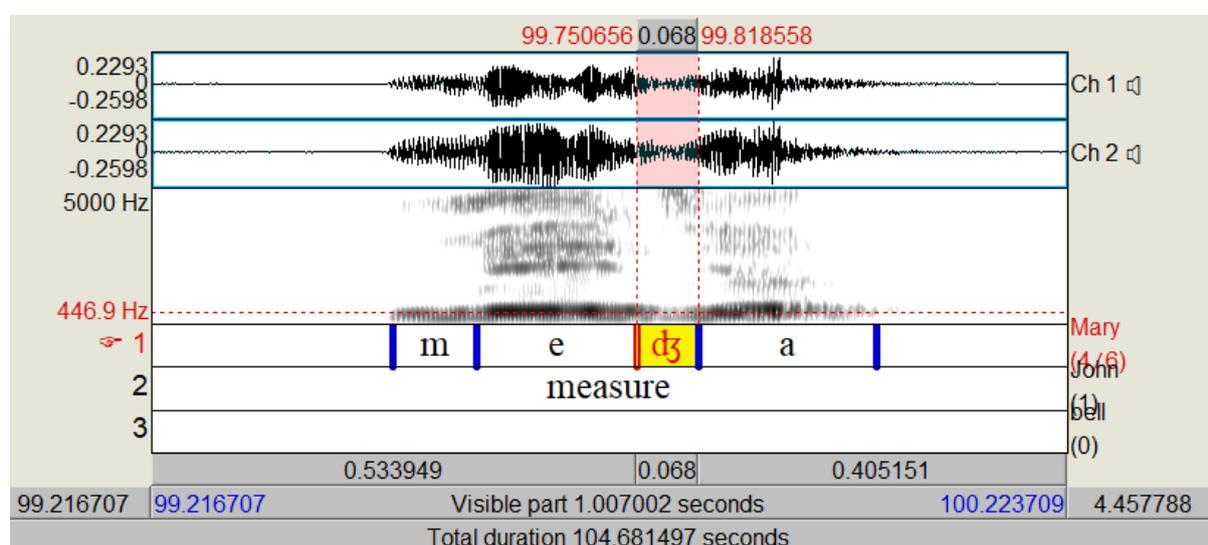


Figure 4.5: Kanuri-English spectrogram for the realisation of the word measure (speaker 011)

4.3.1.6 Velar nasal /ŋ/ → [n]

The velar nasal /ŋ/ is realised as an alveolar nasal [n] at a word boundary as evident in Table 4.26.

Table 4. 26: Examples of velar nasal /ŋ/ realisation in Kanuri-English

Environment	Realisation	Word	Transcription	Style
_ #	[n]	long	[lɔ:n]	RB
_ #	[n]	boiling	[bɔɪɪn]	RB

/ŋ/ is mainly realised as [n] in Kanuri-English despite its existence in Kanuri phonology. The velar nasal only occurs either word-initially or word-medially in Kanuri. Thus, /ŋ/ and /n/ are

neutralised word-finally in Kanuri-English. For example, Kanuri speakers do not distinguish the two phonemes in English as in ‘king’ and ‘kin’.

4.3.2 Phonetic processes in Kanuri English

Three main phonetic processes are observed in the current data of Kanuri-English. These are consonant elision, vowel epenthesis and vowel elision.

4.3.2.1 Consonants elision in Kanuri English

Kanuri speakers elide consonants in consonant clusters. As mentioned in Chapter 2, the syllable structure of Kanuri allows CV or CVC only (Bulakarima & Shettima, 2012). Thus, Kanuri does not allow a sequence of two or more consonants without an intervening vowel in both onset and coda positions. It is, therefore, presumed that the speakers of Kanuri might break the consonant clusters or drop the syllable-final consonants. Table 4.27 shows some examples of consonant elision in Kanuri-English. All the three conditions are syllable coda-conditioned. However, cluster reduction is mainly observed in free speech. Many of the participants pronounced each of the sounds when reading aloud. Except for the word ‘wind’ of the word list data (all Kanuri participants elided the final /d/), few final consonants are elided in syllable coda position, as is evident in the two reading excerpts.

Table 4. 27: Some examples of consonant elision at a word boundary in Kanuri-English

Cluster	Realisation	Words	Transcription	Style
/nd/	[n]	explained	[esple:n]	RB
/sd/	[s]	caused	[kɔ:s]	RB
/ks/	[s]	accepted	[aseɸtet]	RB

4.3.2.2 Vowel epenthesis in Kanuri-English

The schwa vowel mainly breaks the consonant clusters in syllable onset positions of Kanuri English. On the other hand, Kanuri speakers mainly pronounce a schwa vowel [ə] word-finally. Almost all Kanuri participants additionally attach the schwa vowel to the final position of the neuter preposition ‘it’ when it occurs before ‘is’. Some examples are provided in Table 428.

Therefore, the frequent use of the schwa vowel in English consonant clusters as realised by Kanuri speakers is attributed to their L1 system. Generally, consonant clusters do not exist in L1 Kanuri (Bulakarima & Shettima, 2012). Thus, Kanuri speakers insert vowels in between consonant clusters in either syllable onset or coda position. The schwa vowel is the most widely distributed vowel in the L1 Kanuri, and Kanuri native speakers transfer their language attitudes into Kanuri-English.

Table 4.28: Some examples of vowel epenthesis in consonant clusters in Kanuri-English

Environment	Cluster	Realisation	Words	Transcription	Style
C_C	/dr/	[dər]	drops	[dərɒps]	RB
_#	/d/	[də]	explained	[esplendə]	RB
_#	/ɪt/	[ɪtə]	it is	[ɪtə.ɪs]	RB

In summary, Table 4.29 provides a full list of all possible realisations of the selected English consonant phonemes in Kanuri-English.

Table 4.29: Seven selected English consonants and their realisations in Kanuri-English

Phonemes	Realisations in Kanuri English	
	Main realisation	Occasional realisation
/p/	[ɸ] syllable-initially	[p] syllable-finally
/f/	[ɸ] syllable-initially	[p] syllable-finally
/v/	[b] syllable-initially	[p] syllable-finally
/θ/	[t]	[s]
/ð/	[d]	NIL
/z/	[dʒ] in closed syllables	[ʃ] in open syllables
/n/	[n]	[ŋ]

4.4 Yoruba sound system

Of the twenty-four English phonemes, fifteen similar phonemes, /b, t, d, k, g, f, s, l, h, m, n, w, j, ʃ, dʒ/ exist as comparable units in Yoruba. Nine English phonemes /p, θ, ð, v, z, ʒ, r, tʃ, ŋ/ do not exist in Yoruba.

4.4.1 Yoruba-English consonant system

Eight of the non-existing English phonemes in Yoruba /p, z, θ, ð, v, ŋ, tʃ, ʒ/ have been carefully studied for determining their realisations in Yoruba. The articulation of these phonemes in all environments in English words was carefully observed. Despite their non-existence in Yoruba, the four English phonemes /p, z, tʃ, v/ are mainly realised as in Received Pronunciation. The dental fricatives /θ/ and /ð/ are mainly realised as [t] and [d], as is evident in all the five speech styles. On the other hand, the glottal fricative /h/ is available in Yoruba sound system, but most Yoruba-English speakers do not pronounce it.

4.4.1.1 Voiced labio-dental fricative /v/ → [v] [f]

The voiced labiodental fricative /v/ is realised as [v] in syllable-initial position or intervocalic position. Unlike what Jibril (1982) reported, there is no evidence of replacing /v/ with its voiceless counterpart [f] word-initially or syllable-initially in the current corpus. However, /v/ is realised as [f] in coda position word-finally, as shown in Table 4.30.

Table 4. 30: Examples of the realisations of the English voiced labiodental fricative in Yoruba-English

Environment	Realisation	Words	Transcription	Style
#_	[v]	vegetables	[vedʒɪtebulz]	PD
σ_	[v]	interview	[ɪntevɪw]	WL
_#	[f]	have	[haf]	RB

In some cases, /v/ is also realised as [f] when the voiced alveolar plosive /d/ of the past tense morpheme <ed> is deleted. Some evidence provided by Jibril (1982) too were only instances at a word boundary, as in ‘relieve’ and ‘behave’. The syllable-initial realisation of /v/ as [f] was not evident in Jibril’s (1982) findings. Thus, it suggests that a word-final or syllable-final [f] realisation is a general phenomenon in both Yoruba-English and Igbo-English; it could even be a devoicing of /v/. In the current corpus, almost all the Yoruba participants realised /v/ as [v] in all five speech styles.

4.4.1.2 Voiced dental fricative /ð/ → [d] [t]

The voiced dental fricative /ð/ is mainly realised as a voiced alveolar plosive [d]. While it is realised as a voiceless plosive [t] in a few English words, as shown in Table 4.31, it is realised as [ð] by some speakers. While an overlap between /ð/ and /d/ is not observed (as was reported by Jibril (1982)), another observation is the occasional realisation of /ð/ as [t] intervocalically in words such as ‘northern’ and ‘within’. Table 4.31 provides some examples of such a realisation.

Table 4.31: Examples of the realisations of the English voiced dental fricative in Yoruba-English

Environment	Realisation	Words	Transcription	Style
#_	[d]	there	[deja]	PD
_#	[t]	northern	[nɔtən]	RB

/ð/ in both ‘northern’ and ‘within’ is natively realised as [ð]. In turn, Yoruba speakers are expected to maintain their norm of realising /ð/ as [d]. However, the reverse is the case. All Yoruba speakers who used the word ‘northern’ realised it as [nɔtən]. It could perhaps be generalised as a Southern Nigerian English habit. Since Yoruba speakers pronounced the voiceless dental fricative as [t], they might have derived the variant pronunciation from the base word ‘north’. Consequently, the realisation of /ð/ as [t] is extended to the derived adjective ‘northern’ after attaching the suffix <ern>.

Yoruba speakers, however, pronounced /ð/ as [d] in the word 'neither' which further supports the argument that the realisation of northern as [nɔtan] is morpho-phonological. Contrary to Jibril's (1982) finding, variation between speakers and within individual speakers is rarely observed in the three words: 'with', 'within' and 'without', as all of them have [t] for /ð/ in these words.

4.4.1.3 Voiceless dental fricatives /θ/ → [t] [t̪] [θ]

The voiceless dental fricative /θ/ has three realisations, as shown in Table 4.32. It is mainly realised as the voiceless alveolar plosive [t]. While it is occasionally realised as the native form [θ] (mostly in reading), some speakers occasionally realised it as a voiceless dental plosive [t̪] by raising their tip of the tongue against the back of the upper teeth. Sometimes, the voiceless alveolar stop is also realised as [t̪] by Yoruba speakers, as in 'bottle' [bɔt̪u].

Table 4.32: Examples of the three realisations of the English voiceless dental fricative in Yoruba-English

Environment	Realisation	Words	Transcription	Style
#_	[t]	nothing	[nɔtɪn]	WL
_#	[t̪]	north	[nɔt̪]	WL
#_	[θ]	thought	[θɔt]	WL

4.4.1.4 Voiced alveolar fricative /z/ → [z] [s]

As mentioned above, /z/ does not exist either as a contrastive phoneme or an allophone in Yoruba. As a result, the absence of such a sound in Yoruba may extend to Yoruba-English. Conversely, evidence from our current corpus indicates that /z/ is mainly realised as [z] in all the five speech styles. The realisation of /z/ as [s] is suspected to be caused by orthographic influence rather than L1 Yoruba phonological influence. While /z/ is realised as [z] in all the English words spelt with letter <z>, it is realised as [s] in some words spelt with grapheme <s>, as exemplified in Table 4.43.

Table 4.33: Examples of the realisations of the English voiced alveolar fricative in Yoruba-English

Environment	Realisation	Words	Transcription	Style
#_	[z]	horizon	[hɔɾɪzɔn]	RB
_#	[s]	physically	[fɪsɪkəlɪ]	RB

Contrary to what Jibril (1982) reported, there is no evidence of Yoruba speakers pronouncing the word 'socialisation' with an [s] sound. Although the word is spelt with letter <s> rather than <z> in British English, the other example given by Jibril is 'present', which also has letter <s>. Similarly, /z/ is realised as [z] in several words such as 'business', 'prism', 'observed', 'imposition' and 'easy' in both

picture description and read speech. None of the Yoruba participants realised these words with the voiceless alveolar fricative [s] in the current corpus despite their spelling with grapheme <s>.

4.4.1.5 Voiceless postalveolar affricate /tʃ/ → [tʃ]

The Yoruba phonemic inventory does not have an equivalent of the voiceless postalveolar affricate /tʃ/. As a result, it is predicted that Yoruba speakers might confuse it with one of the nearest Yoruba sounds in Yoruba-English. Jibril (1982) observed that the sound is realised as a voiceless postalveolar fricative [ʃ]. However, our current corpus reveals that /tʃ/ is pronounced as in the native English way in all the five speech styles. The Yoruba participants mainly realised the sound as in Received Pronunciation in both onset and coda positions of the English words, as exemplified in Table 4.34.

Table 4.34: Examples of Yoruba realisation of the English voiceless post-alveolar affricate /tʃ/

Environment	Realisation	Words	Transcription	Style
#_	[tʃ]	choose	[tʃus]	WL
_#	[tʃ]	which	[wɪtʃ]	RB
_#	[ʃ]	which	[wɪʃ]	PD

However, three cases are observed in the speech of participants (15), (17) and (19), where they realised ‘which’ of the word list data as [wɪʃ] rather than [wɪtʃ]. While the examples from participants (15) and (19) stand for the only cases at word boundary, those of participant (17) are from both syllable-initial and final positions, for example, ('children' [ʃɪldrən] and 'picture' [pɪkʃə]). Therefore, Yoruba-English speakers (undergraduates and postgraduates from the ages of 18-40) are shifting from what they were doing in the past.

4.4.1.6 Voiced postalveolar fricative /ʒ/ → [ʃ] [ʒ]

The voiced postalveolar fricative /ʒ/ is realised as [ʃ] or [ʒ] in Yoruba-English, as shown in Table 4.35. It is mainly realised as [ʃ], particularly in closed syllables in English words. It is only realised as [ʒ] in an open syllable. Also, two participants realised it as palatal approximant [j] in ‘measure’. As explained above, Fig 4.6 contains a spectrogram showing the region where [ʒ] is realised for /ʒ/.

Table 4.35: Examples of the realisations of the English voiced postalveolar fricative in Yoruba-English

Environment	Realisation	Words	Transcription	Style
V_VC	[ʃ]	division	[dɪvɪʃən]	WL
V_VC	[ʒ]	measure	[meʒə]	WL

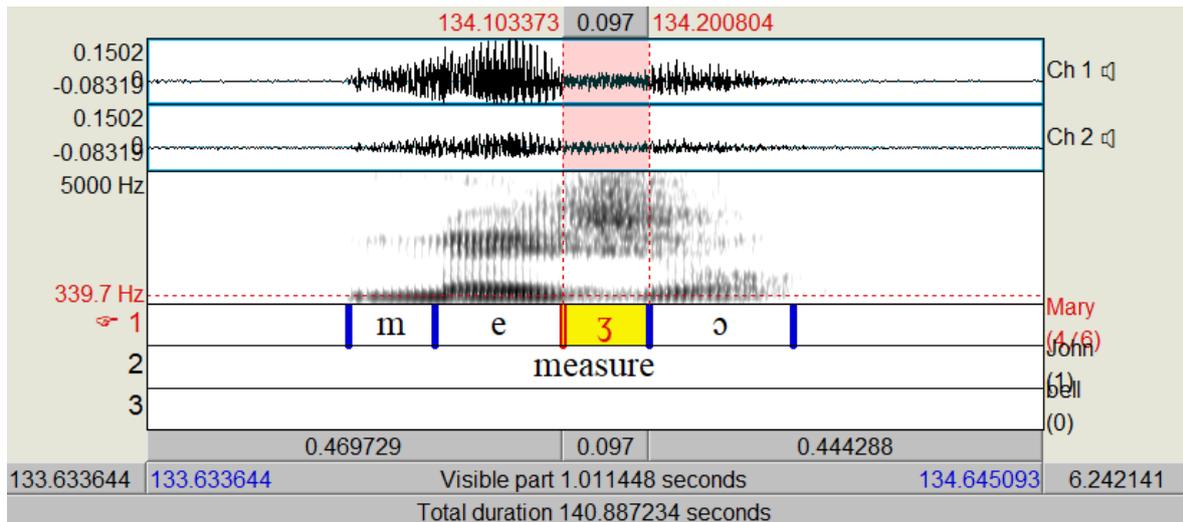


Figure 4.6: Yoruba-English spectrogram for the realisation of measure (Yoruba speaker 006)

On the other hand, the realisation of [ʒ] is mainly evident in open syllables in English words, as in ‘measure’ [meʒɔ]. The realisation of the voiced postalveolar fricative /ʒ/ is retained as observed by Jibril (1982). However, three of the four realisations [d, z, s] predicted by Jowitt (1991) are not evident in the speech of Yoruba speakers. Only [ʒ] is evident.

4.4.1.7 Voiced velar nasal /ŋ/ → [n]

Despite the presence of the English velar nasal /ŋ/ in Yoruba, it is mainly realised as an alveolar nasal [n]. There is no evidence of /n/ becoming [ŋ] in Yoruba-English. The finding of this study contradicts the finding of Jibril (1982). All the Yoruba participants realised /n/ as [n] in the word ‘confess’ in the North Wind and the Sun data. Thus, /n/ is mainly realised as [n] regardless of which phoneme precedes or follows it in the current corpus. When the velar nasal is followed by a /g/ phoneme, as in ‘finger’ and ‘stronger’, it is not very clear whether the velar nasal /ŋ/ is realised as velar nasal [ŋ] or alveolar nasal [n]. Words with <ing> endings are variably realised as [n].

4.4.2 Phonetic processes in Yoruba-English

Four phonetic processes have been observed in the Yoruba-English data. These are consonant epenthesis, consonant deletion, vowel epenthesis and devoicing of the voiced alveolar plosive /d/.

4.4.2.1 Consonant elision in Yoruba-English

Voiceless glottal fricative /h/

The voiceless glottal fricative /h/ occurs in both Akinlabi’s (1994) and Oyebade’s (1991) consonant charts of Yoruba, but the phoneme is mostly deleted in Yoruba-English. Many studies, including Jibril (1982) and Jowitt (1991) identified /h/ deletion word-initially in Yoruba-English. This is also observed and confirmed in the current study. Although Jibril (1982, p. 98) observed that /h/ is

often deleted in Yoruba-English, especially word-initially, he did not mention any evidence of /h/ epenthesis. In the current study, both occur in all the four speech styles. Some examples are shown in Table 4.36.

Table 4.36: Some examples of elision and epenthesis of the glottal fricative in Yoruba-English

Environment	Realisation	Words	Transcription	Style
#_	[∅]	inhumane	[ɪnumɛn]	WL
	[h]	end	[hend]	NWS
∅	[h]	everything	[hevɾɪtɪn]	FR

The glottal fricative [h] is introduced in both word-initial and syllable-initial positions. It is introduced to the syllable-initial position regardless of whether it is first or second syllable of the word in question. For example, 'throughout' in the Rainbow data and 'end' in the North Wind and the Sun data were realised as [truɬaut] and [hent] by some of the participants.

Voiced alveolar lateral /l/

Yoruba speakers often delete the voiced alveolar lateral /l/. Instead of articulating the phoneme /l/, they elongate the preceding vowel, as shown in Table 4.37. A word-final /l/ is often deleted in Yoruba-English, as indicated under the vowel epenthesis sub-heading below. Jibril (1982) reported that /l/ is deleted post-vocally in a single consonant coda position or when it is the first consonant of a consonant cluster in coda position (p. 204).

Alveolar nasal /n/

Also, alveolar nasals are deleted after a diphthong at word boundary, as shown below. All the Yoruba participants dropped the final nasal /n/ in the word 'mine' of the word list. In most of the Jibril's (1982) examples, /n/ is deleted when preceded by short vowels in Yoruba-English. Conversely, deletion of /n/ usually occurs after a diphthong in this corpus. Jibril (1982) argued that the /n/ deletion is as a result of the presence of five nasalised vowels in Yoruba. Thus, Yoruba speakers transfer their L1 feature into their L2 English.

Table 4.37: Examples of the alveolar nasal /n/ and alveolar lateral /l/ elision in Yoruba-English

Environment	Realisation	Words	Transcription	Style
V_C /l/ →	[∅]	gold	[gɔ:d]	RB
		result	[ɾɪzɔ:t]	RB
_# /n/ →	[∅]	mine	[maɪ]	WL

4.4.2.3 Consonant epenthesis in Yoruba-English

Yoruba-English speakers often articulate a velar stop [k] after a velar nasal at a word boundary, as Table 4.38 shows. The velar nasal is also usually realised as the alveolar nasal [n]. This is more prominent in Yoruba-English than in the other Nigerian English varieties.

Table 4.38: Some examples of consonant epenthesis at a word boundary in Yoruba-English

Environment	Realisation	Words	Transcription	Style
/ŋ/ → [ŋk] _#	[ŋk]	long	[lɔŋk]	NWS
		sing	[sɪŋk]	WL

4.4.2.4 Vocalisation in Yoruba-English

In Yoruba-English, the [u] vowel usually substitutes a final /l/ in consonant clusters in coda positions. When the affected words have the alveolar lateral /l/ word-finally, /l/ is deleted and substituted with an [u] vowel. The epenthetic [u] vowel is also elongated, as shown in Table 4.39. Similarly, Jibril (1982) reported that the alveolar lateral is deleted in postvocalic position in Yoruba-English, even if it is not the final consonant of a word.

Table 4.39: Some examples of vowel epenthesis in Yoruba-English

Environment	Realisation	Words	Transcription	Style
C_C	[l] → [u]	bottle	[bɔtu:]	PD
		beetle	[bitu:]	WL

4.4.2.5 Vowel nasalisation after elision of post-vocalic nasal /n/

In Yoruba-English, some of the L1 Yoruba nasal vowels /ĩ, ě, ã, ỹ, ü/ (see the Yoruba phonology section in Chapter 2) occur in English word-final positions. Simo Bobda (2007) observes post-vocalic vowel deletion in Nigerian English, although he did not specify which of the Nigerian English accents has such a feature. In this corpus, it is observed that post-vocalic word-final nasal /n/ is deleted and the nasality is transferred on to the preceding vowel in some English words pronounced by Yoruba participants, as shown in Table 4.40.

Table 4.40: Some examples of post-vocalic nasal elision and subsequent vowel nasalisation

Environment	Realisation	Words	Transcription	Style
/i/ _# - /n/ →	[ĩ]	mine	[majĩ]	WL
		one	[wɔĩ]	WL

4.4.2.6 Devoicing of alveolar plosive /d/ in Yoruba-English

The voiced alveolar plosive is realised as its voiceless [t] counterpart at a word boundary in Yoruba-English, as is evident in the words ‘wind’ and ‘stupid’.

In summary, Table 4.41 provides a full list of all possible main and occasional realisations of the selected English phonemes: /p, z, θ, ð, v, ŋ, tʃ, ʒ/ in Yoruba-English.

Table 4.41: Realisations of the eight selected English consonants in Yoruba-English

Phonemes	Realisations in Yoruba-English	
	Main realisation	Occasional realisations
/p/	[p]	[kp] is not evident despite its prominence in L1 Yoruba.
/v/	[v] syllable-initially	[b] and rarely [f]
/θ/	[t]	[θ] [t̥]
/ð/	[d]	[t]
/z/	[z]	[s] only in spelling pronunciation
/ʒ/	[ʃ]	[ʒ] only in an open syllable
/tʃ/	[tʃ]	
/ŋ/	[ŋ]	[ŋ] word-finally
/h/	[∅] syllable-initially e.g. ‘house’ [aus]	
/∅/	[h] syllable-initially e.g. ‘end’ [hent]	

Despite the non-occurrence of consonant clusters in all the four Nigerian languages, the speakers of such languages do not appear to face serious challenges in articulating the consonant clusters in onset positions. A substantial number of consonant clusters are pronounced without an intervening vowel in the syllable onset position, although vowel epenthesis is more apparent in coda positions. The following are some of the major differences between the northern and southern regions.

Consonant elision could be used to distinguish the two regional varieties of English. The speakers of northern varieties (Hausa and Kanuri) often pronounce the first consonant in the coda but drop the second one, the speakers of southern varieties (Igbo and Yoruba) may drop the first consonant even if it is the only consonant in the coda position. Monosyllabic words (with a lax vowel) may have their consonants devoiced in both Igbo-English and Yoruba-English, for example, words such as ‘end’ and ‘red’ are realised as [ent] and [ret]. The next sub-sections are detailed descriptions of the selected English phonemes under each of the four accents.

4.5 Vowel Descriptions of Hausa-English, Igbo-English, Kanuri-English and Yoruba-English

Of the seven short English monophthongs: KIT, TRAP, DRESS, FOOT, LOT, STRUT, LETTER, there is not a marked difference among the four accents in pronouncing the KIT, TRAP, DRESS, FOOT and

LOT vowels. Their realisations by the four accent groups is given in Table 4.42. (see comparison of vowel acoustics section for further F1 and F2 insight about their variation in Fig 4.9, 4.10, 4.11, 4.12, 4.13, and bullet point summaries of such variations). The averaged F1-F2 values of these five vowels were taken from the realisation of the same five lexical sets (KIT, DRESS, TRAP, LOT and FOOT in a word list) of three respondents from each of the four Nigerian English accents.

Table 4. 42: Realisations of KIT, DRESS, TRAP, LOT & FOOT vowels by four Nigerian English accents

VOWELS	ACCENT GROUPS			
	Hausa-English	Igbo-English	Kanuri-English	Yoruba-English
KIT	[i]	[ɪ]	[ɪ]	[i]
DRESS	[e]	[ɛ]	[e]	[ɛ]
TRAP	[a]	[a]	[a]	[a]
LOT	[ɔ]	[ɔ]	[ɔ]	[ɔ]
FOOT	[ʊ]	[ʊ]	[ʊ]	[ʊ]

Two other monophthongs (STRUT and NURSE) are discussed based on their differences between northern (for Hausa and Kanuri) and southern (for Igbo and Yoruba) regions of Nigeria. Five diphthongs are also discussed based on their different realisations between northern and southern Nigeria. The diphthongs are FACE, MOUTH, NEAR, SQUARE and CURE. In addition, PRICE is discussed for its variability in Hausa-English and Kanuri-English only. The other two diphthongs, CHOICE and GOAT, are not included as they have very similar realisations in all the four Nigerian English varieties. The variability might be influenced by spelling, but each of the realisations is still attributable to the speakers' L1 influence.

4.5.1 Hausa-English versus Kanuri-English vowels

There are eight selected English vowels discussed in this sub-heading: STRUT, NURSE, FACE, MOUTH, PRICE, CURE, NEAR and SQUARE. These vowels have some specific realisations that can be used to distinguish Hausa and Kanuri from Igbo and Yoruba speakers. Each of these vowels is discussed below.

4.5.1.1 STRUT /ʌ/ → [ɔ] [a]

This vowel splits into two main realisations in Hausa-English and Kanuri-English. It is mainly realised as [ɔ] and occasionally as [a], as shown in Table 4.43. Apart from the word 'one' in which the vowel is predictably realised as [a], it is variably realised as [ɔ] or [a] word-initially. However, it is mainly realised as [ɔ] in between consonants.

Table 4.43: Examples of the realisations of the STRUT vowel in Hausa- and Kanuri-English

Realisations	Words	Transcription	Styles
[ɔ]	cut	[kɔt]	WL
[a]	one	[wan]	WL

4.5.1.2 NURSE /ɜ:/ → [ɔ] [a] [e]

Vowel duration does not also result in a significant difference among the four varieties of Nigerian English. Only the NURSE vowel shows a slight pronunciation difference between northern and southern Nigerian English speakers. Thus, only examples of the realisation of NURSE are provided in Table 4.44. The variability of NURSE is dependent on the spelling. Most of the English words spelt with digraph <or> are realised with [ɔ] in both the northern and the southern regions. While digraph <ur> is realised as [ɔ] or [a] in the north, it splits as [ɔ] or [e] in the southern region. Digraph <er> is mainly realised as [a] in both regions. While digraphs <ir> and <ear> are mainly realised as [ɛ] in the south, they are variably realised as [a] or [e] in the north.

Table 4.44: Examples of the three realisations of the NURSE vowel in Hausa-English and Kanuri-English

Environment	Realisation	Words	Transcription	Styles
<or>	[ɔ]	working	[wɔkɪŋ]	PD
<ur>	[ɔ]	turn	[tɜ:n]	FS
<ear>	[a]	earth	[a:s]	RB
<ir>	[a]	birth	[bat]	WL
<ir>	[e]	first	[fest]	NWS
<er>	[a]	observed	[ɔbzəp]	RB

4.5.1.3 FACE /eɪ/ → [e] [e:]

The FACE diphthong is reduced to a monophthong and split into two realisations. While it is mainly realised as [e] in both Hausa-English and Kanuri-English, it is occasionally elongated as [e:] in Hausa-English only. This is also influenced by the spelling of words. As shown in Table 4.45, words spelled with <ai> and <ay> digraphs are mainly realised as [e:], while words spelled with a single letter <a> have [e]. Such realisations are observed in both read and free speech. For example, the word ‘take’ is realised as [tek] in both the North Wind and the Sun and picture description. The point, here, is that even when a speaker reads the words spelt with a single letter <a>, there is a high likelihood of pronouncing them as [e] compared to those with <ai> and <ay> digraphs. For Kanuri, the diphthong is mainly realised as [e]. Unlike what is observed in Hausa-English, spelling does not determine the realisations of this vowel in Kanuri-English.

Table 4.45: Examples of the realisations of the FACE diphthong in Hausa-English and Kanuri-English

Environment	Realisation	Words	Transcription	Styles
<ai>	[e:]	mainly	[me:nɪ]	RB
<a>	[e]	take	[tek]	PD

4.5.1.4 PRICE /aɪ/ → [a:jɪ] [aɪ]

The PRICE diphthong exists in the Hausa vowel system but not in Kanuri. Apparently, both parts of the diphthong have equal duration in the two English varieties. Sometimes, it is realised with an intervening palatal approximant [j]. The palatal [j] breaks the diphthong when its first part /a-/ is lengthened, and the diphthong is followed by a consonant, as shown in Table 4.46. However, epenthetic [j] is not evident when the /aɪ/ occurs syllable-finally. For Kanuri, PRICE is realised as [aɪ], or sometimes with an intervening palatal approximant. But it is not possible to draw a clear line between the two realisations. As shown in Table 4.46, 'while' and 'white' have similar syllabic and orthographic structures, but they fall under different vowels.

Table 4. 46: Examples of the realisations of the PRICE diphthong in Hausa-English and Kanuri-English

Environment	Realisation	Words	Transcription	Styles
C_C	[a:jɪ]	side	[sa:jɪd]	PD
C_C	[a:jɪ]	while	[wa:jɪl]	PD
_#	[aɪ]	white	[waɪt]	FR

4.5.1.5 MOUTH /aʊ/ → [a:wu] [au]

The bilabial approximant /w/ is inserted between the two parts of MOUTH. The second part of the diphthong [ʊ] influences the epenthesis of [w]. Hausa has a diphthong /aʊ/, which is similar to the English MOUTH diphthong. Unlike Received Pronunciation, both parts of the diphthong have an equal duration in Hausa. Some examples of its realisations shown in Table 4.47 could be due to the influence of certain Hausa words. While there are disyllabic Hausa words such as kaawu (uncle) and awu (weighing) that have a long /a:/ or short /a/ occurring syllable-finally, the second syllable comprises bilabial approximant /w/ and back vowel /u/.

For Kanuri-English, this realisation may be as a result of a similar structure in Kanuri phonological processes. There exists in Kanuri a sonorisation process where stop consonant phonemes such as /b, k, g/ lenite to [w] between vowels or after liquids /l/ and /r/. While there are two diphthongs in Hausa which are similar to MOUTH and PRICE, there are none in Kanuri. The Hausa diphthongs do not occur in a closed syllable (i.e., they always occur syllable-finally). For this reason, [w] breaks the diphthongs due to a lack of a similar structure in both languages. Similar observation

was also made by Jibril (1982). Speakers of Hausa and Kanuri have similar realisations of this diphthong.

Table 4.47: Examples of the realisations of MOUTH diphthong in Hausa-English and Kanuri-English

Environment	Realisation	Words	Transcription	Styles
C_C	[a:wu]	about	[aba:wut]	RB
	[au]	found	[ɸaun]	RB

4.5.1.6 CURE /ʊə/ → [uwa]

The CURE diphthong is realised mainly as [uwa] and occasionally as [ɪwɔ] by Hausa-English and Kanuri-English speakers. There exists a similar syllable structure in Hausa. It has disyllabic words such as uwa (mother) and ruwa (water) that have a back vowel /u/ occurring syllable-finally in the first syllable. The second syllable [wa] is composed of the bilabial approximant [w] and the open vowel [a]. This might have let the Hausa speakers to apply their L1 phonological structure in their English speech. Table 4.48 shows the realisation variability based on the spelling differences.

Table 4.48: Examples of the realisations of the English CURE diphthong in Hausa- and Kanuri-English

Spelling	Environment	Realisation	Words	Transcription	Styles
<oor>	_#	[uwa]	poor	[ɸuwa]	WL
<ua>	C_C	[uwa]	actual	[aktɸuwal]	RB
<ure>	_#	[ɪwɔ]	pure	[ɸɪwɔ]	WL

4.5.1.7 NEAR /ɪə/ → [ɪja] [ɪa]

The palatal approximant [j] breaks the NEAR diphthong in both Hausa-English and Kanuri-English, as shown in Table 4.49. Apart from palatal [j] epenthesis, the second part /ə/ of the NEAR diphthong is variably realised as [a, e, ɔ]. While it is mainly realised as [ɪa] or [ɪja], NEAR is realised as [ɪjɔ] when spelled as <iou> by most of the participants in this case, but it was rarely realised as [je] by a few Kanuri speakers.

The [ja] realisation of this diphthong could be influenced by Hausa. There are multisyllabic Hausa words that contain a [ja] syllable where the syllables are preceded by another syllable ending in /i/ or /e/ vowel. For example, biya → [bɪja] (to pay) and giya → [gɪja] (alcohol). Similarly, some Kanuri words have similar structure, for example, diya → [dɪja] (outdoors).

Table 4. 49: Examples of realisations of the English NEAR diphthong in Hausa- and Kanuri-English

Environment	Realisation	Words	Transcription	Styles
_ #	[ɪja]	bear	[bɪja]	WL
_ #	[ɪje]	clear	[klɪje]	WL
C_C	[ɪjɔ]	various	[berɪjɔs]	RP

4.5.1.8 SQUARE /eə/ → [eja] [ea]

The SQUARE diphthong is also sometime interrupted by the epenthetic palatal approximant [j] in both Hausa-English and Kanuri-English, as shown in Table 4.50. However, it is also realised as [ea] without the [j] insertion.

Table 4.50: Examples of the realisations of the SQUARE diphthong in Hausa- and Kanuri-English

Environment	Realisation	Words	Transcription	Styles
_ #	[eja]	air	[eja]	RB
_ #	[ea]	there	[dea]	RB

In summary, Table 4.51 provides a full list of all possible main and occasional realisation of the English selected vowel phonemes in Hausa- and Kanuri-English.

Table 4.51: Comparison of the realisations of nine selected English vowels in Hausa- and Kanuri-English

Phonemes	Realisations in Hausa-English		Realisations in Kanuri-English	
	Main realisation	Occasional realisation	Main realisation	Occasional realisation
STRUT	[ɔ]	[a]	[ɔ]	[a]
LETTER	[ɔ] [a]	[ɪ] [e] [u]	[ɔ]	[a] [e] [u] [ɪ] spelling
NURSE	[ɔ] [a]	[ɔ:] [e]	[ɔ]	[e] [a]
FACE	[e]	[e:]	[e]	NIL
PRICE	[a:jɪ]	[aɪ]	[aɪ]	[ajɪ]
MOUTH	[awu]	NIL	[awu]	NIL
CURE	[uwa]	[ɪwɔ]	[uwa]	[ɪwɔ]
NEAR	[ɪja]	[ɪjɔ] when spelled <iou>	[ɪja]	[ɪjɔ] <iou>
SQUARE	[eja]	[ea]	[eja]	[ea]

4.5.2 Igbo-English and Yoruba-English vowels

Only two of the English monophthongs: /ʌ, ɜ:/ and five diphthongs: /eɪ, aʊ, ʊə, ɪə, eə/ are selected for discussion under this sub-section. While NURSE has multiple realisations dependent on

the spelling of the English words, the STRUT vowel has a single realisation regardless of where it occurs (a realisation linked to southern Nigeria). The diphthongs (FACE, MOUTH, CURE, NEAR, SQUARE) are discussed for their different realisations in comparison with the other varieties of Nigerian English. Each of the seven vowels is discussed below.

4.5.2.1 STRUT /ʌ/ → [ɔ]

The STRUT is invariably realised as [ɔ] in Igbo-English and Yoruba-English, as shown in Table 4.52. As observed in the Hausa-English and Kanuri-English varieties section above, there is a similarity between Igbo-English and Yoruba-English.

Table 4.52: Examples of consonant elision at a word boundary in Igbo-English

Realisations	Words	Transcription	Styles
[ɔ]	strut	[strɔt]	WL
[ɔ]	cut	[kɔt]	WL

4.5.2.2 NURSE /ɜ:/ → [ɔ] [ɛ] [a]

As noted in Hausa-English versus Kanuri-English vowel section above, vowel duration does not result in a significant difference among the four Nigerian English accents and/or between Igbo-English and Yoruba-English. Only the NURSE vowel shows a slight pronunciation difference between northern and southern Nigerian English speakers. For this reason, only realisations of NURSE are provided, as shown in Table 4.53. The variability in the realisation of the NURSE vowel is determined by the region of the speakers (northern or southern Nigeria), and it is dependent on the spelling. Most of the English words spelt with the digraph <or> are realised with [ɔ] in both north and south regions. While the digraph <ur> is realised as [ɔ] or [a] in the north, it is split as [ɔ] or [ɛ] in the south. The digraph <er> is mainly realised as [a] in both regions. While the digraphs <ir> and <ear> are mainly realised as [e] in the south, they are variably realised as [a] or [ɛ] in the north.

Table 4.53: Examples of the three realisations of the English NURSE vowel in Igbo- and Yoruba-English

Environment	Realisation	Words	Transcription	Styles
<or>	[ɔ]	working	[wɔkɪn]	PD
<ur>	[ɛ]	nurse	[nes]	WL
<ear>	[ɛ]	earth	[et]	RB
<ir>	[ɛ]	first	[fest]	NWS
<er>	[a]	universal	[univasal]	RB

4.5.2.3 FACE /eɪ/ → [ɛ:] [ɛ]

The FACE diphthong is mainly realised as long [ɛ:] and occasionally as short [ɛ] in both Igbo-English and Yoruba-English, as shown in Table 4.54. In the case of Igbo-English, spelling does not determine its realisations. Some [ɛ] realisations are orthographically represented by <ai> digraph, while other [ɛ:] realisations are represented by single vowel letter <a>.

Table 4.54: Examples of the realisations of the English FACE diphthong in Igbo- and Yoruba-English

Realisation	Words	Transcription	Styles
[ɛ:]	based	[bɛ:st]	SP
[ɛ]	eight	[ɛt]	PD

4.5.2.4 MOUTH /aʊ/ → [au] [a:] [ou]

This diphthong is mainly pronounced by both Igbo-English and Yoruba-English speakers as [au]. While it is occasionally realised as [a:] by both Igbo and Yoruba speakers, it is also realised as [ou] by some Igbo and Yoruba speakers. The long [a:] is usually observed in closed syllables, as shown in Table 4.55. As discussed in Chapter 2, neither Igbo nor Yoruba possesses any diphthongs in their sound systems. Similarly, Jibril (1982) reported monophthongisation of the MOUTH diphthong in both Igbo-English and Yoruba-English.

Table 4.55: Examples of three realisations of the MOUTH diphthong in Igbo- and Yoruba-English

Vowel	Environment	Realisation	Words	Transcription	Styles
<ou>	C_C	[au]	about	[abaut]	RB
<ou>	C_C	[a:]	round	[ra:n]	RB
<ou>	C_C	[ou]	amount	[amount]	FR

4.5.2.5 CURE /ʊə/ → [ʊɔ] [ɔ] [ɪɔ] [ua]

The CURE diphthong variably splits into four realisations in both Igbo-English and Yoruba-English: [ʊɔ], [ɔ], [ɪɔ], [ua]. Different spellings of CURE determine the variability of the realisations, as shown in Table 4.56. While the first three realisations are observed at a word boundary, CURE is invariably realised as [ua] in between consonants in a closed syllable.

Table 4.56: Examples of the four realisations of the CURE diphthong in Igbo- and Yoruba-English

Vowel letters	Environment	Realisation	Words	Transcription	Styles
<ure>	_ #	[ʊɔ]	tenure	[tenuɔ]	WL
<oor>	_ #	[ɔ]	poor	[pɔ]	WL
<ure>	_ #	[ɪɔ]	pure	[piɔ]	WL
<ua>	C_C	[ua]	actual	[aktʃual]	RB

4.5.2.6 NEAR /ɪə/ → [ɪe] [ɪa]

The NEAR vowel is variably realised as [ɪe] or [ɪa] in Igbo-English and Yoruba-English. It is pronounced as [ɪɔ] when it is represented by <iou> in the word ‘various’ only, as shown in Table 4.57. It is usually pronounced as [ɪa] in between consonants as in ‘ideas’.

Table 4.57: Examples of the three realisations of the NEAR diphthong in Igbo- and Yoruba-English

Environment	Realisation	Words	Transcription	Styles
_ #	[ɪe]	near	[nɪe]	WL
_ #	[ɪa]	here	[hɪa]	RB
C_C	[ɪɔ]	various	[bɛrɪɔs]	RB

4.5.2.7 SQUARE /eə/ → [ɛ:] [ea] [ɪe]

The SQUARE diphthong is mainly realised as [ɛ:] and occasionally as [ea] or [ɪe] in both Igbo-English and Yoruba-English, as shown in Table 4.58.

Table 4.58: Examples of the three realisations of SQUARE diphthong in Igbo- and Yoruba-English

Environment	Realisation	Words	Transcription	Styles
_ #	[ɛ:]	pairs	[pe:s]	WL
_ #	[ea]	there	[deɑ]	PD
_ #	[ɪe]	share	[ʃɪe]	RB

In summary, Table 4.59 provides a full list of all possible main and occasional realisations of the selected English vowels in Igbo-English and Yoruba-English.

Table 4.59: Comparison of the realisations of nine selected English vowels in Igbo-English and Yoruba-English

Phonemes	Realisations in Igbo-English		Realisations in Yoruba-English	
	Main realisation	Occasional realisation	Main realisation	Occasional realisation
STRUT	[ɔ]	NIL	[ɔ]	NIL
SCHWA	[ɔ]	[a] [ɛ] [u]	[ɔ]	[a] [ɛ] [u]
NURSE	[ɔ]	[e] [a:]	[ɔ]	
FACE	[ɛ:]	[ɛ]	[ɛ:]	[ɛ]
PRICE	[aɪ]	NIL	[aɪ]	NIL
MOUTH	[au]	[a:]	[au] [a:]	[ɔu]
CURE	[uɔ]	[ɔ:] [ɪɔ] [ua]	[uɔ] [ɔ]	[ɪɔ] [ua]
NEAR	[ɪe]	[ɪɔ] <iou> [ɪa]	[ɪe]	[ɪa] [ɪɔ] <iou>
SQUARE	[ɛ:]	[ea] [ɪe] [ɪa]	[ɛ:]	[ea] [ɪe] [ɪa]

4.6 Comparison of F1 and F2 values of NURSE, STRUT, KIT, DRESS, TRAP, LOT and FOOT vowels realisation in Hausa-English, Igbo-English, Kanuri-English and Yoruba-English

This section compares the averaged F1 and F2 values of the seven vowels. The individual and averaged data point charts can be seen in Appendix D.

4.6.1 STRUT vowel

The following bullet point summaries are extracted from Fig 4.7.

- Kanuri and Yoruba are closer to each other in both F1 and F2 compared to Hausa and Igbo, and they are slightly more back, with lower F2.

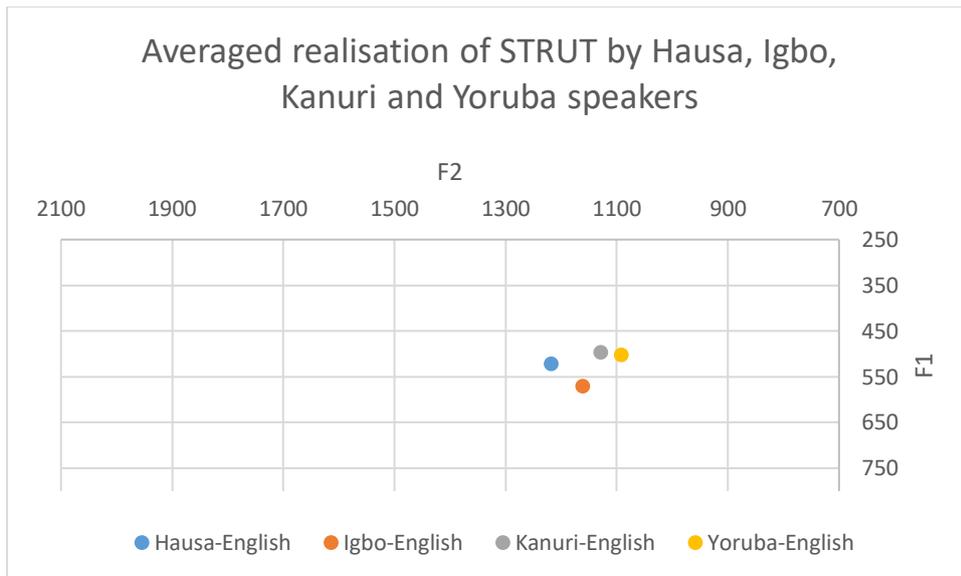


Figure 4.7: A comparison of averaged STRUT realisation by four Nigerian English accents

4.6.2 NURSE vowel

The following bullet point summaries are extracted from Fig 4.8.

- The four accents are more similar in F1 than in F2.
- There is almost an overlap between Hausa and Yoruba in both F1 and F2,
- Igbo is the most fronted, and Kanuri is the most back.

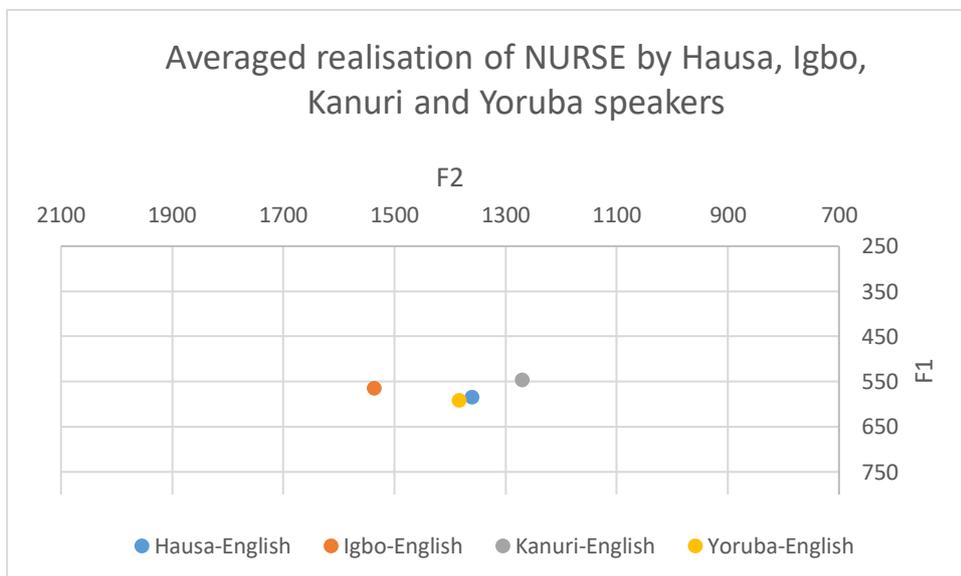


Figure 4.8: A comparison of averaged NURSE realisation by four Nigerian English accents

4.6.8 KIT vowel

The following bullet point summaries are extracted from Fig 4.9.

- Hausa is the most close in F1 and the most backward compared to the other three accents.
- Yoruba is the most fronted in F1.

- Igbo is closer to Kanuri in both F1 and F2 values compared to Hausa and Yoruba.
- Igbo is the most open due to highest F1 value compared to the other three accents.

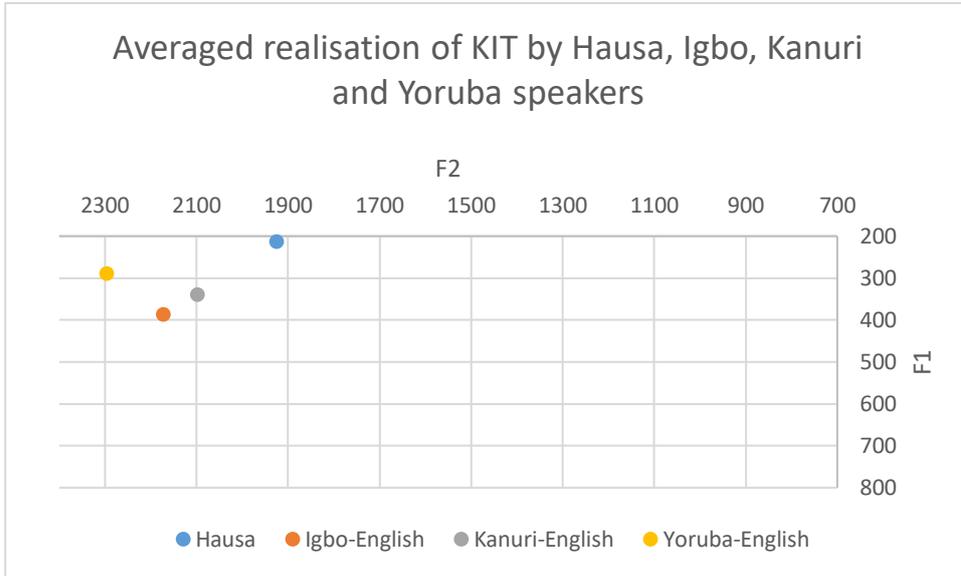


Figure 4.9: A comparison of averaged KIT realisation by four Nigerian English accents

4.6.9 DRESS vowel

The following bullet point summaries are extracted from Fig 4.10.

- There is an overlap between Hausa and Kanuri compared to Igbo and Yoruba, though they also have some similarities in their realisation of DRESS.
- Igbo realisation is more open than Yoruba due to high F1 (above 500 HZ).

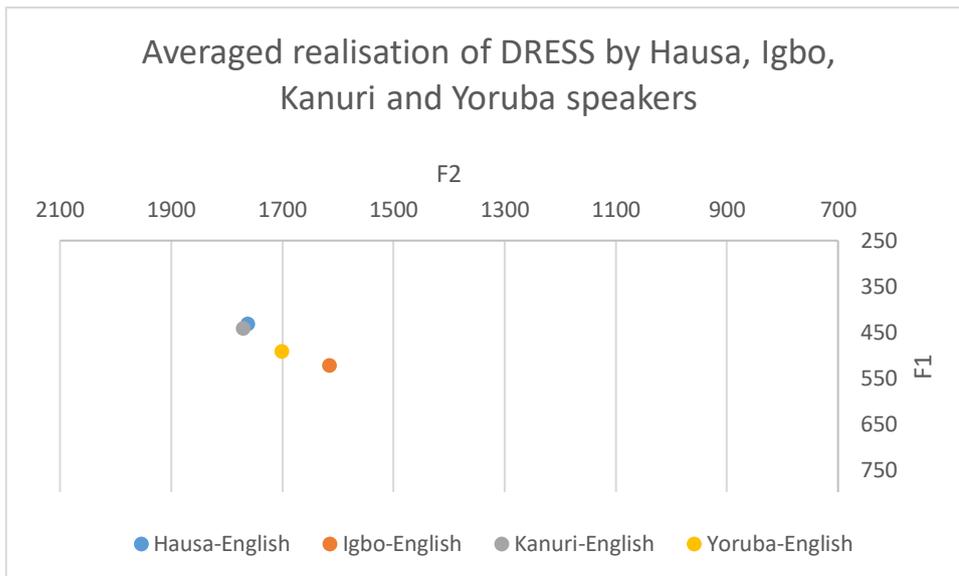


Figure 4.10: A comparison of averaged DRESS realisation by four Nigerian English accents

4.6.10 TRAP vowel

The following bullet point summaries are extracted from Fig 4.11.

- All the four accents have similar realisation for TRAP in both F1 and F2, as shown in Fig 4.11.
- In relation to F1, they are in-between [ɛ] and [ɒ] in both F1 and F2 values (600-650 for F1 and 1330-1420 for F2).

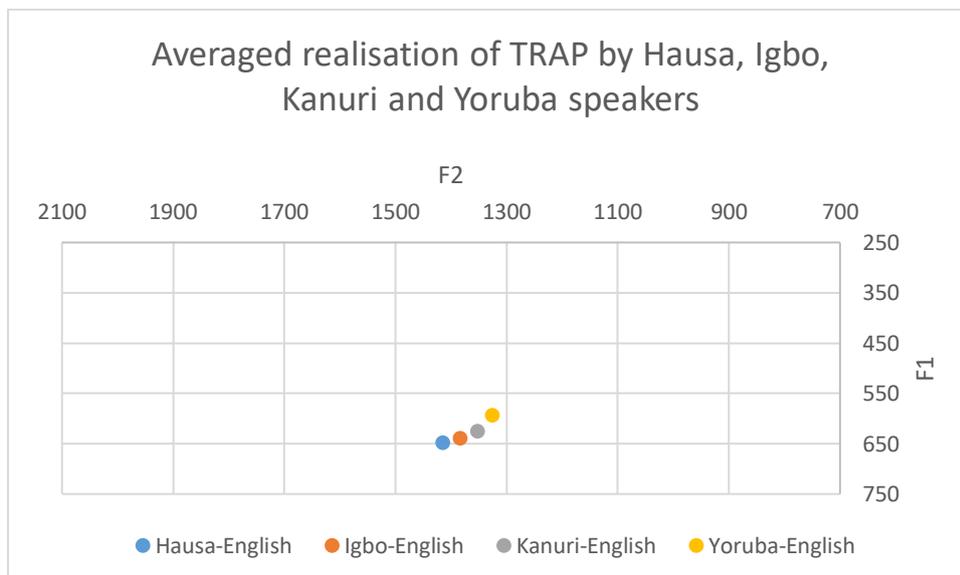


Figure 4.11: A comparison of averaged TRAP realisation by four Nigerian English accents

4.6.11 LOT vowel

The following bullet point summaries are extracted from Fig 4.12.

- The four accents differ in both F1 and F2, but they are more varied in F2 (frontness of the tongue body).
- Hausa is the most fronted, while Yoruba is the most back.
- No significant difference between Igbo and Kanuri in F2.

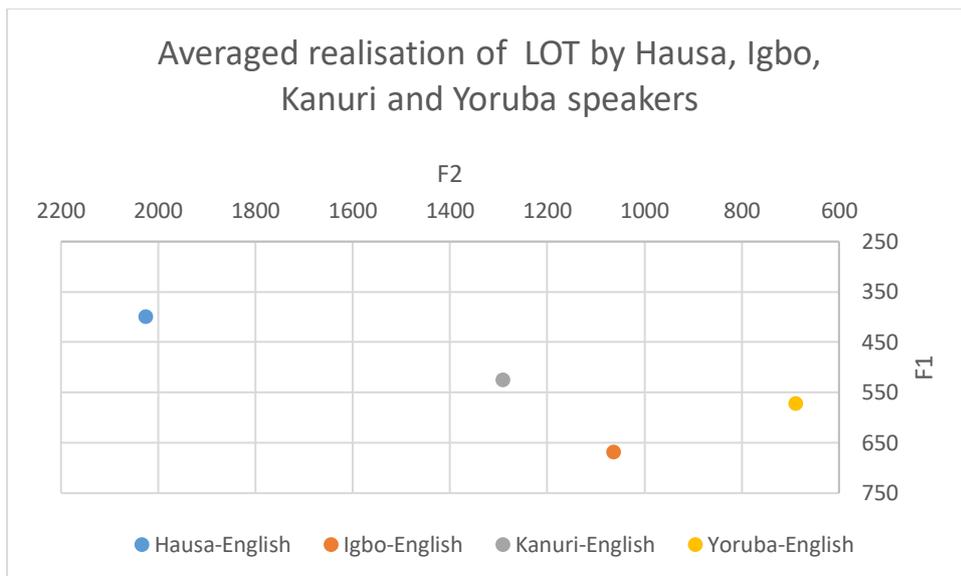


Figure 4.12: A comparison of averaged TRAP realisation by four Nigerian English accents

4.6.12 FOOT vowel

The following bullet point summaries are extracted from Fig 4.13.

- Hausa and Yoruba share the same F1 value but vary in F2, with Yoruba being more fronted.
- Igbo and Kanuri are closer in F1 but differ in F2, as Igbo is more fronted than Kanuri.

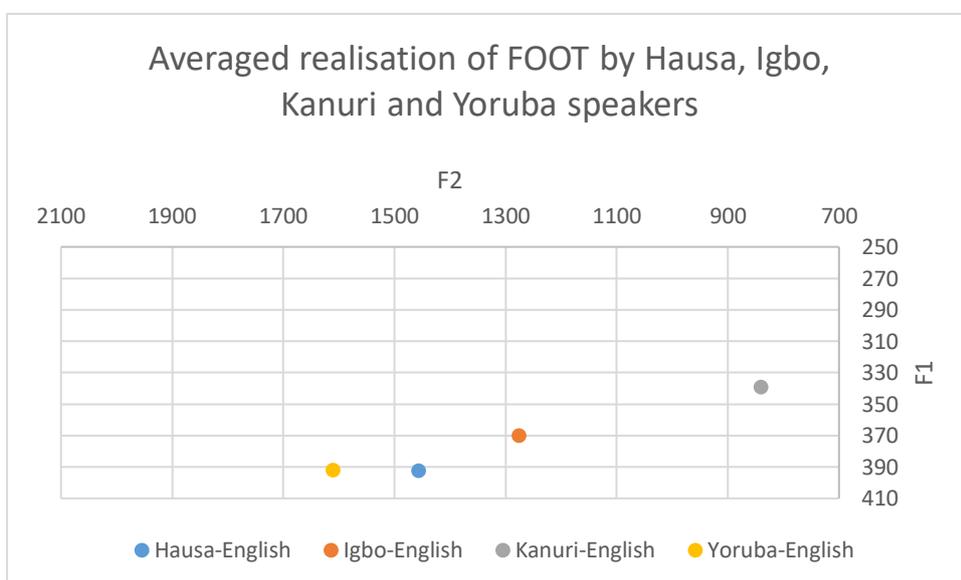


Figure 4.13: A comparison of averaged TRAP realisation by four Nigerian English accents

The above comparison reveals that vowel similarity is not restricted to sharing a region in Nigeria by the Nigerian English accents (from north to south), but it also cuts across regional boundaries of speakers. It is observed that the Kanuri and Yoruba accents are more similar in the realisation of STRUT and CURE, while Hausa and Yoruba are more similar in the realisation of NURSE

and MOUTH. Igbo and Kanuri are more similar in the realisation of NEAR vowel compared to the similarity between Igbo and Yoruba or Hausa and Igbo. The following may be some of the reasons for such similarities.

First of all, the majority of the respondents were below 25 years at the time of the data collection, although a few of them were between 30-40 years. Responses gathered from the post-speaking questionnaire indicated that several English teachers of Kanuri speakers in Maiduguri, especially in private primary and secondary schools, are native speakers of Igbo, and a few of them are Yoruba native speakers. This finding, though speculative, is suggestive of English-teacher influence on the Kanuri vowel realisations. Since no older respondents (above 40 years) were involved in the study, it is hard to speculate on the evidence of significant variation between the educated Kanuri youngsters and the ageing educated Kanuri English speakers. About four decades ago, Jibril (1982) had already expected this trend of vowel realisation overlap between northern and southern speakers of English. He argues that inadequate English teachers and gradual increase in pupil school enrolment in the north, especially after the Nigerian independence, necessitated recruiting English teachers from southern Nigerian. He further argues that massive return of English native teachers to England after the independence and the recruitment of southern English teachers in northern schools will affect the linguistic features of English spoken in the north. Consequently, it is hard to group these four accents in line with their regional differences in Nigeria.

4.7 Summary and Conclusion

In this chapter, up-to-date segmental descriptions of accents of Nigerian English: Hausa-English, Igbo-English, Kanuri-English and Yoruba-English have been provided. As predicted, many English sounds (without equivalents in the four Nigerian L1s) vary in their pronunciations from those of the native English speakers. The English velar nasal /ŋ/ was challenging to these four groups of speakers despite its availability in Hausa, Igbo, Kanuri and Yoruba. Vowel disparity is largely between the northern and southern regions of Nigeria. Hausa and Kanuri speakers from northern Nigeria have many similarities in the articulation of English vowels. Likewise, Igbo and Yoruba speakers from southern Nigeria pronounce the English vowels in a similar way. Therefore, it might be challenging to distinguish Igbo-English from Yoruba-English or Hausa-English from Kanuri-English based on their vowel articulation differences. A confident decision to distinguish one variety from another is more achievable in some consonants.

The following paragraphs and tables provide a further summary of how the current findings corroborate with the findings of the past studies. It also summarises some segmental variance between the findings extracted from the current corpus and the earlier findings reported in the past

literature, as earlier anticipated (see the research questions and hypotheses that guided this chapter in the end of Chapter 2). Contrary to the findings of this study, the elision of vowels and consonants in Nigerian English reported in Jibril's work was not divided according to the specification of the three varieties of Hausa-English, Igbo-English and Yoruba-English. The realisations of nine selected English vowels covered in this work resemble their realisations reported by Jibril (1982) and Jowit (1991). The elision of [t] postvocally and word-finally in fast speech in Nigerian English was reported by Jibril. However, this is not evident in Hausa-English and Kanuri-English in this corpus.

Hausa-English

For Hausa-English, the current corpus identified [ʃ] realisation for /ʒ/ in addition to only [dʒ] reported by Jibril (1982). As reported by Jibril (1982), there is evidence of occasional realisation of /ŋ/ as pronounced in the native English way. In addition to this, some Hausa-English speakers hypercorrect it by applying the Hausa language phonetic rule in pronouncing the words ending in /nd/ consonant cluster as [ŋ]. The elision of [k] in Nigeria English generally (across all the three varieties) was reported in Jibril (1982). Conversely, this is only commonly evident in Hausa-English and Kanuri-English in this corpus.

Jibril (1982) reported that /l/ is only deleted before labials in Hausa-English, while it is both deleted before labials and even when it is the only consonant in coda position in Igbo-English and Yoruba-English. However, the findings of this study show that /l/ is mostly pronounced with an epenthetic vowel in both Hausa-English and Kanuri-English.

Jibril (1982) reported that consonant phonemes /t, d, k, g/ are hardly deleted in syllable coda position in Nigerian English. Contrary to this assertion, word-final /d/ preceded by another consonant is commonly elided in Hausa-English data of this corpus. Table 4.60 provides a summary of comparing the Hausa realisations of such English consonant phonemes.

Table 4.60: A summary of comparing the Hausa realisations of English consonant phonemes

Hausa-English				
Phonemes	Current corpus	Sogunro (2012)	Jowit (1991)	Jibril (1982)
/p/	[ɸ] [p]	[p] main		
/f/	[ɸ] [p] seldom	[ɸ] seldom [p] seldom		
/v/	[b] syllable-initially [ɸ] [p] syllable-finally	[b] seldom [ɸ] seldom		
/θ/	[s] [t]	[s] seldom [t] average		
/ð/	[z] [d]	[z] seldom [d] average		
/ʒ/	[ʃ] in closed syllables [dʒ] in open syllables	[ʃ] seldom [dʒ] seldom		[dʒ] only
/d/ elision Word-finally	Yes	Yes		Not reported
/t/ elision word-finally	Not found in Hausa-English	Not reported	Not reported	[t] word-finally
/l/	[lə] is found in consonant cluster in Hausa-English	Not reported	Not reported	Not reported

Igbo-English

For Igbo-English, [t] substitutes /ð/ in words such as northern and within. This was not reported in Jibril's (1982) study. The [dʒ] realisation of /ʒ/ reported in Jibril's (1982) study is not evident in this corpus and Sogunro's (2012) work, but the other two realisations [ʃ] and [ʒ] are evident. The [ɔu] realisation of MOUTH diphthong in Igbo-English is not mentioned in Jibril's work. Devoicing of /d/ word-finally in Igbo-English and Yoruba-English was not reported in Jibril's (1982) work. Table 4.61 provides a summary of comparing the Igbo realisations of such English phonemes.

Table 4.61: A summary of comparing the Igbo realisations of some English consonant phonemes

Igbo-English				
Phonemes	Current corpus	Sogunro (2012)	Jowit (1991)	Jibril (1982)
/ð/	[t] in within and northern	Not reported	Not reported	Not reported
/ʒ/	[ʃ] in closed syllables [ʒ] in open syllables [dʒ] not found	[ʃ] [ʒ] Not reported [dʒ] Not reported		[ʃ] [ʒ] [dʒ]
/d/	[t] word-finally in Igbo- English and Yoruba- English	Reported in Yoruba only	Not reported	Not reported
MOUTH	[ɔu]	Not reported		Not reported

Yoruba-English

Past studies such as Jibril (1982) and Jowit (1991) reported realisation of the English /t/, z, v/ as [ʃ, s, f] in Yoruba-English. However, the current study shows that /t/ is mostly pronounced as in Received Pronunciation with exception of three of the fifteen Yoruba speakers in the current corpus. The consonant phoneme /z/ is only rarely substituted with [s] when spelled with “s” grapheme. Likewise, /v/ is only pronounced as [f] in syllable coda position word-finally compared to both the syllable-initial and –final positions reported in the past literature.

The glottal fricative [h] epenthesis and elision word-initially are evident in the current corpus. However, only /h/ deletion was reported in Jibril’s (1982) work. The prediction of three realisations [d, z, s] for /ʒ/ is not evident in the current Yoruba-English corpus. Vowel epenthesis was not reported in Yoruba-English in Jibril’s work. Table 4.62 provides a summary of comparing the Yoruba realisations of such English phonemes.

Table 4.62: A summary of comparing the Yoruba realisations of some English consonant phonemes

Yoruba-English					
Phonemes	Current corpus		Sogunro (2012)	Jowit (1991)	Jibril (1982)
/t/	[t]	[ʃ] seldom	[ʃ] occasional	[ʃ]	[ʃ]
/v/	[v]	[f] only word-finally	[f]	[f]	[f]
/z/	[z]	[s] is seldom	[s]	[s]	[s]
/h/ elision	Yes		Yes		Yes
[h] epenthesis	Yes		Yes		Not reported
/ʒ/	[dʒ]	[d, z, s] not found	Not reported	[d, z, s]	

Finally, this chapter has brought the first phase of the research to the end. The next chapter is the beginning of the second phase.

Chapter 5

(LADO/LAAP DEBATE)

5.0 Introduction

This chapter provides the history of language analysis for the determination of origin, LADO. It also provides an overview of several arguments (among linguists including sociolinguists, phoneticians and dialectologists) concerning legitimate methods and required qualifications for conducting language analysis in the asylum procedure. The chapter includes a brief history of LADO, countries which practice it, current methods across various European countries and the two major approaches in carrying out the analysis: the expert linguist approach and the supervised native speaker approach. Some arguments for both approaches are also provided below. The potential value of an automatic accent recognition system, Y-ACCDIST (which was developed for forensic purposes) is briefly discussed.

5.1 Background

'Language analysis is used to determine the authenticity of a claimed origin or to provide an opinion about a subject's likely origin' (Foulkes, French & Wilson, 2019, p.100). Language analysis for the determination of origin, LADO, is almost three decades old now. It was started in 1993 by the Swedish Migration Board (Reath, 2004; Patrick, 2019). The board started applying this analysis to generate formal papers to ease the asylum application process and the lack of supporting documents. LADO aims to test the reality of a claim of a particular asylum applicant's nationality origin or citizenship (Patrick, 2019). Most of the analyses are for verification purposes since a claim has already been made about a national origin. Thus, it is also referred to as Language Analysis in the Asylum Process, LAAP (Cambier-Langeveld, 2010a). Since people fleeing their countries lack, lose, destroy or dispose of their identification documents that state their country of origin, LADO aims to determine where a person (a purported refugee) came from to verify his or her claimed origin (Cambier-Langeveld, 2010a).

With the influx of migrants (as a result of crisis, war, and other forms of violence) from several Middle Eastern and African countries to Europe, governments are concerned about distinguishing genuine refugees from fake ones (who struggle for an improved livelihood or any other false reason). Before attaining the status of refugee, asylum seekers need to show evidence (through a formal application) of both their claimed original country and valid reasons for fleeing to escape danger (Eades & Arends, 2004). The United Nations General Assembly held in 1951 recognized the right of people fleeing their countries on the ground of well-founded fear of being persecuted for various reasons to seek asylum (Patrick, 2019). This pressure has necessitated the use of several methods,

including LADO, to verify applicants' claimed origins. As we shall see in the next section, LADO is inconsistently used by both public and private agencies (Elias-Nava, 2017).

5.2 Countries using LADO

Many European countries now use LADO as part of processing asylum applications. These countries include Sweden, Switzerland, Norway, Germany, Belgium, United Kingdom, Austria, Australia, Italy, the Netherlands, New Zealand, Finland and Denmark (Eades & Arends, 2004). After Sweden, Switzerland was the second European country to begin to use language analysis (Cambier-Langeveld, 2010). Language analyses are conducted by both government departments and private companies. While some of these countries have established their state language analysis agencies (e.g. Belgium, the Netherlands), other nations engage private language companies to analyse the speech of the asylum seekers (Elias-Nava, 2017). While some of the countries have already established a government department and employed their internal language analysts (e.g., Lingua of Switzerland, Bureau Taalanalyse of the Netherlands), other countries, such as Australia and the UK, contract private companies for the analysis (Eades & Arends, 2004). In Australia, the Department of Immigration and Multicultural and Indigenous Affairs holds the responsibility for taking decisions on asylum applications. Such a decision is based on the outcome of the language analysis of the applicants' speech by overseas companies (Eades et al., 2003).

Private firms, such as Sprakab, Verified AB and Eqvator, based in Sweden, have conducted language analyses in Sweden for many other countries. While BLT (Bureau Land en Taal) is a unit of the Dutch Government's Office for Country Information and Language Analysis, OCILA, which carries out the initial language analysis, a private company, De Taalstudio, also in the Netherlands, provides a contra-analysis report on appeal by rejected asylum applicants. Like the BLT of the Netherlands, Switzerland also has its own state LADO agency, Lingua (Patrick, 2019). The UK Government has not yet established its independent agency or department for language analysis. Sprakab was initially providing the UK's Home Office with the analysis before the contract shifted to Verified AB (Home Office p.5 cited in Matras, 2018). Matras took a critical look into the method employed by Verified in analysing the Arabic speech of Syrian asylum applicants in the UK (Matras, 2018).

5.3 Methods of conducting the analysis

A main point of contention in the field of LADO is the lack of a uniform procedure employed by all agencies and individuals carrying out the analysis. Verrips (2010) argues that LADO also lacks recognised and appropriate linguistic criteria and standards for ensuring objectivity in assessing the claims of origin. Several methods are used by countries or agencies conducting language analysis (Eades, 2005; Foulkes, French & Wilson, 2019). Such methods are not fully transparent (Foulkes,

French & Wilson, 2019), as the agencies do not publicise a complete picture of how they conduct such analyses.

Given that the process of LADO normally begins from conducting an interview to collect speech samples of the applicants for analysis, the method of conducting the interview is briefly discussed below.

5.4 Language analysis interview

The interview is organised by an immigration officer in a border agency (mainly for language analysis), while an interpreter may be engaged for assistance (Verrips, 2010). The interview is usually conducted in the L1 of the asylum seekers, their L2, or any other languages they can speak. In some states, including Germany, language analysis interviews tend to be conducted in L2 English or French, while countries such as Australia and the UK conduct the interviews in the L1s of asylum seekers (Eades & Arends, 2004). OCILA, the Dutch Government's unit conducting language analysis, organises an interview for taking the profile of an asylum seeker (Cambier-Langeveld, 2016). An asylum seeker is asked to freely narrate his story (e.g., family, education & linguistic backgrounds) in his native language. Also, using any topics in 45-60 minutes, they are asked to talk about their life experiences in all languages that they can speak (Cambier-Langeveld, 2016). Many linguists are concerned with this method of interviewing. Corcoran (2004) laments that the interviews were fully controlled by the immigration officers, where topics of discussion were imposed. Further, Eades (2005) argues that an asylum seeker, whose dialect differs from the interviewer's dialect, might shift to speak the interviewer's dialect, and the interviewer will likely suspect that the asylum seeker is faking his speech.

However, Baltisberger and Hubbuch (2010) reported that LINGUA, a Swedish agency, conducts interviews via a telephone call by an expert interviewer (mostly a linguist) who does the analysis directly. In other words, the linguists who conduct the analysis directly contact the asylum seekers for the interview. Native speakers serve as informants for linguist experts or interviewers only if direct interview cannot be made.

5.5 Right for appealing decisions made by immigration services

Asylum seekers have the right to appeal against a negative decision to their application. Several countries, such as the Netherlands, Australia and the UK, have legal departments which review initial negative decisions made by immigration departments. Asylum seekers are allowed to provide their counter-expert analysis if they are not satisfied with the outcome of their applications (Eades et al., 2003). In Australia, the Refugee Review Tribunal (RRT) is responsible for reviewing initial decisions made by the Department of Immigration and Multicultural and Indigenous Affairs (DIMIA), while further appeal can be made to the Federal Court and High Court (Eades, 2005, p.507). The applicants

are responsible for engaging another counter-expert to analyse their speech for the second time (Eades et al., 2003), which will be submitted for review by the RRT. Similarly, Verrips (2010) confirmed that the Dutch law provides asylum seekers with the right to appeal against their non-approval of refugee status by providing a counter-expertise. In the Dutch context, De Taalstudio, in most cases, is contracted to conduct a contra-analysis for asylum seekers whose asylum applications were rejected. Unless the counter-expertise provides, with a high degree of certainty, a conclusion favouring the asylum seeker's claim, the decision of the Netherlands Immigration and Naturalisation Service (IND) will not be reversed (Verrips, 2010, p. 286). IND can turn down the report of counter-experts if it identifies a lack of capacity for evaluating its (IND's) initial report and the absence of solid proof in the second report. Normally, both first and contra analyses are conducted using the same speech samples of an asylum seeker (recorded during an interview). But Dutch courts conditionally consider a further recording as evidence for further analysis if the initial recording (of the first interview) is poor due to some disruptions such as technical and background noise (Verrips, 2010).

Two approaches are employed in LADO: the supervised native speaker approach and the single expert linguist approach. For the supervised native speaker or team approach, government departments, such as the IND of the Netherlands, engage native speakers of the languages concerned to do the analysis under the supervision of linguists (Cambier-Langeveld, 2010). Similarly, other private firms such as Sprakab and Verified, use the team approach where linguists (without specialisation in the language in question) and native speakers of languages in question collaborate in language analysis (Verrips, 2010; Patrick, 2019). On the other hand, for the expert linguist approach, private companies such as De Taalstudio and Lingua use only expert linguists in the language(s) in question throughout the analysis process (Singler, 2004; Verrips, 2010). Most of these experts hold a PhD degree in the languages concerned including peer-reviewed publications. They also have the knowledge of neighbouring varieties of the language in question and the cultural knowledge of the region of socialisation.

A number of expert linguists are permanently employed by the private company, De Taalstudio, to take charge of language analysis (Verrips, 2010; Cambier-Langeveld, 2016). Similarly, the IND of the Dutch Government also has permanent linguist staff, who supervise and manage the process of language analysis. For De Taalstudio, one of the primary responsibilities of such staff is finding a reliable and relevant linguist, who is an expert of the language in question, to carry out contra-analysis of an initial analysis (Verrips, 2010). De Taalstudio contracts relevant expert linguists from all over the world in case of any need for contra-analysis (Verrips, 2010). Thus, independent linguists who have expertise of the language in question are consulted for further analysis of an official recording. Lingua is the only non-commercial agency that has adopted the 2004 Guidelines, as listed

below, (Baltisberger & Hubbuch, 2010), to use only expert linguists for language analysis. However, LINGUA only engaged non-linguists in the absence of specialised linguists in the relevant area, and the recruited native speakers were only those who succeeded in correctly identifying/reanalysing initially-analysed recordings, and their works are supervised by LINGUA staff, while such analyses are cross-checked by other native speakers as well as other academic linguists, if possible (Baltisberger & Hubbuch, 2010, p. 13). These two approaches are separately discussed in detail.

5.6 Expert linguist approach

The single expert linguist approach requires only qualified linguists who have extensive expertise in the language in question to carry out language analysis. This sub-section provides arguments in recognition of this approach. A group of Australian linguists first published their concerns in 2003 (Eades et al., 2003) to attract public attention over the lack of reliability observed in language analysis reports produced by Evaluator for the Australian Government. Eades et al. (2003) reviewed fifty-eight language analysis reports. They observed that all fifty-eight reports were produced by lay native speakers, translators, or interpreters, who had no linguistic training at all. Some of the issues of concern observed in the reports include the use of capital letters altogether rather than IPA symbols for transcriptions and definite assertions in drawing conclusions rather than using probability. Also, they were concerned about identifying certain applicants based on evidence of a few features of a particular language in their speech, and decisions were made based on just a few lexemes. Eades et al. (2003) argue that such features can be added to their (asylum applicants') repertoire due to long-term residence in a particular country. Although their position was not against the use of native speakers, they discussed their concern based on the native speakers' ignorance of many crucial linguistic considerations in determining asylum seekers' origins based on their speech. Similarly, LINGUA linguists argue that linguists are aware of various factors that can influence a person's linguistic behaviour, and that linguists are less prone to folk linguistic beliefs. However, they also opine that it is not every linguist is automatically a qualified expert (Baltisberger and Hubbuch, 2010, p. 17).

In 2004, some linguists came up with a set of guidelines for use by governments and others in deciding whether and to what degree language analysis is reliable in particular cases (NLOG, 2004). This was published in the *International Journal of Speech, Language and the Law*, 2004. "The following guidelines are therefore intended to assist governments in assessing the general validity of language analysis in the determination of national origin, nationality or citizenship" (NLOG, 2004, p. 261). The document containing a list of eleven guidelines, is provided below.

General guidelines (NLOG 2004, p. 261-263):

- (1) Linguists advise, governments make nationality determinations.

- (2) Socialisation rather than origin. Language analysis cannot be used reliably to determine national origin, nationality or citizenship. Language analysis can be used to draw reasonable conclusions about the country of socialisation of the speaker, but cannot be used reliably to determine national origin, nationality or citizenship for their political or bureaucratic characteristics that may necessarily be connected to language. The way that people speak has a strong connection with how and where they were socialised: that is, the languages and dialects spoken in the communities in which people grow up and live have a great influence on how they speak.
- (3) Language analysis must be done by qualified linguists. Judgements about the relationship between language and regional identity should be made only by qualified linguists with recognised and up-to-date expertise, both in linguistics and in the language in question, including how this language differs from neighbouring language varieties.
- (4) Linguists' degree of certainty. Linguists should have the right and responsibility to qualify the certainty of their assessments. It is rarely possible to be 100 percent certain of conclusions based on linguistic evidence alone, as opposed to fingerprint or DNA evidence, so linguistic evidence should always be used in conjunction with other non-linguistic evidence. Linguists should not be asked to, and should not be willing to, express their certainty in quantitative terms, but rather in qualitative terms such as possible, likely, highly likely and highly unlikely.
- (5) Language analysis requires useful and reliable data. Linguists should be allowed to decide what kind of data they need for their language analysis. If the linguist considers the data provided for analysis to be insufficiently useful or reliable, he or she should either request better data or state that a language analysis cannot be out in this case.
- (6) Linguists should provide specific evidence of professional training and expertise, with the right to require that this information remain confidential.
- (7) The expertise of native speakers is not the same as the expertise of linguists. People without training and expertise in linguistic analysis should not be asked for such expertise, even if they are native speakers of the language, with expertise in translation and interpreting. Skill in speaking a language is not the same as the ability to analyse a language and compare it to neighbouring language varieties.

More specific guidelines (NLOG 2004, p. 263-265):

- (8) Where related varieties of the speaker's language are spoken in more than one country. In many regions throughout the world, national borders are not the same as linguistic borders, and the same language, or closely related varieties of the same language, is/are spoken in more than one country.

- (9) Language mixing: It is unreasonable in many situations to expect a person to speak only one language variety in an interview or other recording.
- (10) Where the language of the interview is not the speaker's first language. An interviewee with limited proficiency in the language of the interview may—simply because of language difficulties—appear to be incoherent or inconsistent, thereby leading the interviewer to a mistaken conclusion concerning the truthfulness of the interview.
- (11) Where the dialect of the interviewer or interpreter is different from the dialect of the interviewee. Interviewees from a local dialect will attempt to accommodate to the Standard dialect of the interviewer, whether consciously or subconsciously, in which they may not necessarily have good proficiency, and this may make it difficult for interviewees to participate fully in the interview.

5.7 Supervised native speaker approach

The principal proponent of the supervised native speaker or team approach is a specialised linguist, Cambier-Langeveld, who currently works with the IND. The Guidelines (especially no. 3 and 7 mentioned above) were criticised by Cambier-Langeveld at a specialist workshop on LADO in Amsterdam in 2007 (Fraser, 2009, p. 116-117). She argued that the language analysis should involve native speakers of the language in question, and therefore put forward for endorsement, in the same year, a statement recognising the role of native speaker judgements in LADO at the International Association for Forensic Phonetics and Acoustics (IAFPA)'s Annual General meeting (Fraser, 2009, p. 117). Upon receiving a report from a four-member committee set up for the evaluation of the situation in 2008 (Fraser, 2009), the IAFPA published on the internet a position statement recognising the contributions to be made by:

- (i) Linguists and educated native speakers with the latter working under the guidance and supervision of the former
- (ii) Linguists with in-depth research knowledge of the language(s) in question

The conclusion expressed in the material should in all cases reflect not only the strengths and weaknesses of the material analysed but also of the personnel involved.

<http://www.iafpa.net/langidres.htm>

Similarly, in 2010, Cambier-Langeveld published an article in response to the 2004 Guidelines. She argues that the 'Guidelines 2004' had ignored the strong value of native speaker competence in verifying the claims of asylum seekers, and that the Guidelines do not include three crucial things as outlined below:

- (a) The Guidelines fail to recognise that academic linguists, specialised in the language varieties involved, are not by definition capable of making accurate judgements about the regional origin of speakers either.
- (b) The Guidelines rightly point out that the expertise of native speakers is not the same as the expertise of linguists, but fail to recognise that both types of expertise are relevant and should be included in LADO.
- (c) The Guidelines fail to point out the relevance of being aware of the forensic aspects of LADO (Cambier-Langeveld, 2010a, p.71).

Cambier-Langeveld firmly believes that 'LADO' is not just about analysing language but also about judging language to ensure the speaker in question is neither hiding knowledge of a language nor faking knowledge of a language by presenting a second language as a their first language, adding speech features that do not belong in their natural speech variety (Cambier-Langeveld, 2010a, p.73). Thus, this argument suggests that the combination of native-speaker competence of his or her native language and expertise of linguistics are equally crucial in LADO, as the expertise of non-native linguists and the expertise of non-linguist native speakers are (in some crucial aspects) complementary.

The expertise of both should therefore be involved in LADO, because it is not practically possible to produce any reliable outcome while ignoring either. She equally accepted the fact that there are some risks in the judgements made by native speakers, but further argues that such risks cannot result in better performance by linguists since the judgements made by non-native linguists too (who are non-native speakers of a language in question) will hardly be risk-free. Cambier-Langeveld observed that the majority of the cases presented in her 2010a article had contra-analyses (which produced reports that the immigration authorities suspected them of bias, seeking to favour the bogus asylum seekers in the Netherlands). While involving native speakers in LADO is crucial, she equally argues that only testing native speakers by several means can give absolute assurance of their qualities and abilities to do the task. Cambier-Langeveld proposed three possible ways of combining the expertise of both a linguist and a native speaker.

- (a) A specialised linguist performing the analysis in consultation with a native speaker who is a good informant
- (b) A trained native speaker performing the analysis under the tight supervision of a linguist; the native speaker and the native speaker's capability must be tested by the supervising linguist.
- (c) Specialised linguists who are also native speakers, though such experts are scarce (Cambier-Langeveld, 2010a, p. 85-6).

5.8 Lado debates

The hot debate between the proponents of the expert linguist and the supervised native speaker approaches was started in 2007 as mentioned above. The crucial point of the debate questions the validity of untrained native speakers of languages in question in analysing the speech of someone who claimed to be a native speaker of that language. It is all about deciding the methods and required qualifications for undertaking a valid and reliable language analysis. Since the inception of the field of LADO, about three decades ago, it has been seriously criticised by several linguists. The first grievous concern was raised in Eades et al. (2003), almost a decade after its emergence.

However, many linguists (including Fraser, 2009) have criticised the proposals contained within the IAFPA guidelines. Using some of her points below, Fraser (2009) argues that guideline no. 3 'remains correct and proper and stands to prevent untrained native speakers' over-confident judgements' (Fraser 2009, p.126). Fraser had further alleged that the interim resolution reached by IAFPA at its 2007 annual general meeting was full of ambiguity, as it did not clarify the actual sense of terms, such as educated native speakers, linguists, and supervision. She maintains that about 70% of IAFPA members who participated in the 2007 meeting had not read the guidelines; this could be the reason for not predicting the ambiguity of their proposed interim resolution. She further argues that the linguistic situation of asylum seekers is mostly complex with many languages, dialects, and creoles in contact, and that a mixture of dialects and language features is possible in refugee camps where those asylum seekers may have stayed for a long time. Consequently, their native accent may be heterogeneous. Thus, Fraser argues that such situations cast doubts on the reliability of findings of a native speaker who truly shares the same dialect or language with an asylum seeker. In support of her argument, Fraser, citing Collins & Blair (1989), observed that non-linguist Australians always remain confident in identifying other people as fellow members of their accent group due to the presence of specific accent features, which are also available in other communities.

Similarly, Eades et al. (2003) argue that sociolinguistic factors, such as language and dialect shifting, make identification of origin unreliable. Pronunciation of certain words may also be modified, while individual speakers of a particular accent may shift to a different accent or dialect for clearer communication or to attain a particular social class. But only regional accents can reliably be identified using conscious features which are discussed below (Eades et al., 2003). Eades & Arends (2004) assert that the claim of asylum seekers is falsified on the ground of identifying features of other varieties in their accents, as analysts expect "undiluted" speech without evidence of mixing features of other varieties. Similarly, Eades (2005) observed that the comments of non-experts written in the reports showed ignorance of sociolinguistic aspects of language, such as different dialects of the same

language, language dynamism, and code-switching. Eades argues that such linguistic changes can happen in refugee camps where asylum seekers stay for some time. On the other hand, Verrips (2010) claimed that expert linguists always remain cautious in their concluding opinions. She observed that linguists who provide counter-analysis reports hardly ever reject asylum seekers' claimed origin due to mixed dialect features in their speech; they are aware of the linguistic reality in multilingual or multidialectal communities. Native speaker analysts often base their arguments on mixed features to reject the claimed origin, as observed in BLT reports. While specialised linguists are always careful in making conclusions, native speaker analysts often opt for making a strong conclusion 'with a high degree of certainty' (Verrips, 2011, p.138). Also, Baltisberger and Hubbuch (2010)

Eades et al. (2003) argue that reliable determination of the geographical origin of a person from their speech is a folk view, and this view often lacks valid linguistic support. They argue that 'the language analyses of the 58 Australian reports examined were based on folk views about the relationship between language and nationality and ethnicity in such 58 cases rather than on sound linguistic principles' (Eades et al., 2003, p. 183). They observed that 'above consciousness' differences (that are very noticeable and known by speakers) were considered in determining the origin of the asylum seekers rather than considering 'below consciousness differences' (features characterising regional accents but not noticed by speakers, and which are highly unlikely to change in speakers) (p. 186). Eades & Arends (2004) point out that native speakers lack linguistic skills that will allow them to accurately interpret their perceptions using linguistic terms and symbols for transcription.

Similarly, Patrick (2012) argues that LADO analysts must be aware of sociolinguistics (which is the integral part of LADO) as part of their expertise. He further argues that a lack of in-depth research expertise causes unreliable assertions in reporting language analysis. The expertise of linguists ensures objectivity and reliability for the outcome of language analysis. It is necessary for all stakeholders, especially firms responsible for producing LADO reports, to understand the complexity in relating language use to social experience and identity (Patrick, 2012). Patrick warns that ignorance of such complexity (as observed in some firms and government departments) diminishes the role of linguists as a reliable and valid tool in the asylum application process, while preferred use of 'folk beliefs' rather than linguistic expertise can lead to taking unfair decisions against asylum applicants. Patrick (2012) argues that native speakers must not carry out language analysis but can work with a supervising linguist, simply owing to their lack of awareness of language mixing and contact.

Shortly after Cambier-Langeveld's (2010) publication, two more articles (Fraser, 2011; Verrips, 2011) emerged to express several concerns over her claims. In defence of the absolute value of guideline no. 3, language analysis must be done by qualified linguists, Fraser (2011) argues that the eight language analysis reports on which Cambier-Langeveld based her position had predated the entire 2004 Guidelines. Since the Guidelines had predated the idea of the team approach, there is no

basis for the allegation of destroying the usefulness of the team approach. Fraser argues that the appropriate selection of native speakers with relevant backgrounds is judged by linguists, but reliable guidelines for this task are scarce. Further, Fraser argues that there is no clear indication (in the reports) of specific lapses due to the absence of a native speaker's contribution. Reacting to Cambier-Langeveld's accusation, Fraser maintains that involving native speakers was never condemned by the Guidelines. They only, in the absence of a proper evaluation, rejected native speakers' conclusions. She argues that LADO could only be recognised as one of the branches of forensic phonetics if it is handled within the same procedures and standards of evaluating other branches of the field. Instead of criticising the Guidelines, they could have been improved by suggesting additions to the list (Fraser, 2011). Fraser also alleged that evidence for Cambier-Langeveld's position (untrained native speakers are more reliable than expert linguists) was not established from the eight reports examined. Further, she observed that the reports showed a lack of correlation between accuracy and confidence in listeners' abilities; conditions such as limiting the context of information and deliberate or unintentional manipulation of context lower listeners' performance. More recently, Fraser (2019) has clarified that the Guidelines were intended to prevent poor LADO practice rather than prevent the team approach.

In the same vein, Verrips (2011) raised concerns about the strong claim made by Cambier-Langeveld. She argues that the eight cases examined by Cambier-Langeveld (to justify the validity of the native speaker approach) cannot be used for generalisations; they are a small fraction of the whole. Verrips (2011) also asserts that there was no fairness in selecting the cases since only cases of false claimants were used, and there was no evidence of using case reports of genuine claimants in the study. Using false claimants' reports will only identify one type of error (false positive; Verrips, 2011, p.133). Therefore, identifying a false negative is impossible since cases of the asylum seekers who revealed their true origin were not included (Verrips, 2011). Of the eight examined reports, Verrips argues that three such cases are not comparable. Two of them were not analysed based on the same speech samples, while a counter expert of the other one had not had adequate time for the analysis (this resulted in giving her report as an impression rather than a conclusion).

Further, Verrips (2011) argues that despite considering forensic awareness as a very significant requirement in LADO, Cambier-Langeveld did not provide evidence of OCILA analysts having such skills. Verrips observed that objectivity is not always ensured in language analyses conducted by OCILA, stressing the need to have a fair report by including evidence of features that support a conclusion and those that do not support it, as only features supporting OCILA's conclusion were provided in the reports, while those that do not support the conclusion were ignored. Verrips also argues that the reliability of the analysis results is doubtful since the reports did not include a complete picture of the method employed in the analyses. For these concerns, she opposed the view

of recognising a native speaker's impression as a basis for concluding a report. Verrips maintains that native speakers should only serve as informants, while a conclusion should remain in the hands of specialised linguists.

In response to both Fraser's (2011) and Verrips' (2011) critiques, Cambier-Langeveld (2012) argues that scientific basis is lacking to support any view of native speakers being outperformed by specialised linguists in identifying the origin of speakers. She argues that since the Guidelines indicate that native speaker competence and linguistic expertise are different, it is not justifiable to consider the relevance of one over the other. Reacting to Fraser's assertion that 'the conclusion of native speakers without appropriate evaluation is unacceptable' (Fraser, 2011, p.125), Cambier-Langeveld argues that the role of the native speaker is not stated in the Guidelines. She further laments that Guideline 7 can be interpreted as not considering the native speakers' competence at all. Instead of ignoring the native speaker significance in the Guidelines, a recommendation of feasible methods of assessing the judgements of native speakers under the supervision of linguists could have solved the problem (Cambier-Langeveld, 2012). She accused the proponents of the Guidelines of banning native speakers from playing the role of language analysts. She further stresses the need to require in-depth and sufficient information concerning both the specialised linguist and supervised native speaker approaches rather than emphasising the supervised native speaker approach only. Cambier-Langeveld also contends that proponents of one approach, say approach A, may identify poor practices among advocates of another approach, while the proposed approach A might also be identified with poor practices by others. Having accepted the inclusion of linguistic expertise in LADO, she finally calls for a detailed study and description of up-to-date guidelines (which can accommodate the legitimacy of both approaches).

In response to Patrick's (2012) points above, Cambier-Langeveld (2014, p. 372) argues that emphasising linguistic expertise only while ignoring 'other aspects such as native speaker expertise, individual testing and forensic nature of LADO' is alarming. She accused the Guidelines of recognising only one approach of language analysis as reliable, and Patrick's (2012) insistence that only linguists should conduct language analysis indicates rejection of the team approach. She argues that Patrick's position (non-linguist native speakers 'should not be asked to perform analysis') (2012, p.544) does not have any empirical research backing. Further, she argues that there is hardly any identified qualification for conducting LADO. Contrary to Patrick's claim that LADO is a sociolinguistic issue, Cambier-Langeveld argues that it is a 'forensic one since the history of speech community membership and language socialisation is unknown' (2014, p.377). She accused Patrick's chapter of supporting the expert linguist approach, while no evidence has confirmed the better performance of one approach over the other. Cambier-Langeveld suggests that the debate's emphasis should be laid on empirical research rather than their polemic basis to establish well-founded evidence.

In a later article, Cambier-Langeveld (2016) further challenges both Fraser (2011) and Verrips (2011) for their failure to invalidate the conclusion of her 2010a article. She argued that the only situation that may allow the use of linguists alone without the support of a native speaker is when a particular native language of one country is claimed to be that of another country. In this situation, available word lists (which have translations in English or any other working language understood by the analyst) of the claimed language can be consulted by any linguist (Cambier-Langeveld, 2016). In support of this claim, she asserts that some false asylum seekers of Nigerian L1 Igbo origin had claimed to speak Dinka of South Sudan as their L1. As a result of the complex linguistic nature of languages, she noted that the ability to differentiate several varieties of a language will always determine the kind of a language analyst to select, and native speakers of the same language will vary in terms of their ability to categorise distinct dialects.

Secondly, Cambier-Langeveld (2016) argues that some native speakers are more mobile than others, having stayed for quite a reasonable time in several places in a particular country. This mobility gives them an opportunity of gaining vast experience in many other languages, varieties and cultures. Thus, native speakers with such qualities might be able to work on several casework, while those who are not mobile are more likely to have limited skills to identify only people from their immediate community. Thirdly, she also argues that the language situation in the country of origin determines the selection of language analysts. When a language in question is spoken as a lingua franca in a country (for example, Nigerian English/or Nigerian Pidgin English), and considering the complex linguistic diversity of Nigeria (where hundreds of independent indigenous languages and their varieties exist), language analysts can best be drawn from among the L2 speakers of Nigerian English. The job of the L2 speakers is to work on some L2 English samples produced by the asylum seekers whose claims were falsified in an initial analysis (Cambier-Langeveld, 2016).

More recently, Matras (2018) has reviewed 50 reports produced for the UK Government by Verified AB. Verified AB claimed to conduct language analysis under the Guidelines. However, Matras has raised issues, such as ignorance of language variation and the possibility of dialect mixture due to a long stay in a new place where speakers of several dialect backgrounds are in contact. He also criticised the approach of using a fixed alternate hypothesis about the asylum applicant's true region of socialisation. Therefore, Matras proposes an inductive approach, an 'open hypothesis' in which a claimant can be from any dialect region of the language in question.

Shortly after the publication of Matras, a rejoinder to his article emerged. Matras has been criticised by Hoskin, Cambier-Langeveld & Foulkes (2019). While acknowledging the appropriateness of Matras' concern of ignoring language variation and dialect mixture in some language analyses, they faulted his claim of proposing/applying an inductive approach in his review of the analysis of such 50 reports. Hoskin, Cambier-Langeveld & Foulkes (2019) argue that the inductive approach is only

relevant to classification cases—not verification cases that mostly require a deductive approach in LADO—, where asylum seekers’ most likely region of socialisation is identified after a failure to confirm the asylum applicants’ claim of a particular region. In support of this argument, language analysis conducted without a prior claim of a particular region of socialisation is labelled as analysis for classification purposes (Foulkes, French & Wilson, 2019). Hoskin, Cambier-Langeveld, & Foulkes (2019) argue that the deductive approach requires the formulation of a hypothesis first before looking up for linguistic data to explain it, while the inductive approach requires the initial availability of data before formulating a hypothesis for an explanation. Conversely, verification cases allow for the formulation of an alternate hypothesis in comparison with an initial hypothesis formulated from asylum applicants’ stories/information (Hoskin, Cambier-Langeveld & Foulkes, 2019). They argue that Matras’ use of the asylum applicant’s migration story (about locations of stay before arriving at the host country) to generate/support a hypothesis of likely region of origin made the approach a “deductive” one.

Three main issues in Matras’ contribution were raised by Hoskin, Cambier-Langeveld and Foulkes: (1) opposing the juxtaposition of two hypotheses (2) ignoring the principles of forensic evidence in his approach and (3) use of free wording of conclusions. Hoskin, Cambier-Langeveld & Foulkes (2019) rejected the Matras’ view that framing the question of linguistic background as two juxtaposed hypotheses risks biasing the results of analysis. They argue that assessing the evidence in light of only one hypothesis is known in forensic science as well as in the social sciences to introduce the risk of bias, and such attempt by Matras is an error that contravenes general forensic principles appropriate to sound expert evidence.

They argue that verification cases require comparison of the initial hypothesis with an alternative hypothesis as an essential component of a fair forensic analysis that ought to be recognised at all stages (p. 263). To ensure the fairness, verification task ought to consider the linguistic evidence that supports the claimed origin against those not supporting the claimed origin. When the linguistic evidence is consistent with the claimed origin, that does not lead to expression of the strength of the evidence. Such evidential strength should be expressed under two hypotheses: (1) how plausible the evidence is if the initial hypothesis is true (2) how plausible is it if the alternative hypothesis is true.

While acknowledging that consistency between the initial hypothesis and observed linguistic evidence provides a reason for a plausible explanation for the claimed origin, it, however, on the other hand, cannot allow for testing the strength/degree of evidence using only single hypothesis as this always risks biasing. The extent to which the observed patterns (linguistic evidence) support the claimed origin should only be assessed if alternatives are explicitly assessed through the following questions, for example: (1) To what degree are they consistent? (2) Do they contain relatively unremarkable and non-distinctive features, or do they contain a set of shibboleths? To avoid a

confirmation bias, according to them, it is widely a requirement within Forensic Speech Science to evaluate the strength of evidence through considering both the evidence when the hypothesis is true and the evidence when the hypothesis is not true.

Matras accused Verified's analysts of using free wording of conclusions rather than specifying the range of possible conclusions. In relation to this, Hoskin, Cambier-Langeveld and Foulkes called for using a fixed conclusion scale—that is considered as the standard in forensic sciences and government agencies to identify where the strength of the conclusion is situated within the intended range of conclusion (p. 270).

5.9 Issues with qualified linguists

There has been an exchange of views regarding linguistic qualification requirements to be a language analyst in the LADO field. Cambier-Langeveld claims that eight of the cases she examined in her 2010a article had contra-analyses by linguists who were consulted by lawyers of the asylum seekers. However, this assertion was rebutted by three opposing scholars (Fraser, 2011; Verrips, 2011; Patrick, 2016). Fraser and Verrips insisted that the analysts who provided counter-analyses of the eight cases are not linguists (Fraser, 2011; Verrips, 2011); some of them were researchers in anthropology, cultural studies or literature. Patrick (2012) argues that mandatory linguistic knowledge for LADO includes 'phonetics, phonology, the lexicon, syntax, morphology, semantics, pragmatics, language acquisition, language contact, language change and variation' (p. 541). By this assertion, Patrick insists that LADO analysts must possess knowledge of all these branches of linguistics. He also contends that lower linguistic qualifications such as BA and MA are not sufficient to produce any reliable and fair analysis reports. Also, he argues that qualification requirements (such as advanced degrees in linguistics, peer-reviewed research in the relevant language and an understanding of the forensic process) for expert linguists should not be compromised in the process of producing reports (Patrick, 2016). Along with several others, Foulkes, French & Wilson (2019) have rejected the view of recognising any linguists without expertise of forensic analysis. They argue that linguistic 'qualifications alone do not guarantee practical competence in specific empirical tasks' (p.113). Similarly, Baltisberger and Hubbuch (2010) argue that linguistic expertise does not automatically qualify every linguist to be expert analyst. Foulkes, French & Wilson emphasised the need for intensive training in 'practical linguistic analysis' (p.110), especially in phonetics and sociolinguistics.

5.10 Testing native speakers

Fraser (2011) argues that Cambier-Langeveld's process as 'training, testing of native speakers and supervising native-speaker analysts' does not provide any detail about how it is conducted in LADO (p.124). This casts doubt as regards to its validity. It is not also clear enough for comparison with how other agencies conduct such analyses. In order to bring to an end, the allegedly poor language

analyses conducted by other agencies, Cambier-Langeveld was challenged to provide detail of what and how the process is done by IND. Considering Cambier-Langeveld's statement 'testing is relatively easy to do, by requiring only a set of speech samples' (Fraser, 2011, p. 125), Fraser argues that Cambier-Langeveld's above statement suggests lack of awareness about issues of validity and validation in testing, particularly of language (p. 125). Fraser recommends assisting the analyst to specialise in the required linguistic branches rather than the in-house testing, training and supervision provided. Further, Fraser (2019) argues that undergoing linguistic training normally lasts a long time, and native speakers will hardly have such a time for the in-house training; this might mislead the native speakers to be overconfident in their performance (Fraser, 2019, p.12). Thus, Fraser argues that LADO lacks any standard procedure for testing native speakers. She stresses the need for an open academic discussion to establish agreed criteria for collecting and evaluating evidence for the reliability and validity of the native speaker approach.

Similarly, Patrick (2016) argues that this method of in-house training will never be the same as linguistic analysis training undertaken in pursuance of degrees at recognised academic institutions; the training method is most likely not going to be considered by linguists, tribunals or appeal courts (Patrick, 2016, p.135). However, Cambier-Langeveld (2012) clarified her position concerning the testing of supervised native speakers (unlike the allegation of Fraser 2011, p.127) that continuous cross-checking of the same analysed cases by several other native speaker analysts from various agencies should be ensured to verify the authenticity of the analysis. She further argues that individual testing involves both non-linguist native speakers and non-native linguists rather than only non-linguist native speakers. On the other hand, Foulkes, French & Wilson (2019) presented their method of authenticating the work of native speaker consultants (see below). Nolan (2012) argues that native speakers' ability to distinguish their fellow native speakers 'must be pre-tested on known data' (p.15). However, Cambier-Langeveld has not confirmed whether her agency possesses any database containing speech samples of languages in question for pre-testing their native speaker analysts. Fraser (2012), Nolan (2012) and Matras (2018) have recommended an approach that compares speech samples of asylum applicants. This recommendation is interesting, but none of them provided a full description of a method of the comparison.

Bennett's (2016) experiment was aimed at determining the best form of training that non-native speakers need in language identification. The experiment attempted to ascertain the effect of frequent listening/exposure to audio recordings, a detailed information of dialects in question or a combination of both in improving the language identification accuracy rates. The experiment tested the abilities of listeners at distinguishing Arabic dialects from Turkish dialects or different Arabic dialects from each other. Forty listeners—who had little or no familiarity with either Arabic or Turkish, and some of whom had a foreign linguistic training—were tested under four conditions/training

methods: (1) They listened to audio examples of each language (2) They were asked to read a short text, (3) go through a linguistic information on the differences between languages and dialects (but in non-linguistic terms) and (4) a combined auditory and linguistic information were also given to them. The listening participants were randomly divided into four groups and “assigned one of the four training modules” (p. 35).

Overall findings show that the highest accuracy and improvement was achieved by the participants who received the combined audio and written training, while the group that did not receive any training got the worse score in the post-training task. Bennett argues that training has improved the accuracy and improvement rates of individual participants who lack previous knowledge of the target and foil languages. Higher improvement rates were observed in discriminating between Arabic dialects than from Arabic to Turkish.

All participants (in Bennett’s study) who had no linguistic training in foreign languages had higher accuracy rates against listeners who had linguistic training in foreign languages (other than the target language). Given this finding, Bennett argues that advanced linguistic expertise in foreign languages other than the target language/dialect in question did not improve/affect participants’ ability in distinguishing between languages and dialects, no matter the training they received (p. 53). Bennett opines that ‘any form of training can lead to higher accuracy rates and possible improvement (p. 65).

5.11 Empirical studies in support of the team approach

Wilson (2009) conducted the pioneer empirical study on LADO, which aimed to investigate the value and capacity of non-linguist native speakers and phonetics in language analysis. The study involved four groups of listener participants: Ghanaian English native speakers, academic linguists/postgraduates in linguistics, undergraduate students in linguistics and professionals in language analysis. Apart from the native speakers of Ghanaian English, all the other three linguist groups received working material which described the features of Ghanaian English. Her findings revealed that despite their lack of linguistic skills, untrained native speakers of Ghanaian English were the best performing group (86% accurate) in distinguishing their fellow Ghanaian English speakers from Nigerian English speaker foils. These native speakers were more confident in their judgements, though they were also highly confident even when their choice was wrong. While academic and postgraduate linguists were 81% accurate, professional language analysts (working in some agencies) were 50% accurate, i.e., they performed at chance levels. Wilson argues that the negligible performance difference between linguist groups suggests that in-depth linguistics knowledge with peer-reviewed journal publications, may not be more significant than a short training for a reliable language analysis.

Since the study did not include asking native speakers to differentiate the Ghanaian English speakers based on their L1 differences, Wilson recommended investigating the performance of native speakers who are also linguists. One of the research questions of this thesis aimed to identify linguist native speakers' performance in comparison with non-native speaker linguists. It may also be interesting to see if they may be cautious in rating their confidence for the identification task, especially when they are inaccurate.

Hedegard (2015) conducted an experiment assessing the abilities of four conditions in a Japanese dialect identification. The conditions were: native speakers, trained native speakers, native speakers paired with non-native linguists and non-native linguists only group. Hedegard's study was focused on determining the interaction/relationship between linguistic training and native speakership. They were asked to categorise Japanese language into three accent groups: Tokyo, Tohoku and Kansai.

Findings of the study show that native speaker linguists were the most accurate but not significantly better than the non-linguist native speakers, while the statistical test showed that non-native Japanese linguists were significantly the poorest group compared to the other groups. The native speaker phonologists had the same performance rate as non-native Japanese experts who had vast experience on the Japanese dialect features.

In terms of self-confidence rating, native Japanese speaker linguists (who specialised in the language in question) were more cautious than the other conditions in the identification task. Similar results were produced by native speaker non-linguists, native speaker linguists and a pair of a native speaker and a linguist working in tandem. Paired condition (native speakers + linguists) showed greater caution in their incorrect responses. Native speaker and linguist participants gave the same confidence rating on average for both correct and incorrect responses. Although this work seems to be a great contribution to LADO/LAAP, a dialectal variation was not considered in recruiting its participants of the study.

Another study conducted by Jenkins (2016) compared the abilities of humans versus computers in identifying imitated Scottish English accent. Performance of three human groups: laymen, actors and phoneticians and Y-ACCDIST (automatic accent recognition system) were compared.

The human performance results show that the listeners from Scottish region or who had lived for a long time in Scotland outperformed the listeners from other region in successfully distinguishing the disguised Scottish-accent speakers from the genuine ones (78% versus 63%). On the other hand, little difference was observed between the linguist and untrained listener group performance (66% and 65% correct judgments). Jenkins claims that the performance similarity might be due to asking for

only linguistic training, and therefore suggested asking phonetic and dialectology training in future studies.

The findings from human versus Y-ACCDIST comparison show that Y-ACCDIST outperformed human listeners for having fewer false-genuine judgement of samples. However, there was no significant difference between any speaker groups in Y-ACCDIST analysis.

One of the future studies recommended by Jenkins is to train Y-ACCDIST on multiple varieties of English to pave way for investigation into whether Y-ACCDIST can determine a speaker's native accent.

In relation to Jenkin's recommendation, the listening part of Kim's (2008) experiment compared the abilities of phoneticians and non-phoneticians in identifying imitated Scottish English accent. Kim reported no difference between the two groups, as all respondents from both groups could not distinguish the imitated Scottish English stimuli from the authentic one.

In support of the native speaker approach, though it is not based on empirical research, Nolan (2012) accuses the proponents of the Guidelines of underrating the significant role of native speakers by implicitly rejecting their invaluable contribution to the LADO process. He argues that the knowledge of native speakers and linguists who have localised expertise in the language in question are complementary, and native speakers' internalised knowledge of recognising fellow speakers of their accent is over and above what can be captured in abstract linguistic descriptions achievable using notations (including those of narrow phonetic transcription). Further, Nolan argues that such abstract descriptions cannot capture the exact behaviour of speech organs—which have degrees of freedom of tongue movements in the vocal tract whereby particular muscles are free to vary in shape and movements in coordinative structures—during the articulation of sounds of a particular community or accent group.

To support this argument, using different articulation characteristics of implosives and retroflex sounds discussed by Ladefoged & Maddieson (1996), Nolan argues that several dimensions of articulatory freedom result in different languages having sounds that are distinct in their production and acoustic realisation, but such sounds are treated as entirely the same in traditional phonetics (p.16). These characteristics of sounds reflect the true articulatory idiosyncrasies of a particular group of speakers, while their exact qualities can only be known 'through quantitative experimental phonetics rather than discrete linguistic information' (p.23). While native speakers are not trained to use linguistic terms to represent their native perception in analysis, linguists, on the other hand, cannot detect speech information that is below such abstract phonemes (that are always used in the analysis). Nolan's arguments were never disputed by anyone. Thus, his position remains uncriticised.

In the same vein, Hoskin (2018) argues that the involvement of native speakers who have undergone a substantial training is of utmost significance, and thus should not be rejected in LADO. Hoskin has reviewed 20 language analysis reports produced by the Swedish agency, Verified AB (in collaboration with native speaker non-linguists), to support his belief that native speaker non-linguists too possess the knowledge (such as heterogeneity, linguistic accommodation and language mixing) that qualify them to work in LADO. Some native speaker analysts “know a lot more than others do about language” (p. 26). He argues that non-linguists are aware of the linguistic complexities within and among speech communities (p. 27). He points out that evidence from the reports indicates that native speaker analysts are able to identify further heterogeneity—that are not included in the literature of Kurmanji language—through sub-classifying previously attested linguistic communities (available in the literature of Kurmanji), clarifying language situation, multilingual/multidialectal communities, identifying instances of linguistic accommodation, language mixing and code-shifting (p. 28). He, therefore, rejects the allegation of homogeneity ideology in native speaker non-linguists arguing that native speakers are able to identify complexities in languages.

Similarly, Foulkes, French & Wilson (2019) have called for recognising the value of the teamwork approach with a clear division of responsibilities for both the supervising linguists and native speaker consultants. They described how they work with native speaker consultants in speaker comparisons or speaker profiling in some cases. The contributions of consultants are also sought for analysing language varieties. Native speakers who are also phoneticians or linguists with at least masters-level qualifications are consulted in handling foreign language cases. Foulkes, French and Wilson argue that involving a native speaker consultant (if available) who is also trained in linguistics is worthwhile in casework. In case of scarcity of such a combination, native speakers who also hold Masters Degrees in other disciplines are engaged. Potential native speaker consultants are drawn by assessing their abilities to engage in language analysis, and they are asked to identify some ‘tokens of vowel phonemes’ (Foulkes, French & Wilson, 2019, p. 104) by listening to samples of the language in question. While a forensic analyst remains the sole analyst in the process, especially by conducting an acoustic analysis of the samples, a consultant is normally asked to confirm whether the sample is completely produced in the suspected language by only one speaker. The consultant also checks the summary of published descriptive features of the language which the forensic analyst sourced.

Further, Foulkes, French & Wilson (2019) argue that collaborative work between forensic analysts and native speaker consultants yields positive results. For example, the consultant's primary responsibility in Ghana case was to carry out a complete transcription of the recordings. In order to ensure no additions or subtractions are made to the original material, the forensic analysts work in collaboration with the consultants to listen to the recording and compare it with the transcription on

several occasions. Such consultants undergo in-house training for using analysis software such as Sound Forge and Praat to mark relevant parts of the samples for subsequent discussion. After completing the required training, the consultant is asked to extract 'tokens of all contrastive vowel phonemes' (p.105).

Sufficient empirical evidence of the viability of a particular method of conducting LADO over others is not yet available, as virtually all contributions in the debate are at the level of polemic. In other words, there is not yet a lot of empirical evidence to support the various merits of the contending approach. For this reason, the International Journal of Speech, Language and the Law has stopped considering any LADO-related article that does not have empirical backing (Foulkes, French & Wilson, 2019).

In sum, they highlighted how they adopted a team work approach when dealing with a foreign language or unfamiliar vocabulary. This is done by engaging native speaker consultants—preferably linguists with a minimum of an MA degree or another MA degree holder from another discipline. The consultants' work is strictly monitored and checked by a supervising linguist, who takes full responsibility for the case and deals with tasks that cannot be handled by the consultants. Considering the limitations of their non-native expertise in the language in question, forensic phoneticians collaborate with native speakers of the language/dialect in question to produce accurate, thorough and reliable analysis.

Several other studies investigated the performances of different human listener groups in distinguishing fellow speakers of their accent group from speakers of other accents (e.g., Clopper & Pisoni, 2006; Ikeno & Hansen, 2006; Purnell, Idsardi & Baugh, 1999; Walton & Orlikoff, 1994) or different automatic systems at categorising different accents (e.g., Arslan & Hansen, 1996; Huang, Hansen & Angkititrakul, 2007; Richardson, Campbell, Torres-Carrasquillo, 2009). Hanani, Russel and Carey (2013) are among the few studies that compared human versus automatic accent recognition systems in classifying accents of the same language. The present study includes an automatic accent recognition system, Y-ACCDIST, as a method of accent classification. Its performance is compared with that of three human listener groups. Brief information about how Y-ACCDIST works and its performance in three studies carried out by its designer (Brown, 2014) is given below.

5.12 Automatic accent recognition systems

Most of the arguments in the LADO debate have been based on impressionistic judgements or traditional auditory-acoustic phonetic analysis of speech samples. Some engineering-based models automatic accent/dialect recognition systems, such as Gaussian Mixture Model—Universal Background Model (GMM-UBM), Gaussian Mixture Model—Support Vector Machine (GMM-SVM), and Phonological Gaussian Mixture Model—Support Vector Machine (Phonological GMM-SVM), are

acoustic-based systems that are concerned with acoustic values obtained from a speech sample. However, another system, Accent Characterisation by Comparison of Distances in Inter-segment Similarity Table (ACCDIST), was also designed in 2004 by Huckvale. The use of this system and its successors became prominent in the work of Huckvale and was further developed in 2007 (Huckvale, 2007). However, these and other automatic systems only focused more on phonetics and phonology in sociolinguistics studies (Brown, 2017). By contrast, Y-ACCDIST was developed for forensic applications (though it has not yet been applied in any forensic casework so far).

5.12.1 Y-ACCDIST

In 2014, a new version of ACCDIST, named York-Accent Characterisation by Comparison of Distances in Inter-segment Similarity Table (Y-ACCDIST), was designed by Brown at the University of York. Speech technology of this kind has not yet been applied in speaker profiling or LADO (Brown, 2016b). Unlike the previously mentioned engineering-based systems, Y-ACCDIST is segmentally-informed phoneme-based system—that focuses on how different vowel and consonant phonemes are phonetically realised by individual speakers to identify the accent of a particular speaker. Y-ACCDIST is an improved version of ACCDIST designed to work with both scripted and free speech data. While ACCDIST only works with read data and vowel phonemes, Y-ACCDIST analysis also includes consonants (Brown & Wormald, 2017). It attempted to propose a new ‘method for assessing similarity between speakers of different accent varieties’ (Brown & Wormald, 2017, p.424).

Comparing the performance of five different accent recognition systems—GMM-UBM, GMM-SVM, Phon-GMM-SVM, Y-ACCDIST-Correlation and Y-ACCDIST-SVM—, Y-ACCDIST—SVM outperformed all the other four systems by achieving an 87.5% accuracy rate at categorising four (geographically-proximate) English and Scottish accents—Berwick-upon-Tweed, Eyemouth, Carlisle and Gretna— spoken along Scottish/English border (Brown, 2016a). Also in a separate experiment, using the Northern English corpus that comprises samples of three accents: Manchester, York and Newcastle accents, Y-ACCDIST achieved 80% accuracy (Brown, 2016b). Brown & Wormald (2017) investigated the performance of Y-ACCDIST-Correlation at categorising four English accents—Bradford-Punjabi English, Bradford Anglo-English, Leicester-Punjabi English and Leicester-Anglo-English. The study attempted to check how Y-ACCDIST corroborates with the initial sociophonetic analysis of these accents conducted by Wormald (2016). They observed that Y-ACCDIST was as good as the traditional auditory-acoustic analysis in categorising these four accents. Using a leave-one-out configuration setup, 72% accuracy was achieved by Y-ACCDIST. Most of the errors were due to confusing accents spoken within the same region not accents of the different L1 backgrounds, but spoken in different regions; i.e., Leicester-Punjabi English is more prone to being confused with Leicester-Anglo English than Bradford-Punjabi English.

As found in the Wormald's non-automated analysis, findings of Y-ACCDIST suggest that language background does not have a strong effect on distinguishing the two varieties of Punjabi English (Bradford and Leicester). Using ANOVA to run feature selection—for ranking the significance of Y-ACCDIST matrix elements in distinguishing the accents (calculated phoneme pair distances) by generating the p-values—, Y-ACCDIST also identified some features to be more useful (highly ranked) in distinguishing different accents, as they had the smallest p-values.

More recently, Brown, Almbark, French, & Hellmuth (2019) reported that a very high success rate was achieved by Y-ACCDIST in classifying eight dialects of Arabic. Y-ACCDIST was 99% accurate using reading passage data, while it was 77.8% accurate using spontaneous speech data of the same eight Arabic dialects.

5.13 Conclusion

Claims to the reliability of both the expert linguist and the supervised native speaker approaches lack adequate empirical research. The debate is still largely based on polemic rather than empirically-grounded findings (Cambier-Langeveld, 2012, 2014; Foulkes, French & Wilson, 2019). Virtually all contributors to the debate (Fraser, 2009, 2011, 2019; Verrips, 2011; Patrick, 2012, 2016; Eades et al., 2003; Eades & Arend, 2004; Eades, 2009; Cambier-Langeveld, 2010, 2012, 2014, 2016) have called for in-depth empirical research into the field for reliable solutions. Despite this call, there seems to have been little appetite for mounting empirical research in this area. Except for Wilson (2009) and Hedegard (2015), the very few available studies in support of the native speaker approach were conducted by non-forensic linguists or those who have never been involved in LADO casework. Conceding that native speakers should be involved in the LADO procedure by the proponents of the expert linguist approach is now seen as a move towards reaching a consensus in the debate (Foulkes, French & Wilson, 2019). However, this consensus is partially reached since the involvement of a native speaker is only considered to be possible but not necessary, while the linguist takes full responsibility for producing the whole reports of the analyses (Fraser, 2011, 2019; Patrick, 2012). On the other hand, the proponents of the supervised native speaker see the role of a native speaker as nearly mandatory.

Testing and training are now considered to be a prerequisite step for practising LADO. Cambier-Langeveld (2010b) and Wilson (2009) argue that possessing linguistic expertise cannot provide an automatic qualification to engage in the forensic phonetic field. Some linguists who are signatories of the Guidelines had incorrect conclusions in their language analysis reports (Cambier-Langeveld, 2010b). Cambier-Langeveld (2010b) further argues that 'individual competence and experience affect the quality of analyses regardless of the method' (p. 31). This view is strengthened by Foulkes, French & Wilson (2019). Foulkes, French and Wilson contend that 'academic qualifications alone do not guarantee practical competence in specific empirical tasks' (p.113). Thus, anybody

(regardless of linguistic expertise) who intends to conduct reliable forensic analyses must undertake a prerequisite 'intensive training in practical linguistic analysis, especially in phonetics and sociolinguistics' (Foulkes, French & Wilson, 2009, p.110).

Wilson's (2009) recommendation (investigating the performance of native speakers who are also linguists) is the focus of this study. Since previous studies have shown native speaker competence to be significant in accent classification, this research question asks whether linguistic expertise can add significant value to the native speakership in the correct identification of one's native language variety. The automatic accent recognition system (Y-ACCDIST) is also tested along with the three human classifications. As speech samples may have different qualities and quantities of cues, a single method may not work well on such tasks.

Having identified these gaps, this study intends to provide an empirically-oriented method, or perhaps a combination of methods (across both automatic systems and human ones), of testing and carrying out language analyses for determination of origin, as recommended by many linguists who are involved in the debate. To achieve this, the following research questions and hypotheses were formulated to guide the next stages of the research: classification fieldwork, methodology and data analysis of the second phase of the research.

5.13.1 Research questions and hypotheses

Phase 2: Classification of Nigerian English accents for the determination of speakers' origins

Research questions:

- (1) How and by whom in a LAAP context should the analysis of spoken English be carried out? Is it native speaker linguists? Or native speaker non-linguists?
- (2) If expertise of linguistics is found to be effective, which specific kind(s) of linguistic expertise will be required?
- (3) Which of the methods performs best?
- (4) Are errors of the methods in complementary distribution? If so, which methods should be combined to give optimum performance?
- (5) What type of errors did the methods produce?
- (6) How does accent familiarity affect listeners' performance?

Based on these questions, the project has been guided by the following hypotheses.

Research hypotheses

For the classification task, seven hypotheses were formulated concerning who would best identify speakers' true region or country of socialisation.

- (1) Nigerian native speakers of any of the four Nigerian language backgrounds—Hausa, Igbo, Kanuri and Yoruba—will outperform the non-native speakers of such four Nigerian languages at correctly identifying fellow English speakers of their L1 group.
- (2) Nigerian native speakers who are also linguists will perform better than the Nigerian native speaker non-linguists. It is anticipated that the Nigerian linguists will outperform the Nigerian non-linguists owing to great conscious awareness of language structure and variation formal study of linguistics brings.
- (3) Nigerian native speaker linguists who are also phoneticians will perform better than the non-phonetician linguists.
- (4) Exposure to speakers of any of the Nigerian English accents would be an added advantage for accurate identification of a particular L1.
- (5) Listeners with in-depth research knowledge on the sound system of any of the L1 Hausa, Igbo, Kanuri or Yoruba will outperform other listeners lacking such knowledge.
- (6) UK forensic phoneticians may outperform other non-forensic academic phoneticians owing to their long-term practical experience in forensic phonetics casework.

Y-ACCDIST may outperform the UK phoneticians owing to its high success rate reported in some previous literature.

Chapter 6

Classification experiments and methodology

6.0 Introduction

This chapter concerns fieldwork for running the accent classification experiments in four Nigerian cities. The chapter includes the following: sampling technique, ethical considerations, instruments (Qualtrics, questionnaire) used for data collection in Nigeria and in the UK, profiles of the participants, as well as distributing the Qualtrics survey link to the UK-based participants.

The fieldwork had three main experimental groups: linguistically-untrained native speakers, native speaker linguists and UK-based phoneticians. The first and second group experiments took place in Nigeria, while the third group experiment was held in the UK. Each of the two Nigerian native speaker groups is further sub-divided (according to the L1 backgrounds of the participants) into Hausa, Igbo, Kanuri and Yoruba sub-groups.

The fourth experiment uses the automatic accent recognition system, Y-ACCDIST. For clarity in describing the procedure employed in the four experiments, each of the experiment is given an independent section below. The last sections of the chapter contain details about the research design, the population of the study area and method of statistical analysis.

6.1 Classification experiment fieldwork in Nigeria

For a pilot study, five Nigerians currently pursuing PhD programmes in York, participated before I travelled to Nigeria for the main classification fieldwork in November 2019. Based on their responses to the questions, we replaced some questions and improved others.

As in the recording fieldwork, the classification fieldwork involving speech classification again took place in four Nigerian universities and cities hosting them in December 2019. These are as follows:

- (5) Bayero University Kano and Kano City, North West Nigeria (Hausa)
- (6) University of Nigeria Nsukka and Nsukka City, South East Nigeria (Igbo)
- (7) University of Maiduguri and Maiduguri City, North East Nigeria (Kanuri)
- (8) University of Ibadan and Ibadan City, South West Nigeria (Yoruba)

Two major groups of untrained native speakers and native speakers who are also linguists, were involved. Each of these groups was divided into four sub-groups. Both linguist and non-linguist native speakers' sub-groups were Hausa, Igbo, Kanuri and Yoruba-educated native speakers. I initially intended to recruit phonetics/phonology specialists, but their number was very low in the four universities. Thus, linguists who specialised in various branches of linguistics were recruited, but only

very few of them were phonetics or phonology specialists. For the linguist group, they were Hausa, Igbo, Kanuri and Yoruba linguists.

6.1.2 Ethical consideration

As stated in Chapter 3, ethics approval was granted before commencing the perception fieldwork.

6.1.3 Sampling technique

The participants were selected under the following conditions:

- (1) Native speakers of Hausa, Igbo, Kanuri and Yoruba (for experiment 1)
- (2) Age must be 18 years or above
- (3) Native speakers of Hausa, Igbo, Kanuri and Yoruba + linguistics expertise (for experiment 2)
- (4) Both male and female participants were eligible

6.1.4 Procedure

Qualtrics survey software registered by the University of York was used for the collection of the data in Nigeria. Both the questionnaire and the extracts from the recordings of the speakers made in phase 1 were uploaded onto the software. The questionnaire and the stimuli were split into 20 blocks. The default block 1 contained the pre-classification background information of participants, as detailed under section 1 of the questionnaire section below. Blocks 2-19 contained the 18 stimuli of the classification task, as detailed below. The blocks of the recordings were set to be clicked before they would play. The last block 20 contained the post-classification questionnaire (see Section 2 of the questionnaire section for detailed information about all the three groups).

The participants signed the consent forms before taking part. For the Nigerian participants, due to the lack of a strong internet connection in some locations in Nigeria, I had to meet each of the participants at a different place. A Samsung tablet and headphones (HD 280 prof 64) were used by the participants during the survey. A detailed instruction on how to take the survey was first displayed on the background page of Qualtrics.

6.1.5 Stimuli

Eighteen stimuli were presented to the listeners, and each of the listeners was asked to identify the L1 of the speaker in the recording. Five response options were presented with each stimulus: Hausa, Igbo, Kanuri, Yoruba, and none of the above if the participant believed the speaker did not speak a variety of Nigerian English. They were also required to assign (none of the above) option to any stimulus they felt didn't fit with the four named categories. A self-confidence rating scale was attached to each of the audio clips for the participants to state how confident they were in

making their choices. The 18 stimuli were randomised to avoid possible external assistance to respondents during their participation.

For all the three experiments, the stimuli were eighteen audio recordings of speakers of the four varieties of Nigerian English as well as two non-Nigerian English foils (Ghanaian and Guinean English speakers). Each of the four accents of Nigerian English was represented by four stimuli in the survey. These stimuli were selected from the recordings earlier made in Nigeria (see the recording fieldwork in Chapter 3). Sometimes participants accidentally revealed a city or tribe in the recording. These were subsequently removed for use in the accent classification task. All personal information and demographic markers such as the names of speakers, city, region, tribe, workplace and school (which could expose the L1 background of the speakers), were removed from the selected recordings. All disfluencies such as external noise, pauses, and repetitions of words or phrases were also removed from the samples.

Using Audacity, each of the selected stimuli was reduced to 30 seconds in length and comprised of spontaneous and read speech. The spontaneous excerpt was a life experience narrated by the participants of the first section of the research, while the read-speech excerpt was the first few sentences of the Rainbow passage. Material from the other tasks such as reading a word list and describing pictures was used in addressing the phase 1 questions, as mentioned in Chapter 3. To have an equal volume rate across all stimuli, all the stimuli were normalised using Sound Forge.

6.1.6 Recording

The Qualtrics software automatically recorded the data collected. These were subsequently retrieved for further analysis. The data were downloaded in Microsoft Excel format and saved as .csv format for analysis in R.

6.1.7 Questionnaire

The questionnaire was divided into two sections. Both sections of the questionnaire were uploaded to Qualtrics.

Section 1: Nigerian Non-Linguists

The first section of the survey was the language background questionnaire that was contained in the default block 1 of Qualtrics. In this section, participants were required to provide their contact information, educational background (schools attended), birthplace, gender, age, native language (whether Hausa, Igbo, Kanuri or Yoruba). They were also asked to state whether they spoke any other language (s) apart from their native language (s), how they learned the other language(s), and whether they had ever lived in other regions of Nigeria, with a specification of state, duration of stay and

languages spoken in the state. This block was not set to randomise to always appear first every time a new respondent begins the survey.

Section 2: Nigerian Non-Linguists

The last section of the survey is a post-listening task questionnaire. This questionnaire was contained in the last block 20 of Qualtrics and had four questions that asked the respondents to state their basis for identifying each of the four Nigerian English accents. Time spent in taking the survey varied across the Nigerian non-linguist participants, but each of them participated at a go (without starting to finish later). The block was also not set to randomise so as to allow all participants to make post-classification comments only after completing the classification task. Time spent taking the survey varied across the respondents, as some were quicker in deciding to assign an L1 to the stimuli. But each of them started and finished the survey at a go.

Section 1: Nigerian Linguists

The first section of the survey for this group was language and linguistic background information questionnaire that was contained in the default block 1 of Qualtrics. The questionnaire contained 11 background questions that distinguished the Nigerian linguists from the Nigerian non-linguists. The participants were required to provide background information such as their area of specialisation in linguistics and phonetics, their level of studies at which they attended phonetic courses (whether at undergraduate, postgraduate or a mixture of both), whether they had studied the sound systems of any of the other three Nigerian languages apart from their native languages in the past, at what level they had studied any of the other three languages, where they attended the phonetic lectures (whether in a normal lecture class/theatre, in an equipped phonetic laboratory or a mixture of both), how often they attended phonetic lab sessions in a week, whether they had computers with headsets during phonetic practical sessions for speech production and perception. They were also asked to indicate the languages from which examples of phonemes were drawn during their phonetic lessons, and to state whether they had ear training in phonetics, whether they had ever done any work on LADO/LAAP or whether they had any hearing difficulties.

Section 2: Nigerian Linguists

The last section of the survey is a post-listening task questionnaire. This questionnaire was contained in the last block 20 of Qualtrics. The last block 20 contained four questions that asked the respondents to comment on their basis for identifying the four accents of Nigerian English. As with the other experiments, this block was not set to randomise so as to always remain the post-

classification questionnaire. Time spent taking the survey varied across the respondents, but each of them started and finished the survey at a go.

All Nigerian participants used the Samsung tablet to do the survey due to a lack of efficient internet connection and access of computers by some of the participants. For these reasons, it was not feasible to email the Nigerian participants the survey links, as many of them could not do it, while some did not have active email accounts.

Section 1: UK-based Phoneticians

The first section of the survey for this group was language, linguistic and phonetic background information questionnaire contained in the first default block of Qualtrics. The questionnaire contained 15 specific questions that distinguished the UK phoneticians from the Nigerian participants. The UK-based participants were required to provide their background information such as contact information, age, gender, place of work (university or other), whether they had ever studied overseas or Nigerian English sound systems, how long they had worked in phonetics, which of the phonetician associations they belong to, whether they are principally academic phoneticians, forensic phoneticians or combined both features, whether they had done any work on LADO/LAAP, whether they had ever analysed recordings of Nigerian English in the past or had sustained direct contact with any native speakers of Nigerian language, whether they had any hearing difficulties, which of the British English variety they spoke. The background information questions of the default block 1 were not randomised so as to always appear first every time a new respondent begins the survey.

Section 2: UK-based Phoneticians

The last section of the survey was a post-classification questionnaire contained in the final block 20 of Qualtrics. The block contained four questions that asked the respondents to provide their basis for identifying each of the four Nigerian English accents. Therefore, no randomisation option of the Qualtrics was clicked to keep blocks 1 and 20 always the opening and closing blocks of the survey respectively. Question numbers of the other 18 blocks (2-19) were not shown to the respondents to avoid any possible clue for the right answer.

Time spent taking the survey varied across the respondents, as no time limit was given, and the respondents were allowed to start and finish the survey later if they wished to. Unlike the Nigerian participants, tracked responses recorded in Qualtrics revealed that some of the UK phoneticians started the survey and finished at a later time, while others started and finished at one sitting. The block was also not set to randomise so as to serve as a post-classification task questionnaire to all respondents. The UK-based phoneticians had the option of starting and finishing the survey later and

using software to listen to the stimuli in case they wanted to go for in-depth analysis before the classification task. They were given the chance of doing so as they were not met face to face to do the survey on the researcher's Samsung tablet (as done in Nigeria by both linguists and non-linguists).

6.2 Experiment 1: Untrained native speakers

The experiment made use of four sub-groups: Hausa, Igbo, Kanuri and Yoruba-educated native speakers. It aimed to determine the relative performance of each group in identifying their fellow L1 speakers speaking L2 English. The performance of identifying their L1 speakers is compared with other L1 groups' performance.

6.2.1. Sample size

Eighty participants selected from the four regions of North-West (Hausa), North-East (Kanuri), South-East (Igbo) and South-West (Yoruba) participated. Their ages ranged from 18 to 70 years (mean age = 28, SD = 9). Each of the four groups is discussed below.

6.2.2 Hausa untrained native speakers

For the Hausa group, 20 Hausa native speakers were recruited at both old and new campuses of Bayero University and the City of Kano. This group comprised 10 male and 10 female participants who were either undergraduate or graduate students. The participants were 3 male and 3 female graduate students, 7 male and 7 female undergraduate students from different disciplines. Twelve of the 20 Hausa participants had not been to any non-Hausa region in Nigeria and could not speak any other Nigerian language. Four of the Hausa participants had been to Abuja (Nigeria's capital city), a non-Hausa region.

6.2.3 Igbo untrained native speakers

For the Igbo group, 20 Igbo native speakers were all recruited at the University of Nigeria, Nsukka. The group comprised 10 male and 2 female graduates, 6 male undergraduate students, 1 female undergraduate student and 1 male postgraduate student. They were from various departments of the University.

6.2.4 Kanuri untrained native speakers

For the Kanuri group, 20 Kanuri native speakers, (7 male and 4 female graduates; 4 male and 5 female undergraduate students; 1 male and 1 female postgraduate student), were recruited at the University of Maiduguri and Maiduguri City.

6.2.5 Yoruba untrained native speakers

For the Yoruba group, 20 participants, (1 female graduate; 11 male and 8 female undergraduate students), were also recruited at the University of Ibadan. These included 1 female staff, 10 male undergraduate students, 6 female undergraduate students, 1 male postgraduate student and 2 female postgraduate students of the University. While some of the participants had lived in other Nigerian regions, others had not been to other regions at all.

6.3 Experiment 2: Native Speakers who are also linguists

The second experiment was run to determine the relative performance of native speaker linguists at distinguishing the varieties of Nigerian English. It aimed to find the effect of linguistic expertise in categorising the Nigerian accents of English.

6.3.1 Sample size

Twenty-five linguists who were native speakers of Hausa, Igbo, Kanuri or Yoruba participated in the group. Their ages ranged from 35 to 70 years (mean age = 50, SD = 11).

6.3.2 Hausa native speaker linguists

For the Hausa linguist group, six Hausa native linguists (4 males and 2 females) were recruited at the Department of Foreign Languages and Linguistics of Bayero University Kano. Although only one of the six participants specialised in phonetics/phonology, the other five participants had PhD degrees in other branches of linguistics such as applied linguistics, discourse analysis, syntax, morpho-syntax, pragmatics, translation, morphology, stylistics and language communication. While two of the Hausa linguists had their PhD degrees from the UK (specialised in morpho-syntax) and US (specialised in syntax) universities, the other four had carried out their studies at Bayero University Kano. Thirty-three percent of the participants had been to Adamawa State (of the North—Eastern region) and Plateau State (of the North—Central region) for one year. Sixty-seven percent of the participants had not lived in any other part of the country. Besides Hausa and English, none of the Hausa participants had studied the sound systems of any other languages.

Challenges during the experiment

The internet connection was too slow at the Department of Linguistics and Foreign Languages at Bayero University Kano. None of the participants who accepted to take part initially could do so due to the slow internet connection on campus. Thus, I had to suspend it for the next day. I secured a different internet source and returned to the campus. Some people declined to participate based on reasons such as tight commitments and lack of time.

6.3.3 Igbo native speaker linguists

For the Igbo group, nine Igbo native linguists (5 males and 4 females) were recruited at the Department of Linguistics, Igbo and other Nigerian Languages, University of Nigeria Nsukka. Only one of the female participants specialised in phonology. The remaining eight Igbo linguists specialised in the areas such as applied linguistics, discourse analysis, syntax, pragmatics, semantics, morphology and sociolinguistics. In terms of the movement in other parts of Nigeria, 22% of the participants had been to the Northern states (Kaduna and Kano) for three and six months only. While 11% of the participants had lived in Adamawa (of the North Eastern region) for six years, another 11% had lived in Kano for one year and Plateau (of the North Central region) for four years. While another 11% visited all the thirty-six states of Nigeria for a month, another 11% visited Lagos (of the South-Western region) for two months only. Thirty-three percent had not lived in any other parts of the country. Only 33% of the participants had studied the sound systems of Hausa and Yoruba.

Challenges during the experiment

Challenges faced in Nsukka were mainly related to the internet connection. The internet source was replaced on several occasions before completing the survey for the Igbo group. While randomising the questions of the survey on Qualtrics, one question was inadvertently skipped. A question was not displayed to all the participants. Consequently, I had to postpone my journey to Ibadan and stayed for another couple of days in Nsukka. Except for three of the participants, all the other participants were traced and met again to take the hidden question. Two new participants were recruited to replace the untraced ones.

6.3.4 Kanuri native speaker linguists

For the Kanuri group, five Kanuri native linguists at the Department of Languages and Linguistics of the University of Maiduguri participated. One of them is a professor of Kanuri phonology. While three participants specialised in syntax, the other one specialised in applied linguistics. Other 40% of the participants (no. 2 and no. 3) had not stayed in any part of Nigeria. Sixty percent of them (no. 1, no. 4 and no. 5) had been to other regions where they stayed for one year each. The first Participant had been to Ondo State (of South-West Nigeria) and Abia (of South-East Nigeria) for one year each. While the fourth participant had been to Lagos State (of South-West Nigeria: Yoruba region) for one year, the fifth participant stayed in Edo State (of South-South Nigeria) for one year. Only 20% of the participants studied the sound systems of other languages.

Challenges during the experiment

The internet connection was the main challenge faced during the fieldwork at the University of Maiduguri. The stimuli (speech samples) did not boot on Qualtrics due to a poor internet connection on campus. It did not work in places such as the Department of Languages and Linguistics, the

Professors' Office building, the Computer Centre and the El-Kanemi Hall. The time spent doing the survey was three times more at the University of Maiduguri than the other places. The Kanuri linguists had been supportive and patient during the experiment. It took us a whole week before completing the survey. Four different internet sources were used in the university. We even went very close to the mobile service masts before the recordings booted. An offline version of Qualtrics did not work either. It only worked for the first time but instantly failed thereafter.

6.3.5 Yoruba native speaker linguists

For the Yoruba group, three of the five native Yoruba linguists were recruited at the Department of Linguistics and African Languages of the University of Ibadan. The other two participants were recruited at the Department of English, University of Nigeria Nsukka and the University of Maiduguri respectively. Only one of the participants (participant no. 1) specialised in experimental phonetics. He obtained his PhD from a Canadian university. He had lived for 38 years in Maiduguri where he had been lecturing since 1982 at the University of Maiduguri. While participant number 4 had a PhD in phonology and he was in his 22nd year in Nsukka, Enugu State (Igbo speaking area), the other three participants at the University of Ibadan specialised in Yoruba syntax, semantics and syntax-machine translation.

While participant no. 3 had stayed for six years in Nassarawa State and three years in Niger State (both in the North-Central region), participant no. 5 had spent one year in Enugu. While 60% of the participants had not studied the sound system of other languages, 40% (2 participants) had studied the Hausa and Igbo sound systems. Another 40% of the listeners (2 participants) had been to the north for 38 and 9 years respectively. While participant 1 had lived in Maiduguri (of North-East) for 38 years, participant no. 3 had stayed in Nasarawa for six years and Niger for three years. Another 40% of the participants had been to the South Eastern Igbo region for 21 years and 1 year, respectively. While participant 4 has so far lived in Enugu State (of South-East) for 21 years, participant no. 5 had been to Abia State (of South-East) for only 1 year. Twenty percent of the participants had not lived in any other region(s) of the country.

Challenges during the experiment

As in the other regions, the poor internet connection was the primary challenge faced at the University of Ibadan. Location was changed four times before the first participant completed his survey. It took us about three hours in the case of one retired professor. Neither of my internet sources worked properly. Many participants became tired of taking part because of the poor connection. It created some uncertainties and a lack of confidence regarding when the experiment was going to be completed. Most of the untrained native speakers would ask how long it was going to take, but any estimate given was not realistic.

6.4 Experiment 3: UK-based Phoneticians

For a pilot study, two academic phoneticians at the Department of Language and Linguistic Science, University of York and a forensic phonetician from JPFrench Associates were used. The phoneticians were different people from those that participated in the main experiment. Based on some suggestions offered, some questions and their organisation were improved before the main collection of data.

This third experiment was run to determine the relative performance of the UK-based phoneticians for a comparison with the performance of other methods such as the Nigerian participants and Y-ACCDIST. The participants of this group comprised academic phoneticians, academic phoneticians who are also forensic phoneticians, and non-academic forensic phoneticians. Contrary to the two experiments run in Nigeria whereby participants were met in person by the researcher, the participants of this group were first contacted via their official email addresses. They were invited to participate in the research. The list of the target potential participants in other UK universities was secured through checking/reading their profiles on their Linguistics departmental websites. For the University of York where the PhD research is being pursued, all the academic phoneticians and academic phoneticians who are also forensic phoneticians were contacted.

6.4.1 Sample size

Out of 13 participants in the main study, two are both academic and forensic phoneticians, while the other three are forensic phoneticians working at JPFrench Associates. The participants were drawn from the University of York(4), York St John University(1), University of Newcastle(1), Lancaster University(2), University of Huddersfield(1), Oxford University(1) and the JP French Associates, York(3) (a private forensic phonetics laboratory). Their ages ranged from 28 to 63 (mean age = 40, SD = 11).

6.5 Experiment 4: Y-ACCDIST

This fourth experiment was run using Y-ACCDIST, an automatic accent recognition system designed by Brown (2014) at the University of York and further developed by her at Lancaster University. Y-ACCDIST was involved in the study to compare its performance with the three human methods above. More stimuli of the four Nigerian English accents were used in the Y-ACCDIST analysis compared to the samples used in the human analysis. All the 16 stimuli classified by the human participants were used in the Y-ACCDIST analysis, and 44 more stimuli were added, making a total of 60. Each of the four accents was represented by 15 stimuli. Contrary to the human methods, both pre-classification and post-classification questionnaires were not used, and the self-confidence rating scale attached to each of the 18 stimuli in the three human methods above was also not included in the Y-ACCDIST analysis. Y-ACCDIST results were presented in two phases: results of the 16 stimuli

earlier classified by the human participants and the results of the bigger data of 60 samples. To avoid duplication of the method, detailed information of Y-ACCDIST analysis and procedure is given in Chapter 10.

6.6 Research design

As mentioned in Chapter 3, in this Phase 2 of the study, the classification of accents, is also based on a comparative survey of abilities of four methods of accent identification. The comparison of linguistic variables in the second phase is based on the L1 differences of the respondents, linguistic, phonetic and nationality backgrounds of the respondents.

6.7 Population

For the classification phase of the study, a total of 118 respondents participated. As shown above, three human groups (2 in Nigeria and 1 in the UK) were involved in the second phase of this research. This chapter has provided a detailed description of the classification fieldwork procedure in Nigeria for the two Nigerian participant groups (Nigerian linguists and non-linguists). It has also provided a detailed information about the procedure for the third human group (UK-based phoneticians). Table 1 shows the demographics of all respondents of the three human experiments.

Table 6.1: Demographics of the three groups of human respondents

S/NO	Respondent group	Number of respondents
	Nigerian non-linguists	80
1	Hausa non-linguists	20
2	Igbo non-linguists	20
3	Kanuri non-linguists	20
4	Yoruba non-linguists	20
	Nigerian linguists	25
5	Hausa linguists	6
6	Igbo linguists	9
7	Kanuri linguists	5
8	Yoruba linguist	5
9	UK-based phoneticians	13
	Total	118

The next three chapters (Chapters 7, 8 & 9) concern the presentation, description and analysis of findings from the three human groups.

Chapter 7

Experiment 1: Untrained L1 Nigerian native speakers

7.0 Introduction

This chapter presents the results of the performance of Nigerian native speaker non-linguists in classifying the four Nigerian English accents. It provides the methods used in the experiment, overall accuracy of all the Nigerian non-linguists classifying the Nigerian English accents and non-Nigerian foils, isolated accuracy of each of the four groups—Hausa, Igbo, Kanuri and Yoruba—, overall and isolated confusions of the accents as well as statistical significance testing for determining variables that had a significant effect. The last section is a summary of the whole chapter. The native speaker non-linguists will henceforth bear the abbreviation “NNLS” throughout the chapter.

7.1 Method

Before travelling to Nigeria for the experiment in November 2019, a pilot study was conducted using five Nigerians, currently pursuing PhD programmes at the University of York. Based on their responses to the questions, some questions were replaced and others were improved others. The main issues raised during the pilot were related to the structure and organisation of the questionnaire in Qualtrics. Question 16 was not displayed to the respondents during the survey, as it was skipped during questions randomisation. Question numbers were not displayed. The respondents were not able to return to previous questions to make changes. Such lapses were all resolved before the main experiment for this group which took place in Nigeria between December 2019 and January 2020.

7.1.1 Participants

Eighty participants were drawn from four regions of North-West (Hausa), North-East (Kanuri), South-East (Igbo) and South-West (Yoruba). These 80 participants were recruited in four Nigerian cities—Kano, Nsukka, Ibadan and Maiduguri—representing four distinct geographic and linguistic regions of the country.

Hausa

For the Hausa NNLS group, 20 Hausa NNLS were recruited at Bayero University and Kano metropolis (see Chapter 6 for further details).

Igbo

For the Igbo NNLS group, 20 Igbo NNLS were recruited from the University of Nigeria, Nsukka. The group comprised (see Chapter 6 for further details).

Kanuri

For the Kanuri group, 20 Kanuri NNLS were recruited from both the University of Maiduguri and Maiduguri metropolis.

Yoruba

For the Yoruba group, 20 Yoruba NNLS were also recruited at the University of Ibadan. These included staff, undergraduates and postgraduates of the university (see Chapter 6 for further details).

7.1.2 Stimuli

As explained in Chapter 6, eighteen audio recordings of speakers of the four varieties of Nigerian English as well as two non-Nigerian English foils were used. Each of the four varieties of Nigerian English had four speakers in the survey (see Chapter 3 for details of the recording).

7.1.3 Procedure

As explained in Chapter 6, Qualtrics survey software was used for the collection of data. Both the questionnaire and the recordings of the speakers were uploaded onto the software. In order to identify the L1 of each of the stimuli, each of the stimuli was exposed to the listeners. The language background questionnaire and post-listening task questionnaire appeared at the initial and final stages of the survey. As mentioned in Chapter 6, a self-confidence rating scale was attached to each of the audio clips for the participants to state how confident they were in making their choices.

7.2 Results

The relative performances of the participants are compared against chance performance. The chance performance can be viewed in two ways. There are five different accent groups, including non-Nigerian-English foils. When non-Nigerian-English stimuli are taken into account, the chance level is 20% percent ($100/5 = 20\%$). In the event of disregarding the non-Nigerian foils, the chance level is 25% ($100/4=25\%$).

7.2.1 Overall accuracy

The NNLS were overall 49% (711/1440) accurate in the task, as shown in Table 7.1 below. In isolation, NNLS were 76.5% accurate at identifying fellow speakers of their own native accents, while they were 41.60% accurate at categorising other Nigerian English accents (including non-Nigerian foils), as shown in Table 7.2. This indicates that NNLS were 35% more accurate in identifying their own accents than other accents.

The statistical significance test indicates that only native speakers' accuracy of identifying fellow speakers of their own accent group was significant, as detailed in the analysis of statistics below.

7.2.2 Statistical significance testing

To test the statistical significance of the relevant variables, responses were analysed with a logistic mixed-effects model using the lme4 R package (RStudio, 2020) with a binary dependent variable (1= correct, 0= incorrect). The model included fixed effects of “native speaker match”, “stimulus language”, confidence rating, the interaction between stimulus language and confidence rating, as well as a random intercept and slope of confidence rating for participant. Native speaker match had two levels: whether the L1 of the participant (the listener) matched the L1 of the speaker or not. This variable was sum coded with no-match as the held-out level (i.e., no-match received a weight of -1).

The factor for stimulus language had five levels: Hausa, Igbo, Kanuri, Yoruba or Non-Nigerian. This factor was sum-coded with non-Nigerian as the held-out level (assigned a value of -1). As mentioned in Chapter 6, the experiment included self-rating confidence levels using a sliding scale from 0-100. These confidence levels of the listeners were converted to z-scores. The alpha region was 0.05 for determining the p-value.

The expectation is for a significant and positive effect of native speaker match, indicating a higher accuracy when the listener’s native language matches the native language of the stimulus.

The effect of stimulus language was included to determine whether some languages were more difficult to identify than others.

As predicted, native speaker match was significant, indicating that listeners exposed to stimuli of their L1 were approximately 2.26 times as likely to be accurate than when exposed to stimuli of other L1s ($\beta_{match} = 0.75, p < 0.001$).

To determine the statistical significance of identifying each of the accent groups, the native language match effect and the stimulus language effect were combined within the same above model.

The result of the stimulus language test shows that identification of each of the four Nigerian English accents was statistically significant, but in different directions. These results indicate that listeners were significantly better than chance for Hausa, Igbo and Yoruba classification ($\beta_{Hausa} = 0.72, p < 0.001$), ($\beta_{Igbo} = 0.45, p < 0.001$), ($\beta_{Yoruba} = 0.37, p < 0.001$), but significantly less accurate for Kanuri classification ($\beta_{Kanuri} = -0.41, p < 0.001$). Listeners were significantly less accurate when exposed to Kanuri-English stimuli)

The result of testing the interaction between confidence and accuracy indicates that the correlation between Nigerian non-linguists’ confidence and accuracy is not significant ($\beta_{zconf} = 0.50, p > 0.47$).

7.2.3 Descriptive statistics

The overall results of both the four Nigerian English accents and the non-Nigerian foils are first presented, and these are then followed by the results of classifying Nigerian English accents only. As reported earlier, each of the four L1s was exposed four times to the respondents, and they were also exposed to non-Nigerian foils two times. Thus, each of such participants listened to Hausa, Igbo, Kanuri and Yoruba four times.

Table 7.1 shows that NNLS were overall 49% (711/1440) accurate at correctly identifying their own L1s, other Nigerian L1s and non-Nigerian foils (Ghanaian and Guinean English speakers). They were only at chance accurate with 20.6% at rejecting the two foils.

Table 7.1: Overall Accuracy of Nigerian and Non-Nigerian English Accents: NNLS

Nigerian & Non-Nigerian English combined	Nigerian English	Non-Nigerian foils
49% (711/1440)	53% (678/1280)	20.6% (33/160)

NNLS were 76.5% accurate at distinguishing the speakers of their own L1s from other L1s, while they were overall 41.60% accurate at categorising other L1s (including non-Nigerian foils), as shown in Table 7.2.

Table 7.2: Overall accuracy of Native Speaker Non-Linguists: Own L1s versus Other L1s

Native Speaker Non-Linguists [80 participants]	Own L1 % Correct	Other L1s % Correct
	76.5% (245/320)	41.60% (466/1120)

The accuracy of NNL groups at identifying their own L1s from the other language groups ranges from 71% to 81% compared to 33% to 45% of the other L1s, as shown in Table 7.3. The Hausa NNLS was the best group, while the Yoruba NNLS was the poorest group.

All the four groups' performance in identifying speakers of their own L1s is well above their performance in classifying speakers of other L1s, as shown in Table 7.3. The second row of Table 7.3 presents the NNLS accuracy in identifying the other three Nigerian English accents.

Table 7.3: Accuracy of the Four Groups: Own L1s versus Other L1s

Naive Native speakers	Hausa	Igbo	Kanuri	Yoruba
Own L1	81.% (65/80)	77.5% (62/80)	76.% (61/80)	71% (57/80)
Other L1s	50% (120/240)	46% (111/240)	46.6% (112/240)	37.5% (90/240)

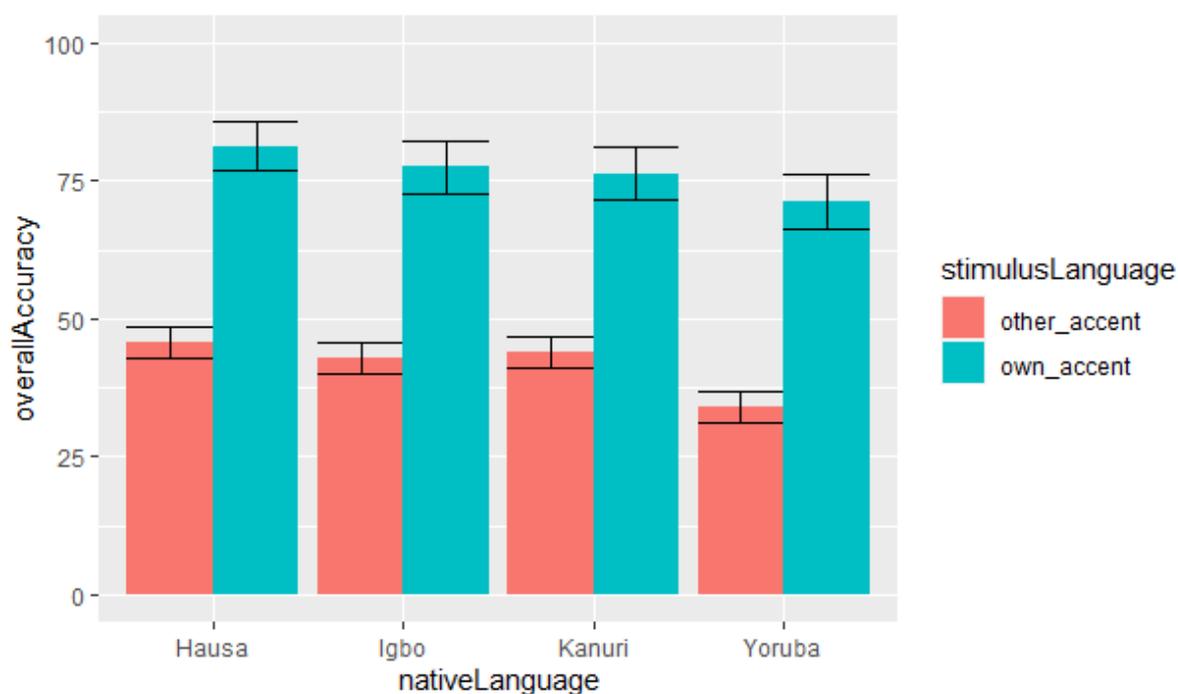


Figure 7.1: Accuracy of classifying Nigerian English Accents: Own L1s versus Other L1s

The following bullet point summaries are extracted from Table 7.3 and Fig 7.1 above.

- Hausa NNLS were the most accurate group across the four groups with 46% accuracy.
- Yoruba NNLS were the least accurate with 34% accuracy
- Igbo and Kanuri NNLS had similar accuracy of 43% and 44% respectively.

Table 7.4 shows that participants of each of the four NNL sub-groups were highly accurate at their own L1s compared to their accuracy of the other four accents.

Table 7.4: Accuracy of Nigerian and Non-Nigerian Stimuli: Own L1s versus Other L1s

Non-Linguists	Hausa	Igbo	Kanuri	Yoruba	Non-Nigerian
Hausa group (20 listeners)	81.2% (65/80)	57.5% (46/80)	36.2% (29/80)	56.2% (45/80)	20% (8/40)
Igbo group (20 listeners)	66.2% (53/80)	77.5% (62/80)	21.2% (17/80)	51.2% (41/80)	22.5% (9/40)
Kanuri group (20 listeners)	47.5% (38/80)	48.7% (39/80)	76.2% (61/80)	43.7% (35/80)	27.5% (11/40)
Yoruba group (20 listeners)	53.7(43/80)	38.7% (31/80)	20 (16/80)	71.2% (57/80)	12.5% (5/40)
Total % of other L1s only	56% (134/240)	48% (116/240)	26% (62/240)	50% (121/240)	20.6% (33/160)

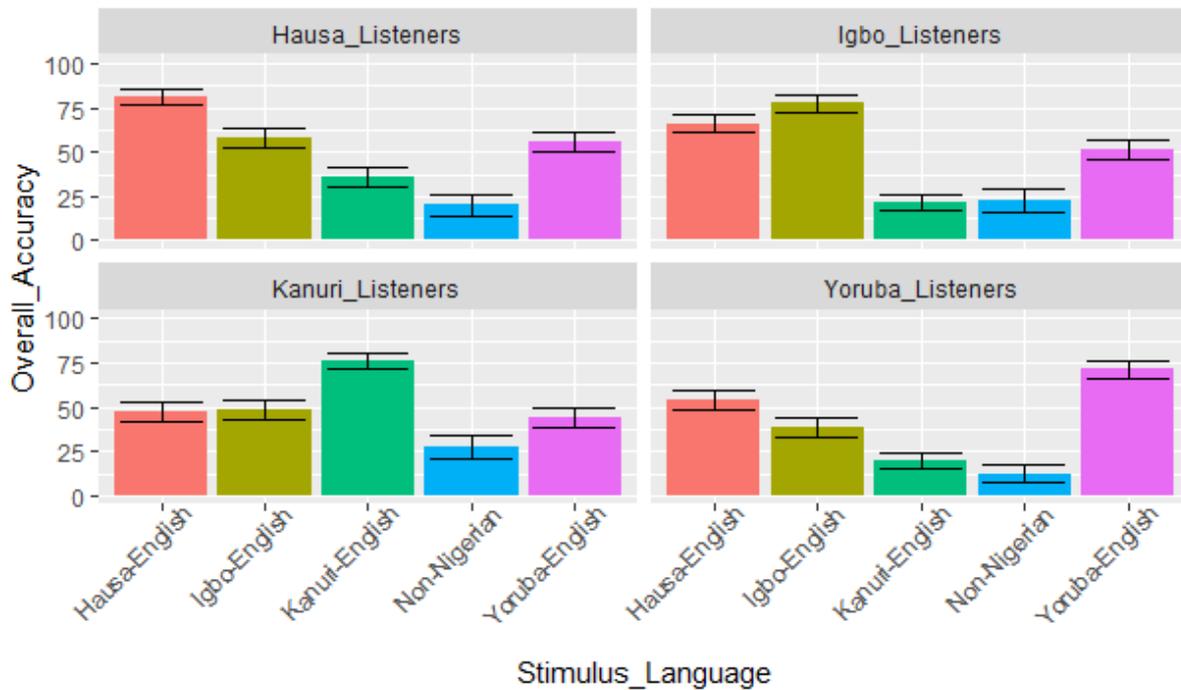


Figure 7.2: Isolated Accuracies of Classifying Nigerian & Non-Nigerian English Accents

The following bullet point summaries are extracted from Table 7.4 above.

- L1 Hausa was accurately identified 56% of the time by the other three groups of NNLS.
- L1 Kanuri was the least accurately identified at 26%.
- L1 Yoruba was the second-most accurately identified at 50%.
- L1 Igbo was accurately identified 48% of the time.
- Kanuri NNLS were the most accurate group 27.5% of the time at rejecting the two non-Nigerian foils.
- Yoruba NNLS were the least accurate with 12.5% at rejecting the two non-Nigerian foils.

This suggests that Kanuri-English was the most difficult Nigerian English accent to identify by NNLS. Some of the Hausa NNLS stated that they had no observation of how Kanuri people speak English.

As stated in the Hausa-English and the Kanuri-English description sections of Chapter 4 above, the voiceless bilabial plosives /p/ are not produced by most of the Hausa-English speakers, especially in syllable onset position. However, other native Hausa listeners reported that voiceless bilabial plosives are not a problem for native Kanuri speakers. Both Igbo and Yoruba stated that Kanuri speakers sound like Hausa speakers, as they confused /p/ with [f] either, although they are more fluent than Hausa speakers.

7.2.4 Accuracy of individual NNLS

To determine whether the identification task accuracy was consistent among the individual NNLS, the individual performance results are broken according to their four native languages.

7.2.4.1 Accuracy of individual NNLS: Own accents

Fig 7.3 shows the accuracy of the individual respondents of the four Nigerian native groups in identifying fellow speakers of their own accents. As shown in Fig 7.3, most of the respondents were between 75% and 100% accurate, while few of them, from Kanuri and Yoruba, were 25% and 50% accurate.

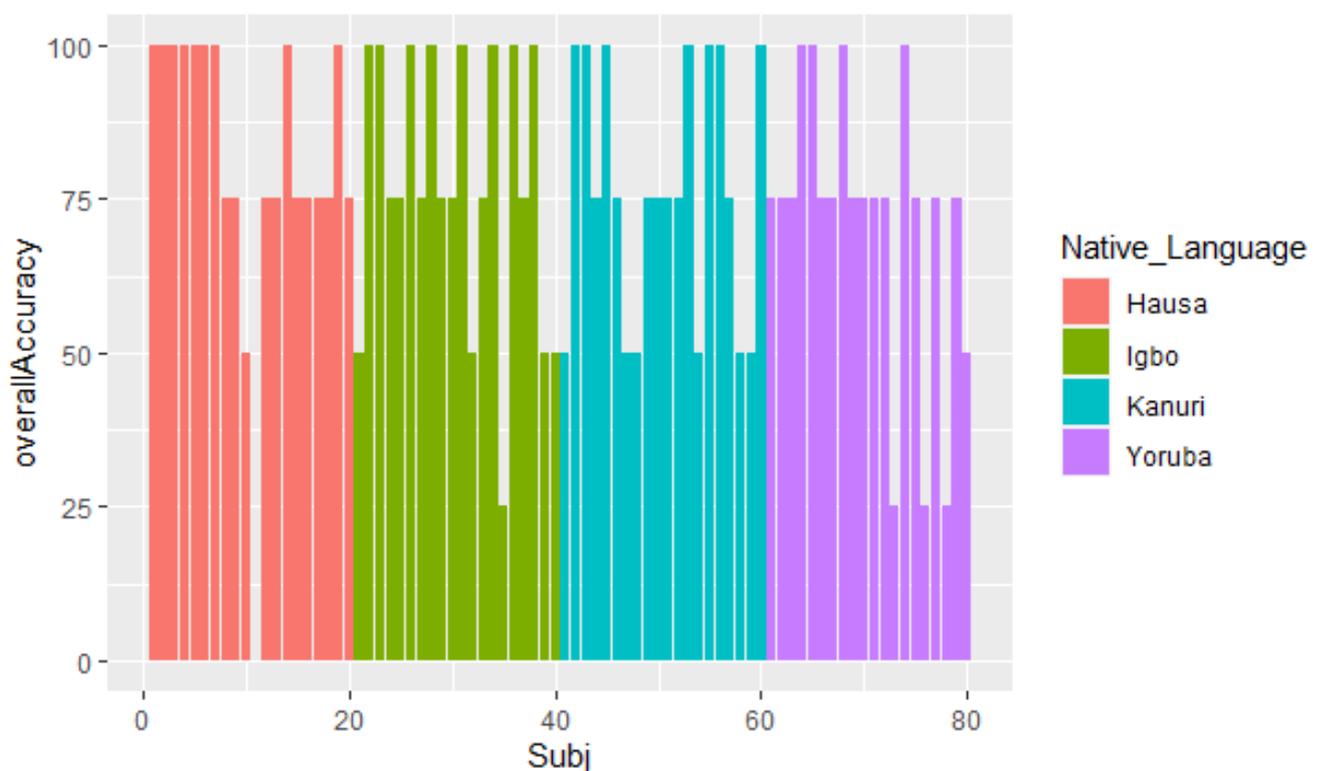


Figure 7.3: Accuracy of individual NNLS for identifying their own accents: Hausa-English, Igbo-English, Kanuri-English & Yoruba-English

Accuracy of individual Hausa NNLS: Own accent

The following bullet point summaries are extracted from Fig 7.3.

- 45% of the Hausa NNLS were at 100% accurate in identifying fellow speakers of Hausa-English.
- Another 45% of them were at 75% accurate.
- 90% of them were, therefore, at 75% to 100% accurate in identifying fellow Hausa-English speakers.

Accuracy of individual Igbo NNLS: Own accent

The following bullet point summaries are extracted from Fig 7.3.

- 40% of the Igbo NNLS were at 100% accurate in identifying Igbo-English stimuli.
- Another 35% of the Igbo NNLS were at 75% accurate.
- One of the participants was very poor, having had only 5% accuracy rate.
- 75% of them were, therefore, at between 75% and 100% accurate.

Accuracy of individual Kanuri NNLS: Own accent

The following bullet point summaries are extracted from Fig 7.3.

- 35% of the Kanuri NNLS were at 100% accurate in identifying Kanuri-English stimuli.
- Another 35% of them were at 75% accurate, while the remaining 30% were at 50% accurate.

Accuracy of individual Yoruba NNLS: Own accent

The following bullet point summaries are extracted from Fig 7.6.

- 20% of the Yoruba NNLS were 100% accurate in identifying Yoruba-English.
- Another 60% of them were 75% accurate.

7.2.4.2. Accuracy of individual NNLS: Other accents

This sub-section presents the performance of individual respondents in identifying stimuli of other Nigerian English accents. Majority of the respondents were less than 50% accurate. Only one participant from the Hausa group was 77% accurate, as shown in Fig 7.4. There was also a high variability in the performance of the respondents.

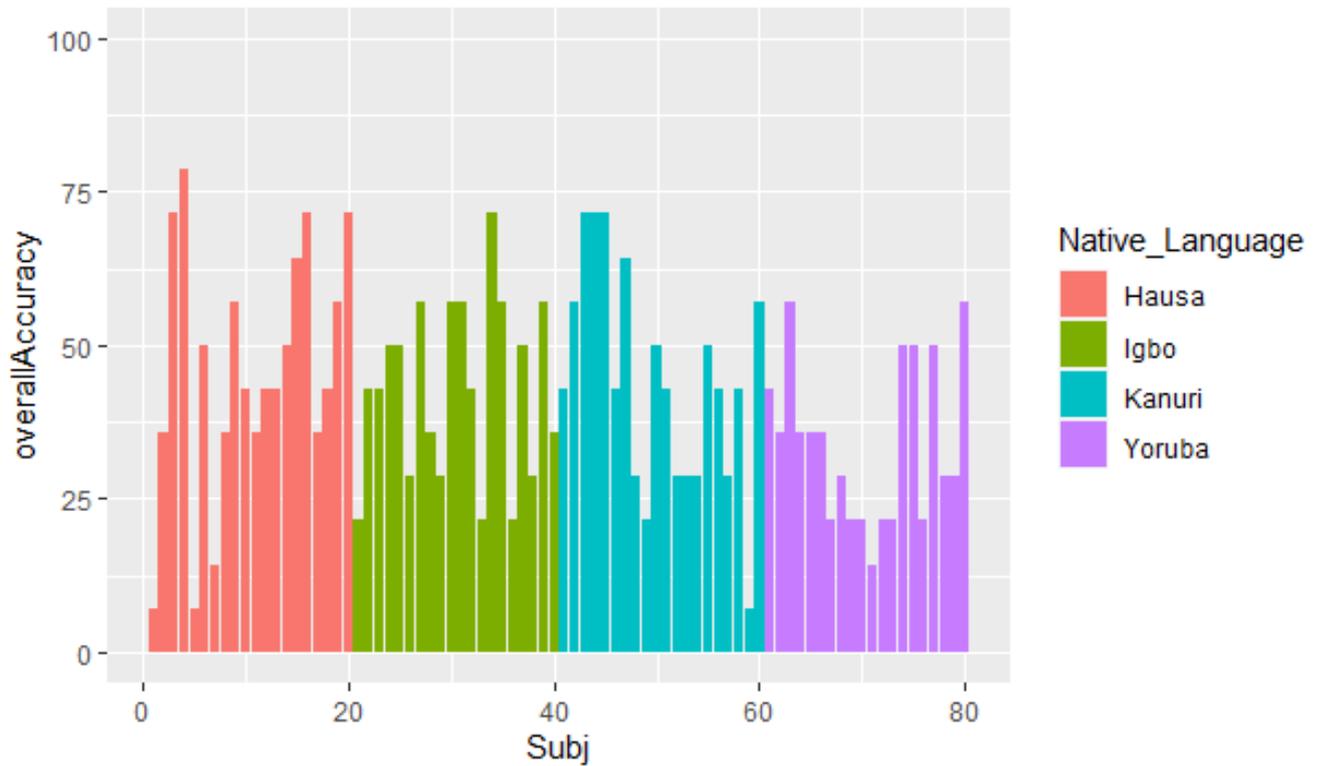


Figure 7.4: Accuracy of individual NNLS for identification of other Nigerian English accents and the two foils

7.2.5 Confidence versus Accuracy

As stated above, a self-confidence rating scale was attached to each of the audio clips for the participants to state how confident they were in making their choices. Fig 7.7 below indicates marginal difference between correct and incorrect averaged-self-confidence rates of the four NNL groups. These marginal differences did not show a significant correlation between accuracy and confidence of the NNLS. The NNL groups were above 70% confident when they were inaccurate.

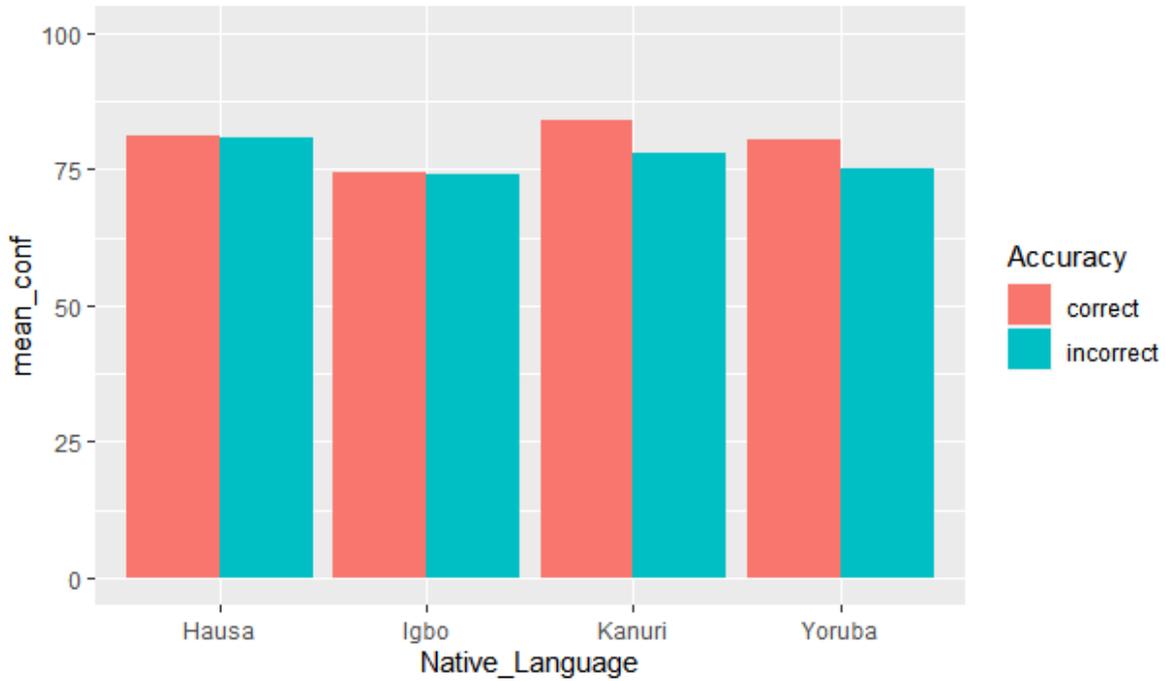


Figure 7.5: Self-confidence rating averaged for four native speaker groups of NNLS

7.2.5.1 Confidence versus Accuracy: Individual NNLS

The averaged individual confidence rates of the 80 NNLS are shown in Fig 7.6. The average self-confidence assessment of individual IGNNLS, KNNLS and YNNLS only shows slight difference between the correct and incorrect responses.

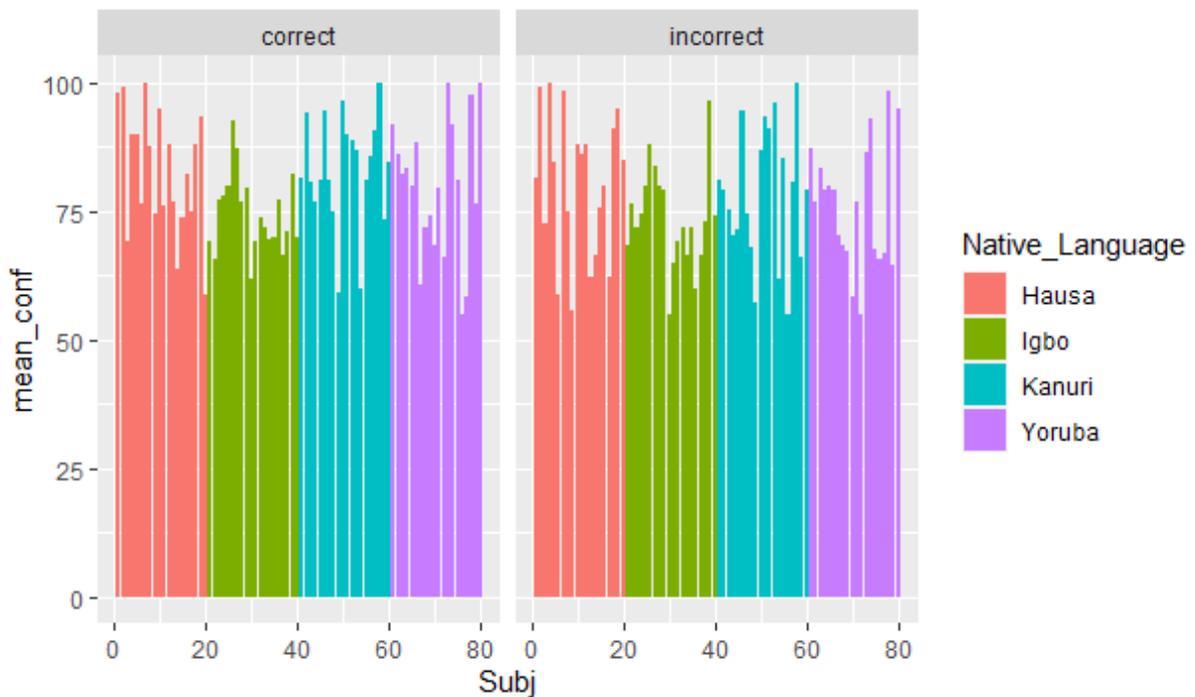


Figure 7.6: Self-confidence rating for all individual NNLS: correct versus incorrect responses

The following bullet point summaries are extracted from Fig 7.6.

Confidence versus Accuracy: Hausa NNLS

- Hausa NNLS were highly confident in both correct and incorrect responses.
- Sixty percent of the Hausa NNLS were above 80% confident when inaccurate.
- Some of them were even more confident when inaccurate.

Confidence versus Accuracy: Igbo NNLS

- Some of the Igbo NNLS had nearly the same high average rates for correct and incorrect responses.
- Others were more confident when they were inaccurate.
- About 70% of them were over 70% confident when they were inaccurate.

7.2.5.3 Confidence versus Accuracy: Kanuri NNLS

- 85% of KNNLS were 75% and above confident when they were accurate.
- 70% of them were above 75% confident when inaccurate.
- They were only slightly more confident when they were accurate.

7.2.5.4 Confidence versus Accuracy: Yoruba NNLS

- Thirty percent of the Yoruba NNLS were far above 75% confident when they were both accurate and inaccurate.
- Some of them gave the same confidence rates for both correct and incorrect responses.
- Others were even more confident when they were inaccurate.

7.2.6 Confusion of Nigerian English Accents

This section presents the overall correct identification and confusions of both Nigerian English accents and non-Nigerian foils (regardless of the L1 backgrounds of the respondents). The listeners confused the four Nigerian languages in an attempt to assign an L1 to each of the stimuli. The following bullet point summaries are extracted from Table 7.5.

- Kanuri-English was mainly confused with Hausa-English.
- Hausa-English was mainly confused with Kanuri-English.
- Igbo-English was mainly confused with Yoruba-English.
- Yoruba-English was mainly confused with Igbo-English.
- Non-Nigerian English was mainly confused with Igbo-English.

Table 7.5: Overall confusion of Native Speaker Non-Linguists

Variety	Hausa	Igbo	Kanuri	Yoruba	Non-Nigerian	% Correct	Total
Hausa	62%	7.5%	22.8%	2.8%	4.7%	62%	320
Igbo	1%	57%	5.6%	28.7%	8.7%	57%	320
Kanuri	47.5%	5%	38%	5.6%	3.4%	38%	320
Yoruba	3.7%	30%	4%	57%	6%	57%	320
Non-Nigerian	9%	30%	18.7%	20.6%	20.6%	21%	160

7.2.6.1 Direction of four main confusions of Nigerian English accents

Nigerian English accents were confused with one another, but their four major types of the confusion are shown in Fig 7.7. The confusions are: Kanuri-Hausa, Hausa-Kanuri, Igbo-Yoruba and Yoruba-Igbo. For a more clarification of the confusions, for instance, Kanuri-Hausa in Table 7.6 represents confusing Kanuri-English with Hausa-English. Forty six of the 51 misidentified Kanuri-English stimuli were confused with Hausa-English, and this number (46) represents 90% of the total misidentification of Kanuri-English stimuli.

The following bullet point summaries are extracted from Table 7.6.

- Hausa NNLS were most likely to confuse Kanuri-English with Hausa-English and vice versa.
- While 46 of the total 51 Kanuri-English errors were misidentified as Hausa-English, 11 of the total 15 Hausa-English errors were confused with Kanuri-English.
- Except for Hausa, all the other three NNL groups were least likely to confuse their fellow L1 speakers with others.

Table 7.6: Four Main Confusions of Nigerian-English accents: Native Speaker Non-Linguists

Participants	Kanuri-Hausa	Hausa-Kanuri	Igbo-Yoruba	Yoruba-Igbo
Hausa (20 participants)	90% (46/51)	73% (11/15)	59% (20/34)	71% (25/35)
Igbo (20 participants)	76% (48/63)	55% (15/27)	56% (10/18)	69% (27/39)
Kanuri (20 participants)	68% (13/19)	62% (26/42)	61% (25/41)	69% (31/45)
Yoruba (20 participants)	70% (45/64)	57% (21/37)	76% (37/49)	61% (14/23)

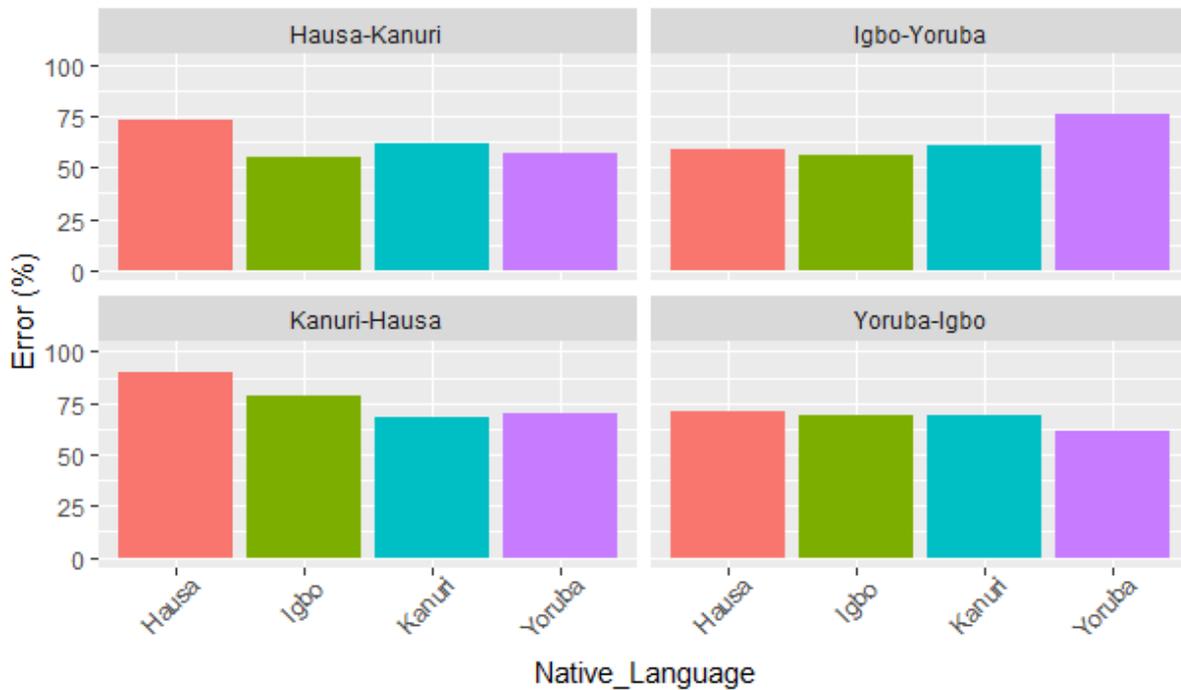


Figure 7.7: Graph showing the four major confusions of Nigerian English accents

7.2.7 Confusion of Non-Nigerian English Foils

The following bullet point summaries are extracted from Table 7.7.

- Hausa NNLS mainly confused Non-Nigerian English with Igbo-English.
- Igbo NNLS mainly confused Non-Nigerian English with Yoruba-English or Kanuri-English.
- Kanuri NNLS mainly confused Non-Nigerian English with both Igbo-English and Yoruba-English.
- Yoruba NNLS mainly confused Non-Nigerian English with Kanuri-English or Igbo-English.

Table 7.7: Confusion of Non-Nigerian English Foils: All four groups

Variety	Hausa	Igbo	Kanuri	Yoruba	Non-Nigerian	% Correct	Total
Hausa	10%	35%	15%	20%	20%	20%	40
Igbo	12.5%	10%	22.5%	30%	25%	25%	40
Kanuri	5%	30%	5%	22.5%	37.5%	37.5%	40
Yoruba	12.5%	20%	52.5%	5%	10%	10%	40

7.2.8 Classification of Errors in Classifying the Nigerian English Accents

7.2.8.1 False rejection

False rejection is observed when a respondent listens to a speaker belonging to his L1, but fails to correctly identify the L1 of the speaker, and confuses it with another L1. Table 7.11 and Fig 7.4

show that the Hausa NNLS were least likely to misidentify fellow English speakers of their L1 among the four groups, while the Yoruba NNLS were least likely to misidentify fellow speakers of their L1 Yoruba.

Table 7.8: False negative errors (misses) of the four groups: Nigerian Non-Linguists

NNLS	Hausa	Igbo	Kanuri	Yoruba
Nigerian Non-Linguists	19%	22.5%	24%	29%

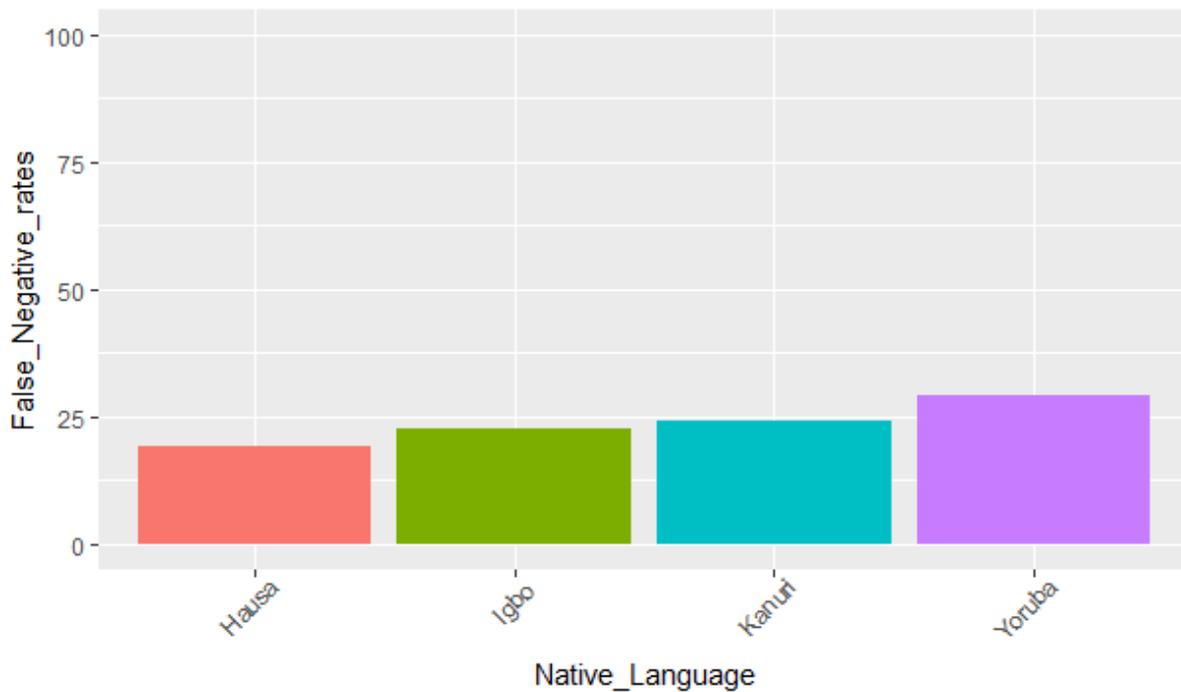


Figure 7.8: False Negative error rates of the four groups of Nigerian non-Linguists

7.2.8.2 False acceptance

False acceptance is observed when a respondent listens to a speaker belonging to another L1 but identifies him as a member of his own L1. For example, a Hausa NNLS listened to, say, a Kanuri stimulus and said it is a Hausa stimulus. Table 7.12 and Fig 7.5 show that Hausa NNLS were most likely to accept Kanuri-English as their fellow Hausa-English speakers, while Igbo and Kanuri NNLS equally accepted other L1 speakers as their fellow L1 speakers.

Table 7.9: False positive errors of the four L1 groups of: Nigerian Non-linguists

NNLS	Hausa	Igbo	Kanuri	Yoruba
Nigerian Non-Linguists	57.7%	33.7%	32.5%	46%

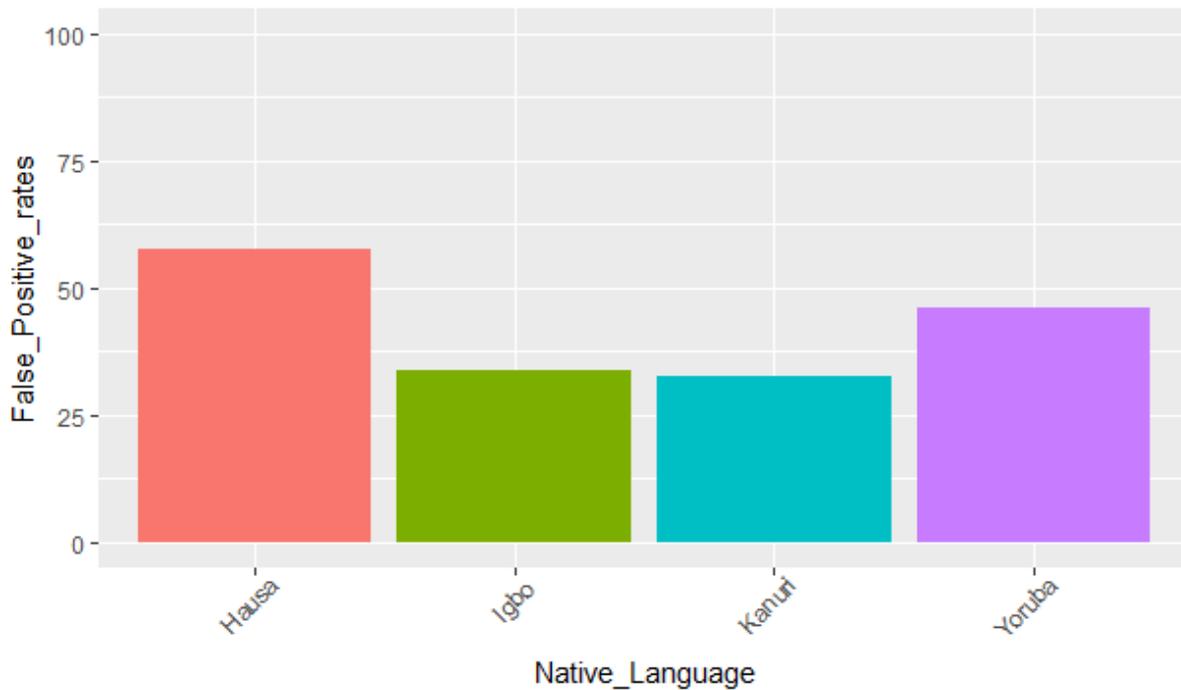


Figure 7.9: False Positive error rates of the four groups of Nigerian non-Linguists

As both Tables 7.11 and 7.12 show, all the four NNL groups were more likely to accept a false claimant of their own L1 group than to reject a true claimant. It is observed that the false hits instances are predominantly within the same region where the confused samples occur (i.e., Hausa-Kanuri, Kanuri-Hausa—northern Nigeria, & Igbo-Yoruba versus Yoruba-Igbo—southern Nigeria). All the other false hits were of negligible amount. L1 Hausa and L1 Yoruba NNL groups had more false hits. Thus, they were more likely to accept non-members of their own L1 into those L1s than the L1 Igbo and L1 Kanuri NNLS.

7.3 Summary and Conclusion

All the four groups, in isolation, were highly accurate in identifying fellow members of their L1s. Only accuracy of identifying fellow speakers of their own L1s showed a significant effect compared to all other variables. Comparison of false rejections and false acceptances showed that all the four groups had more false acceptances than false rejections. The implication of this result for LAAP is that NNLS are more likely to accept false claimants as true claimants. This might be possible when false claimants share some linguistic features with true speakers of claimed origins (e.g., regions, nations, ethnic groups).

All the four NNL groups had similar confusions of the Nigerian English accents. Four major types of confusions have been identified: Hausa-Kanuri, Kanuri-Hausa, Igbo-Yoruba and Yoruba-Igbo. The similarity of realisations of some English phonemes, especially vowels, between Hausa and Kanuri or Igbo and Yoruba might be the reason for these kinds of confusion.

On the other hand, the confusion of non-Nigerian foils differs based on the regional backgrounds of listeners. Hausa and Kanuri listeners (of northern Nigeria) mainly confused non-Nigerian foils with Igbo- or Yoruba-English. Igbo listeners mainly confused non-Nigerian foils with Yoruba-English or Kanuri-English, while Yoruba listeners mainly confused it with Kanuri-English or Igbo-English. These confusion patterns suggest that the Hausa and Kanuri listeners hardly accept non-Nigerian foils into their northern region, while Igbo and Yoruba listeners confused non-Nigerian foils with either their south Nigerian English accents or north Nigerian accents.

Chapter 8

Experiment 2: Nigerian Native Speaker Linguists

8.0 Introduction

The second experiment was run to determine the relative performance of native speakers who are also linguists at categorising the varieties of Nigerian English. It also aimed to determine the efficacy of linguistic expertise at categorising the four accents of Nigerian English. It provides the methods used in the experiment, overall accuracy of all the Nigerian phonetician linguists and non-phonetician linguists classifying the Nigerian English accents and non-Nigerian foils, isolated accuracy of each of the four groups—Hausa, Igbo, Kanuri and Yoruba—, overall and isolated confusions of the accents as well as statistical significance testing for determining variables that have a significant effect. The Nigerian phonetician group comprised both phoneticians and phonologists. The last section is a summary of the whole chapter. The native speaker linguists will henceforth bear the abbreviation “NLS” throughout the chapter.

8.1 Methods

As the first experiment for the Nigerian non-linguists, the fieldwork for the Nigerian linguists took place in Nigeria from December 2019 to January 2020.

8.1.1 Participants

Twenty-five participants were recruited in this group. The participants comprised Hausa, Igbo, Kanuri and Yoruba NLS. Their ages ranged from 35 to 70 years.

Hausa

Six Hausa linguists were recruited at the Department of Foreign Languages and Linguistics of Bayero University, Kano (see Chapter 6 for further details).

Igbo

For the Igbo group, nine Igbo NLS were recruited at the Department of Linguistics, Igbo and other Nigerian languages, University of Nigeria, Nsukka. Only one of the participants is a professor of phonology (see Chapter 6 for further details).

Kanuri

For the Kanuri group, five Kanuri NLS at the Department of Languages and Linguistics of the University of Maiduguri participated in this group. One of them is a professor of Kanuri phonology (see Chapter 6 for further details).

Yoruba

For the Yoruba group, five Yoruba NLS were recruited at the Department of Linguistics and African Languages of the University of Ibadan. Only one of them is a professor of phonetics and he obtained his PhD from a Canadian university (see Chapter 6 for further details).

8.1.2 Stimuli

As already reported in Chapter 6 and 7 above, both Nigerian non-linguist and Nigerian linguist experiments were run in the same way, using the same stimuli (see stimuli section of experiment 1 in Chapter 7 and Chapter 3 for details of the recordings).

8.1.3 Procedure

Qualtrics survey software was used for the collection of data in Nigeria. Both the questionnaire and the recordings of the speakers were uploaded onto the software. In order to identify the L1 of each of the stimuli, each of the stimuli was exposed to the listeners. The language background questionnaire and post-listening task questionnaire appeared at the initial and final stages of the survey (see Chapter 6 for further details).

8.2 Results

This section presents the findings of the experiment. The relative performances are compared against the chance performance. There are five accents in the classification task. When non-Nigerian English foils are taken into account, the chance level is 20% (100/5), while it is 25% for classifying the four Nigerian English accents only.

8.2.1 Overall accuracy

The results revealed that NLS were overall 55% accurate in the task, while they were 76% accurate at identifying fellow speakers of their L1s. They were 48.5% accurate at identifying other L1s (including non-Nigerian foils), as shown in Table 8.2. This shows that they were 37.5% more accurate in identifying their own English accents.

The statistical significance test indicates that only native speakers' accuracy of identifying fellow speakers of their own accent group was significant, while linguistic expertise did not significantly raise the accuracy of the participants as detailed in the analysis of statistics below. The Nigerian phoneticians were only numerically better than the Nigerian non-phonetician linguists, as detailed later in descriptive statistics section.

8.2.2 Statistical significance testing

To test whether Nigerian linguists significantly outperformed their Nigerian non-linguist counterparts, the Nigerian dataset (containing both Nigerian linguists and Nigerian non-linguists) was used.

To test the statistical significance of the relevant variables, responses were analysed with a logistic mixed-effects model using the lme4 R package (RStudio, 2020), with a binary dependent variable (1= correct, 0= incorrect). The model included fixed effects of “native speaker match”, “linguists”, “stimulus language”, confidence rating, the interaction between stimulus language and confidence rating, as well as a random intercept and slope of confidence rating for participant.

Native speaker match had two levels: whether the L1 of the participant (the listener) matched the L1 of the speaker or not. This variable was sum-coded with no-match as the held-out level. Linguist had two levels: whether the participant was a linguist or non-linguist. This factor was sum-coded with non-linguist as the held-out level. The factor for stimulus language had five levels: Hausa, Igbo, Kanuri, Yoruba or Non-Nigerian. This factor was sum-coded with non-Nigerian as the held-out level.

As mentioned in the methodology section, the experiment included self-rating confidence levels using a sliding scale from 0-100. These confidence levels of the listeners were converted to z-score confidence values. The confidence variable was attached to the linguistics effect (using * as linguistics*zconf) to check the presence or absence of significant correlation between Nigerian linguists' confidence and accuracy in classifying the Nigerian English accents. The alpha region is 0.05 for determining the p-value.

The expectation is for a significant and positive effect of native speaker match, indicating a higher accuracy when the listener's native language matches the native language of the stimulus.

Another expectation is for a significant effect of linguistics background, indicating higher accuracy when the native language of the stimulus matches the native language of the listeners, who are also linguists.

The effect of stimulus language was included to determine whether some languages were more difficult to identify than others.

As predicted, native speaker match was significant, indicating that listeners exposed to stimuli of their L1 were approximately 2.26 times as likely to be accurate than when exposed to stimuli of other L1s ($\beta_{match} = 0.50, p < 0.001$). However, the effect of linguist was not significant ($\beta_{linguistics} = 0.06, p > 0.47$), i.e., there was not a significant difference between native speakers who are also linguists and their non-linguist counterparts.

The result of the stimulus language shows that identification of each of the four Nigerian English accents was statistically significant, but in different directions. These results indicate that listeners were significantly better than chance for Hausa, Igbo, and Yoruba classification

($\beta_{Hausa} = 0.60, p < 0.001$; $\beta_{Igbo} = 0.43, p < 0.001$; $\beta_{Yoruba} = 0.64, p < 0.001$), but significantly less accurate for Kanuri classification ($\beta_{Kanuri} = -0.68, p < 0.001$).

The Kanuri-English accent seemed to be the most challenging accent to accurately identify by this group (including the Kanuri linguists).

A significant positive correlation is also observed between Nigerian linguists' confidence and accuracy in identifying all four Nigerian English accents ($\beta_{linguist: zconf} = 0.48, p < 0.001$).

To test whether Nigerian phonetician linguists significantly outperformed the Nigerian non-phonetician linguists, and to test the interaction between confidence and accuracy for Nigerian phoneticians, the same model as described above was re-run, but the two-level factor of linguist was instead replaced with a three-level factor of phonetician. The three levels were: Nigerian phonetician, Nigerian non-phonetician linguists or Nigerian non-linguists. The variable was sum-coded with Nigerian non-linguist as the held-out level. Although the Nigerian phoneticians' sample size is low, there may be useful insight gained from running this model in addition to the one above.

The phonetician effect was not significant, indicating that Nigerian phoneticians were not significantly better than the Nigerian non-phonetician linguists ($\beta_{phonetician} = 0.20, p > 0.23$).

A significant positive correlation is also observed between Nigerian phonetician' confidence and accuracy in identifying all four Nigerian English accents ($\beta_{phonetician: zconf} = 0.17, p < 0.001$).

The result of testing the interaction between Nigerian phoneticians' confidence and accuracy of Nigerian phoneticians in identifying any of the four Nigerian English accents was significant. Specifically, for Hausa and Kanuri speakers, confidence and accuracy were negatively related, but for Igbo speakers, confidence and accuracy were positively related ($\beta_{Hausa: zconf} = -0.47, p < 0.001$; $\beta_{Igbo: zconf} = 0.25, p < 0.001$; $\beta_{Kanuri: zconf} = -0.46, p < 0.001$; $\beta_{Yoruba: zconf} = 0.28, p < 0.001$).

8.2.3 Descriptive Statistics

The NLS' overall results of both the Nigerian English accents and the two foils are initially presented, as shown in Table 8.1. The overall results are then split into Nigerian English accents, non-Nigerian English foils and each of the four NL groups accuracy. Participants' accuracies of identifying fellow native speakers of their own L1s are also separated from their accuracies of classifying stimuli of other L1s. The performance of the phonetician NLS is also separated from that of the non-phonetician NLS.

They were also 58% accurate when the two foils were removed from the data, while they were 32% accurate at rejecting the two foils. The phonetician NLS were more accurate than the other NLS at identifying their own L1 and categorising other L1s.

Table 8.1: Overall Accuracy of Nigerian and Non-Nigerian English Accents: NLS

Nigerian & Non-Nigerian English combined	Nigerian English	Non-Nigerian foils
55% (248/450)	58% (232/400)	32% (16/50)

NLS were 76% accurate at identifying fellow speakers of their L1s, while they were 48.5% accurate at identifying other L1s (including non-Nigerian foils), as shown in Table 8.2.

Table 8.2: Overall Accuracy of Nigerian Linguists

Nigerian Linguists [25]	Own L1 % Correct	Other L1s % Correct
	76% (76/100)	48.5% (170/350)

The findings, as shown in Table 8.3 and Fig 8.1, further revealed that Hausa, Igbo and Yoruba NLS were between 75% and 92% accurate at identifying their L1, while Kanuri NLS at 35% were the least accurate.

Table 8.3: Accuracy of the Four Linguists Groups-Own L1

Nigerian Linguists	Hausa NLS	Igbo NLS	Kanuri NLS	Yoruba NLS
Own L1	87.5% (21/24)	91.6% (33/36)	35% (7/20)	75% (15/20)
Other L1s	50% (42/84)	45% (57/126)	53% (37/70)	49% (34/70)

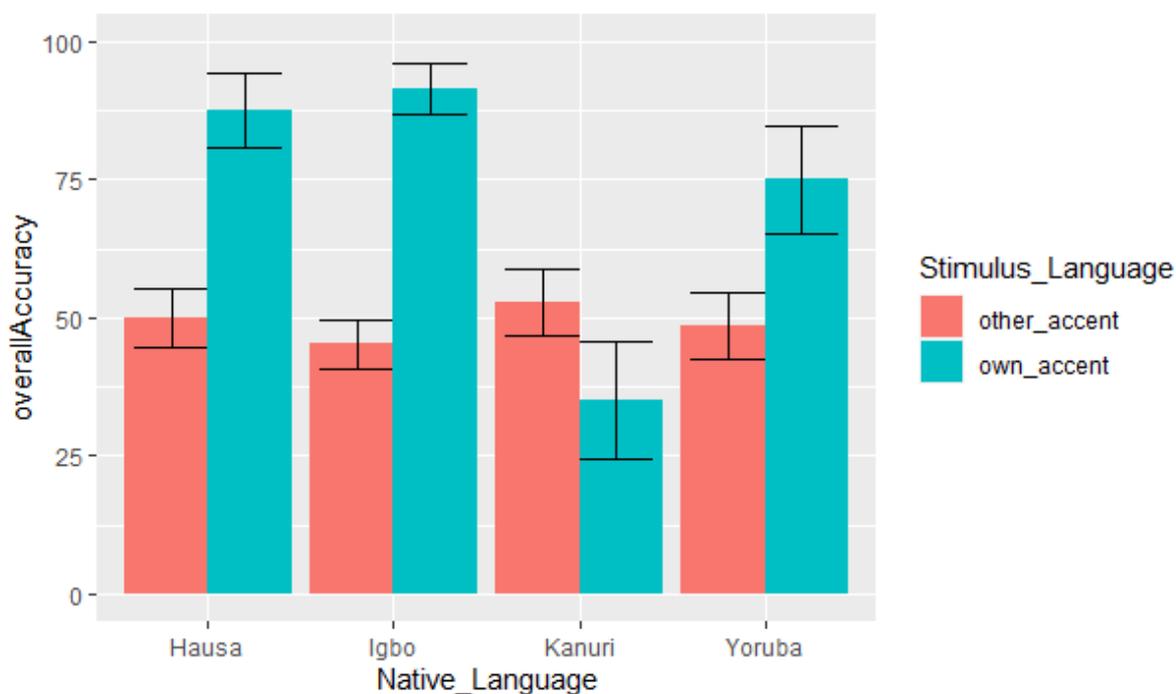


Figure 8.1: Accuracy of classifying Nigerian English Accents: Own L1s versus Other L1s

The following bullet point summaries are extracted from Table 8.3 above.

- The second row of Table 8.3 above shows that Kanuri NLS were at 53% the best performing group at categorising the other three non-L1 Kanuri-English stimuli.

- Igbo NLS were the poorest group with a 45% success rate. Hausa and Yoruba NLS had about equal success rates.
- Igbo NLS who were the best performing group at identifying their fellow L1 speakers have dropped to the lowest position at identifying speakers of other Nigerian L1s.
- Kanuri NLS were the poorest performing group at their own L1 identification, while they were better than Hausa, Igbo and Yoruba NLS at categorising other L1s.

Table 8.4: Overall Accuracy of Native Speaker Phoneticians versus Non-Phonetician NLS

Nigerian Linguists – Phoneticians [5]	60% (54/90)
Nigerian Linguists – Non-Phoneticians [20]	52% (188/360)

The phonetician NLS outperformed the non-phonetician NLS, as Fig 8.2 shows. The following bullet point summaries are drawn from Table 8.4.

- The phoneticians were 8% better than the non-phonetician NLS. This gap did not cause a significant decrease in the larger NL group due to the limited number of phoneticians (only 5) in the corpus.
- NLS (with phoneticians) were overall 55% accurate as indicated above, the NLS (without phoneticians) were 52% accurate.

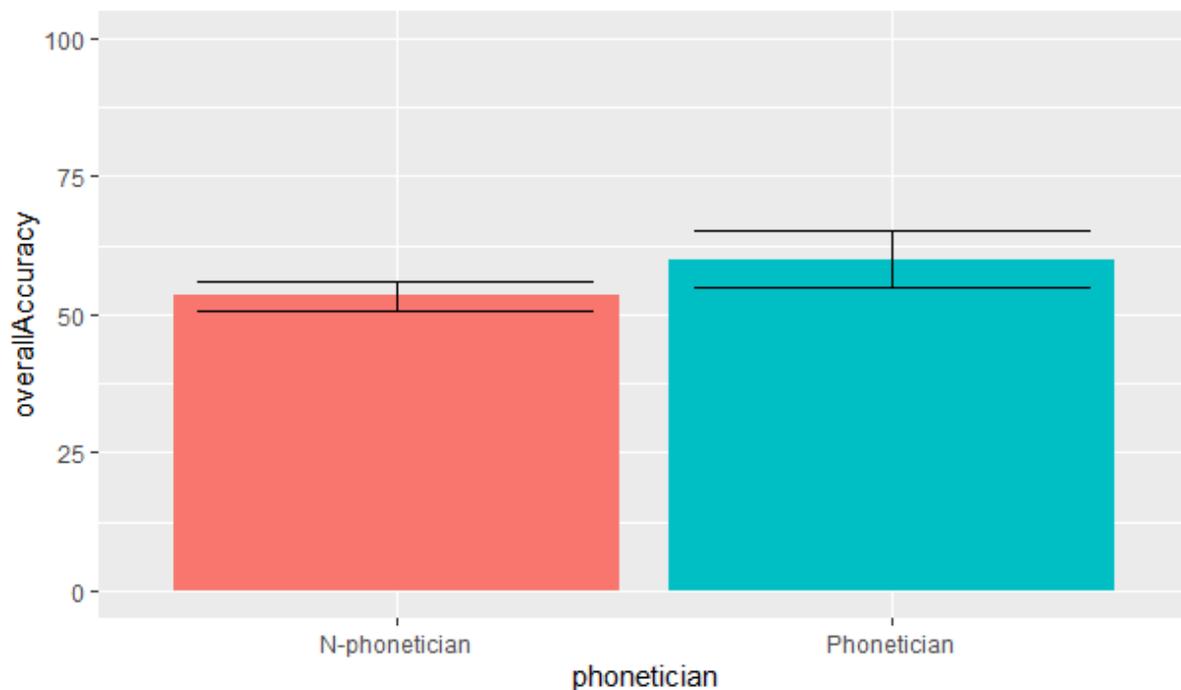


Figure 8.2: Overall Accuracy of Phoneticians versus Non-Phonetician Linguists

Table 8.5: Accuracy of Classifying Nigerian English Accents versus Non-Nigerian foils

	Nigerian English	Non-Nigerian foils
Nigerian Phoneticians	67.5% (54/80)	0% (0/10)
Nigerian non-Phonetician Linguists	53.75% (172/320)	40% (16/40)

The following bullet point summaries are drawn from Table 8.6 and Fig 8.3

- Kanuri-English was the most challenging accent to identify compared to the other three Nigerian English accents. The accuracy of identifying Kanuri-English by all the four L1 groups is the lowest compared to all other accents.
- All non-Hausa NLS highly performed at correctly identifying the Hausa stimuli, as shown in the Hausa column of Table 8.6.
- The Igbo column of Table 8.6 indicates that the Hausa NLS were 70% the most accurate at identifying Igbo stimuli compared to the other two groups of Kanuri and Yoruba with 55% and 65% respectively.

Table 8.6: Accuracy of Nigerian and Non-Nigerian Stimuli of the Four Nigerian Linguist Groups

Linguists	Hausa	Igbo	Kanuri	Yoruba	Non-Nigerian
Hausa group	87.5% (21/24)	71% (17/24)	33% (8/24)	67% (16/24)	8% (1/12)
Igbo group	67% (24/36)	91.6% (33/36)	22% (8/36)	47% (17/36)	44% (8/18)
Kanuri group	70% (14/20)	55% (11/20)	35% (7/20)	40% (8/20)	40% (4/10)
Yoruba group	75% (15/20)	65% (13/20)	25% (5/20)	75%(15/20)	10% (1/10)
Total %	70% (53/76)	64% (41/64)	26% (21/80)	51% (41/80)	28% (14/50)

In addition, the following bullet point summaries are drawn from Fig 8.3.

- Hausa-English was most accurately identified by the non-Hausa NLS, while Kanuri-English was least accurately identified by all the three non-Kanuri NLS.
- Except for Yoruba NLS, all the other three NL groups accurately identified more Igbo-English stimuli than the Yoruba-English ones.
- The non-Nigerian column of Table 8.6 indicates that Igbo NLS were the best performing group at correctly rejecting the two foils.
- Yoruba and Hausa NLS were the poorest groups at rejecting the two non-Nigerian foils.

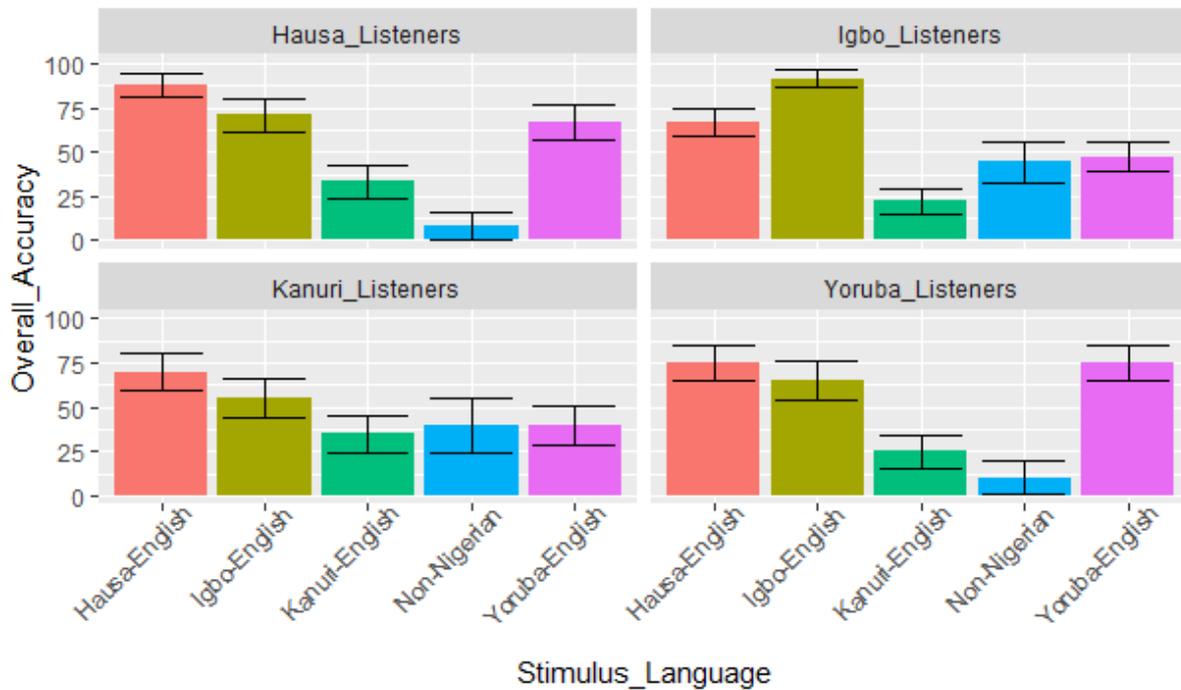


Figure 8.3: Isolated Accuracies of Classifying Nigerian & Non-Nigerian English Accents

Table 8.7 indicates that Hausa and Igbo phoneticians were 100% accurate in identifying fellow speakers of their own L1s. This shows that they outperformed the non-phonetician NLS. However, the only Kanuri phonetician was outperformed by non-phonetician Kanuri NLS, while both Yoruba phonetician and non-phonetician NLS had equal rates. Fig 8.4 shows a clear graphical representation of both groups' performance.

Table 8.7: Accuracy of Nigerian Phoneticians versus Nigerian Non-Phonetician Linguists: Own L1

Own L1	Hausa NLS	Igbo NLS	Kanuri NLS	Yoruba NLS
Nigerian Phoneticians	100% (4/4/)	100% (4/4)	25% (1/4)	75% (6/8)
Non-Phonetician Linguists	85% (17/20)	90.6% (29/32)	37.5% (6/16)	75% 9/12)
Other L1s	Hausa NLS	Igbo NLS	Kanuri NLS	Yoruba NLS
Nigerian Phoneticians	57% (8/14)	71% (10/14)	57% (8/14)	46% (13/28)
Non-Phonetician Linguists	48% (42/70)	42% (47/112)	52% (29/56)	50% (21/42)

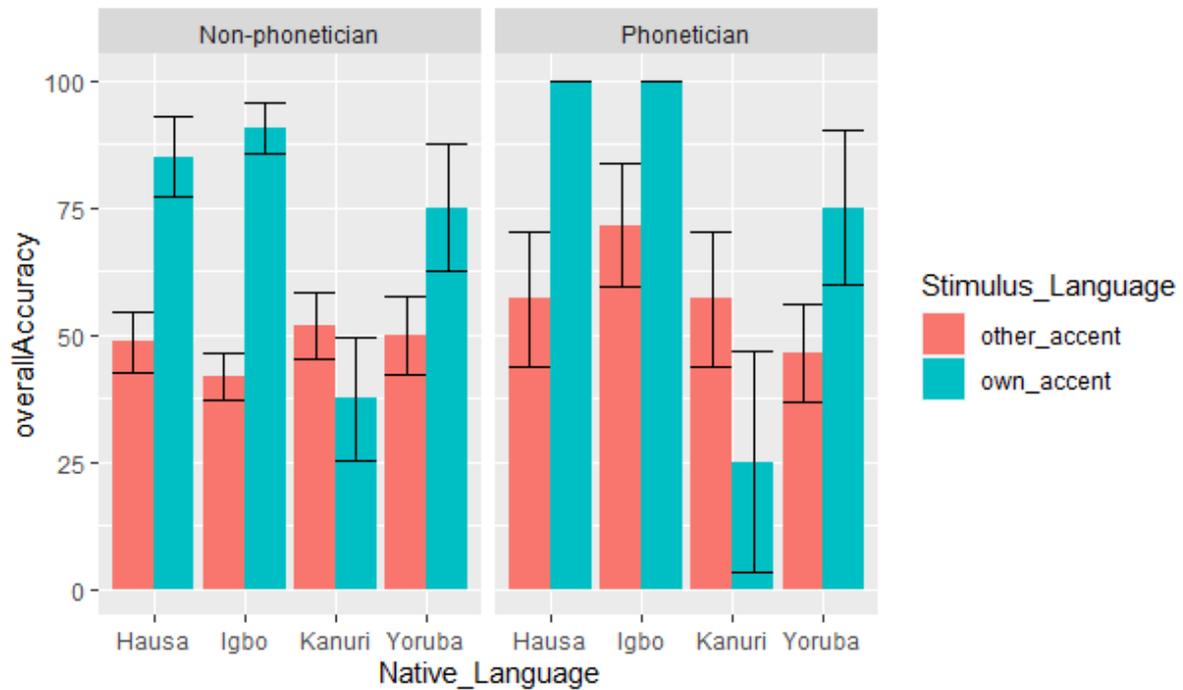


Figure 8.4: Overall Accuracy of Nigerian Non-Phonetician versus Phonetician Linguists: Own L1

Table 8.8 and Fig 8.5 indicate that Hausa, Igbo and Kanuri phonetician NLS outperformed their non-phonetician counterparts in identifying speakers of other L1s. However, Yoruba phoneticians were slightly outperformed by the Yoruba non-phonetician NLS.

8.2.4 Accuracy of individual NLS

To determine whether the identification task accuracy was consistent among the individual NLS, the individual performance results are broken according to their four native languages.

8.2.4.1 Accuracy of Individual NLS: Own accent

Fig 8.5 indicates that most of the individual Igbo NLS were at 100% accurate, while most of the individual Kanuri NLS were only at 25% accurate.

The following bullet point summaries are extracted from Fig 8.5.

- 50% of the Hausa NLS were at 100% accurate, while the other 50% were 75% accurate.
- 78% of the Igbo NLS were at 100% accurate.
- 40% of the Kanuri NLS were at 50% accurate, while the other 60% were only 25% accurate.
- 40% of the Yoruba NLS were at 100% accurate, while 20% were at 75% accurate, and another 40% were only at 50% accurate.

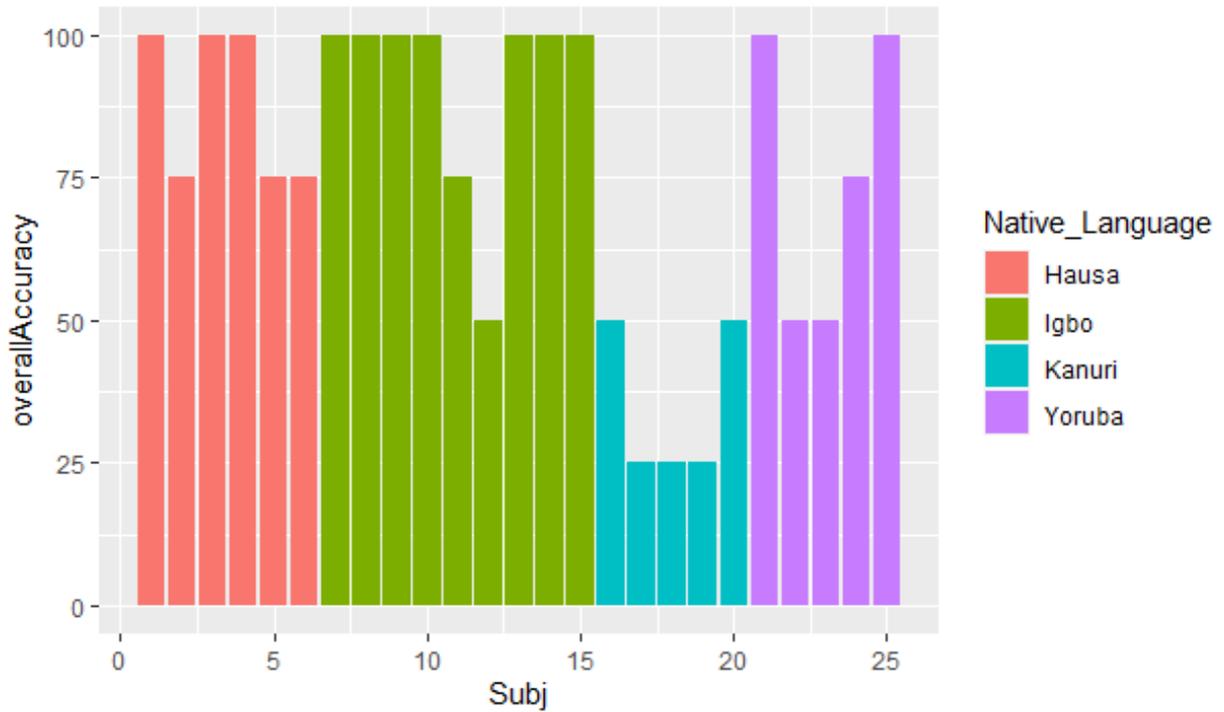


Figure 8.5: Accuracy of individual Nigerian linguists: own L1

8.2.4.2 Accuracy of Individual NLS: Other accents

This sub-section presents the performance of individual respondents in identifying stimuli of other Nigerian English accents. The accuracies of the individual respondents are varied, as Fig 8.6 shows. Only two Hausa NLS and two Igbo NLS had the same accuracy rates.

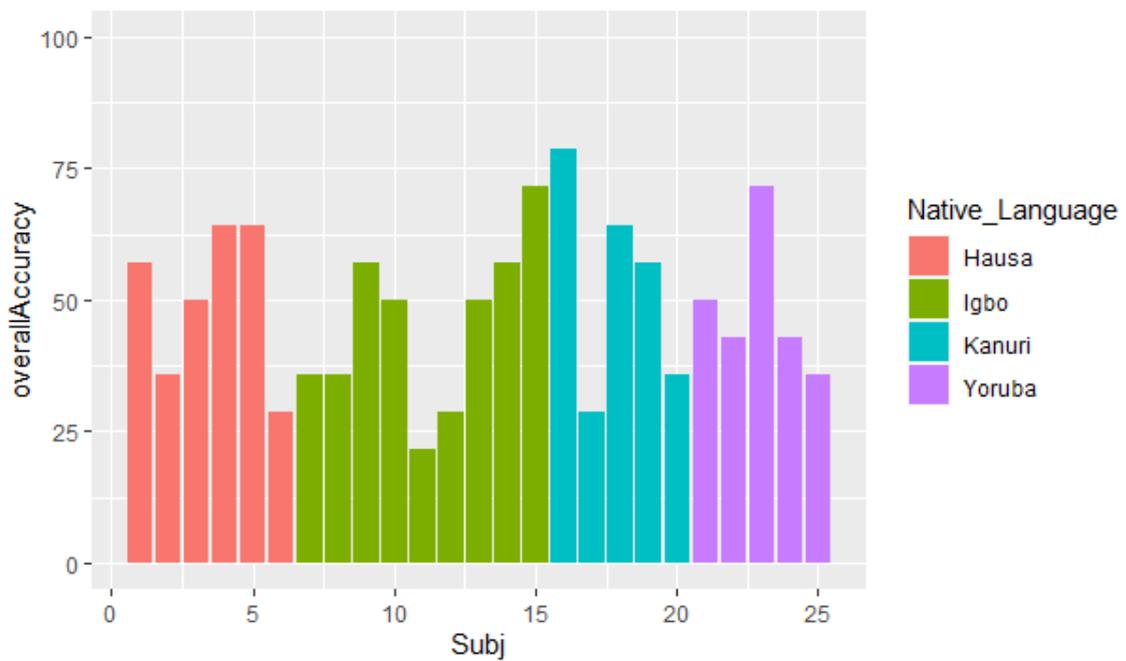


Figure 8 6: Accuracy of individual Nigerian linguists: own L1

8.2.5 Confidence versus Accuracy

As stated in Chapter 7, a self-confidence rating scale was attached to each of the audio clips for the participants to state the level of their confidence in making their choices. As stated in the statistical significance testing section above, a significant positive correlation is also observed between Nigerian linguists' confidence and accuracy in identifying all four Nigerian English accents ($\beta_{\text{linguist: zconf}} = 0.48, p < 0.001$).

A significant positive correlation is also observed between Nigerian phonetician' confidence and accuracy in identifying all four Nigerian English accents. However, as observed in the non-linguist chapter, these Nigerian linguists were also highly confident even when they were inaccurate in their decisions, as Fig 8.7 shows.

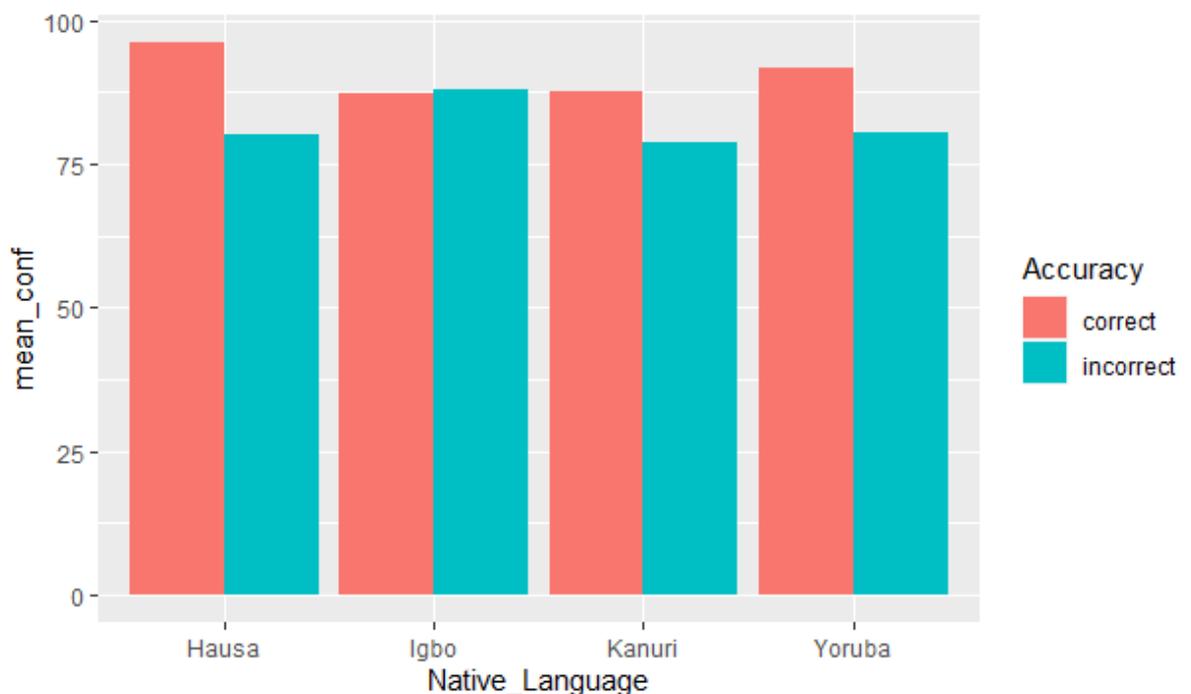


Figure 8.7: Self-confidence rating averaged for four native speaker groups of NLS

8.2.5.1 Confidence versus Accuracy: All individual NLS

The averaged individual confidence rates of the 25 NLS are shown in Fig 8.8. Each of the individual linguists was slightly more confident when he or she was correct compared to incorrect responses. They were also very confident when inaccurate.

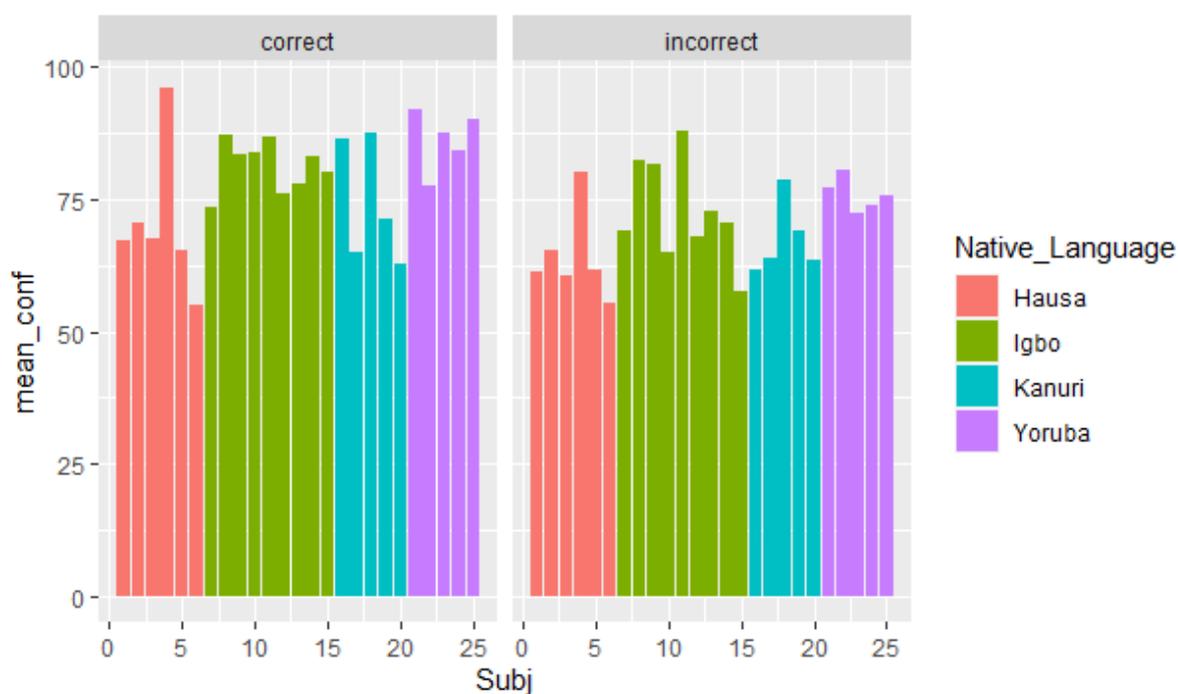


Figure 8.8: Self-confidence rating averaged for all individual NLS: correct versus incorrect responses

8.2.6 Confusion of Nigerian English Accents

As reported in the Nigerian NNL group, the Nigerian NLS also confused the four Nigerian languages in an attempt to assign an L1 to each of the stimuli. The following bullet point summaries are drawn from Table 8.9.

- Kanuri-English was mainly confused with Hausa-English and vice versa.
- Igbo-English was mainly confused with Yoruba-English and vice versa.
- Non-Nigerian English was mainly confused with Igbo-English.

Table 8.8: Overall confusion of Nigerian English accents: NLS

Variety	Hausa	Igbo	Kanuri	Yoruba	Non-Nigerian	% Correct	Total
Hausa	74%	2%	15%	2%	7%	74%	100
Igbo	0%	74%	3%	21%	2%	74%	100
Kanuri	46%	6%	28%	1%	19%	28%	100
Yoruba	2%	33%	2%	56%	7%	56%	100
Non-Nigerian	8%	14%	7%	5%	16%	32%	50

8.2.6.1 Direction of four main confusions of Nigerian English accents

As explained in Chapter 7, Nigerian English accents were confused with one another, but four major types of confusions were identified, as shown in Fig 8.9. The confusions are: Kanuri-Hausa, Hausa-Kanuri, Igbo-Yoruba and Yoruba-Igbo. For a more clarification of the confusions, for instance,

Igbo-Yoruba in Table 8.10 represents confusion of Igbo-English with Yoruba-English. All three misidentified Igbo-English stimuli were confused with Yoruba-English only, and this number represents 100% of confusing Igbo-English.

The following bullet point summaries are drawn from Table 8.10 below.

- Hausa NLS mainly confused Kanuri-English speakers with their fellow L1 Hausa speakers.
- Hausa NLS confused their fellow L1 speakers with speakers of L1 Kanuri only.
- Kanuri NLS had the lowest rate of confusing Hausa-English with fellow speakers of their L1 Kanuri-English.
- Igbo NLS confused their fellow Igbo-English speakers with Yoruba speakers only
- Yoruba NLS mainly confused Igbo-English with their fellow Yoruba speakers.
- All NLS confused Hausa-English with Kanuri-English, with Igbo NLS having the lowest confusion rate.
- All NLS confused Igbo-English with Yoruba-English, with Igbo NLS having the highest confusion rate, and Hausa NLS having the lowest confusion rate.
- All NLS confused Yoruba-English with Igbo-English, with Hausa NLS having the highest confusion rate, and Kanuri NLS having the lowest rate.
- Only Kanuri NLS were least likely to confuse their own L1 with other L1s compared to the other three NL groups.

Table 8.9: Direction and Percentage of Confusing Nigerian L1s: NLS

Participants	Kanuri-Hausa	Hausa-Kanuri	Igbo-Yoruba	Yoruba-Igbo
Hausa linguists [6]	75% (12/16)	100% (3/3)	71% (5/7)	100% (8/8)
Igbo linguists [9]	61% (17/28)	42% (5/12)	100% (3/3)	79% (15/19)
Kanuri linguists [5]	46% (6/13)	50% (3/6)	78% (7/9)	58% (7/12)
Yoruba linguists [5]	73% (11/15)	80% (4/5)	86% (6/7)	60% (3/5)

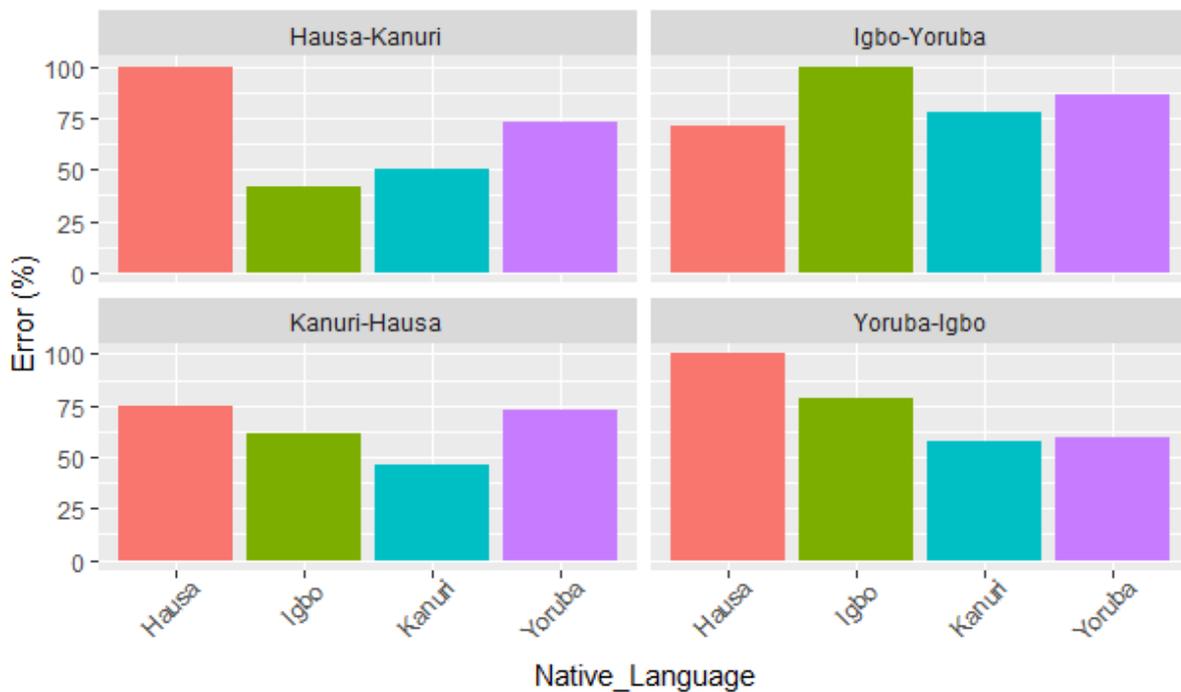


Figure 8.9: Four major confusions of Nigerian English accents by the Nigerian linguists

8.2.7 Confusion of Non-Nigerian-English Foils

Although the non-Nigerian foils were misidentified as all the four Nigerian English accents, they were mostly misidentified as Igbo-English.

- Hausa NLS mainly confused Non-Nigerian English with Igbo-English.
- Igbo NLS mainly confused Non-Nigerian English with Kanuri-English or Yoruba-English.
- Kanuri NLS mainly confused Non-Nigerian English with Igbo-English and Yoruba-English.
- Yoruba NLS mainly confused Non-Nigerian English with Hausa-English or Igbo-English.

Table 8.10: Confusion of Non-Nigerian English Foils: All four groups

Variety	Hausa	Igbo	Kanuri	Yoruba	Non-Nigerian	% Correct	Total
Hausa	8.33%	50.00%	8.33	25.00%	8.33%	8.33%	12
Igbo	11.11%	5.50%	22.22%	16.66%	44.44%	22.22%	18
Kanuri	10.00%	30.00%	_____	20.00%	40.00%	40.00%	10
Yoruba	40.00%	30.00%	20.00%	_____	10.00%	10.00%	10

8.2.8 Classification of Errors in Classifying the Nigerian English Accents

8.2.8.1 False rejection

False rejection is observed when a respondent listens to a speaker belonging to his native L1, but he fails to identify the L1 of the speaker and confuses it with another L1. Table 8.15 and Fig 8.7

show that Kanuri-English was mostly misidentified compared to the other three Nigerian English accents, while Igbo-English was least misidentified by the Kanuri and Igbo NLS respectively.

Table 8.11: False negative errors (misses) of the four L1 groups: NLS

NLS	Hausa NLS	Igbo NLS	Kanuri NLS	Yoruba NLS
	12.5%	8.4%	65%	25%

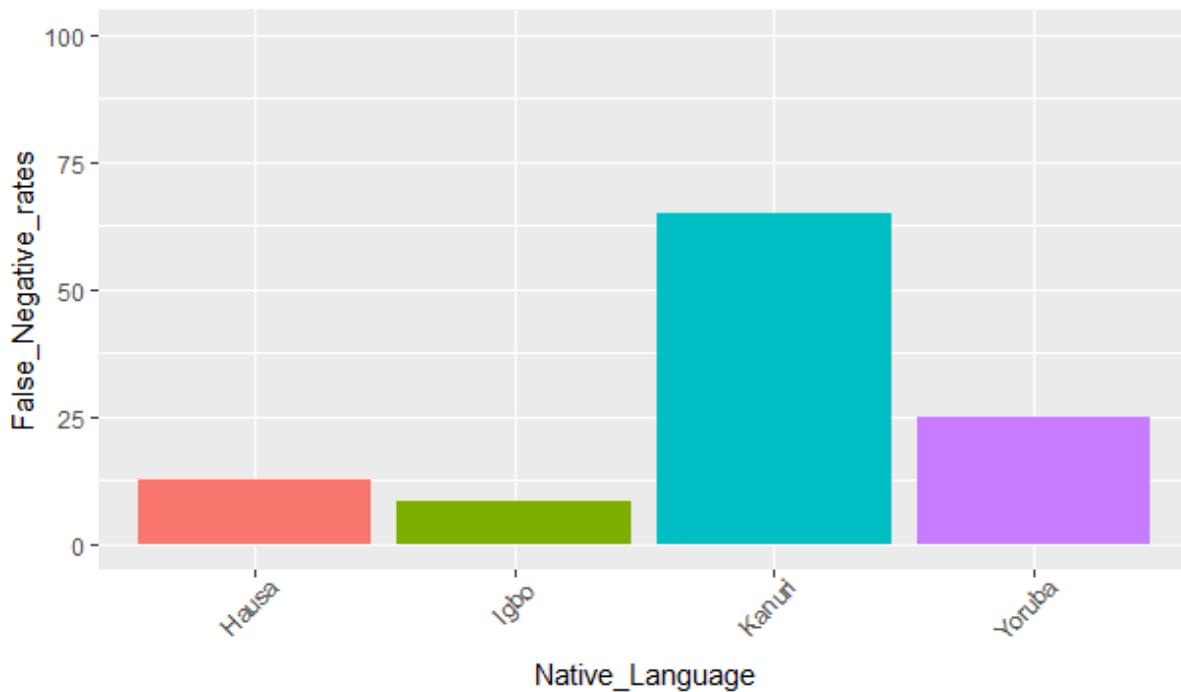


Figure 8.10: False Negative error rates of the four groups of Nigerian Linguists

8.2.8.2 False acceptance

False rejection is observed when a respondent listens to a speaker belonging to another L1, but he identifies him as a member of his own L1 group. Table 8.16 and Fig 8.8 indicate that Hausa NLS were most likely to identify Kanuri-English as Hausa-English, while L1 Kanuri-English speakers were least likely to accept a non-member of their L1 Kanuri as a fellow member of Kanuri.

Table 8. 12: False positive errors of the four L1 groups: NLS

NLS	Hausa NLS	Igbo NLS	Kanuri NLS	Yoruba NLS
	50%	41.6%	15%	30%

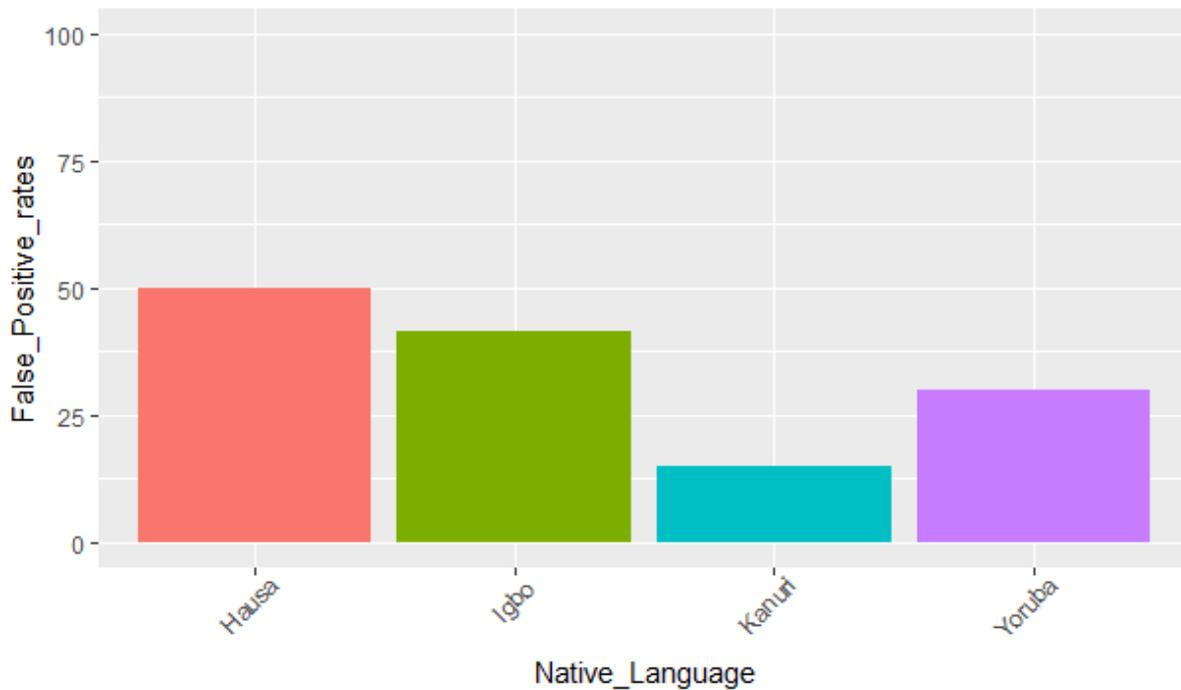


Figure 8.11: False Positive error rates of the four groups of Nigerian Linguists

Except for the Kanuri NLS, the other three NL sub-groups' results show that they were more likely to have false acceptances than false rejections. Kanuri NLS produced the highest rate of misses (65%) by misidentifying 13 of their fellow 20 Kanuri-English stimuli. However, their result for the false hit also varies from the other sub-groups. They had the lowest rate of confusing non-Kanuri English speakers with their fellow Kanuri-English speakers. Thus, despite their low performance at identifying their fellow L1 Kanuri speakers, they were more cautious to accept a non-L1 Kanuri as a fellow speaker of L1 Kanuri.

8.3 Summary and Conclusion

All the four linguist groups were highly accurate in identifying members of their native language. The effect of linguistic training over its absence failed to reach a significant level. Comparison of false rejections and false acceptances showed that, with the exception of the Kanuri NLS, all the other three NL groups had more false acceptances than false rejections. On the other hand, Kanuri NLS missed more of their fellow Kanuri-English speakers. But they were also cautious to accept non-Kanuri-English speakers as Kanuri-English speakers. The implication of this result for LAAP is that Kanuri NLS may fail to confirm the claim of a true L1 Kanuri-English speaker at some level, but may be more likely to reject other Nigerian L1 speakers claiming Kanuri origin.

All the four Nigerian linguist groups had similar confusion patterns for the Nigerian English accents. Four major types of confusion have been identified: Hausa-English -- Kanuri-English, Kanuri-English -- Hausa-English, Igbo-English -- Yoruba-English and Yoruba-English -- Igbo-English.

On the other hand, the confusion of non-Nigerian foils is in line with the difference in the listeners' regional backgrounds. Hausa and Kanuri NLS mainly confused non-Nigerian foils with Igbo- or Yoruba-English. Igbo and Yoruba NLS confused non-Nigerian foils with all other Nigerian English accents, with Hausa-English or Kanuri-English having the highest confusion rates. Igbo NLS confused non-Nigerian with Kanuri-English, Yoruba-English and Hausa-English, while Yoruba NLS mainly confused it with Hausa-English and Igbo-English, and occasionally with Kanuri-English.

The next chapter concerns the UK-based phonetician experiment.

Chapter 9

Experiment 3: UK-based phoneticians

9.0 Introduction

This chapter presents the results of the third experiment, which is the performance of the UK-based phoneticians classifying the four Nigerian English accents. The chapter consists of the overall and isolated accuracies of academic phoneticians, academic phoneticians with interest in forensic phonetics as well as forensic phoneticians currently employed by JPFrench Associates. It also provides patterns of confusing the Nigerian English accents and the statistical significance testing of the UK-phoneticians performance. The last section provides a summary of the whole chapter. The UK-based phoneticians will henceforth bear the abbreviation “UKPHS” throughout the chapter.

9.1 Methods

The experiment was sent to the respondents via their official email addresses. They were first contacted to identify whether they were interested in taking part in the survey. Those who expressed interest in participating were sent the Qualtrics survey link. They were also provided with feature matrices of the four Nigerian English accents (see Appendix B no. 4). The feature matrices were the realisations of certain English consonants and vowels in the four Nigerian English accents, as found in the speech samples used in the experiment. They read the information in the matrices to familiarise themselves with the accents before the listening task of categorising the four Nigerian English accents. A folder containing 18 audio recordings of the four accents was also shared with them in case they wanted to use speech analysis/playback software such as Praat or Sound Forge to listen to them before working on Qualtrics.

9.1.1 Participants

Thirteen UKPHS were involved in the survey (see Chapter 6 for further details). They were all native speakers of British English. Ten of these phoneticians (academic phoneticians, and a few academics who are also forensic phoneticians) were drawn from various UK universities, while the other three were forensic phoneticians working at JP French Associates. All of the respondents had PhD degrees in Linguistics with specialisation in Phonetics, Sociolinguistics, or a related field from UK universities.

9.1.2 Stimuli

The materials were the same as used in experiments 1 and 2 (see Stimuli Section in Chapter 6 for further details).

9.1.3 Procedure

As mentioned in Chapter 6, Qualtrics survey software was used for the collection of data. Both the questionnaire and the recordings of the speakers were uploaded into the software. In order to identify the L1 of the speaker of each stimulus, each of the stimuli was presented to the listeners. The participants were required to indicate the L1 of the speaker in each stimulus: Hausa, Igbo, Kanuri, Yoruba or none of the above if the participant believed the speaker did not speak a variety of Nigerian English. Furthermore, they were asked to give the basis of their identification at the end of the listening task.

For a pilot study, three UKPHS—different people from those that participated in the main experiment—, currently working at the University of York and JP French Associates participated before the main survey was sent out. Based on their responses to the questions and some comments, the questions were restructured and the matrices of the features were improved. Two of the three respondents in the pilot study mainly commented on the feature matrices. They suggested addition of more segmental information to the initial matrices. They also asked for further clarifications to remove inconsistencies regarding which segments occur or do not occur in particular accent groups. Vowel phonemes such as TRAP, STRUT, NURSE and DRESS had further explanation as recommended to clearly distinguish between the four Nigerian English accents. Empty cells in the matrices were filled in for clarity as suggested by the respondents of the pilot study.

Speaker numbers were later indicated in Qualtrics survey (as advised by the respondents) to avoid confusing them with wrong samples that were initially worked on (listened to) by the participants in preparation for the survey. One of the respondents said she had spent longer than 45 minutes (the initial survey duration proposed by the researcher) in doing the task, as she had to go back and play each file again in google docs to match it with the one in the survey to double check that they were the same ones. Thus, indicating the speaker numbers in the main survey had solved the problem and made the task quicker or less time-consuming.

9.2 Results

The relative performances of the participants are compared relative to the chance level. The chance level is 20% when non-Nigerian foils are taken into account, while it is 25% (in the event of disregarding the non-Nigerian foils) for classifying the four Nigerian English accents only. As different patterns were observed between the performance of the UK-based forensic phoneticians and non-forensic phoneticians, the accuracies of the UKPHS are split to show the differences of the two sub-groups.

9.2.1 Overall accuracy

The findings indicate that the UKPHS were overall 53.4% accurate at categorising the four Nigerian English accents and the two non-Nigerian English foils (Ghanaian and Guinean English speakers). However, the performance of this group classifying Nigerian English accents nearly doubles the non-Nigerian foils, as shown in Table 9.1 and Fig 9.1.

The statistical significance test indicates that UK-based phoneticians were neither better nor worse than the Nigerian participants in the classification task, as detailed in the analysis of statistics below.

9.2.2 Statistical significance testing

To test the statistical significance of the relevant variables, responses from all the UK-based participants and all Nigerian participants—linguists and non-linguists (data reported in Chapters 6 and 7)—were analysed with a logistic mixed-effects model using the lme4 R package (RStudio, 2020), with a binary dependent variable for accuracy (1= correct, 0= incorrect). The model included fixed effects of “UK phoneticians”, “stimulus language”, confidence rating, the interaction between stimulus language and confidence rating, as well as a random intercept and slope of confidence rating for participant. The factor for UK phoneticians had two levels: UK phoneticians or non-UK phoneticians. This variable was also sum-coded with non-UK phoneticians as the held-out level. The factor for stimulus language had five levels: Hausa, Igbo, Kanuri, Yoruba or Non-Nigerian. This factor was sum-coded with non-Nigerian as the held-out level.

The effect of UK phoneticians investigates whether UK phoneticians may perform significantly better or worse than the average Nigerian participant.

The effect of stimulus language was included to determine whether some languages were more difficult to identify than others.

The result of the test indicates that the effect of country was not statistically significant, indicating that UK phoneticians were neither better nor worse at language identification than native Nigerian participants ($\beta_{ukphoneticians} = 0.12, p > 0.28$).

On the other hand, the effect of stimulus language indicates that the UKPHS were significantly better than chance in correctly identifying Hausa-English, Kanuri-English and Yoruba-English ($\beta_{Hausa} = 0.38, p < 0.001$; $\beta_{Kanuri} = -0.25, p < 0.08$; $\beta_{Yoruba} = 1.03, p < 0.001$). However, their accuracy of identifying Igbo-English did not reach significance ($\beta_{Igbo} = -0.10, p > 0.50$).

The result of the test indicates a significant positive relationship between confidence and accuracy for the entire UK phonetician group ($\beta_{ukphoneticians1: zconf} = 0.26, p < 0.001$).

The interaction between stimulus language effect and confidence shows a significant correlation for only three of the four accents—Hausa-English, Igbo-English and Yoruba-English accents ($\beta_{Hausa} = -0.35, p < 0.001$; $\beta_{Igbo} = -0.67, p < 0.001$; $\beta_{Yoruba} = 0.68, p < 0.001$). But for Hausa and Igbo speakers, confidence and accuracy were negatively related, while the interaction between confidence and accuracy in identifying Kanuri-English accent failed to reach significance ($\beta_{Kanuri} = 0.24, p > 0.09$).

One of the UKPHS correctly identified all the four Kanuri-English stimuli in the classification task. However, the self-confidence rating of this participant was very low. The participant also confirmed in the post-listening questionnaire that he was not confident at all in identifying Kanuri-English stimuli.

9.2.3 Descriptive Statistics

The overall result of classifying task first presented, and it is further divided into accuracies of classifying Nigerian English accents and non-Nigerian English foils. The UK-based phoneticians' group is further sub-divided into forensic and non-forensic phonetician sub-groups, where the performance of the two groups is separately presented in Table 9.1 and Fig 9.1.

Table 9.1: Overall Accuracy of UK-based Phoneticians

Overall accuracy of UKPHS		
UKPHS [13 participants]	53.4% (125/234)	
	Nigerian L1s % Correct	Non-Nigerian L1s % Correct
	56.2% (117/208)	30.7% (8/26)

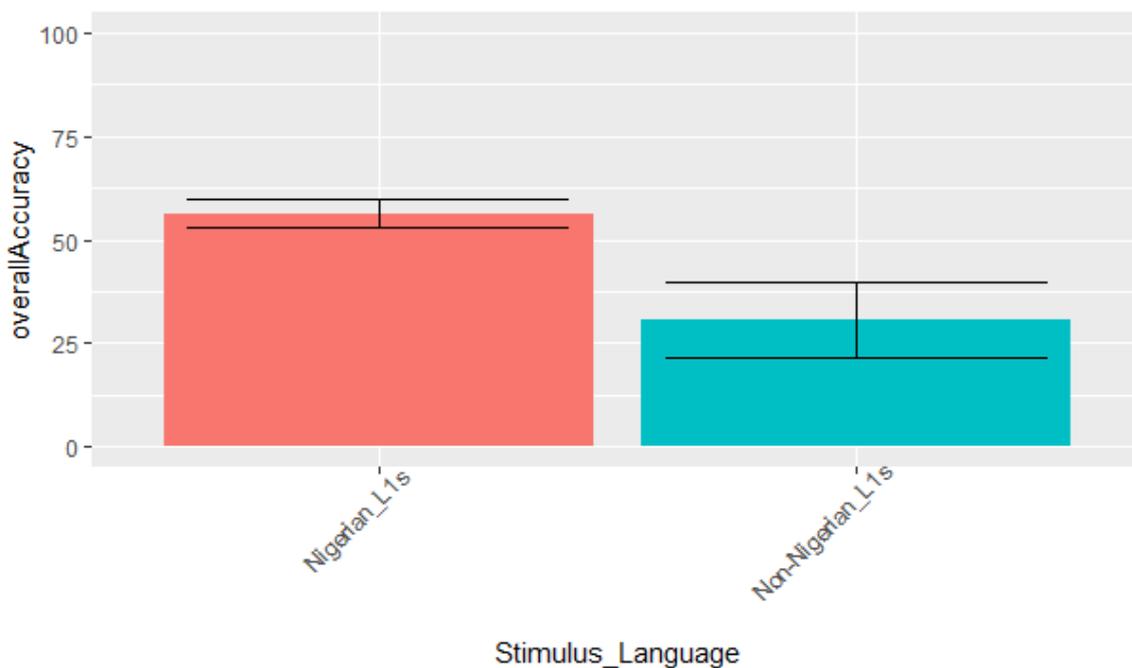


Figure 9.1: Accuracy of UKPHS: Nigerian English Accents versus Non-Nigerian Foils

As shown in Table 9.2 and Fig 9.2, the forensic UKPHS outperformed the academic non-forensic UKPHS by 8.9%.

Table 9.2: Overall Accuracy of All Stimuli: Forensic Phoneticians versus Non-Forensic Phoneticians

Forensic UKPHS	[5 participants]	58.9% (53/90)
Non-Forensic UKPHS	[8 participants]	50% (72/144)

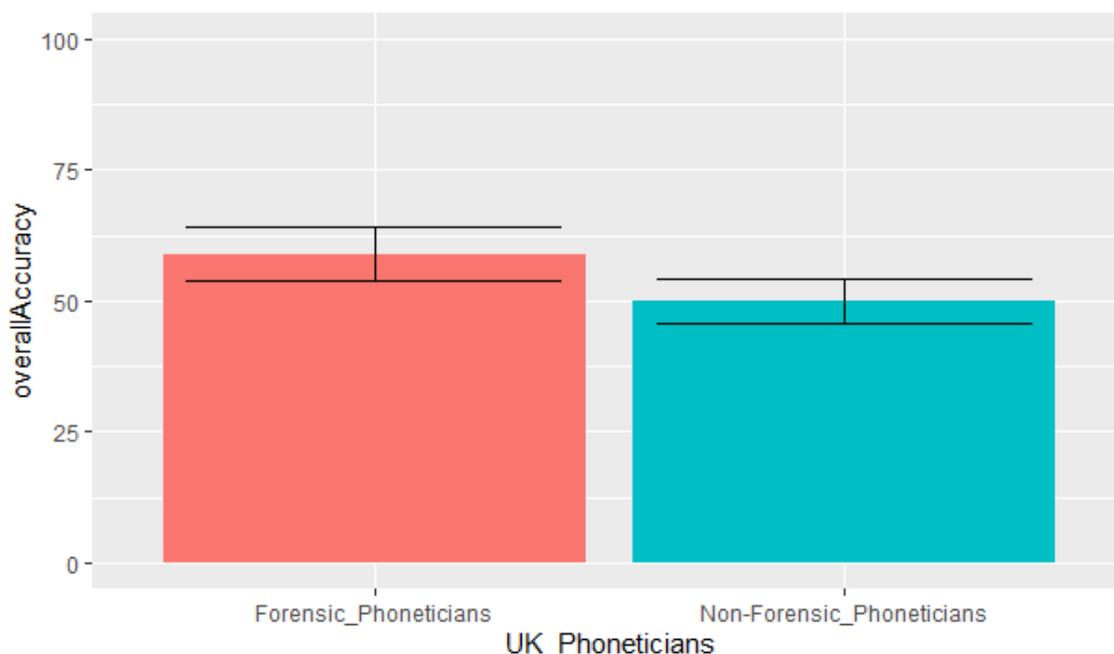


Figure 9.2: Accuracy of Nigerian and Non-Nigerian Accents: Forensic UKPHS versus Non-Forensic UKPHS

Table 9.3 and Fig 9.3 below show that the forensic UKPHS outperformed the academic non-forensic UKPHS in accurately identifying both Nigerian and non-Nigerian stimuli. The gap is wider in identifying the non-Nigerian L1s compared to the classification of the Nigerian English accents.

Table 9.3: Accuracy of Nigerian and Non-Nigerian Stimuli: Forensic UKPHS versus Non-Forensic UKPHS

	Nigerian L1s % correct	Non-Nigerian L1s % correct
Forensic UKPHS	58.7% (47/80)	60% (6/10)
Non-Forensic UKPHS	54.6% (70/128)	12.5% (2/16)

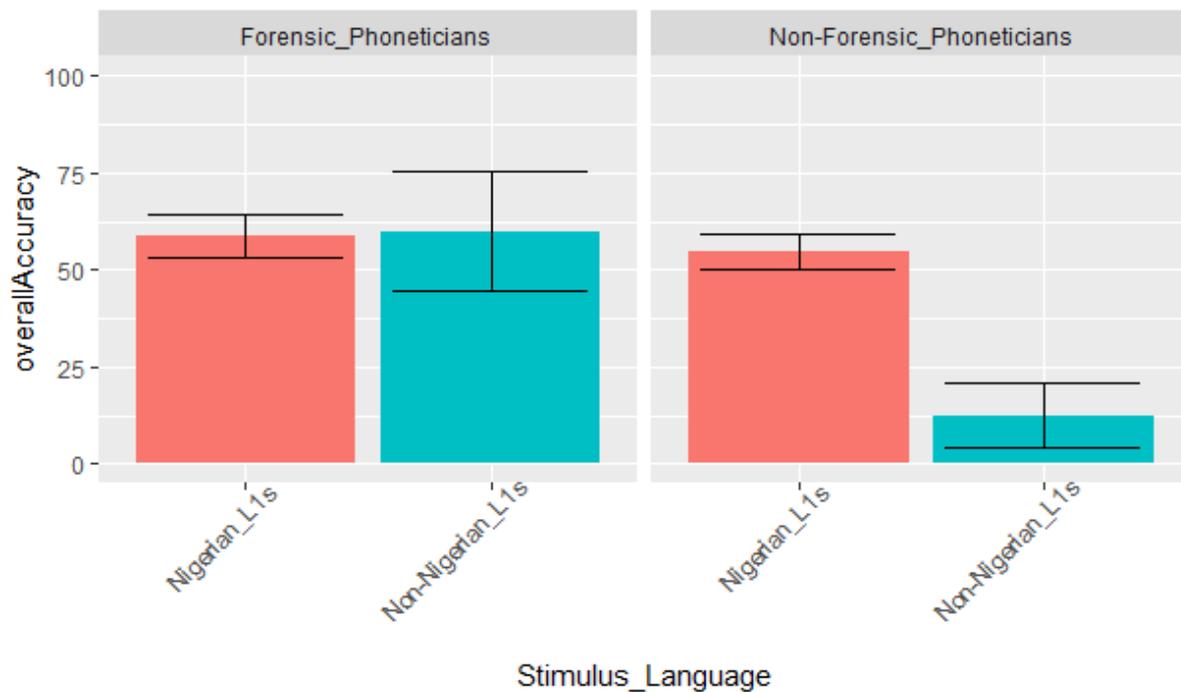


Figure 9.3: Accuracy of Nigerian and Non-Nigerian Accents: Forensic UKPHS versus Non-Forensic UKPHS

Table 9.4 and Fig 9.4 show that Yoruba-English is the easiest accent to identify by the UKPHS, while non-Nigerian foils seemed to be the most challenging to identify.

Table 9.4: Accuracy of All Four Nigerian English Accents and Non-Nigerian Stimuli: All UKPHS

Hausa	Igbo	Kanuri	Yoruba	Non-Nigerian
55.8% (29/52)	32.7% (17/52)	50% (26/52)	86.5 (45/52)	30.8% (8/26)

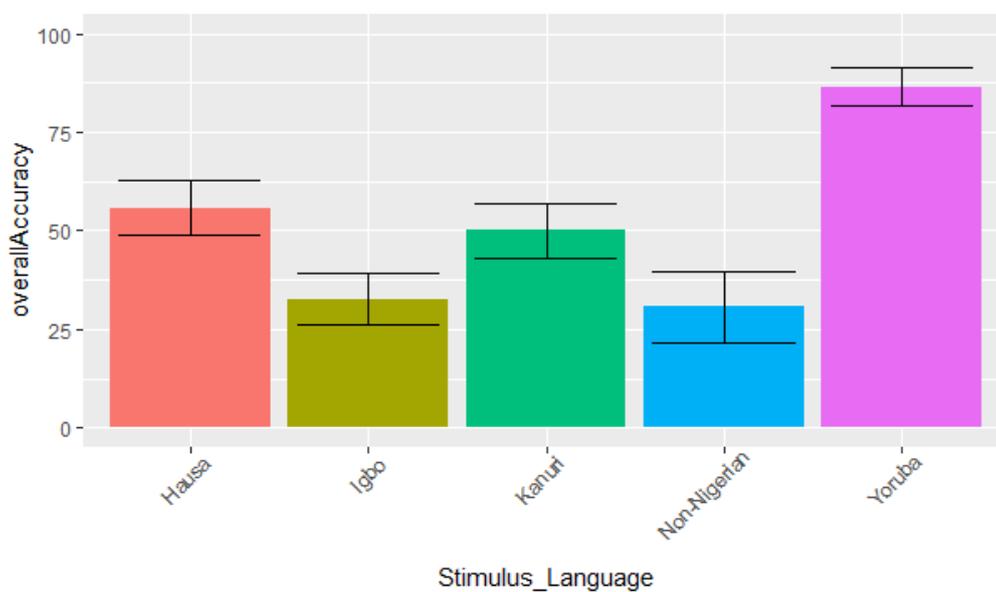


Figure 9.4: Accuracy of classifying each of the five accents: All UKPHS

This section compares the performance of the forensic UKPHS versus the non-forensic UKPHS.

The following bullet point summaries are drawn from Table 9.5 and Fig 9.5.

- The forensic UKPHS outperformed the academic UKPHS in three of the five accent groups: Hausa-English, Yoruba-English and non-Nigerian foils.
- Forensic UKPHS were outperformed by the academic UKPHS in identifying Igbo-English stimuli only.
- Both groups were equally accurate in identifying Kanuri-English.

Table 9.5: Accuracy of classifying the five English accents: Forensic versus Non-Forensic UKPHS

Stimulus language	Hausa	Igbo	Kanuri	Yoruba	Non-Nigerian
Forensic UKPHS	65% (13/20)	20% (4/20)	50% (10/20)	100% (20/20)	60% (6/10)
Non-Forensic UKPHS	50% (16/32)	40.6% (13/32)	50% (16/32)	78.1% (25/32)	12.5% (2/16)

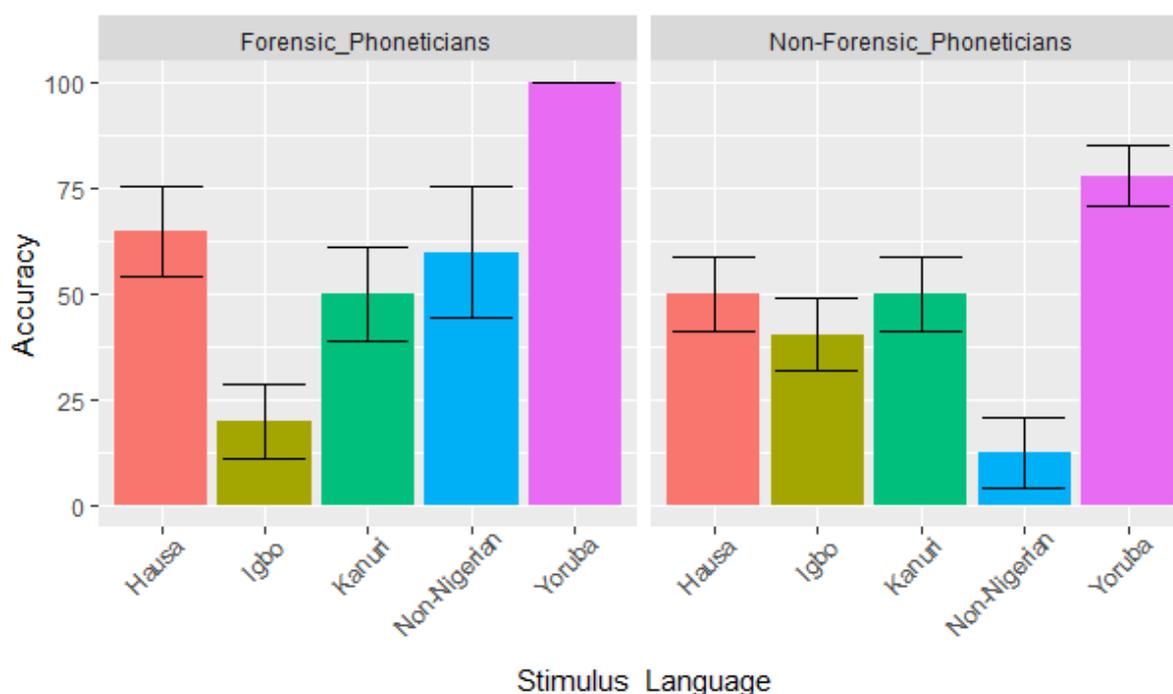


Figure 9.5: Accuracy of Nigerian and Non-Nigerian English accents: Forensic UKPHS versus non-Forensic UKPHS

9.2.4 Accuracy of individual UK-based phoneticians

To determine whether the classification accuracy was consistent among the individual UK-based phoneticians, the individual performance in identifying each of the four Nigerian English accents is shown in Fig 9.6. Only three of the UKPHS had the same accuracy rates, and they were the most performing participants, while the other ten UKPHS had different lower accuracy rates.

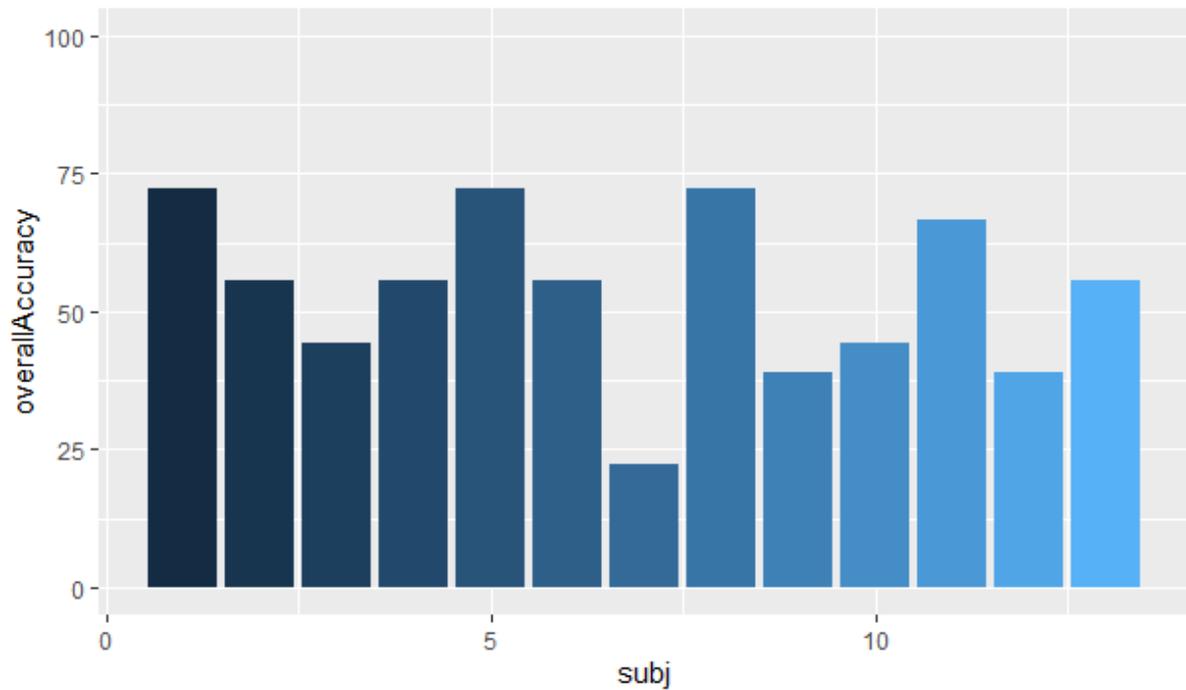


Figure 9.6: Overall accuracy of individual UKPHS for classifying all the four Nigerian English accents and the two foils

9.2.4.1 Accuracy of individual UK-based phoneticians by stimulus language

This sub-section presents the individual performance of the UKPHS in identifying the four Nigerian English accents and the two foils. The following bullet point summaries are extracted from Fig 9.7.

- Five of the 13 UKPHS were at 75% accurate in identifying Hausa-English, while other six UKPHS were at 50% accurate.
- There are more different performance patterns among the UKPHS participants for identifying Igbo-English compared to the three other groups, while four UKPHS had 0% accuracy.
- Ten UKPHS were at 100% accurate in identifying Yoruba, while two of them were at only 25% accurate. All forensic UKPHS were at 100% accurate.
- Seven UKPHS had 0% accuracy rate in identifying the two foils, and they were all non-forensic UKPHS.
- Majority of UKPHS were at 50% accurate in identifying Kanuri-English.

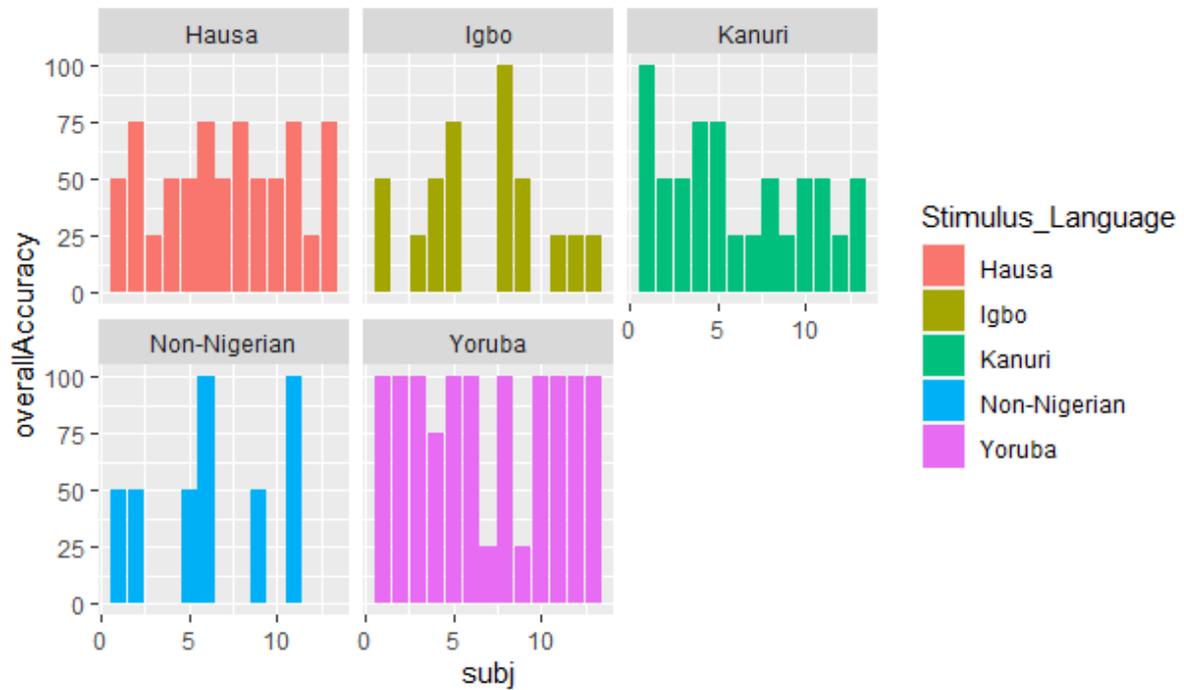


Figure 9.7: Accuracies of individual UKPHS for classifying Hausa-English, Igbo-English, Kanuri-English, Yoruba-English and non-Nigerian foils

9.2.5 Confidence versus Accuracy

As stated above, a self-confidence rating scale was attached to each of the audio clips for the participants to state how confident they were in making their choices. As shown in Fig 9.8, all the individual UKPHS had different confidence rates for correct and incorrect responses. They were more confident when they were accurate. Only one of them was highly confident in both directions.

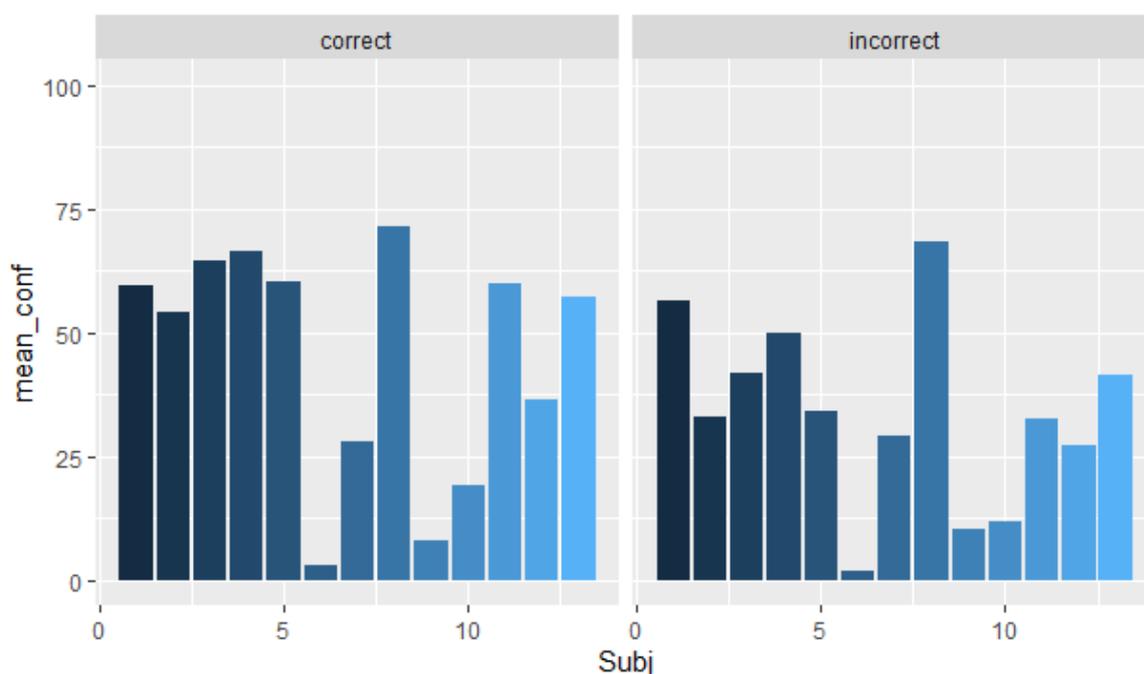


Figure 9.8: Self-confidence rating for all individual UKPHS: correct versus incorrect responses

9.2.6 Confusion of Nigerian and Non-Nigerian L1s

As reported above, four stimuli represented each of the four Nigerian English accents, in addition to the two foils. The following bullet point summaries are drawn from Table 9.6 and Fig 9.9.

- UKPHS mainly confused Hausa-English with Kanuri-English.
- They mainly confused Igbo-English with Kanuri-English and vice versa.
- They were more likely to confuse Yoruba-English with non-Nigerian-English.
- They were most likely to confuse Igbo-English with non-Nigerian-English.
- The confusion of Igbo-English with Kanuri-English, Yoruba-English and non-Nigerian-English is nearly the same.

Both the Igbo-English and the non-Nigerian foils do not have consonant shibboleths, thus distinguishing them from other varieties.

Table 9.6: Overall Confusion of Nigerian and Non-Nigerian English accents: UK UKPHS

Variety	Hausa	Igbo	Kanuri	Yoruba	Non-Nigerian	% correct	Total
Hausa	55.8%	3.8%	25%	7.7%	7.7%	55.8%	52
Igbo	5.7%	32.7%	23%	17%	21%	32.7%	52
Kanuri	17%	15%	50%	7.7%	9.6%	50%	52
Yoruba	1.9%	1.9%	3.8%	86.5%	5.7%	86.5%	52
Non-Nigerian	0%	53.8%	11.5%	3.8%	30.7%	30.7%	26

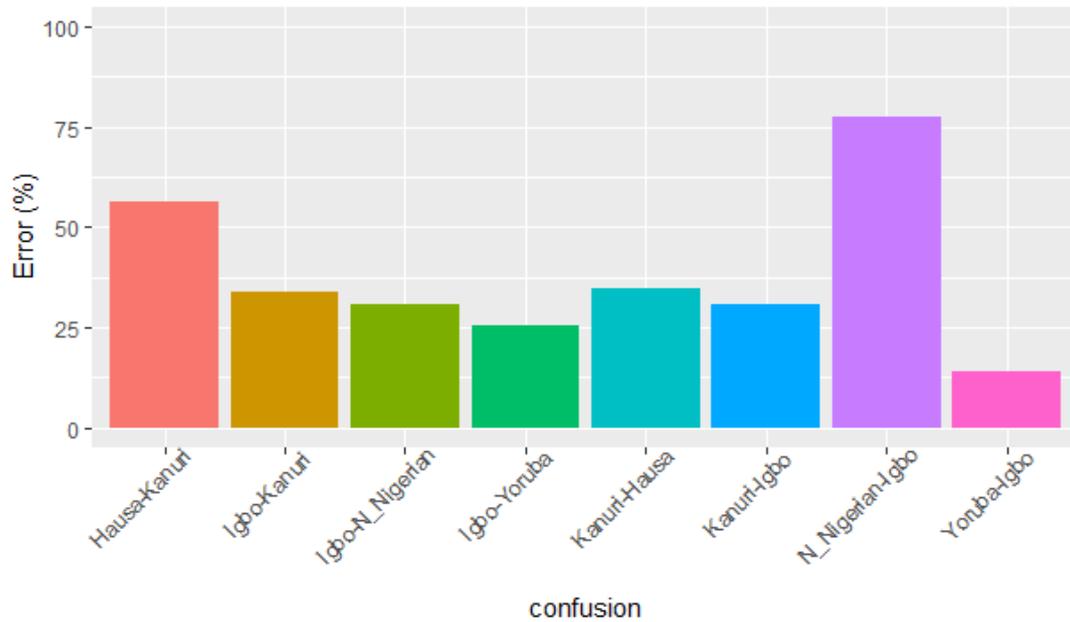


Figure 9.9: Confusion of Nigerian and Non-Nigerian English accents: All UKPHS

9.2.6.1 Confusion of Nigerian and Non-Nigerian English accents: Forensic UKPHS

This section concerns the confusion patterns of Nigerian and non-Nigerian English accents by the UKPHS. The following bullet point summaries are drawn from Table 9.7 and Fig 9.10.

- Hausa-English was mainly confused with Kanuri-English and occasionally with non-Nigerian English, but was neither confused with Igbo-English nor Yoruba-English.
- The UKPHS mainly confused Kanuri-English with Igbo-English or Hausa-English.
- While none of the UKPHS misidentified any of the Yoruba-English stimuli.
- Non-Nigerian-English was only confused with Igbo-English.

Table 9.7: Confusion of Nigerian and Non-Nigerian English Accents: Forensic UKPHS

Variety	Hausa	Igbo	Kanuri	Yoruba	Non-Nigerian	% Correct	Total
Hausa	65%	0%	25%	0%	10%	65%	20
Igbo	5%	20%	25%	20%	30%	20%	20
Kanuri	15%	20%	50%	5%	10%	50%	20
Yoruba	0%	0%	0%	100%	0%	100%	20
Non-Nigerian	0%	20%	0%	0%	30%	60%	10

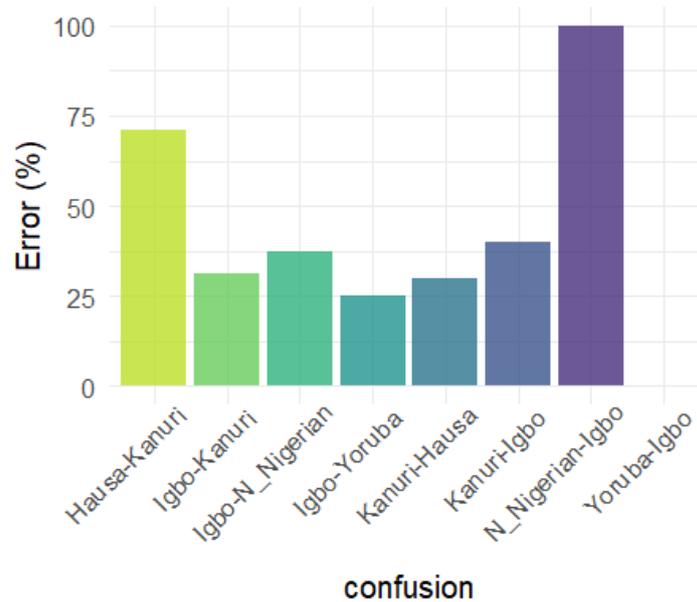


Figure 9.10: Confusion of Nigerian and Non-Nigerian English Accents: Forensic UKPHS

9.2.6.2 Confusion of Nigerian and Non-Nigerian English Accents: Non-Forensic UKPHS

Table 9.8 presents the isolated confusions of the Nigerian and non-Nigerian English accents by the non-forensic UKPHS. Except for confusing non-Nigerian English with Hausa-English, all the four Nigerian English accents and the non-Nigerian English foils were occasionally or mainly confused with one another.

The following bullet point summaries are drawn from Table 9.8 and Fig 9.11.

- Hausa-English was mainly confused with Kanuri-English and vice versa.
- Igbo-English was mainly confused with Kanuri-English and occasionally with non-Nigerian foil or Yoruba-English.
- Yoruba-English was mainly confused with non-Nigerian- or Kanuri-English.
- Non-Nigerian- was mostly confused with Igbo-English.

Table 9.8: Confusion of Nigerian and Non-Nigerian English Accents: Non-Forensic UKPHS

Variety	Hausa	Igbo	Kanuri	Yoruba	Non-Nigerian	% Correct	Total
Hausa	50%	6.2%	25%	12.5%	6.2%	50%	32
Igbo	6.2%	40.6%	21.8%	15.6%	15.6%	40.6%	32
Kanuri	18.7%	12.5%	50%	9%	9%	50%	32
Yoruba	3%	3%	6.2%	78%	9%	78%	32
Non-Nigerian	0%	62.5%	18.7%	6.25	12.5	12.5%	16

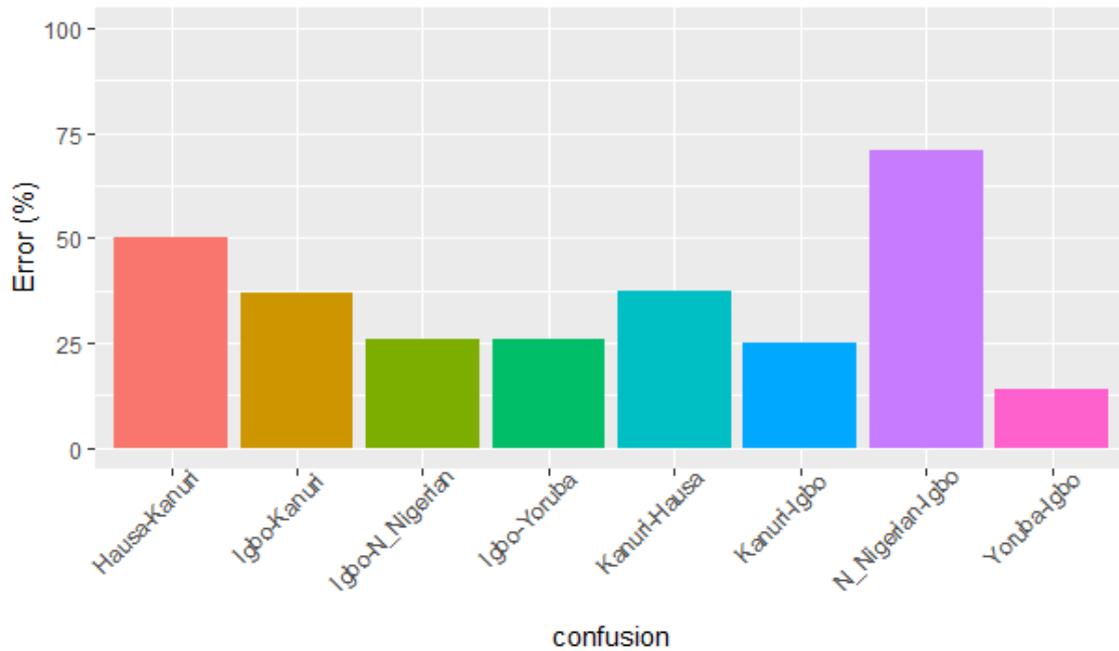


Figure 9.11: Confusion of Nigerian and Non-Nigerian English Accents: Non-Forensic UKPHS

9.2.7 Comparison of Confusing Nigerian and Non-Nigerian English Accents

This sub-section compares the above confusions of Nigerian English accents by the forensic and non-forensic UKPHS.

The following bullet point summaries are drawn from Fig 9.12.

- Forensic UKPHS confused Hausa-English with either Kanuri-English or non-Nigerian foils.
- Academic non-forensic UKPHS confused Hausa-English with all other four accents.
- Forensic UKPHS confused Igbo-English more with non-Nigerian- than Kanuri-English.
- Non-forensic UKPHS mainly confused Igbo-English with Kanuri-English.
- Forensic UKPHS confused Kanuri-English more with Igbo-English.
- Non-forensic UKPHS mainly confused Kanuri-English with Hausa-English.
- None of the forensic UKPHS misidentified any of the Yoruba-English stimuli.
- Non-forensic UKPHS mainly confused Yoruba-English with non-Nigerian foils, and occasionally with all other three accents.

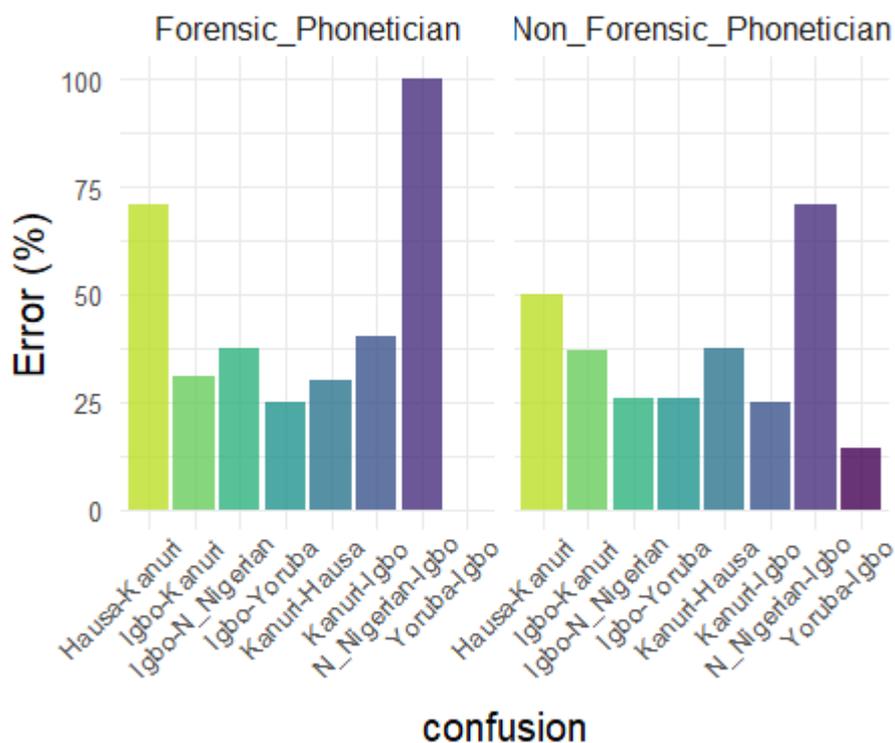


Figure 9. 12: Confusing Nigerian and Non-Nigerian English Accents: Forensic UKPHS versus Non-Forensic UKPHS

9.2.8 Classification of Errors in Classifying the Nigerian English Accents

9.2.8.1 False rejection

False rejection is observed when a respondent listens to a speaker belonging to his native L1, but he fails to identify the L1 of the speaker and confuses it with another L1. Table 9.9 and Fig 9.13 show that Igbo-English is most likely to be misidentified among the four stimuli, while Yoruba-English is least likely to be misidentified by the UKPHS.

Table 9.9: False negative errors (misses) of the four groups: UKPHS

UK Phoneticians	Hausa	Igbo	Kanuri	Yoruba
	44%	67%	50%	13%

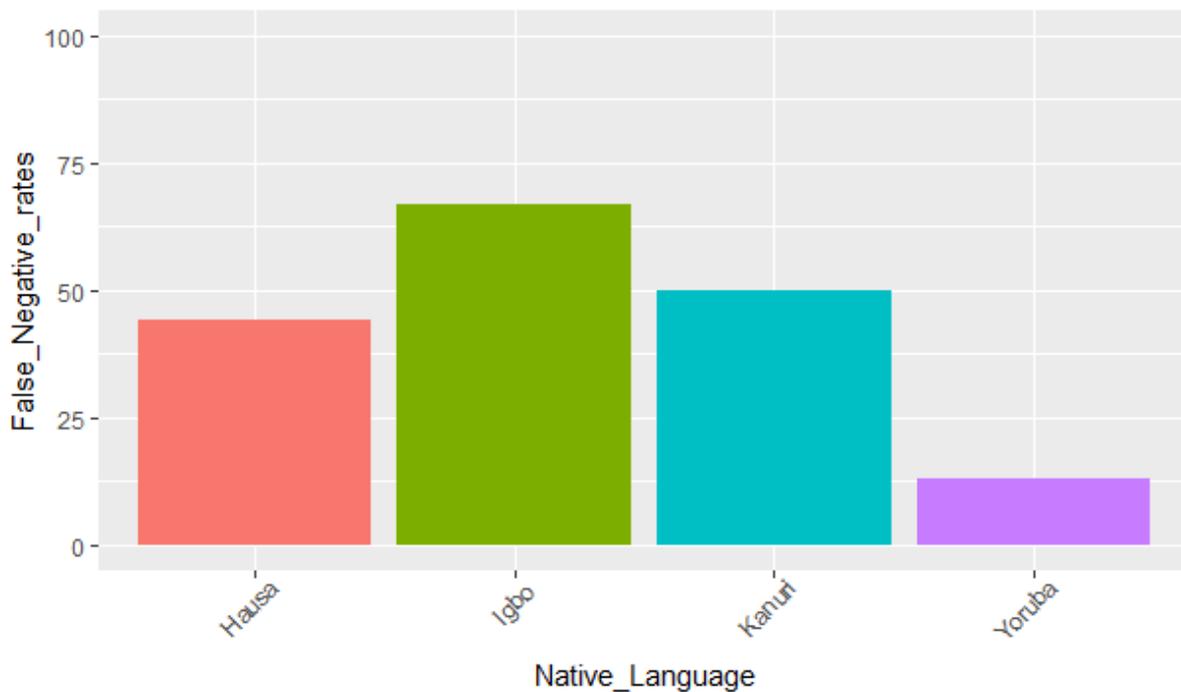


Figure 9. 13: False negative errors (misses) of the four groups: UKPHS

9.2.8.2 False acceptance

False acceptance is observed when a listener listens to a speaker belonging to another L1 but identifies him as a member of his (the listener's) L1. For example, a Hausa listener listened to, say, a Kanuri-English stimulus, and said it is a Hausa-English stimulus. Table 9.10 and Fig 9.11 indicate that the UKPHS were most likely to misidentify Kanuri-English stimuli and non-Nigerian English foils as Igbo-English (false positive), while Hausa-English, Igbo-English and Kanuri-English were least likely to be misidentified as Yoruba-English. Most of the Hausa false-positive errors were from Kanuri-English, while the Kanuri-English false-positive errors were from Hausa-English and Igbo-English.

Table 9.10: False positive errors of the four L1 groups: UKPHS

UK Phoneticians	Hausa	Igbo	Kanuri	Yoruba
	13%	29%	25%	11.5%

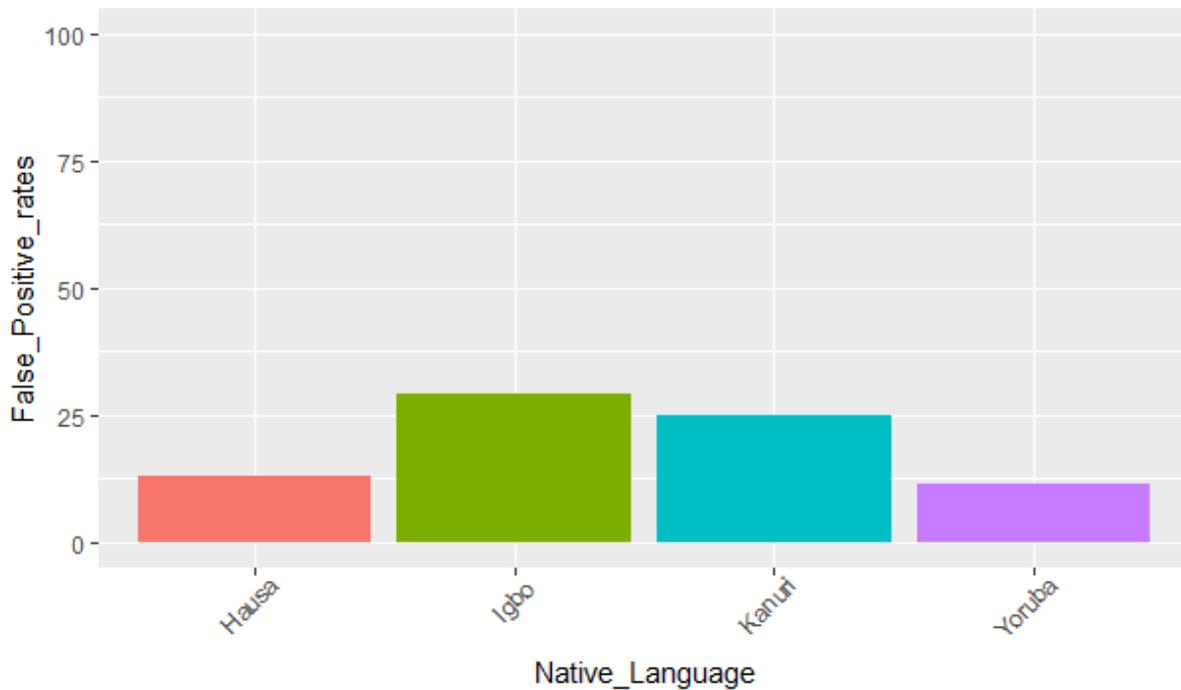


Figure 9.14: False positive errors of the four L1 groups: UKPHS

9.3 Summary and Conclusion

The UKPHS, regardless of whether they are forensic UKPHS, were much more accurate in identifying Yoruba-English compared to all other accents. Comparison of false rejection and false acceptance showed that all UKPHS had more false rejection than false acceptance, perhaps indicating a high degree of caution. All the four Nigerian English accents and the two non-Nigerian foils were confused with other accents. Five major confusion types have been identified: Hausa-Kanuri, Igbo-Kanuri, Kanuri-Igbo and Igbo-non-Nigerian, non-Nigerian-Igbo, and Kanuri-Hausa as well as or Yoruba-non-Nigerian.

The implication of this result for LAAP (language analysis in the asylum procedure) is that the UKPHS are more likely to reject true asylum seekers who truly stated their original place of socialisation. On the other hand, having a lower false acceptance rate suggests that the UKPHS may be less likely to accept false asylum seekers, who falsely claimed to originate from a country or region that is engulfed by humanitarian crises.

This chapter is the third and last human experiment chapter. The next chapter concerns the performance of the automatic accent recognition system (Y-ACCDIST) in classifying the Nigerian English accents.

Chapter 10

Experiment 4: Y-ACCDIST

10.0 Introduction

This chapter presents the performance of Y-ACCDIST in classifying the four Nigerian English accents. It consists of Y-ACCDIST's overall accuracy, isolated accuracies of identifying the four English accents and Y-ACCDIST's patterns of confusing the four Nigerian English accents. It also provides a heat map showing significant phonemes that determined the identification of each of the four Nigerian English accents. The last section provides a summary and conclusion of the whole chapter.

Y-ACCDIST's data is presented in two phases: Data 1 results and Data 2 results. The number of stimuli presented to Y-ACCDIST was different from that of the three human listeners. Sixty stimuli were used in the Y-ACCDIST experiment compared to 16 used in the human experiments. Data 1 result section concerns the presentation and analysis of the results generated from the classification of all 60 stimuli.

The 16 samples initially classified by the three human listener participants were among the 60 stimuli classified by Y-ACCDIST. For a balanced statistical comparison of Y-ACCDIST performance with the human listeners' performance, the results of the 16 stimuli were extracted from the Y-ACCDIST big data (with 60 stimuli) and presented separately. Thus, the Data 2 result section concerns the presentation and analysis of the performance of Y-ACCDIST in classifying such 16 stimuli. The statistical significance testing of Y-ACCDIST performance against the human listener performance was carried out using the 16 samples (not the initial 60 samples of data 1). Y-ACCDIST's performance can only be tested against the human listeners' performance if both groups had the same sample size.

10.1 Method

The method of this experiment differs from the methods of the three human experiments above. The four Nigerian English accents were analysed by Y-ACCDIST (an accent recognition system), which was designed by Brown (2014). Thus, there were no human participants in this section but only Georgina Brown operating the software for the classification task.

10.1.1 Stimuli

The stimuli were audio recordings of 60 speakers of the four accents of Nigerian English. Each of the accents was represented by 15 speech samples in the task. These stimuli were selected from the recordings of Hausa-English, Igbo-English, Kanuri-English and Yoruba-English. For this experiment, only two reading excerpts—The North Wind and the Sun and the Rainbow Passage—were used.

10.1.2 Procedure

As the experiment presented here is based on Y-ACCDIST, neither Qualtrics nor questionnaire was used, and a confidence rating scale was not attached to the stimuli. The two reading excerpts were split into single utterances (sentences). These comprised 19 sentences from the Rainbow passage and 5 sentences from the North Wind and the Sun. Four new folders were first created for each of the accent groups. Within each of these four accent folders, 15 folders of the 15 participants were created. Within each of the 15 participant folders, a folder (named sound_file) was created to contain all the individual .wav audio files of all the individual sentences in both reading excerpts.

10.1.3 Modelling

a. Forced alignment. For every speaker in each of the four accent groups, their spoken individual sentences (of the North Wind and the Sun and the Rainbow passages) were force-aligned, using (Brown's aligner that was constructed using the Hidden Markov Model Toolkit, HTK), and an American English pronunciation dictionary. Phonemic transcription of the sentences was carried out after forced alignment.

b. Construction of Y-ACCDIST matrices for the speakers of the four accents. After aligning all the samples, Mel-Frequency Cepstral Coefficients (MFCC) of each of the vowels and consonants in every sample were extracted. An average MFCC vector was calculated by concatenating all MFCC of the vowel sounds (belonging to the same vowel phoneme) to represent every vowel phoneme in the inventory. These MFCC vectors (representing each vowel phoneme) were lined up in a matrix to contain all possible vowel pairs. The Euclidean distance between each pair of phonemes was then calculated to determine the degree of similarity between them (Brown, 2017, p. 426-7). The differences arising from such distances within vowel pairs distinguish a speaker of one accent from others. An averaged value representing each accent is calculated from Y-ACCDIST matrices of all speakers of the accent. Brown and Wormald (2017) observed that consonants were not included in the modelling process of past systems such as Huckvale (2004; 2007), Hanani et al. (2003) and Brown (2015). They argued that, in addition to the role of vowels in accents characterisation, consonants too have the potential for having distinctive features that can be used to classify accents. Thus, consonants in every sample were considered in the analysis.

10.1.4 Classification

Using Y-ACCDIST-Correlation, Y-ACCDIST was trained to classify the 60 speakers of the four Nigerian English accents according to their linguistic backgrounds (Brown and Wormald, 2017, p. 427). This was done based on a leave-one-out cross-validation setup. Thus, each speaker in the corpus (comprising all the 60 participants of the four accent groups) was once both a training and a test

speaker on rotation. On every rotation, 1 speech sample was removed to serve as a test sample, while the Y-ACCDIST system was trained using all the other 59 speech samples.

Average Y-ACCDIST matrices are generated to serve as a reference for each of the four accents in the corpus. The mean of each of the Y-ACCDIST matrix elements across all speaker matrices in each of the accent classes is calculated. For classifying a test speaker, the speech sample, along with transcription, was converted into a Y-ACCDIST matrix as described above. Using correlation measure, the degree of similarity between the test matrix and each of the reference matrices was determined. Pearson r product-moment correlation between the test matrix and each of the averaged reference matrices of the four accents was calculated. 'The unknown (test) matrix is assigned the same accent label as the reference matrix with which it generates the highest correlation value' (Brown and Wormald, 2017, p. 427). The process of Y-ACCDIST-Correlation is shown in Fig 10.1.

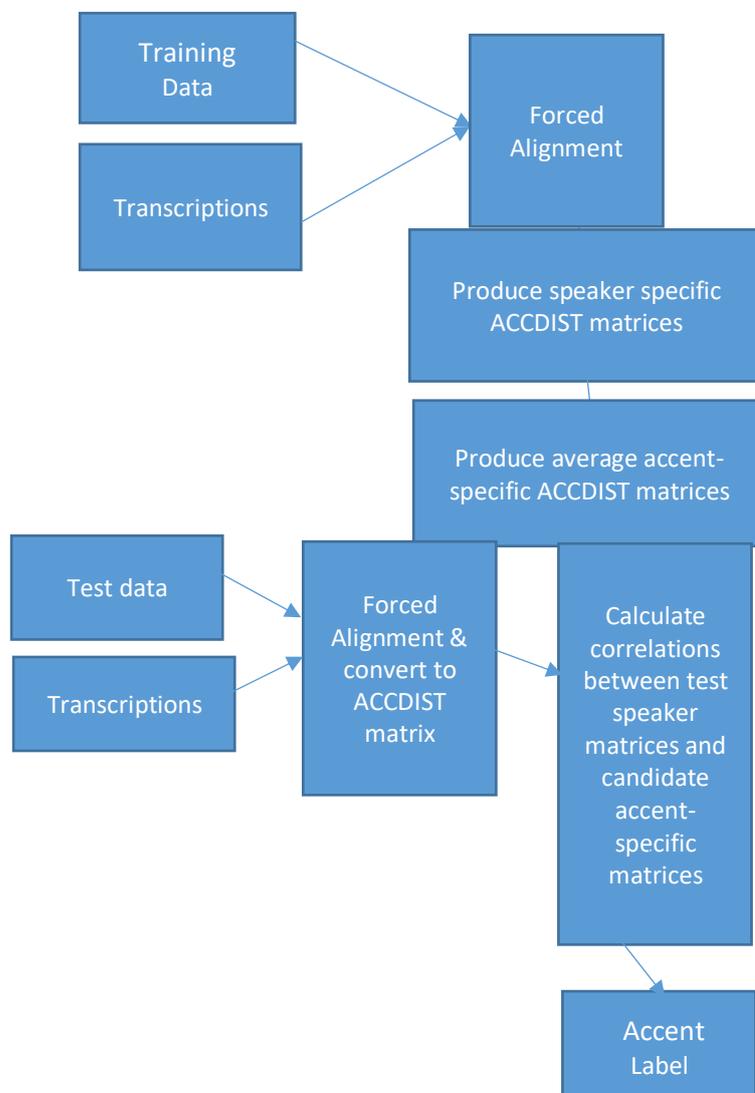


Figure 10.1: Flow Diagram of Y-ACCDIST Correlation System. (Adapted from Brown, 2016)

10.2 Data 1 Results

This section concerns presentation and analysis of the Y-ACCDIST performance in classifying all 60 stimuli of the four Nigerian English accents. The data represent an accumulated score over multiple runs of the classification. The performance of Y-ACCDIST is analysed relative to the chance level. There were four Nigerian English accents in the categorisation task. The chance level is therefore 25%.

10.2.1 Descriptive statistics of the Y-ACCDIST performance

The overall results indicate that Y-ACCDIST was 61.7% (37/60) accurate at classifying the four varieties of Nigerian English. The two foils were not included in the Y-ACCDIST classification. Table 10.1 and Fig 10.2 below show the accuracy of Y-ACCDIST in identifying each of the four Nigerian English accents in isolation. The findings showed that the Yoruba-English was most correctly identified by Y-ACCDIST. While Kanuri was the second easiest accent to identify, the Igbo-English accent was the most challenging to identify.

Table 10.1: Y-ACCDIST's Accuracy of the four Nigerian English accents' stimuli

	Hausa	Igbo	Kanuri	Yoruba
Y-ACCDIST	60% (9/15)	33.3% (5/15)	73%% (11/15)	80% (12/15)

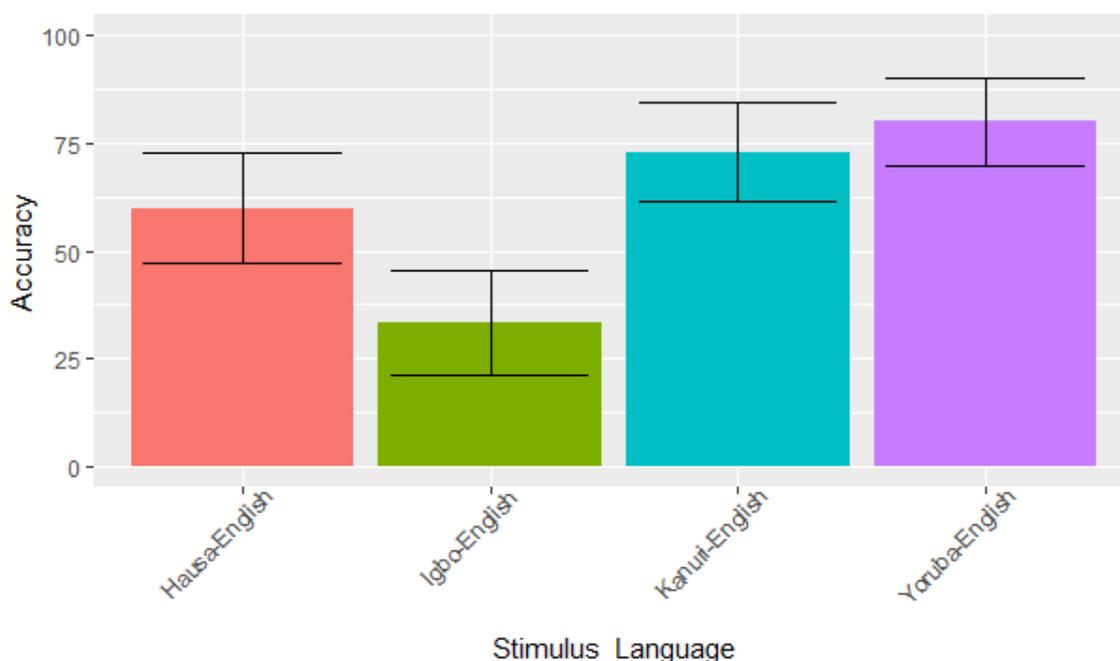


Figure 10.2: Y-ACCDIST's Accuracy of each of the four Nigerian English Accents

10.3 Data 2 Results

To have a balanced statistical comparison of Y-ACCDIST performance with human listeners' performance, the results of this section were generated using the same 16 stimuli that were used for human classification (each accent represented by 4 samples). The 16 samples were part of the 60 samples initially classified by Y-ACCDIST, as shown above. The results of the second data are also analysed relative to the 25% chance level, as there were four accent groups in the classification task.

10.3.1 Descriptive Statistics of the Y-ACCDIST Performance

The overall results in the second data indicate that Y-ACCDIST was 56% (9/16) accurate at classifying the four varieties of Nigerian English. This overall accuracy is 5.7% lower than that of the first data. Table 10.3 and Fig 10.4 below show the accuracy of Y-ACCDIST in identifying each of the Nigerian English accents in isolation. As in the first data, the results for the second data also showed that the Yoruba-English was most correctly identified by Y-ACCDIST with a 75% success rate.

Table 10.2: Y-ACCDIST's Accuracy of Classifying the Four Nigerian English Accents

Y-ACCDIST	Hausa	Igbo	Kanuri	Yoruba
	50% (2/4)	50% (2/4)	50% (2/4)	75% (3/4)

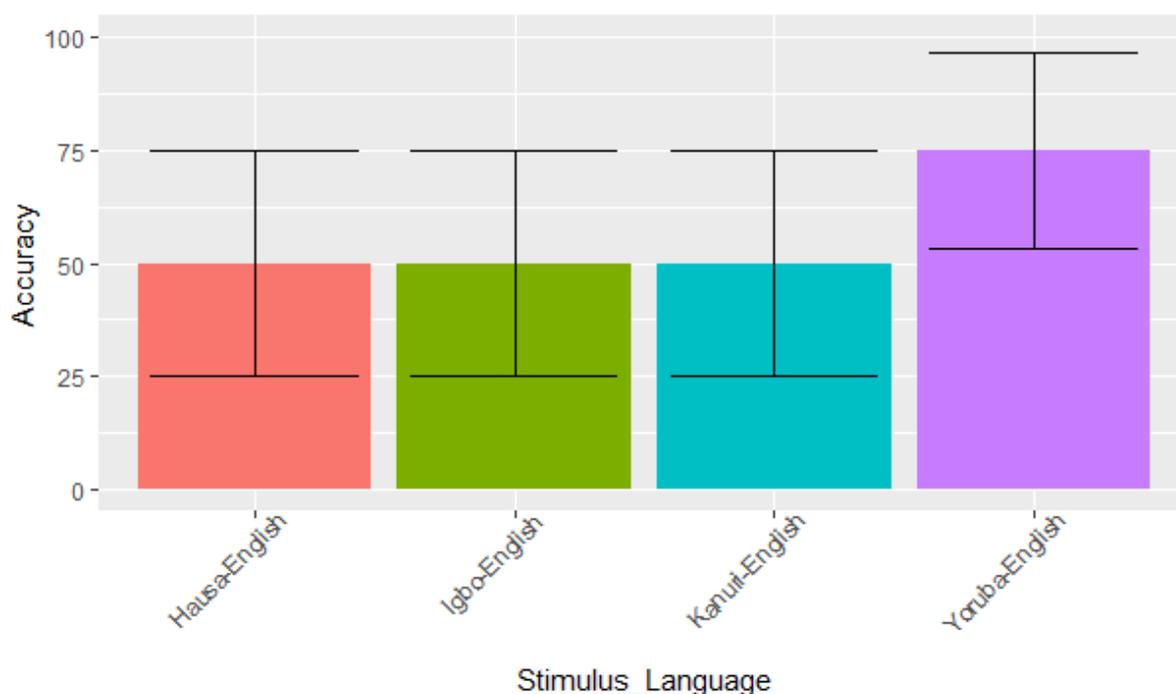


Figure 10.3: Y-ACCDIST's Accuracy of each of the four Nigerian English Accents: Data 2

10.4 Statistical significance testing

To test the statistical significance of the relevant variables, Y-ACCDIST responses were analysed using a logistic mixed-effects model using the lme4 R package (RStudio, 2020). With a binary dependent variable (1= correct, 0 = incorrect). The model included a fixed effect of “Y-ACCDIST” and a random intercept for participant. Y-ACCDIST effect had two levels: whether the participant is Y-ACCDIST (the performance of the automatic accent recognition system) or human listeners. Given that Y-ACCDIST had the highest overall success rate (with the exception of the Hausa linguist group) against all other human group performance, the expectation is for Y-ACCDIST accuracy to reach significance. However, there was not a significant difference between Y-ACCDIST and human listeners’ performance ($\beta_{y-accdist} = 0.10, p > 0.73$).

10.5 Confusion of Nigerian English Accents: data 1

Table 10.2 below presents the Y-ACCDIST’s classification of the four Nigerian accents. It also includes Y-ACCDIST’s confusion of the accents. The main confusions are shown in Fig 10.3. Each of the four accents had 15 stimuli in the classification task. Some of the speech samples were confused by Y-ACCDIST. The following bullet point summaries have been extracted from Table 10.2.

- Hausa-English was more confused with Igbo-English than Kanuri-English.
- Igbo-English was more confused with Hausa-English than Yoruba-English.
- Kanuri-English was mainly confused with Hausa-English.
- Yoruba-English was only confused with Igbo-English.
- Four Kanuri-English stimuli were misidentified, and three of them were confused with Hausa-English.
- Yoruba-English was only confused with Igbo-English.

Table 10.3: Y-ACCDIST Confusion Matrix of Nigerian English Accents

Variety	Hausa	Igbo	Kanuri	Yoruba	% Correct	Total
Hausa	60%	26.6%	13.3%	_____	60%	15
Igbo	40%	33.3%	6.6%	20%	33.3%	15
Kanuri	20%	6.6%	73.3%	_____	73.3%	15
Yoruba	_____	20%	_____	80%	80%	15

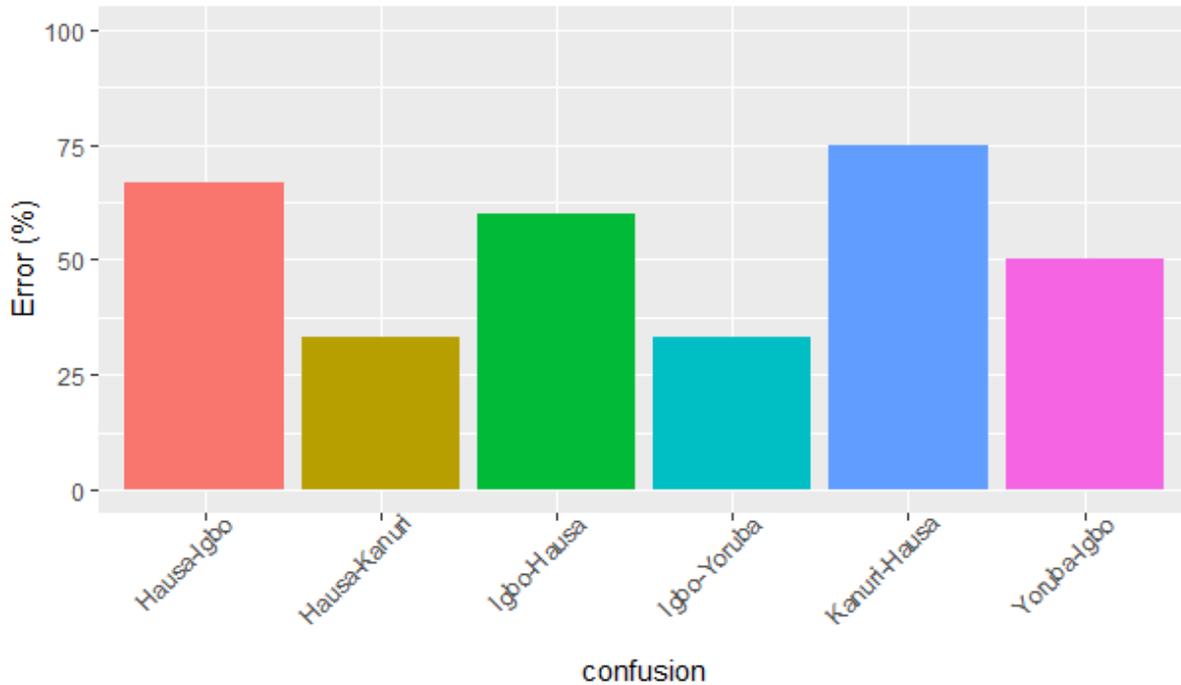


Figure 10.4: Y-ACCDIST's Confusion of Nigerian English Accents: Data 1

10.6. Confusion of Nigerian English Accents: Data 2

Table 10.4 presents Y-ACCDIST's classification of the four Nigerian accents. It also includes Y-ACCDIST's confusions of the accents, as also shown in Fig 10.5. Some of the speech samples were confused by Y-ACCDIST. Contrary to the confusion of the 60 samples in the first data, the direction of confusing the accents is restricted to only one in the second data. The following bullet point summaries are extracted from Table 10.4.

- Hausa-English was only confused with Igbo-English and vice versa.
- Kanuri-English was only confused with Hausa-English.
- Yoruba-English was only once confused with Igbo-English.

Table 10.4: Y-ACCDIST confusion matrix of Nigerian English Accents

Variety	Hausa	Igbo	Kanuri	Yoruba	% Correct	Total
Hausa	50%	50%	_____	_____	50%	4
Igbo	50%	50%	_____	_____	50%	4
Kanuri	50%	___	50%	_____	50%	4
Yoruba	___	25%	_____	75%	75%	4

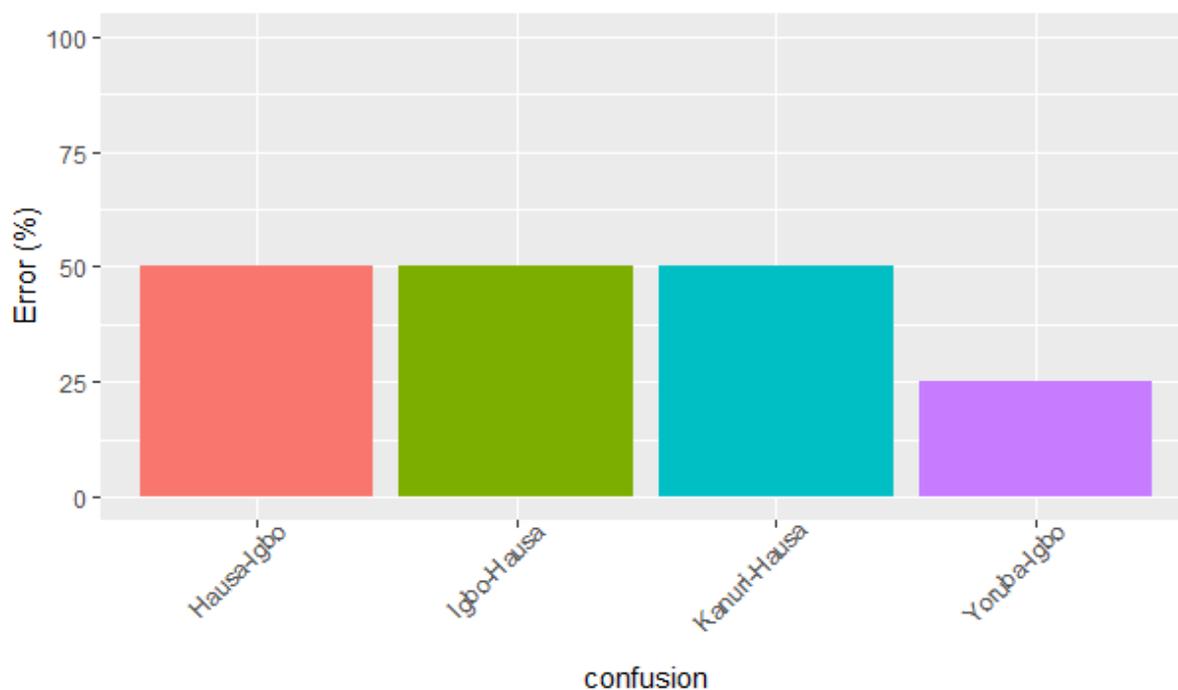


Figure 10.5: Y-ACCDIST's Confusion of Nigerian English Accents: Data 2

10.7 Feature selection

Feature selection is used to identify the most significant segments in discriminating language varieties in a classification task. Brown & Wormald (2017) argued that features that do not significantly contribute towards separating one accent from another could cause 'noise to the analysis' if included in the speech samples in question, and this could result in decreasing recognition rates by automatic accent recognition systems.

Rather than making potentially unreliable assumptions on which segments are the most invaluable for use in classifying accents, the feature selection method includes all available segments in all accents' samples being classified—both consonants and vowels—for the recognition system to specify pair combinations that are highly likely to be reliable diagnostic features for subsequent categorisation of accents. To compare initial impressionistic and acoustic findings regarding diagnostic features that can be used to distinguish between the accents in question, the feature selection method was employed after Y-ACCDIST classification, as explained in the following paragraph.

In order to distinguish between features that are the most significant in distinguishing accents from those that have less value, all segments that are available across samples of all accents in the categorisation task are ranked according to their significance or non-significance. This is to establish a strong diagnostic/distinctive matrix for each accent that is distinguishable from other accents. ANOVA was used to test the significance or non-significance of each of the matrix elements that were initially extracted in Y-ACCDIST. The outcome of the significance testing using ANOVA are the p-values

generated for each matrix element, and such values are finally represented in the heat map in Fig 10.6. Dark cells are usually indicative of high ranking obtained by a matrix element in the heat map. The matrix element that generated significant p-values is considered to have the potential of distinguishing between accents. As shown in Fig 10.6, two consonants and two vowels had the darkest shading in both columns and rows: /t, f, i:, ʌ/. Thus, they are considered the most significant and distinctive segments in distinguishing between the four Nigerian English accents. As presented in Brown and Wormald (2017), a mapping of the consonant and vowels phonemes in question and their equivalent IPA symbols are given in Tables 10.5 and 10.6.

Having identified such two consonants and two vowels for playing a significant role in Y-ACCDIST classification of the Nigerian English accents, the next paragraph compares the impressionistic features (initially given to the UK phoneticians); the segments given by human listeners as being the basis for their identification of each of the accents; as well as acoustic analysis of similarities and differences of such sounds undertaken by the researcher.

The consonant phoneme /t/ was ranked highly significant in the outcome of feature selection for Y-ACCDIST classification. However, neither the initial sociophonetic analysis by the researcher nor the post-listening impressions of the human listeners identified the consonant as distinctive in distinguishing between the accents. Thus, this finding of Y-ACCDIST does not corroborate either the sociophonetic or the human listeners' impressionistic analysis.

The consonant phoneme /f/ was also ranked a highly distinctive segment in the outcome of feature selection. Interestingly, this corroborates both the sociophonetic findings and the post-listening impressions of the human listeners. The consonant was already included as one of the distinctive features in the matrices of distinctive features for distinguishing between the four Nigerian English accents. In order to be familiar with the features of each of the accents in the classification task, the matrices were given to the UK-based phoneticians in advance of their participation in the experiment. Most of the UK-based phoneticians and Nigerian listeners, both linguists and non-linguists had mentioned the consonant /f/ as a distinctive feature for distinguishing between the accents.

The matrices too had already mentioned that Igbo-English and Yoruba-English speakers realised the consonant as its native English form [f], while it is variably realised by the Hausa-English and the Kanuri-English speakers respectively. It is mainly realised as the voiceless bilabial fricative [ɸ] syllable-initially in both Hausa-English and Kanuri-English, while it is mainly realised as the voiceless bilabial plosive [p] word- or syllable-finally in Kanuri-English. It is also realised as the voiceless bilabial plosive [p] syllable-initially by some of the Hausa-English speakers.

The long monophthong /i:/ was the most highly ranked distinctive vowel in the feature selection. Identifying it as having such a quality had already been done previously, as the outcome of

the sociophonetic research shows (see the feature matrices in Appendix B). The duration quality was mentioned as a means of distinguishing Hausa-English from Kanuri-English and Igbo-English from Yoruba-English. The vowel retained its original long-form in Igbo-English, while it is mostly shortened in both Kanuri-English and Yoruba-English. For Hausa-English, its realisation fluctuates between the long and short forms. The identification of this vowel as significant by ANOVA is therefore a further validation of the initial stance of the researcher.

The STRUT monophthong /ʌ/ was found to be significantly distinctive in distinguishing between the Nigerian English accents. This also confirms the initial finding of the researcher as shown in the feature matrices of the accents in question. While impressionistic findings suggest a similar realisation of the vowel in both Igbo-English and Yoruba-English, its realisation varies in Hausa-English and Kanuri-English. The vowel is mostly realised as [ɔ] in both Igbo-English and Yoruba-English, while it is variably realised as [ɔ], [a] or [ʌ] in Hausa-English and Kanuri-English.

However, a few more segments that were considered as features for distinguishing between the accents were not highly ranked in the feature selection. For example, the glottal fricative /h/ plays a significant role in distinguishing the Yoruba-English accent from other accents. The consonant is always deleted or realised before a vowel in Yoruba-English. Most of the human listeners' identifications of Yoruba-English stimuli were based on the elision or epenthesis of the consonant. Despite its role, it may likely not be a relevant feature in Y-ACCDIST analysis of similar classification tasks. It can be argued that the consonant was not significantly ranked due to its restriction to only one of the four accents in the classification task (i.e., Yoruba-English only). This suggests that the feature selection method considers features that are available and also have different realisations across most of the accents (if not all accents) in the classification task.

As stated above, dark blue cells in Fig 10.6 are usually indicative of high ranking obtained by a matrix element in the heat map, and this means segments with dark cells are significant for distinguishing between the accents compared. For example, /t/ is one of the segments that had the darkest blue shading in both columns and rows. To express all the possible phoneme-pair combinations, phoneme labels occur on both the x-axis and y-axis. Only the lower triangle of the matrix is shown to avoid duplicating phoneme-pair values. The matrix has been set up to simply capture all the phoneme-pair combinations possible. Both the rows and columns can be used in equal measure to observe specific phonemes of interest.

Relative to other segments shown in the heatmap, /t/ separates the accents in comparison (in the dataset) more than the other segments such as /z/ and /n/ which had light blue cells. The distance between /t/ and other segments is varied enough among the four Nigerian English accents compared, and this resulted in assigning different labels for each of the four accents. For illustration, the horizontal phoneme /z/ cell that connects to vertical /t/ appears in light blue colour, and it may have

unstable realisation that cannot be used to distinguish the accents. This light blue cell shows no similarity with /t/. It might mean the helpful realisation cannot be expressed when combined with /z/ in the same pair.

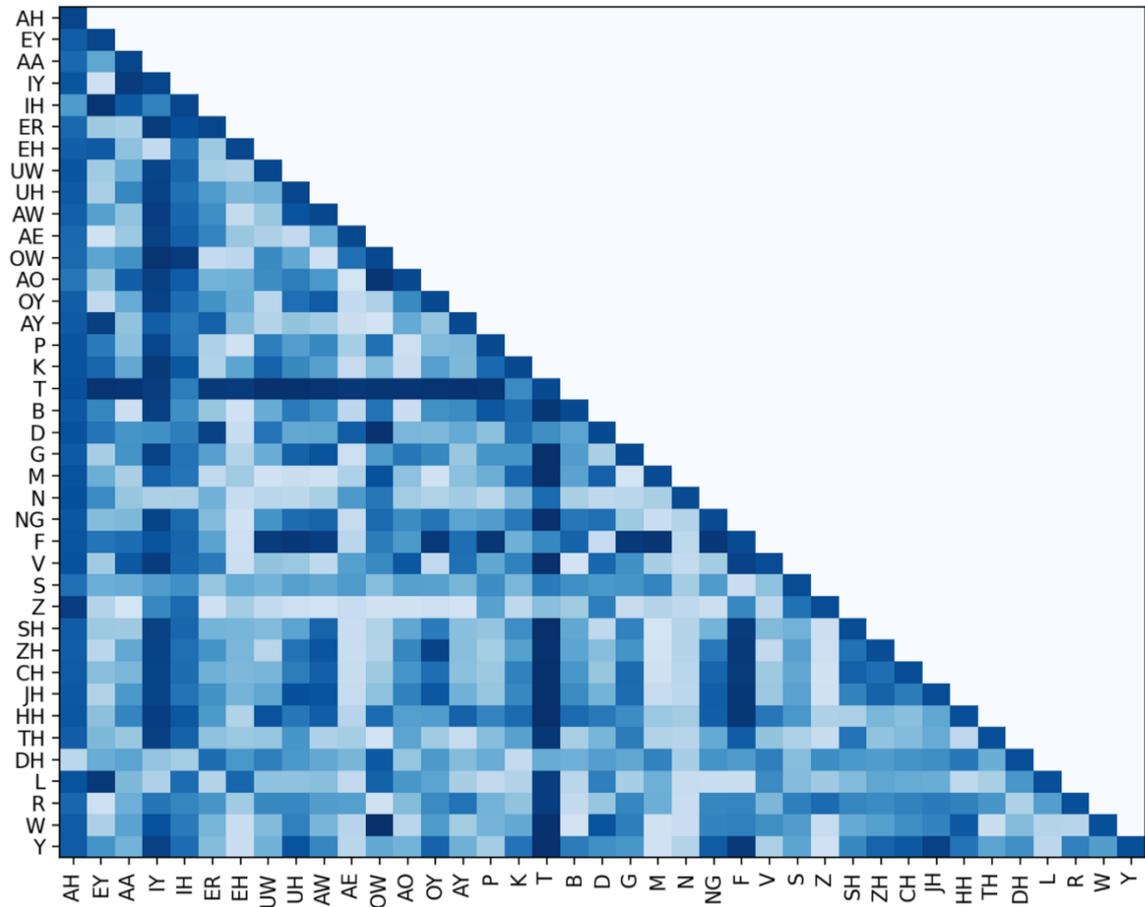


Figure 10.6: Resultant Heat map after performing ANOVA-based feature selection on Y-ACCDIST matrices.

Table 10.5: Mapping of IPA symbols to the consonant symbols used in Fig 6.

IPA symbols	Symbols
/p/	{p}
/b/	{b}
/t/	{t}
/d/	{d}
/k/	{k}
/g/	{g}
/m/	{m}
/n/	{n}
/ŋ/	{ng}
/f/	{f}
/v/	{v}
/θ/	{th}
/ð/	{dh}
/s/	{s}
/z/	{z}
/ʃ/	{sh}
/ʒ/	{zh}
/tʃ/	{ch}
/dʒ/	{jh}
/j/	{y}
/w/	{w}
/l/	{l}
/ɹ/	{r}
/h/	{hh}

Table 10.6: Mapping of IPA symbols to the vowel symbols used in Fig 6 along with their corresponding keyword from Wells (1982).

IPA Symbol	Symbol	Keyword
/ɜ:/	{er}	NURSE
/æ/	{æ}	LOT
/eɪ/	{ey}	FACE
/u:/	{uw}	GOOSE
/ɔ/	{ao}	THOUGHT/NORTH
/i:/	{iy}	FLEECE
/əʊ/	{ow}	GOAT
/ʌ/	{ah}	STRUT
/ɪ/	{ih}	KIT
/e/	{eh}	DRESS
/aɪ/	{ay}	PRICE
/ɑ:/	{aa}	BATH/PALM
/ɔɪ/	{oy}	CHOICE
/aʊ/	{aw}	MOUTH
/ʊ/	{uh}	FOOT

10.8 Summary and Conclusion

Yoruba-English was the most accurately identified accent compared to all other three accents by Y-ACCDIST. Neither Hausa-English nor Kanuri-English was confused with Yoruba-English. Yoruba-English was only confused with Igbo-English. Igbo-English was mainly confused with Hausa-English and occasionally with Yoruba-English.

Reducing the sample size from 60 to 16 has slightly decreased the success rate of Y-ACCDIST. Three of the four accents have had their accuracy decreased, while the accuracy of Igbo-English has risen by 17% (33%-50%). As the chance level is 25%, the overall accuracy of 56% is well above chance. Similarly, isolated accuracy of identifying each of the accents is two times above chance, while it is even three times above chance for Yoruba-English identification.

On the other hand, the decreased sample size has also affected the direction of confusing the accents by the system. Contrary to the confusions of the 60 samples observed, each of the accent groups was only confused with other accents. This suggests that Y-ACCDIST's accuracy is likely to rise if there are many speech samples for a classification task. Considering the real forensic scenario, especially LAAP, securing large samples is not guaranteed in most cases.

Since (unlike Y-ACCDIST's analysis) neither the initial sociophonetic analysis by the researcher nor the post-listening impressions of the human listeners identified the /t/ consonant as distinctive in distinguishing between the accents, in future research it would be worth revisiting the data to at least check whether what Y-ACCDIST is claiming can also be confirmed on a more careful acoustic and impressionistic accounts.

Having presented the performance of Y-ACCDIST (the fourth and last experiment), the next chapter compares the performance of all the four methods (the previous three human groups and Y-ACCDIST).

Chapter 11

Comparison of relative performance levels of the four experiments

11.0 Introduction

This chapter compares the performance of the NNLS, NLS, UKPH and Y-ACCDIST. It provides the overall accuracy of the performance of each of the four groups in classifying the four Nigerian English accents. As the two non-Nigerian English foils were not included in the Y-ACCDIST' classification, it only provides the accuracy of each of the three human groups in correctly rejecting the non-Nigerian English foils. There were 118 participants in the three human groups: untrained Nigerian native speakers = 80, linguist Nigerian native speakers = 25, UK-based phoneticians= 13. In addition to these human participants, Y-ACCDIST (an accent recognition system designed by Brown, 2014), was employed in the classification. As previously mentioned in the individual chapters of the findings, the three major human groups and eight sub-groups of Nigerian participants are abbreviated in this chapter as follows:

1. Nigeria non-linguists (NNLS)
2. Nigerian linguists: (NLS)
3. UK-based phoneticians: (UKPHS)
4. Hausa non-linguists: (Hausa NNLS)
5. Hausa linguists (Hausa NLS)
6. Igbo non-linguists (Igbo NNLS)
7. Igbo linguists (Igbo NLS)
8. Kanuri non-linguists (Kanuri NNLS)
9. Kanuri linguists (Kanuri NLS)
10. Yoruba non-linguists (Yoruba NNLS)
11. Yoruba linguists (Yoruba NLS)

11.1 Comparison of Overall Accuracies of the four methods: NNLS, NLS, UKPH and Y-ACCDIST

The overall results in Table 11.1 and Fig 11.1 below show that Y-ACCDIST outperformed all the three human listener groups in identifying the four accents of Nigerian English.

Table 11.1: Overall accuracy of NNLS, NLS, UKPHS and Y-ACCDIST

	NIGERIAN L1s Only	NIGERIANS & NON-NIGERIANS L1S
Native Speaker Non-Linguists [80]	52.96% (678/1280)	49.37% (711/1440)
Native Speaker Linguists [25]	58.00% (232/400)	54.66% (246/450)
UK Phoneticians [13]	56.25% (117/208)	53.41% (125/234)
Y-ACCDIST	61.7% (37/60)	

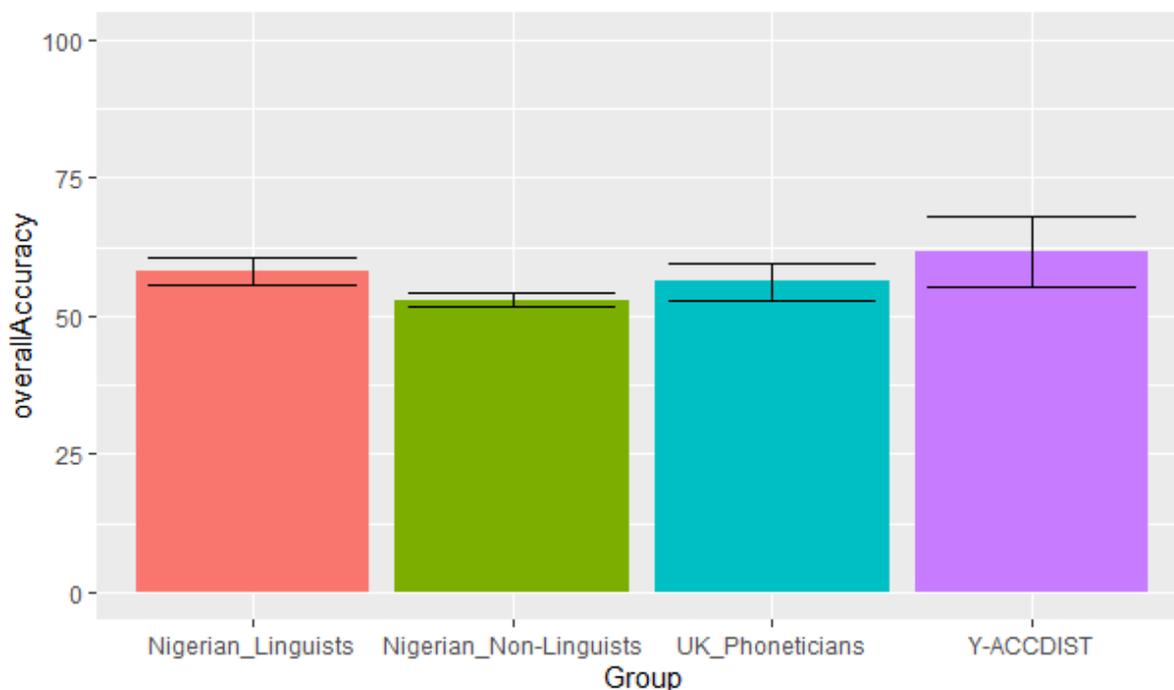


Figure 11.1: Overall accuracy of NNLS, NLS, UKPHS and Y-ACCDIST

The following bullet point summaries are drawn from Table 11.1 and Fig 11.1 above.

- There is not a significant difference between the accuracy of the NLS and Y-ACCDIST groups, albeit Y-ACCDIST slightly outperformed NLS.
- Overall, the NLS (including phoneticians) outperformed the NNLS.
- NLS were 54.66% accurate, while the NNLS were 49.37% accurate only.
- The NLS outperformed the NNLS by 5% only at classifying Nigerian English accents.
- UKPHS slightly outperformed the NNLS.
- Y-ACCDIST, overall, outperformed NNLS by 8%.
- Y-ACCDIST, overall, outperformed the UKPHS by 5%.

11.1.1.1 Accuracies of Classifying of Nigerian-English and Non-Nigerian English Accents: All Four Methods

This sub-section concerns the performance of NNLS, NLS, UKPHS and Y-ACCDIST at classifying each of the five English accents (Nigerian-English and non-Nigerian-English foils). Table 11.2 below shows the accuracy of all participants in each of the four groups at classifying all stimuli of the four Nigerian English accents and non-Nigerian foils. Each of the accent groups' figures consists of the performance of both the L1 speakers of the accent and speakers of other Nigerian L1s. The accuracy of these four groups is different at identifying the accents in isolation.

Table 11.2: Accuracy of classifying all stimuli of Nigerian and Non-Nigerian English accents

	Hausa	Igbo	Kanuri	Yoruba	Non-Nigerian
NNLS	62% (199/320)	57% (178/320)	38% (123/320)	57% (178/320)	21% (33/160)
NLS	74% (74/100)	74% (74/100)	28% (28/100)	56% (56/100)	32% (32/100)
UKPHS	55.8% (29/52)	32.7% (17/52)	50% (26/26)	86.5% (45/52)	30.8% (8/26)
Y-ACCDIST	60% (9/15)	33.3% (5/15)	73% (11/15)	80% (12/15)	NIL

The following bullet point summaries are drawn from Table 11.2.

- Hausa-English is the easiest accent to identify by both NNLS and NLS.
- Igbo-English is the most challenging accent to identify by both UKPHS and Y-ACCDIST.
- Kanuri-English is the most challenging accent to identify by NLS and NNLS.
- Yoruba-English is the easiest to identify by both the UKPHS and Y-ACCDIST.
- NLS and NNLS outperformed the UKPHS and Y-ACCDIST in identifying Hausa-English and Igbo-English accents.
- UKPHS and Y-ACCDIST outperformed NLS and NNLS in identifying Kanuri-English and Yoruba-English.
- Y-ACCDIST outperformed all the other three methods in identifying Kanuri-English with the exception of Kanuri NNLS.
- NLS outperformed the NNLS by about 11% at rejecting the non-Nigerian foils.

11.1.2 Overall Accuracies of Other Nigerian English Accents: NLS, NNLS, UKPH & Y-ACCDIST

This sub-section presents the performance of the four methods in identifying other (non-native) Nigerian English accents. Nigerian participants' accuracies of identifying fellow speakers of their L1s are excluded in this sub-section. As neither UKPHS nor Y-ACCDIST belongs to any Nigerian L1 group, the Nigerian participants' accuracy of identifying the speakers of their own L1s is discussed later in a separate sub-section. Table 11.3 and Fig 11.2 show the breakdown accuracies of the four methods.

Table 11.3: Overall Accuracy of other L1s: NNLS, NLS, UKPHS & Y-ACCDIST

	Hausa Stimuli	Igbo Stimuli	Kanuri Stimuli	Yoruba Stimuli
NNLS	56% (134/240)	48% (116/240)	26% (62/240)	50% (121/240)
NLS	70% (53/76)	64% (41/64)	26% (21/80)	51% (41/80)
UKPHS	55.8% (29/52)	32.7% (17/52)	50% (26/52)	86.5% (45/52)
Y-ACCDIST	60% (9/15)	33% (5/15)	73% (11/15)	80% (12/15)

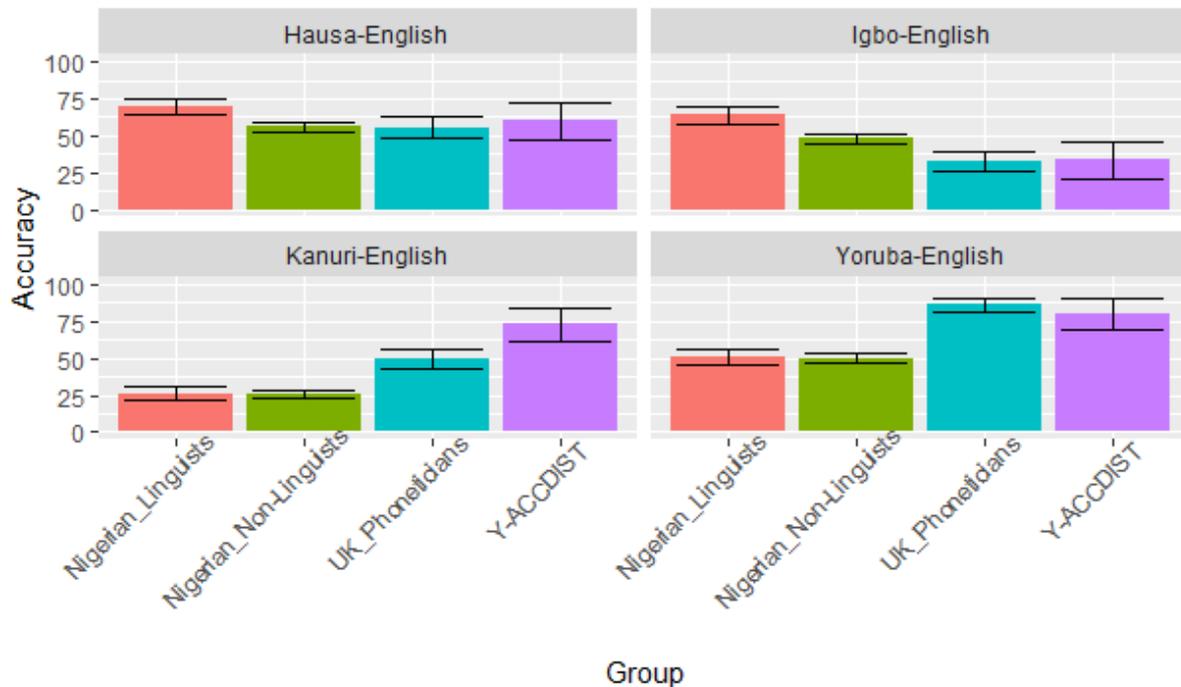


Figure 11.2: Accuracy of classifying Nigerian English accents: NNLS, NLS, UKPHS & Y-ACCDIST

The following bullet point summaries are drawn from Table 11.3 and Fig 11.2 above.

- NLS were more accurate than NNLS at identifying Hausa-English and Igbo-English stimuli.
- There was not a difference in the accuracy of identifying Kanuri-English and Yoruba-English between the two Nigerian groups.
- Y-ACCDIST outperformed the UKPHS in identifying two of the four Nigerian English accents (Hausa and Kanuri). Both groups had equal accuracy in identifying the Igbo-English accent.
- Non-Hausa and non-Igbo NLS were the most accurate at identifying Hausa-English and Igbo-English stimuli.
- UKPHS were the most accurate in identifying Yoruba-English.
- UKPHS group was only outperformed by the NNLS in identifying Igbo-English stimuli.
- Hausa-English was the simplest accent to identify, while Kanuri-English was the most challenging to identify by all non-Kanuri NNLS and NLS.

11.1.3 Comparison of identifying Nigerian English Accents by their L1 speakers, UKPHS, & Y-ACCDIST

This sub-section concerns the accuracy of Nigerian participants (both linguists and non-linguists) at identifying fellow speakers of their own L1s only in comparison with UKPHS' and Y-ACCDIST's performance. The comparison of the two isolated Nigerian sub-groups, UKPHS, and Y-

ACCDIST indicate that (with the exception of L1 Yoruba speakers) L1 speakers outperformed Y-ACCDIST and UKPHS at identifying fellow speakers of their English accents.

11.1.4 Accuracy of L1 Hausa-English

Table 11.4 and Fig 11.3 show that the Hausa NLS were the most accurate among the four sub-groups, while the UKPHS were the least accurate in identifying Hausa-English stimuli.

Table 11.4: Accuracy of Hausa stimuli: L1 Hausa speakers, UK Phoneticians and Y-ACCDIST

Hausa NNLS	Hausa NLS	UKPHS	Y-ACCDIST
81.2%	87.5%	55.8%	60%

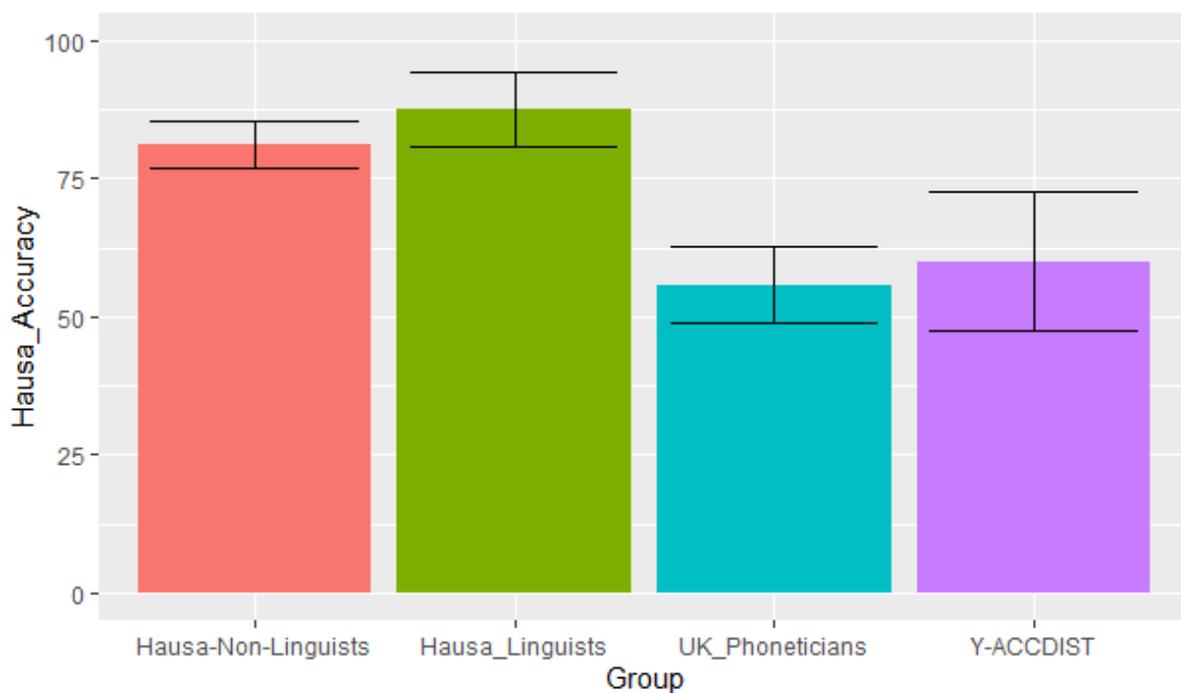


Figure 11.3: Accuracy of Hausa NLS, Hausa NNLS, UKPH and Y-ACCDIST at identifying Hausa-English

11.1.5 Accuracy of L1 Igbo-English

For this group, Table 11.5 and Fig 11.4 show that the Igbo NLS were the most accurate among all the four groups, while there is not a difference between the UKPH and Y-ACCDIST.

Table 11.5: Accuracy of Igbo stimuli: Igbo NNLS, NLS, UKPH and Y-ACCDIST

Igbo NNLS	Igbo NLS	UKPHS	Y-ACCDIST
77.5%	91.6%	32.7%	33.3%

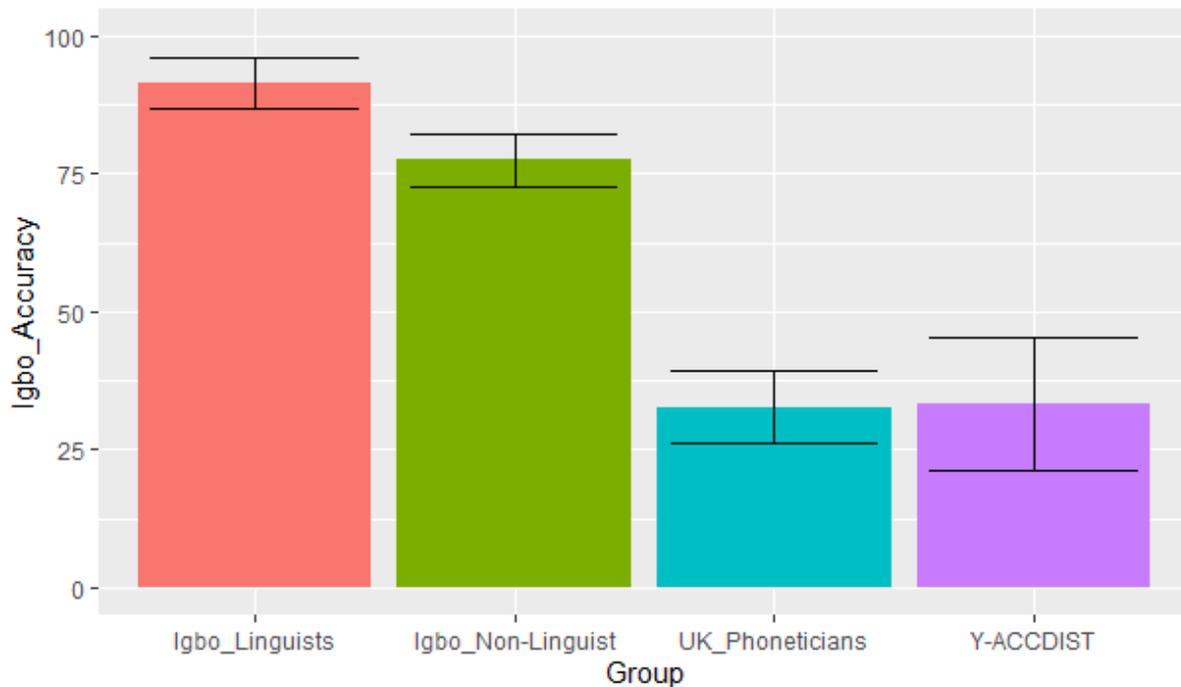


Figure 11.4: Performance of Igbo NLS, Igbo NNLS, UKPHS and Y-ACCDIST at identifying Igbo-English

11.1.6 Accuracy of L1 Kanuri-English

Table 11.6 and Fig 11.5 indicate that the Kanuri NNLS were the most accurate in identifying Kanuri-English, while the Kanuri NLS were the least accurate. While there is only a marginal difference between Y-ACCDIST and KNNLS, Y-ACCDIST significantly outperformed the Kanuri NLS and the UKPHS.

Table 11.6: Accuracy of Kanuri stimuli: L1 Kanuri speakers, UK Phoneticians and Y-ACCDIST

Kanuri NNLS	Kanuri NLS	UKPHS	Y-ACCDIST
76%	35%	50%	73%

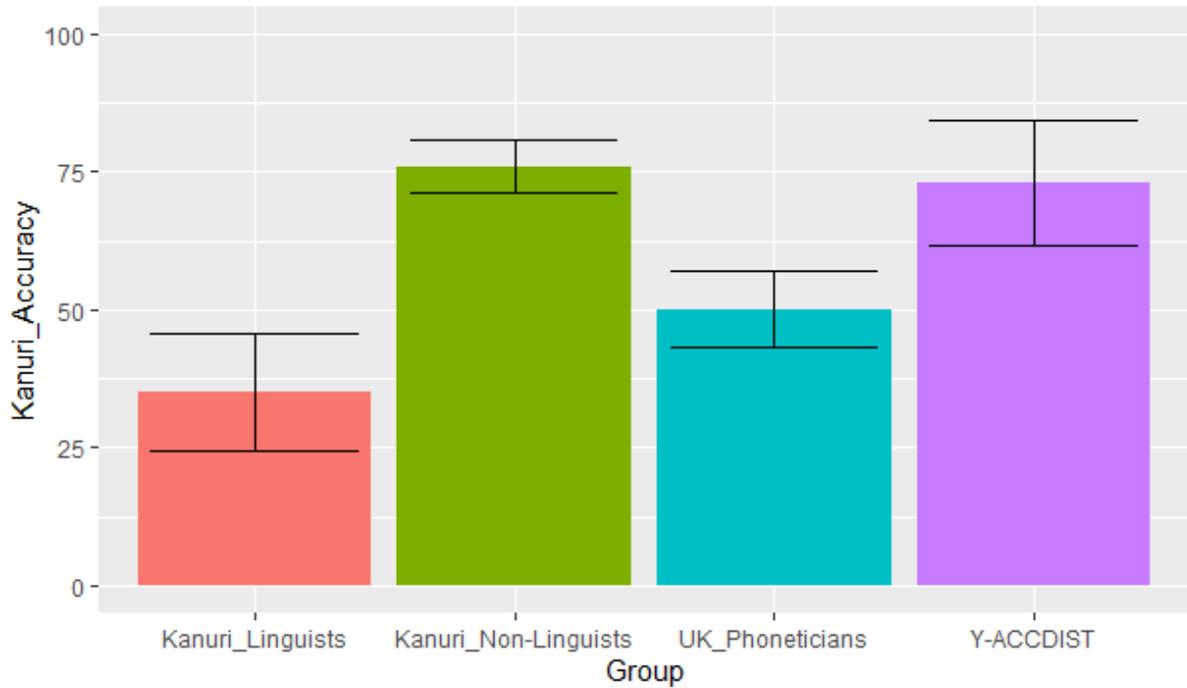


Figure 11.5: Performance of Kanuri NNLS, Kanuri NLS, UKPHS and Y-ACCDIST at identifying Kanuri-English

11.1.7 Accuracy of L1 Yoruba-English

For the Yoruba-English, Table 11.7 and Fig 11.6 show that the UKPHS and Y-ACCDIST outperformed the Yoruba NLS and NNLS. The Yoruba NLS were more accurate than the Yoruba NNLS.

Table 11.7: Accuracy of Yoruba stimuli: Yoruba NNLS, Yoruba NLS, UKPHS and Y-ACCDIST

Yoruba NNLS	Yoruba NLS	UKPHS	Y-ACCDIST
71%	75%	86.5%	80%

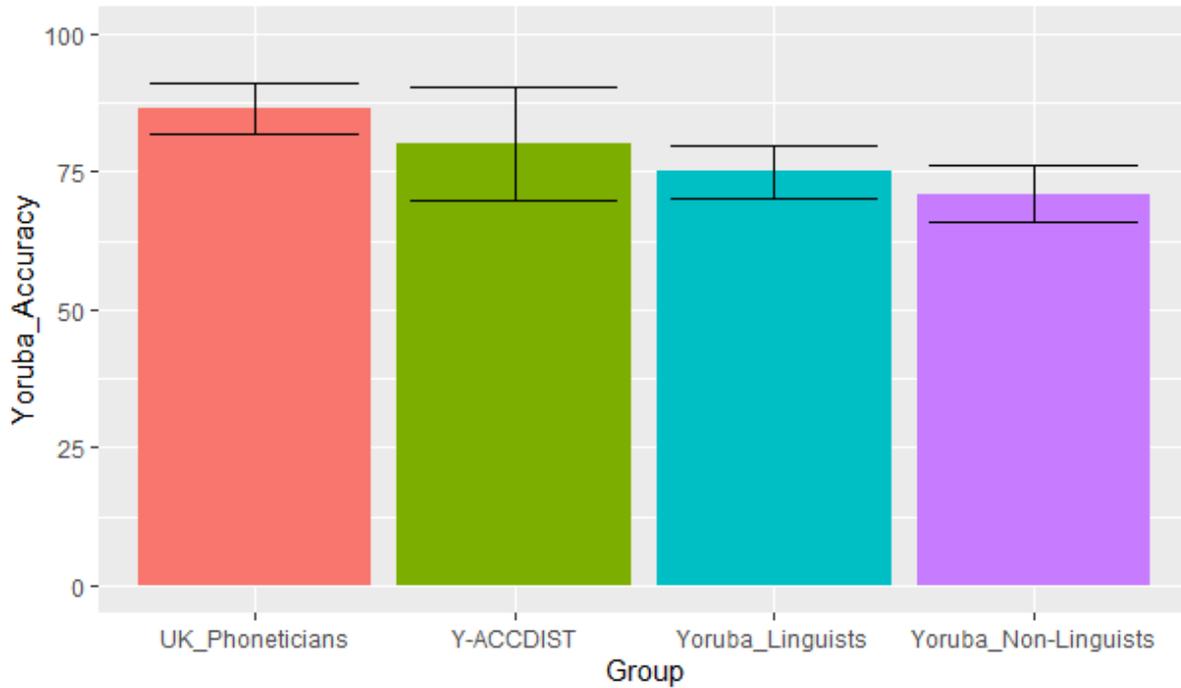


Figure 11.6: Accuracy of Yoruba NLS, Yoruba NNLS, UKPHS and Y-ACCDIST at identifying Yoruba-English

11.2 Comparison of Nigerian Linguists versus Nigerian Non-Linguists

This sub-section compares the overall accuracies of the two Nigerian groups at identifying fellow speakers of their own L1s; overall accuracies of each of the four sub-groups in the two major Nigerian groups (NNLS & NLS); isolated accuracies of each of the eight sub-groups at identifying fellow speakers of their native accent group; and their accuracies of classifying speakers of all other accent groups who do not share the same L1 with them.

11.2.1 Comparison of Overall Accuracy of Own and Other English Accents: NLS versus NNLS

Both NLS and NNLS were equally 76% accurate at identifying fellow speakers of their L1s, as shown in Table 11.8 and Fig 11.7. The other L1s column of Table 11.8 indicates that NLS were only 7% more accurate than the NNLS in classifying the other three Nigerian English accents.

Table 11.8: Accuracy of Own and Other L1s: NLS versus NNLS

	Own L1 % Correct	Other L1s % Correct
Nigerian Non-Linguists [80]	76.56% (245/320)	41.60 % (466/1120)
Nigerian Linguists [25]	76% (76/100)	48.57% (170/350)

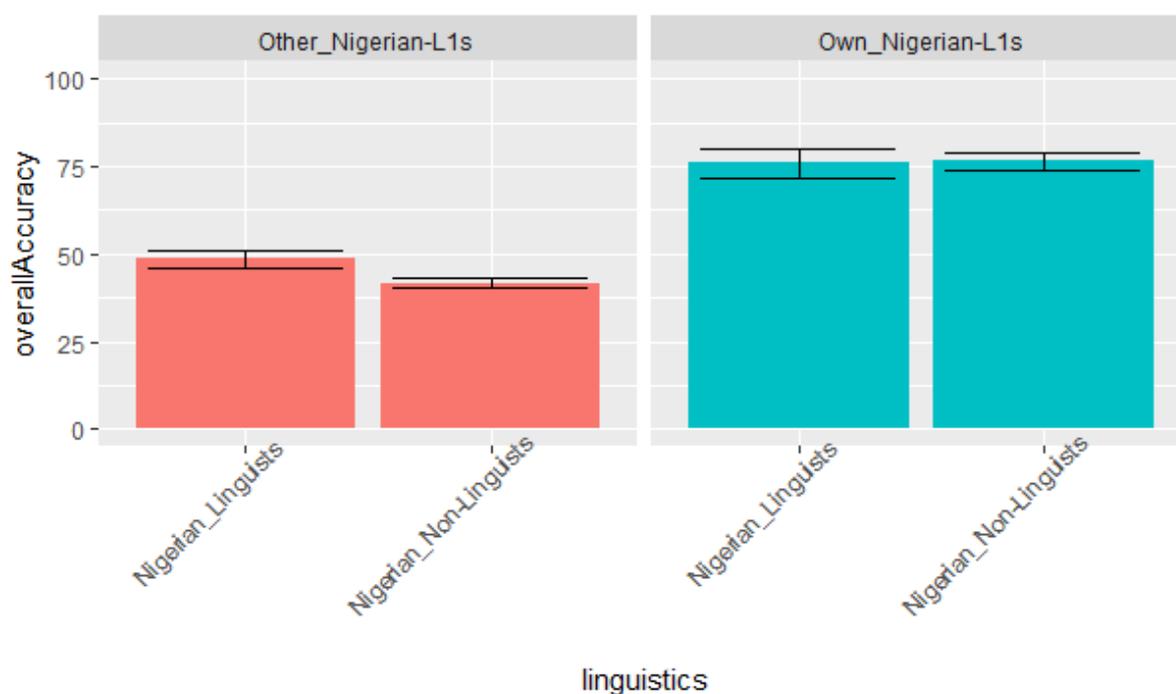


Figure 11.7: Overall accuracy of own L1 versus other L1s: Nigerian linguists versus Nigerian non-linguists

11.2.2 Comparison of Overall Accuracies of each of the eight sub-groups of Nigerian participants

This sub-section compares the overall performance of each of the four sub-groups of NNLS and NLS in classifying the four Nigerian English accents and the non-Nigerian English foils. As shown in Table 11.9, with the exception of Kanuri participants, all three linguist sub-groups outperformed their non-linguist counterparts.

Table 11.9: Overall accuracies of classifying Nigerian English and Non-Nigerian English accents

	Hausa listeners	Igbo listeners	Kanuri listeners	Yoruba listeners
NNLS	54% (193/360)	50% (182/360)	51% (184/360)	42% (152/360)
NLS	58% (63/108)	55.5% (90/162)	48% (44/90)	54% (49/90)

The following three bullet point summaries are drawn from in Table 11.9.

- Hausa participants were the best performing sub-groups in both NNLS and NLS major groups.
- Yoruba NNLS were the lowest-performing group in the NNLS group.
- Kanuri NLS were the lowest-performing group in the NLS group.

11.2.3 Break-Down of Accuracies of Identifying Speakers of Own L1s: NNLS versus NLS

The sub-section concerns NNLS and NLS only. As UKPHS and Y-ACCDIST are not Nigerian participants, they do not belong to any of the Nigerian L1 groups. Table 11.10 and Fig 11.8 provide the performance breakdown of each of the eight Nigerian native speaker sub-groups in identifying stimuli spoken by fellow speakers of their own L1s.

Table 11.10: Accuracy of own L1: Native Speaker Linguists versus Native Speaker Non-Linguists

	Hausa listeners	Igbo listeners	Kanuri listeners	Yoruba listeners
NNLS	81.2% (65/80)	77.5% (62/80)	76.2% (61/80)	71.2% (57/80)
NLS	87.5% (21/24)	91.6% (33/36)	35% (7/20)	75% (15/20)

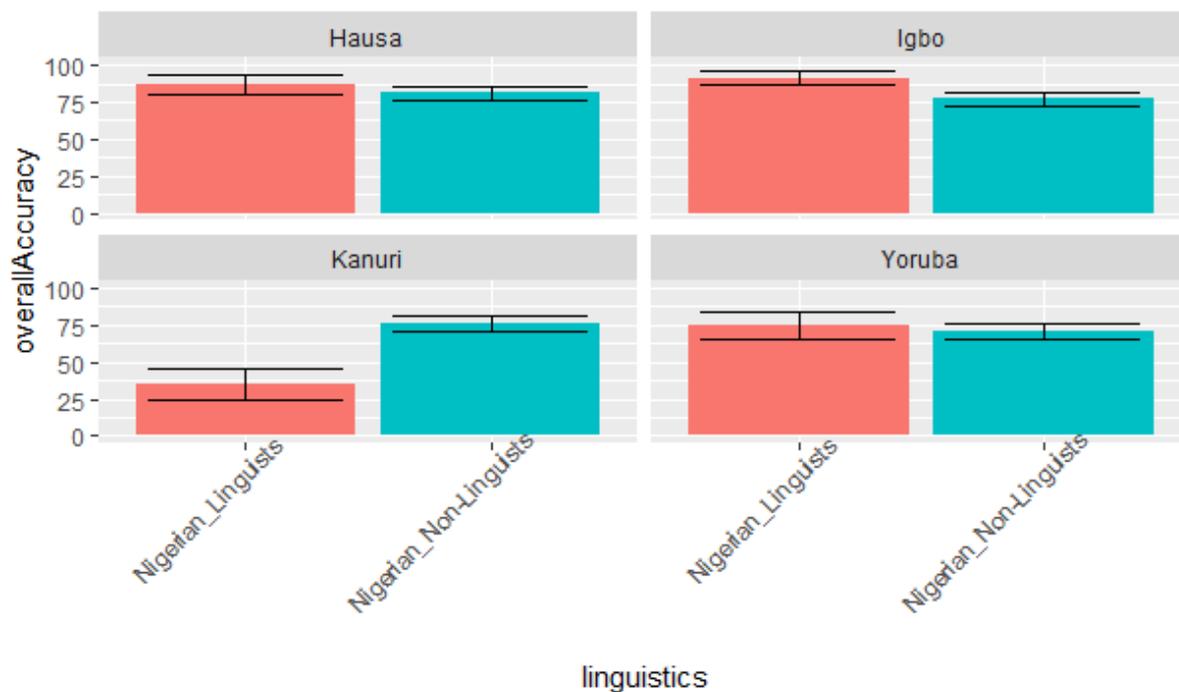


Figure 11.8: Accuracy of identifying own L1: NLS versus NNLS

The following bullet point summaries are drawn from Table 11.10 and Fig 11.8 above.

- Igbo NLS were the best performing sub-group at identifying their fellow speakers Igbo-English compared to the other groups
- Kanuri NLS were the poorest sub-group at 35% at identifying their fellow speakers of Kanuri-English, and Kanuri NLS were significantly outperformed by Kanuri NNLS.
- Hausa NNLS were the best performing sub-group at identifying fellow speakers of their L1 compared to the performance of the other three sub-groups.

11.2.4 Accuracies of Classifying Speakers of Other L1s: NNLS versus NLS

This sub-section also concerns Nigerian participants only. It provides a breakdown of classifying other L1s by each of the eight sub-groups of NLS and NNLS, as shown in Table 11.11 and Fig 11.9. For instance, in the Hausa group, only Hausa listeners' accuracy of Igbo-, Kanuri-, Yoruba- and non-Nigerian-English stimuli (without Hausa stimuli) were calculated. The same procedure was repeated in all the other three groups.

Table 11.11: Accuracy of other L1s (including Non-Nigerian foils): NNLS versus NLS

	Hausa listeners	Igbo listeners	Kanuri listeners	Yoruba listeners
Nigerian Non-Linguists	46% (128/280)	43%(120/280)	44% (123/280)	34% (95/280)
Nigerian Linguists	50% (42/84)	45% (57/126)	53% (37/70)	49% (34/70)

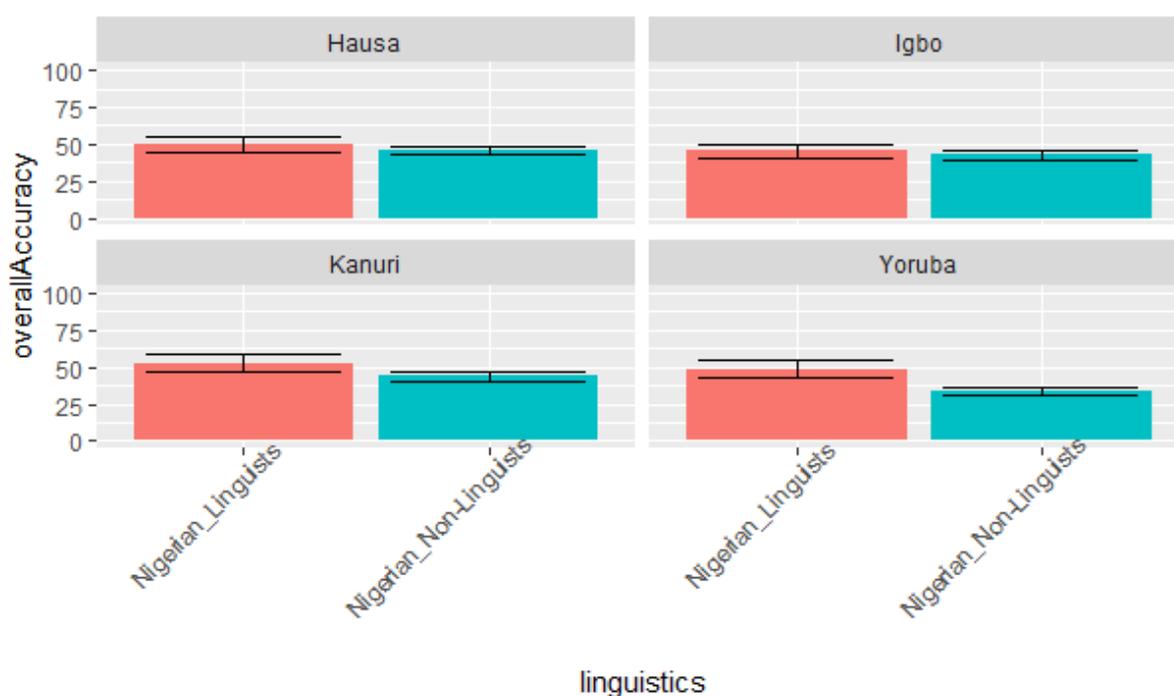


Figure 11.9: Accuracy of classifying other L1s (including non-Nigerian foils): NLS versus NNLS

The following bullet point summaries are drawn from Table 11.11 above.

- Hausa NNLS were the best performing group at categorising the other L1s and the two foils at 46%.
- Kanuri NLS were the best performing sub-group of NLS at 53%.
- Yoruba listeners were the poorest sub-group in the NNLS group at 34%.
- Igbo listeners were the poorest in the NLS group at 45%.
- Kanuri and Yoruba NLS outperformed their Kanuri and Yoruba NNLS counterparts in identifying their own L1 speakers.

- There is a negligible difference between the NLS and NNLS of Hausa and Igbo groups.

The findings indicate a swap of position between Igbo and Yoruba listeners.

11.3 Statistical significance testing of NNLS, NLS, UKPHS & Y-ACCDIST

Statistical significance of the NNLS, NLS and UKPHS compared indicates that only native speaker competence significantly raised the accuracy of participants (see Chapters 7, 8 and 9 above for further details of the test). The model included fixed effects of “linguistics”, “stimulus language”, confidence rating, the interaction between stimulus language and the three participant groups, as well as a random intercept and slope of confidence rating for participant.

To compare the statistical significance of Nigerian linguists and Nigerian non-linguists, the effect of linguistics had three levels: Nigerian linguists, Nigerian non-linguists or UK phoneticians. This factor was sum-coded with UK-phoneticians as the held-out level. (assigned a value of -1).

To compare the statistical significance of Nigerian linguists with UK-phoneticians, the factor was sum-coded with Nigerian non-linguists as the held-out level.

To compare the statistical significance of Nigerian non-linguists with UK-phoneticians, the factor was sum-coded with Nigerian linguists as the held-out level.

The effect of stimulus language was included to determine whether some groups were better than others in identifying some of the four Nigerian English accents.

The result of testing the comparison between the overall accuracy of the Nigerian linguists and the non-linguists indicates that the Nigerian linguists were not significantly better than the Nigerian non-linguists ($\beta_{Nigerian-linguists} = 0.01593$, $p > 0.48$). Likewise, the Nigerian non-linguists were only numerically less accurate than the Nigerian linguists ($\beta_{Nigerian\ non-linguists} = -0.18984$, $p < 0.067287$). Neither the UK phoneticians nor the Nigerian linguists were significantly better than the other ($\beta_{UKphoneticians} = 0.10$, $p > 0.48$), ($\beta_{Nigerian-linguists} = 0.08$, $p > 0.48$). Also, the UK phoneticians were not significantly better than the Nigerian non-linguists ($\beta_{Nigerian\ non-linguists} = -0.18975$, $p > 0.06$), ($\beta_{UKphoneticians} = 0.10289$, $p > 0.49$).

The result of testing the stimulus language shows that the Nigerian linguists were significantly better than the non-linguists in identifying Hausa-English and Igbo-English stimuli ($\beta_{Hausa} = 0.36784$, $p < 0.001$), ($\beta_{Igbo} = 0.74454$, $p < 0.001$). For Kanuri-English identification, the Nigerian linguists were significantly less accurate than the non-linguists ($\beta_{Kanuri} = -0.59412$, $p < 0.001$). The Kanuri non-linguists were significantly better than their Kanuri linguist counterparts ($\beta_{Kanuri} = 0.45623$, $p < 0.001$).

The result of testing the stimulus language shows that the Nigerian linguists were significantly better than the UK phoneticians in identifying Hausa-English and Igbo-English stimuli ($\beta_{Hausa} =$

0.36794, $p < 0.001$), ($\beta_{Igbo} = 0.74452, p < 0.001$). The UK phoneticians were significantly better than the Nigerian linguists in identifying Yoruba-English and Kanuri-English stimuli ($\beta_{Yoruba} = 0.96681, p < 0.001$), ($\beta_{Kanuri} = 0.45765, p < 0.001$).

The result of testing the stimulus language shows that the UK phoneticians were significantly less accurate than the Nigerian linguists in identifying Hausa-English and Igbo-English stimuli ($\beta_{Hausa} = -0.51611, p < 0.001$), ($\beta_{Igbo} = -0.99555, p < 0.001$), while the Nigerian non-linguists were not significantly better than the UK phoneticians in identifying Hausa-English and Igbo-English ($\beta_{Hausa} = 0.14, p > 0.29$), ($\beta_{Igbo} = 0.25, p > 0.07$), the UK phoneticians were significantly better than the Nigerian non-linguists in identifying Yoruba-English and Kanuri-English stimuli ($\beta_{Yoruba} = 0.96908, p < 0.001$), ($\beta_{Kanuri} = 0.45623, p < 0.001$).

Regardless of the background of linguistics or phonetics, native speakers of a particular English accent were significantly better at accurately distinguishing fellow speakers of their English accents. Y-ACCDIST's accuracy was not significantly better than the human participants.

Y-ACCDIST responses were analysed in comparison with the human listener data, using a logistic mixed-effects model using the lme4 R package (RStudio, 2020). With a binary dependent variable (1= correct, 0 = incorrect). The model included a fixed effect of "Y-ACCDIST" and a random intercept for participant. Y-ACCDIST effect had two levels: whether the participant is Y-ACCDIST (the performance of the automatic accent recognition system) or not Y-ACCDIST. Given that Y-ACCDIST had the highest overall success rate (with the exception of the Hausa linguist group) against all other human group performance, the expectation is for Y-ACCDIST accuracy to reach significance. However, there was not a significant difference between Y-ACCDIST and human listeners' performance ($\beta_{y-accdist} = 0.10, p > 0.73$).

11.4 Overall Confusion of Nigerian English and Non-Nigerian Accents: All Four Methods

11.4.1 Comparison of Confusing Nigerian English Accents: NNLS, NLS, UKPHS and Y-ACCDIST

Fig 11.10 and Fig 11.11 present eight patterns of confusing the four Nigerian English accents by the four methods. Four of these patterns are intra-region dependent, as shown in Fig 11.10, while the other four are inter-region dependent, as shown in Fig 11.11.

The confusions between Nigerian English accents spoken within the same region (northern or southern Nigeria, where northern represents Hausa and Kanuri, while southern represents Igbo and Yoruba) are intra-region dependent, while those confusions between accents spoken in different regions are inter-region dependent.

As stated in the direction section of Chapters 7, 8, 9 and 10, Fig 11.10 and 11.11 present the percentage of confusing each of the Nigerian English accents. The major patterns of the accents' confusion are shown in Fig 11.10 and 11.11. To illustrate, Nigerian linguists had the highest rate for confusing Igbo with Yoruba, and this means more than 75% of the total Igbo-English stimuli were confused with Yoruba-English stimuli. On the other hand, Y-ACCDIST had the highest rate (100%) for confusing Yoruba-English with Igbo-English, and this means all misidentified Yoruba-English stimuli were only confused with Igbo-English by Y-ACCDIST.

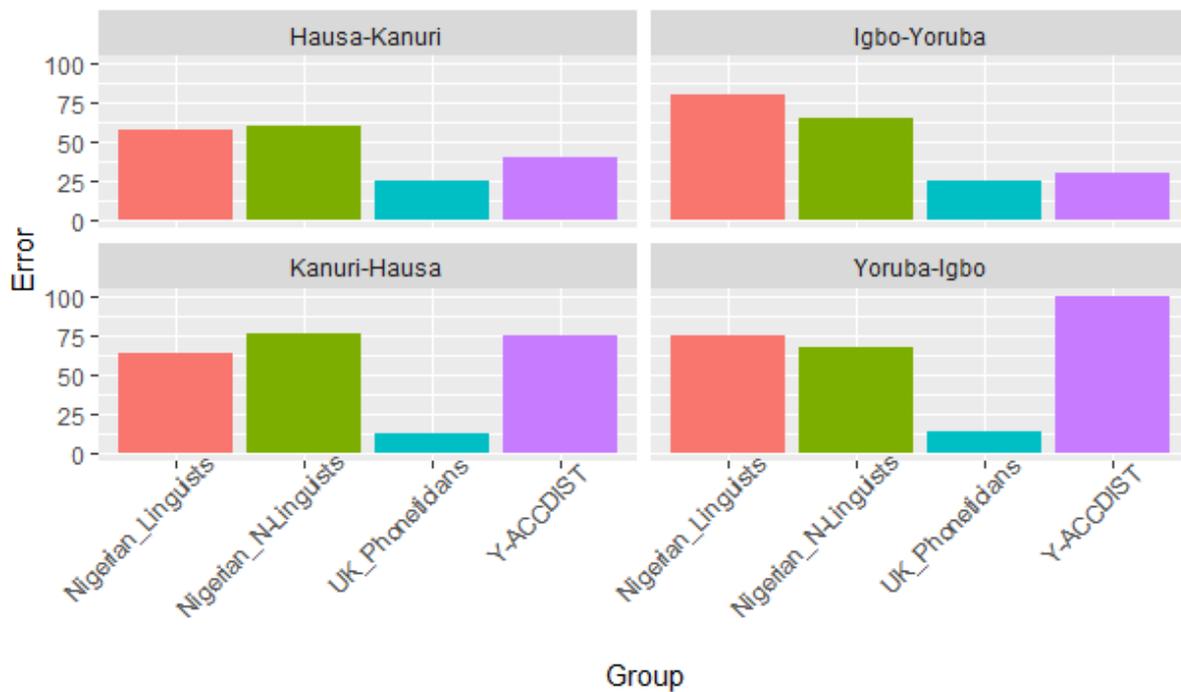


Figure 11.10: Intra-regional Confusion of Nigerian English accents: NLS, NNLS, UKPH, Y-ACCDIST

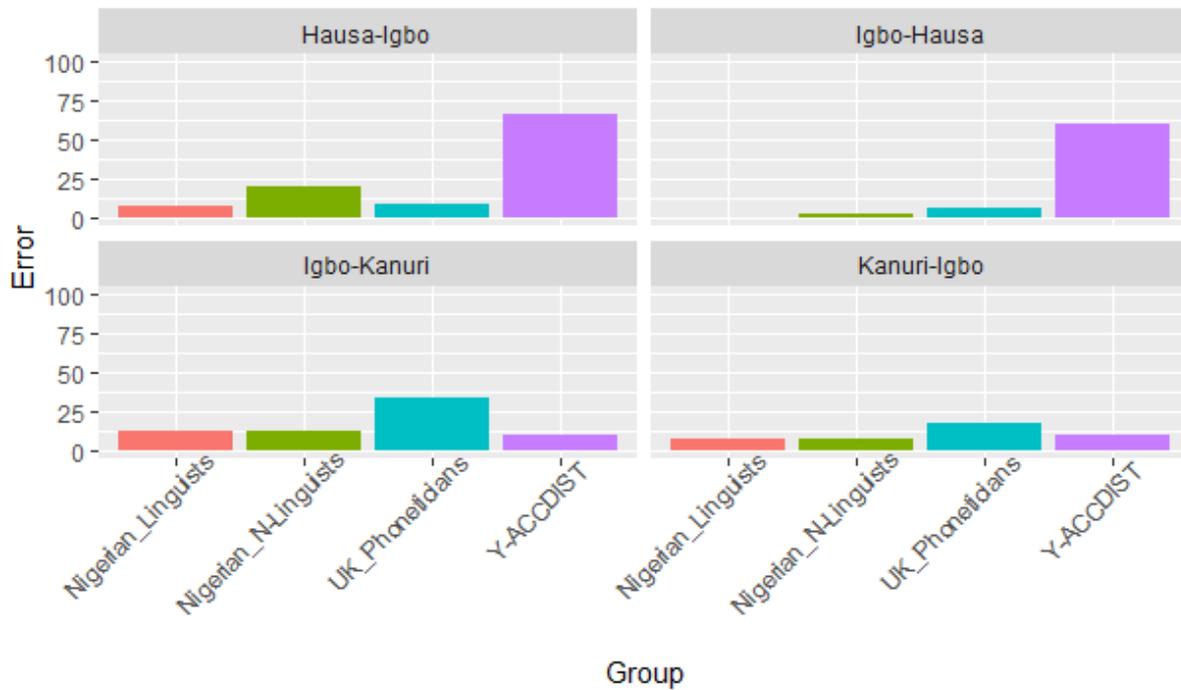


Figure 11.11: Inter-regional confusion of Nigerian English accents: NLS, NNLS, UKPH, Y-ACCDIST

Most of the confusions of the Nigerian English accents by the three human groups are intra-regional, while their inter-regional ones are at a negligible rate, as shown in Fig 11.11. Conversely, Y-ACCDIST's main confusions comprised both inter-regional and intra-regional ones. The pattern of confusing the Nigerian English accents by the UKPHS is different from those of the NLS and NNLS.

The following bullet point summaries are drawn from in Fig 11.10 and 11.11 above.

- Hausa-English was mainly confused with Kanuri-English by NLS and NNLS compared to fewer confusions by UKPHS and Y-ACCDIST.
- Hausa-English was mainly confused with Igbo-English and vice versa by Y-ACCDIST.
- Igbo-English was more confused with Kanuri-English than Yoruba-English by the UKPHS compared to all the other groups.
- Igbo-English was more confused with Yoruba-English by the NLS and NNLS than UKPHS and Y-ACCDIST.
- Kanuri-English was more confused with Igbo-English than Hausa-English by the UKPHS
- Kanuri-English was more confused with Hausa-English by NLS, NNLS and Y-ACCDIST compared to UKPHS
- Kanuri-English was least confused with Hausa-English by UKPHS.
- Yoruba-English was more confused with Igbo-English by Y-ACCDIST compared to all the other groups.

- Yoruba-English was least confused with Igbo-English by UKPHS compared to the other groups.

Although the UKPHS' accuracy of identifying Hausa-English is only 56% (lower than the accuracy of both L1 Hausa NLS and NNLS), they were more successful at finding the differences between the Hausa-English and Kanuri-English accents.

In all the four intra-regional confusions: Kanuri-Hausa, Hausa-Kanuri, Igbo-Yoruba & Yoruba-Igbo, UKPHS had the lowest error rate compared to the other three groups.

These confusion patterns suggest that different cues were considered for distinctiveness and typicality of the speakers' accents. H-dropping and –epenthesis seemed to be a very strong discriminant of Yoruba-English accent in the two Nigerian groups and UKPHS group, but this might not have been for Y-ACCDIST. As shown in the summary of post-listening questionnaire of the three human groups, most of the participants stated that their decisions in identifying Yoruba-English stimuli were mainly based on h-dropping and h-insertion. A complete summary of key post-listening comments on the listeners' basis for classifying the four Nigerian English accents is given in Table 11.30 and Table 11.31 at the end of this chapter.

11.4.2 Description of Nigerian Non-Linguists' Confusion of Nigerian English Accents

The summary of Nigerian non-linguists' confusion of Nigerian English accents is given in the following bullet points.

- Sixty percent of Hausa-English errors were confused with Kanuri, while 77% of the Kanuri-English errors were confused with Hausa-English.
- While 65% of Igbo-English errors were confused with Yoruba-English, 68% of Yoruba-English errors were confused with Igbo-English.
- Thirty-eight percent of non-Nigerian-English errors were confused with Igbo-English. But non-Nigerian English was also confused with Kanuri-English and Yoruba-English at 24% and 26%, respectively.

11.4.3 Description of Nigerian Linguists' Confusion of Nigerian English Accents

The summary of Nigerian linguists' confusion of Nigerian English accents is given in the following bullet points.

- Hausa-English stimuli were mainly confused with Kanuri-English (58%).
- About half the Kanuri-English stimuli were confused with Hausa-English.
- Igbo-English was mainly confused with Yoruba-English (81%).
- Yoruba-English was more confused with Igbo-English (75%).
- Non-Nigerian English was mainly confused with Igbo-English (41%).

11.4.4 Description of Y-ACCDIST's confusion for Hausa-, Igbo-, Kanuri- and Yoruba-English

The summary of Y-ACCDIST's confusion of Nigerian English accents is given in the following bullet points.

- Of the Hausa-English errors, 66.6% were confused with Igbo-English, while 33.4% were Kanuri-English.
- Of the Igbo-English errors, 60% were confused with Hausa-English, while the other 30% were Yoruba-English.
- Kanuri-English stimuli were mainly confused with Hausa-English.
- All the three Yoruba-English errors were confused with Igbo-English.

11.4.5 Description of UK Phoneticians' Confusions of Nigerian English Accents

The summary of UK-based phoneticians' confusion of Nigerian English accents is in the following bullet points.

- Hausa-English was mainly confused with Kanuri. Of the total Hausa-English errors, 56.5% were Kanuri-English.
- Igbo-English was nearly equally confused with Kanuri-English and non-Nigerian English.
- Kanuri-English was mainly confused with Igbo-English.
- Yoruba-English was mainly confused with non-Nigerian English.
- Over 50% of the total non-Nigerian foils were confused with Igbo-English.

11.4.6 Similarities of Confusing Nigerian English Accents: NNLS, NLS, UKPHS & Y-ACCDIST

The summary of similarities of confusing Nigerian English accents by all the four methods is given in the following bullet points.

- Most of the misidentified Hausa-English stimuli were confused with Kanuri-English and vice versa.
- The NLS and NNLS groups had nearly the same confusion of Hausa-English with Kanuri-English at 58% and 60%, respectively.
- Non-Nigerian foils were misidentified as Igbo-English.
- Igbo-English was mainly confused with Yoruba-English and vice versa.
- In isolation, both L1 Hausa NLS and Hausa NNLS were most likely to confuse their fellow Hausa speakers with Kanuri and vice versa.

11.4.7 Differences of Confusing Nigerian English Accents: NNLS, NLS, UKPHS & Y-ACCDIST

11.4.7.1 NNLS versus NLS

The confusion differences between NLS and NNLS are given in the following bullet points, as shown in Fig 11.10 above.

- The NNLS confused more Kanuri-English stimuli with Hausa-English than the NLS did with 77% and 64% confusion rates, respectively.
- NLS confused fewer (21%) Igbo-English stimuli with Yoruba-English stimuli than the NNLS.
- NLS confused fewer (35%) Yoruba-English stimuli with Igbo-English stimuli than the NNLS did.
- In isolation, the Igbo NLS mostly confused Igbo-English with Yoruba-English, while the Igbo NNLS were least likely to confuse Igbo-English with Yoruba-English compared to the other three sub-groups.
- The Yoruba NNLS were least likely to confuse Yoruba-English with Igbo-English, while the Yoruba NLS were not, as the L1 Kanuri NLS had fewer Yoruba-Igbo confusion rate than the Yoruba NLS.
- Yoruba NNLS were most likely to confuse Igbo-English with Yoruba-English.
- Conversely, Igbo NLS had a higher confusion rate of Igbo-English with Yoruba-English compared to the Yoruba NLS.

11.4.7.2 Y-ACCDIST versus UK Phoneticians

The confusion differences between Y-ACCDIST and UKPHS are given in the following bullet points, as also shown in Fig 11.11 above.

- Hausa-English was mainly confused with Kanuri-English by the UKPHS, while it was mainly confused with Igbo-English by Y-ACCDIST.
- Kanuri-English was mainly confused with Hausa-English by Y-ACCDIST, while it was mainly confused with Igbo-English or Hausa-English by the UKPHS.
- Igbo-English was mainly confused with Hausa-English by Y-ACCDIST, while it was occasionally confused with Hausa-English by the UKPHS.
- Yoruba-English was only confused with Igbo-English by Y-ACCDIST, while it is hardly confused with Igbo-English, but confused with non-Nigerian- or Kanuri-English by the UKPHS.

- Except for the confusion of Kanuri-English with Igbo-English and vice versa, UKPHS had a fewer confusion rate than Y-ACCDIST.

11.4.8 Confusing Nigerian English Accents with Non-Nigerian foils: NNLS, NLS & UKPHS

The difference of confusing Nigerian English with non-Nigerian foils show that the NLS are more likely to have cross-national/regional border errors than the NNLS. The confusion differences among the three human methods are given in the following bullet points, as also shown in Fig 11.12 below.

- UKPHS confused more Igbo-English and Yoruba-English with non-Nigerian foils compared to the NLS and NNLS, while NLS confused more Hausa-English and Kanuri-English with non-Nigerian foils.
- NLS confused more Hausa-English and Kanuri-English with non-Nigerian foils than NNLS and UKPHS.
- NNLS were least likely to confuse Hausa-English, Kanuri-English and Yoruba-English with non-Nigerian foils compared to the NLS and UKPHS.

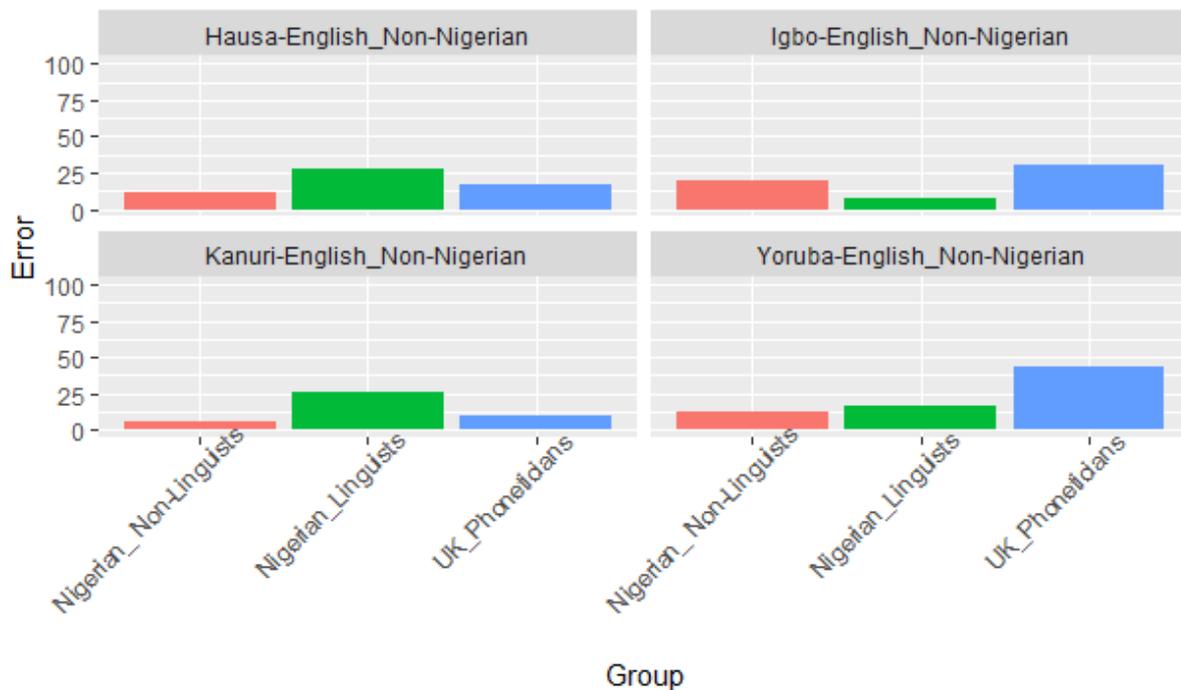


Figure 11.12: Confusion of Nigerian English accents with non-Nigerian foils: NLS, NNLS and UKPH

11.4.9 Confusing Non-Nigerian foils with Nigerian English Accents: All three human methods

Although the participants were misled by the non-Nigerian foils, having had low success rates (slightly above chance level as shown in Table 11.1 above), they mostly confused the non-Nigerian

foils with other Nigerian English accents. Except for Kanuri NLS, other NLS hardly confused it with the stimuli spoken by fellow speakers of their L1s. However, a few NNLS occasionally confused their L1 speakers with non-Nigerian foils and vice versa. This finding further suggests that non-Nigerian fake asylum seekers that falsely claim Nigerian origin will more likely be detected and rejected by NLS.

The three methods' differences of confusing non-Nigerian foils with Nigerian English accents are given in the following bullet points, as also shown in Fig 11.13.

- Some participants confused some speakers of their fellow L1s, but all the participants hardly confused non-Nigerian foils with fellow speakers of their fellow L1s.
- UKPHS confused more non-Nigerian foils with Igbo-English compared to fewer confusions by both Nigerian NLS and NNLS.
- There was a negligible confusion rate of non-Nigerian foils with Hausa-, Kanuri- and Yoruba-English by all the three human groups, but UKPHS had the least confusion rate.
- NNLS confused more non-Nigerian foils with Kanuri-English and Yoruba-English compared to both NLS and UKPHS.

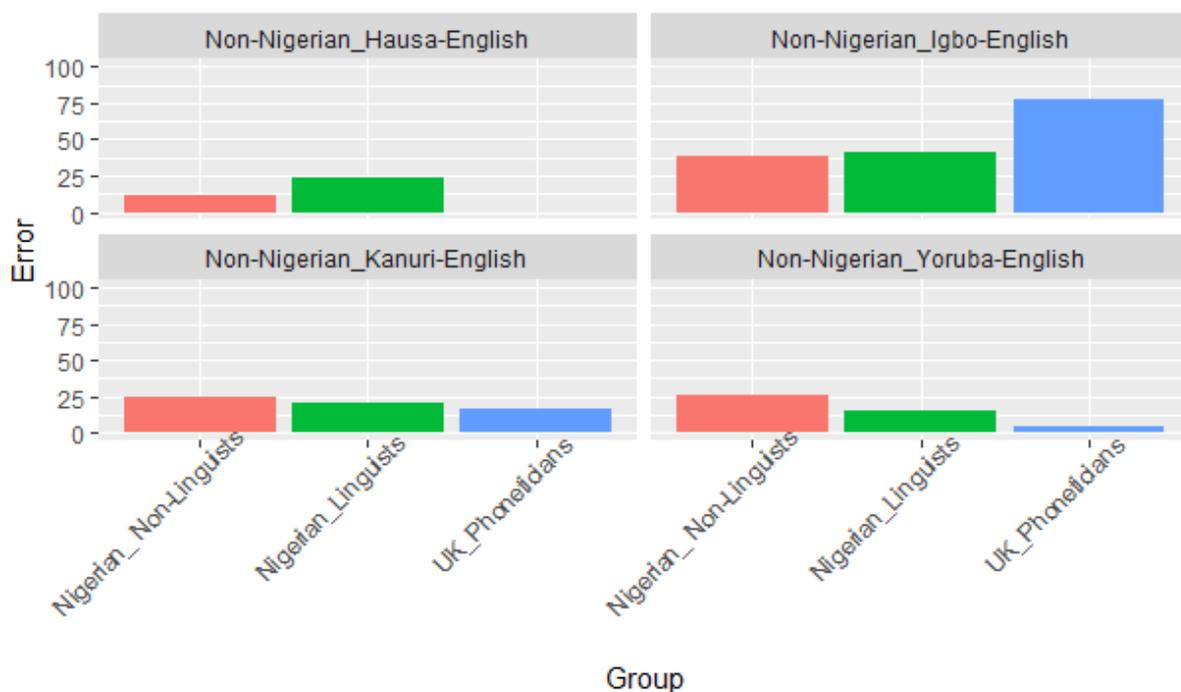


Figure 11.13: confusion of Non-Nigerian foils with Nigerian English accents: NNLS, NLS and UKPH

11.5 Comparison of Errors in Classifying the Nigerian English Accents: All Four Methods

11.5.1 False Rejection: NNLS, NLS, UKPHS & Y-ACCDIST

The false rejection errors of the four groups are compared in this sub-section. The following bullet point summaries are drawn from Table 11.12 and Fig 11.14.

- Except for the Kanuri NLS sub-group, the other three NLS sub-groups: L1 Hausa, L1 Igbo and L1 Yoruba had fewer false rejections than their NNLS counterparts.
- The Kanuri NLS had more false rejections than their fellow Kanuri NNLS.

Thus, the results suggest that Kanuri NLS were more likely to falsely reject their genuine fellow L1 Kanuri claimants than L1 Kanuri NNLS. The implication of these false-negative errors for LAAP in this regard is that L1 Kanuri NLS are not as reliable as their fellow NNLS. However, this is hardly generalisable but speculative, as it may not be true in other cases.

Table 11.12: False negative errors (misses) of the four groups

	Hausa	Igbo	Kanuri	Yoruba
NNLS	19%	22.5%	24%	29%
NLS	12.5%	8.4%	65%	25%
UKPHS	44%	67.3%	50%	13%
Y-ACCDIST	40%	67%	27%	20%

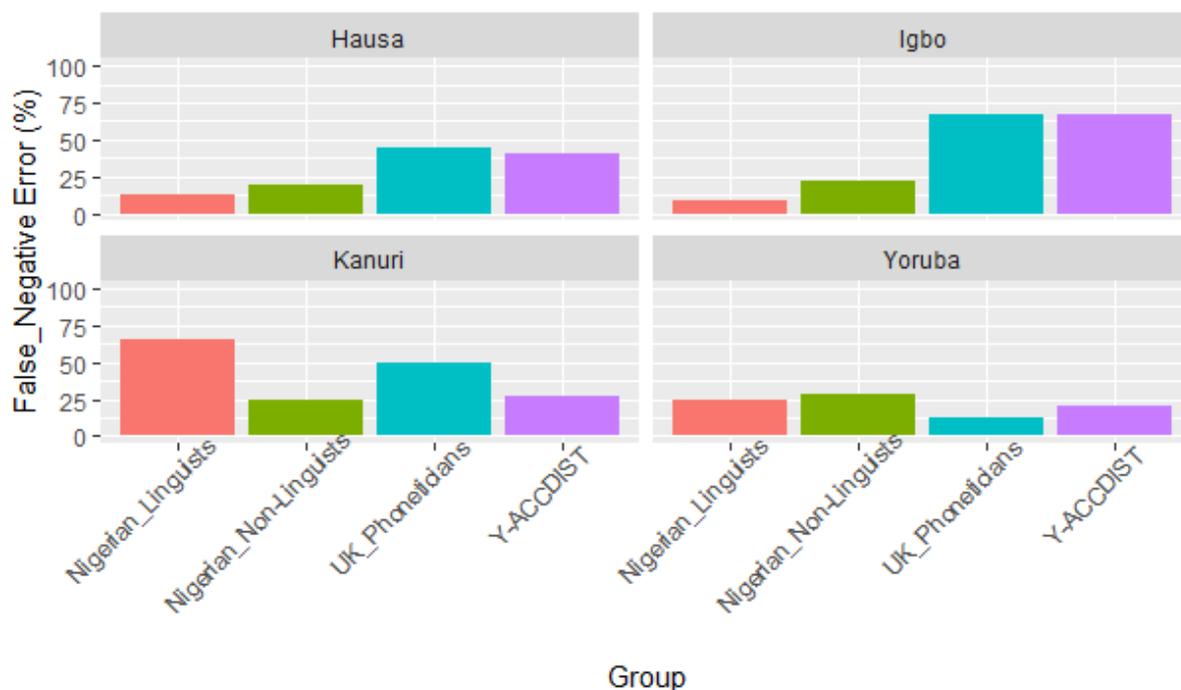


Figure 11.14: False Negative errors: NLS, NNLS, UKPHS and Y-ACCDIST

11.5.2 False Acceptance Errors: NNLS, NLS & UKPHS

The three human groups are considered for a comparison of false acceptances in this subsection, as shown in Table 11.13 and Fig 11.15. Y-ACCDIST is excluded because it does not belong to any of the four Nigerian L1s. UKPHS were incorporated since they were provided with feature matrices of the four Nigerian English accents. Thus, they familiarised themselves with the accents, and this qualifies them to act as native speakers.

Table 11.13: False positive errors of the three human groups

	Hausa	Igbo	Kanuri	Yoruba
NNLS	57.7%	33.7%	32.5%	46%
NLS	50%	41.6%	15%	30%
UKPHS	13%	29%	24%	11.5%

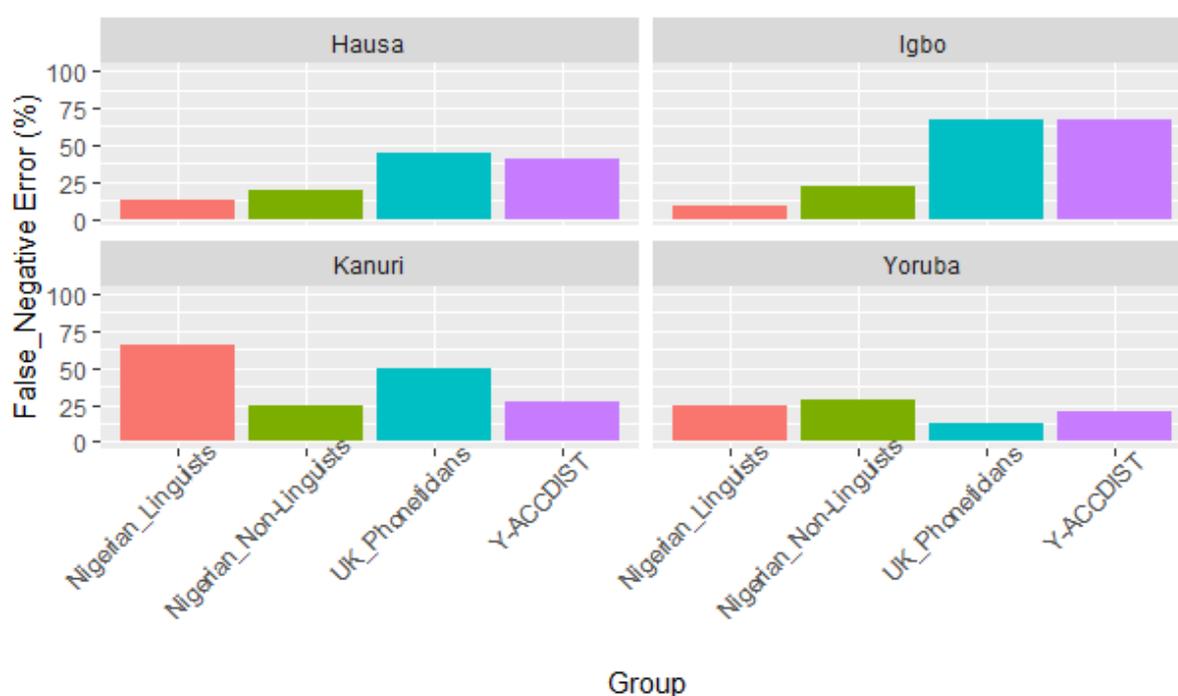


Figure 11.15: False Positive Errors: NLS, NNLS & UKPHS

The false acceptances of the three human groups are given in the following bullet points, as also shown in Table 11.13.

- All the four NNLS groups are more likely to accept a non-member of their L1 groups as a fellow member of their L1 group.
- The false acceptances are predominantly within the same region where the confused accents occur (Hausa-Kanuri versus Kanuri-Hausa in northern Nigeria, and Igbo-Yoruba versus Yoruba-Igbo in southern Nigeria).
- UKPHS had fewer Hausa-, Igbo- and Yoruba-English false hits than both NLS and NNLS.

A summary of false acceptance similarities and differences between the sub-groups of NLS and NNLS is given in the following bullet points.

- Except for Igbo NLS, all the three other L1 sub-groups in the NLS group had fewer false acceptances than their NNLS counterparts.
- Both Hausa NLS and NNLS had more false hits than all the other groups.
- Both Hausa NLS and Hausa NNLS were most likely to confuse their fellow Hausa speakers with Kanuri and vice versa.
- Hausa NLS had fewer Kanuri-false acceptances than the Hausa NNLS, while Hausa NNLS had fewer Hausa-Kanuri false rejections than the Hausa NLS.
- Igbo NLS had more Yoruba-Igbo false acceptances and more Igbo-Yoruba false rejections than the Igbo NNLS.
- Kanuri NLS had the lowest rate of false acceptances among all the four NLS groups.
- Kanuri NLS had more Hausa-false acceptances and Kanuri-Hausa false rejections than the Kanuri NNLS.
- There is no difference between the two groups of L1 Yoruba in producing both types of error.

The results suggest that Igbo NLS were more likely to accept non-L1 Igbo speakers as L1 Igbo speakers. This would have a further implication of falsely confirming a claimant of Igbo origin. The UKPHS were more careful at identifying a non-Yoruba speaker as a Yoruba speaker than all the Nigerian listeners, particularly the L1 Yoruba listeners.

11.6 Comparison of Classifying the Nigerian English Accents based on the stimuli's density of cues

11.6.1 Hausa-English Stimuli

This sub-section provides the accuracy of Hausa-English identification by each of the four participating groups. It also discusses the weighting of the density of cues in the speech samples. Table 11.14 presents the success rates of the UKPHS, Hausa NLS, Hausa NNLS and Y-ACCDIST at identifying the four Hausa-English stimuli. Speculations regarding a correlation between the density of cues in the speech samples and the high/low accuracy rates are discussed below.

For identifying Hausa-English, the native speaker HNLS and HNNLS were the most accurate sub-groups. Yoruba NLS and Kanuri NLS were the second most accurate sub-groups, while Kanuri NLS had the lowest score compared to all other sub-groups.

Table 11.14: Accuracy of the Hausa-English stimuli: UKPH, HSNL, HSL, Y-ACCDIST

Hausa stimuli	UKPHS	Hausa NNLS	Hausa NLS	Y-ACCDIST
Stimulus 1	54% (7/13)	95% (19/20)	100% (6/6)	0% (0/1)
Stimulus 2	77% (10/13)	65% (13/20)	50% (3/6)	100% (1/1)
Stimulus 3	85% (11/13)	85% (17/20)	100% (6/6)	0% (0/1)
Stimulus 4	7.7% (1/13)	80% (16/20)	100% (6/6)	100% (1/1)

Hausa-English Stimulus 1.

This speech sample was well highly accurately identified as Hausa-English by both the Hausa NLS and NNLS groups, as Table 11.15 shows. The UKPHS were also 54% accurate. Only 7 of the 13 Hausa-English stimuli were correctly identified by the UKPHS. Three of the misidentified Hausa-English samples were confused with Yoruba-English, while only two were confused with Kanuri-English.

Despite the density of Hausa-English cues in the sample, it was incorrectly identified by Y-ACCDIST. The speech sample included some cues of the Hausa-English accent. Notwithstanding, it was confused with Igbo-English by Y-ACCDIST. Fig 11.16 shows some common speech cues in both Kanuri- and Igbo-English present in this Hausa stimulus. These realisations might have been the reason for the UKPHS' decision.

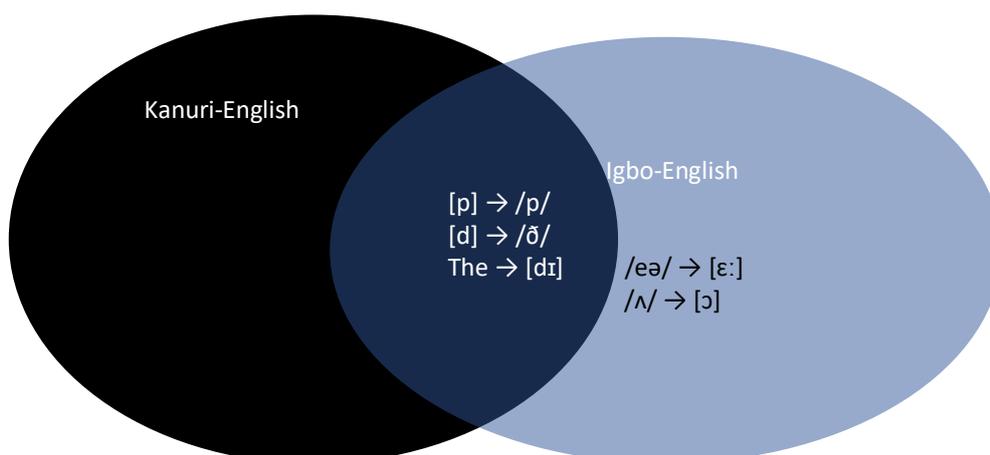


Figure 11.16: Venn diagram showing some cues commonly found in Kanuri-English and Igbo-English

There are multiple occurrences of realising the dental fricative /ð/ as [d] in this sample, while the voiceless dental fricative /θ/ had two realisations, with alveolar fricative [s] having frequent occurrence. Hausa speakers often realise the voiceless dental fricative /θ/ as alveolar fricative [s], while [t] occasionally substituted it, as observed in this sample.

Except for /p/ phoneme which was realised as a voiceless bilabial fricative [ɸ], all other phonemes had once occurred in the sample. However, the speaker in this sample does not realise the voiced dental fricative /ð/ (as many Hausa speakers do) as [z] but [d]. Thus, realisations of voiceless dental fricative /θ/, bilabial plosive /p/ and SQUARE diphthong may have influenced the listeners' decision to identify the sample as Hausa.

Hausa-English stimulus 2.

This sample is the hardest to both the Hausa NLS and Hausa NNLS, as shown in Table 11.16. Conversely, the UKPHS outperformed both the Hausa NLS and NNLS at identifying the Hausa-English stimulus 2. It was also correctly identified by Y-ACCDIST. The realisation of the voiced dental fricative /ð/ as voiced alveolar fricative [z] is apparent in many articles, adverbs or demonstrative adjectives in this speech sample. Likewise, the bilabial plosive /p/ and labio-dental fricative /f/ are merged as a bilabial fricative [ɸ] in some words. This realisation might have facilitated the right decision taken by the UKPHS and Y-ACCDIST.

Hausa-English stimulus 3.

This sample seemed to be the simplest to identify among the four Hausa stimuli, as shown in Table 11.17. It was correctly identified by all the Hausa NLS, while the Hausa NNLS and the UKPHS were equally 85% accurate respectively. However, despite its high rate of correct identification by the three human groups, it was not identified as Hausa-English by Y-ACCDIST. Cues such as [s] for /θ/ and [z] for /ð/ occur in the sample. Although the speaker invariably realised /ð/ as [z], he used [i] and [a] vowels in the realisation of the definite article 'the'. This combines the realisations of Hausa and Kanuri.

Hausa-English stimulus 4.

As Table 11.18 indicates, this Hausa-English stimulus was well correctly identified by the Hausa NLS, Hausa NNLS as well as Y-ACCDIST. Conversely, only 1 of the 13 UKPHS correctly identified it. The sample does not have many cues of Hausa-English accent compared to the other three speech samples above. There is a light occurrence of Hausa-English features in the stimulus. The speaker never realised [z] for the English voiced dental fricative /ð/, but the definite article 'the' is always realised with [a] vowel. This [a] realisation in 'the' is a Hausa-English cue.

There is a number of Kanuri-English dominant realisations of English phonemes in this sample. It may be recalled that the UKPHS' decisions were based on the matrix of the features of the Hausa-English. Most of the UKPHS mentioned that their decision regarding Hausa-English stimuli was based on the realisation of [z] for /ð/ and [za] for 'the'. This sample did not have these cues. Thus, they confused it with Kanuri-English. Fig 11.17 shows a number of realisations that commonly occur in both Hausa-English and Kanuri-English.

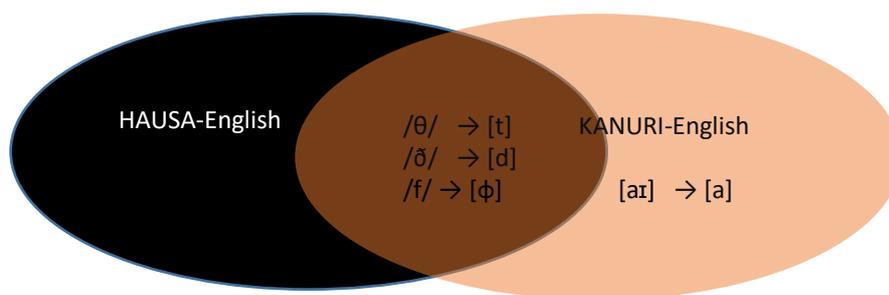


Figure 11.17: Venn diagram showing cues commonly found in Hausa-English and Kanuri-English

Even though it is stated in the matrix that Hausa speakers occasionally pronounce [d] and [t] for the English voiced /ð/ and voiceless dental fricative /θ/, this misidentification of 12 of the 13 UKPHS might be due to the invariable [d] and [t] realisations by the speaker of this speech sample. Likewise, as many Kanuri speakers do, this Hausa speaker does not elongate his [a] realisation of the English PRICE diphthong, as observed in the speech of several other Hausa-English speakers. Thus, this sample is the weakest in terms of the density of the Hausa-English cues. Despite the weakness of the speech sample, both Y-ACCDIST and the Hausa NLS and NNLS performed extremely well over its identification.

Most of the NLS and the UKPHS, in their post-listening task questionnaire, indicated that their decision was based on these three cues: [z] and [s] for ‘th’ and [a:] for PRICE diphthong. The realisations of the alveolar fricatives [z, s] for the dental fricatives /ð, θ/ facilitated their high-performance rates in identifying the second and third Hausa-English samples.

11.6.2 Kanuri-English Stimuli

This sub-section discusses speculations on the accuracy of identifying Kanuri-English by each of the four participating groups. It also discusses the weighting of the cue density in the speech samples. Table 11.19 presents the accuracy rates of the UKPHS, Kanuri NLS, Kanuri NNLS and Y-ACCDIST. It finally provides speculations regarding a correlation between the density of cues in the speech samples and the high/low accuracy rates.

For identifying Kanuri-English, native speaker KNLS performed best. Y-ACCDIST and UKPHS were the second and third most accurate sub-groups respectively compared to all other sub-groups, including the Kanuri NLS.

Table 11. 15: Accuracy of the Kanuri-English stimuli: UKPH, KNNL, KNL, Y-ACCDIST

Kanuri Stimuli	UKPHS	Kanuri NNLS	Kanuri NLS	Y-ACCDIST
Stimulus 1	54% (7/13)	50% (10/20)	20% (1/5)	100% (1/1)
Stimulus 2	46% (6/13)	65% (13/20)	0% (0/5)	0% (0/1)
Stimulus 3	85% (11/13)	95% (19/20)	60% (3/5)	0% (0/1)
Stimulus 4	30.7% (4/13)	90% (18/20)	60% (3/5)	100% (1/1)

Kanuri-English stimuli 1.

This speech sample is the second most challenging to the Kanuri NLS, while it is the hardest to the Kanuri NNLS. Only one of the five Kanuri NLS correctly identified it, while half of the Kanuri NNLS correctly identified it. It was also correctly identified by Y-ACCDIST, as Table 11.20 shows. The UKPHS outperformed both the Kanuri NLS and NNLS by scoring 54% accuracy. Upon completing primary education in his hometown, the speaker moved to a Hausa region for his high school education, where he spent six years. He also obtained a Master's Degree from the University of Maiduguri. His accent suggests that he has, to some extent, shifted away from the typical Kanuri-English accent that is easily detected by fellow Kanuri speakers.

Unlike other Kanuri speakers, this speaker does not confuse the voiceless bilabial plosive /p/ with the voiceless bilabial fricative [ɸ] both syllable-initially and -finally. The dental fricatives are always realised as alveolar plosives [d]. These invariable realisations might be the reason for his confusing the sample mostly with Igbo-English or Yoruba-English but hardly Hausa-English.

Kanuri-English stimulus 2.

This sample seemed to be the most challenging to the Kanuri NLS as none of them correctly identified it. It is the second most challenging stimulus to the Kanuri NNLS and the UKPHS, as shown in Table 11.21. While Kanuri NLS and Y-ACCDIST could not correctly identify it, only 65% of the Kanuri NNLS were accurate. There is a low cue density in the sample as compared to other Kanuri samples. Only the voiced dental fricative /ð/ and the voiceless labio-dental fricative /f/ had multiple realisations of [d] and [ɸ]. All the other English phonemes were only once represented.

The UKPHS were nearly 50% accurate in identifying the Kanuri-English stimulus 2. The Kanuri NNLS and UKPHS outperformed Y-ACCDIST and Kanuri NLS. The speech sample was produced by a primary school teacher. He does not sound like a typical Kanuri-English speaker. Except for confusion of /ð/, /θ/, /f/ with [t], [d], [ɸ], there are not sufficient Kanuri shibboleths in his accent.

Kanuri-English stimulus 3.

As shown in Table 11.22, this speech sample is the simplest Kanuri-English sample, as all the three human groups had correctly identified it with a high success rate. The speaker sounds a typical Kanuri-English speaker, as there are several cues in his speech sample. It is the densest Kanuri-English speech sample. The schwa vowel often occurred in the speech sample. This multiple occurrence of the schwa vowel is commonly observed in L1 Kanuri. Thus, it is an indication of L1 transfer into the speaker's L2 English. The voiceless bilabial plosive /p/ was realised as [ɸ] syllable-initially in three different words, while the voiced labio-dental fricative /v/ was also realised as [p] syllable-finally.

However, it was incorrectly identified by Y-ACCDIST. Kanuri NNLS outperformed their Kanuri NLS counterparts.

Kanuri Stimulus 4.

This sample was simply identified by the Kanuri NLS and NNLS with high accuracy rates. Table 11.23 shows that it was also correctly identified by Y-ACCDIST but incorrectly identified by 70% of the UKPHS. The low performance of the UKPHS could be attributed to the use of some non-Kanuri-English diphthongs. There was a free variation between alveolar fricative [z] and alveolar plosive [d] in the sample. This could be the reason for confusing it with Hausa-English by the majority of the UKPHS. It was also confused with Igbo-English. SQUARE diphthong was realised as [e:] by this speaker. This realisation resembles the Igbo-English and Yoruba-English realisation, as shown in the matrices of features of the four English accents given to UKPHS in advance of the survey. The absence of h-insertion or –dropping in the sample could be the reason for confusing the stimuli with Igbo-English rather than Yoruba-English.

11.6.3 Igbo-English Stimuli

This sub-section compares the accuracy of identifying Igbo-English by each of the four participating groups. Also, it discusses the weighting of the density of cues in the speech samples. Table 11.24 presents the percentage of the accuracy of the UKPHS, Igbo NLS, Igbo NNLS and Y-ACCDIST. Speculations regarding a correlation between the density of cues in the speech samples and the high/low accuracy rates are discussed below.

For identifying Igbo-English, Igbo NLS and NNLS performed best compared to all other sub-groups. Hausa NLS and Yoruba NLS were the second most accurate, while UKPHS and Y-ACCDIST had the lowest equal rate.

Table 11.16: Accuracy of the Igbo-English stimuli: UKPH, NSNL, NSL, Y-ACCDIST

Igbo Stimuli	UKPHS	Igbo NNLS	Igbo NLS	Y-ACCDIST
Stimulus 1	46% (6/13)	75% (15/20)	88.9% (8/9)	0% (0/1)
Stimulus 2	30.7% (4/13)	100% (20/20)	100% (9/9)	100% (1/1)
Stimulus 3	15% (2/13)	75% (15/20)	100% (9/9)	100% (1/1)
Stimulus 4	38% (5/13)	65% (13/20)	77.7% (7/9)	0% (0/1)

Igbo-English stimulus 1.

Table 11.25 shows that this sample is the easiest to the UKPHS, as they were 46% accurate at identifying it. While both the Igbo NLS and NNLS were well accurate at a high success rate in identifying it, Y-ACCDIST was inaccurate.

There is a lot of STRUT vowel realisation as [ɔ] in the sample (as in the words ‘sun, one, colours), and [ɛ:] for SQUARE is evident in the sample (as in the word ‘air’). In addition, /p/ and /f/ were realised as [p] and [f]. This combination of features is neither present in Hausa-English nor in Kanuri-English, while specific Yoruba-English features such as /h/ elision/epenthesis or post-velar nasal alveolar plosive epenthesis is not evident in the sample. This could be the reason for high accuracy achieved by UKPHS compared to other Igbo-English samples.

Igbo-English stimulus 2.

Table 11.26 shows that this sample is the easiest to the Igbo NLS, Igbo NNLS and Y-ACCDIST, while it is the second most challenging to the UKPHS. All the Igbo NLS and NNLS were accurate at identifying this sample.

In addition to vowel realisations, there is also a lot of other Igbo-English features such as [t, d] for dental fricatives, devoicing of /d/ word-finally, /t/ elision word-finally or pharyngealisation of /w/ in the word ‘white’. The availability of these features in the sample could be one of the reasons for the positive identification of it by the three methods—Igbo NLS, Igbo NNLS and Y-ACCDIST. However, UKPHS group’s low accuracy could be due to the non-inclusion of the above-mentioned Igbo-English features in the Igbo-English feature matrix (see Appendix B no. 4).

Igbo-English stimulus 3.

This sample is dense in terms of the Igbo-English cues. It contains several Igbo realisations of both English consonants and vowels. But these clues also occur in Yoruba-English. The cues include the realisations of the dental fricatives as alveolar plosives [t, d], SQUARE diphthong as [ɛ:], NEAR diphthong as [ɪe], and merger of LETTER and STRUT vowels as [ɔ]. It is the second simplest Igbo-English stimulus, as shown in Table 11.24. The Igbo-English stimulus 3 was correctly identified by Y-ACCDIST, all the Igbo NLS and 15 of the 20 Igbo NNLS, while it was the hardest to the UKPHS, as only two of the 13 participants in the group were accurate.

Igbo-English stimulus 4.

This sample is the most challenging to both the Igbo NLS and NNLS. It was also incorrectly identified by Y-ACCDIST, while only 38% of the UKPHS were accurate, as shown in Table 11.24. The sample is the poorest in terms of cue density compared to the other three samples above. The apparent cues in the sample are [d] for voiced dental fricative, [ɔ] for STRUT (as in the words ‘sun, profession, colours), and [f] for the voiceless labio-dental fricative /f/.

11.6.4 Yoruba-English Stimuli

This sub-section compares the accuracy of identifying Yoruba-English by the four groups. It also discusses the weighting of the density of cues in the speech sample. Table 11.29 presents the accuracy rates of the UKPHS, Yoruba NLS, Yoruba NNLS and Y-ACCDIST. Speculations regarding correlations between the density of cues in the speech samples and the high/low accuracy rates are discussed.

For identifying Yoruba-English, both sub-groups of Yoruba native speakers were slightly outperformed by UKPHS and Y-ACCDIST. UKPHS were the most accurate, while Y-ACCDIST was the second most accurate. However, YNLS and YNNLS performed best compared to all other sub-groups of Nigerian participants.

Table 11.17: Accuracy of the Yoruba stimuli: UKPH, YRNL, YRL, Y-ACCDIST

Yoruba Stimuli	UKPHS	Yoruba NNLS	Yoruba NLS	Y-ACCDIST
Stimulus 1	92% (12/13)	80% (16/20)	80% (4/5)	0% (0/1)
Stimulus 2	84.6% (11/13)	45% (9/20)	40% (2/5)	100% (1/1)
Stimulus 3	84.6% (11/13)	75% (15/20)	60% (3/5)	100% (1/1)
Stimulus 4	84.6% (11/13)	75% (15/20)	100% (5/5)	100% (1/1)

Yoruba-English stimulus 1.

This sample contained only one token of h-insertion and two tokens of post-nasal k-insertion as well as devoicing of the voiced postalveolar fricative. As shown in Table 11.30, 80% of the participants of both the Yoruba NLS and NNLS correctly identified the sample. It was the simplest to the UKPHS, as only one of them misidentified it. However, despite these high success rates by the three human groups, it was incorrectly identified by Y-ACCDIST. All the other three stimuli were correctly identified by Y-ACCDIST. Of the four Yoruba-English stimuli presented to all the three human groups, this Yoruba-English stimulus is the weakest in terms of the density of cues, as the h-epenthesis only occurred once.

While both the h-insertion and h-dropping occurred twice or more in all the other three stimuli, there is at least one post-velar nasal [k] insertion in all of them. In addition, the voiced labiodental fricative /ð/ is devoiced at least twice.

Yoruba-English stimulus 2.

This sample was well accurately identified by the UKPHS and Y-ACCDIST, as shown in Table 11.31. But it seemed to be challenging to the Yoruba NLS and NNLS, as only fewer than 50% of them

accurately identified it. There are only two cues of h-dropping in the sample, while there is no h-insertion at all. There are several [ɔ] realisations for LETTER and STRUT vowels in the speech sample.

Yoruba-English stimulus 3.

This sample is the densest with several Yoruba-English cues, especially the h-insertion (4 tokens) and h-dropping (2 tokens). All the three human groups and Y-ACCDIST had high success rates, as shown in Table 11.32.

Yoruba-English stimulus 4.

This sample is the second richest in terms of Yoruba-English cues, and it was the simplest sample to identify, as shown in Table 11.33. Almost all the Yoruba-English shibboleths occurred in the sample. This suggests a correlation between the density in cues and the high success rates for identifying it.

All the Yoruba-English stimuli used in the four experiments had both h-insertion and h-dropping. A response to the post-survey questionnaire indicates that all the participants of the three human groups considered h-insertion and h-dropping as their basis for distinguishing speakers of Yoruba-English from other speakers. However, this decision is stronger in the UKPHS data, where the participants hardly confused a Yoruba-English stimulus with stimuli of the other Nigerian English accents.

11.7 Comparison of Performance of individual Nigerian participants

11.7.1 Hausa participants

The comparison of individual maximum performance in identifying Hausa-English stimuli between Hausa NNLS and NLS below shows no difference between the two groups for scoring 100% (highest). On the other hand, their overall individual performance showed that it is some of the Hausa NNLS that had the highest success rates.

Three Hausa NLS (50% of them) correctly identified all the four Hausa-English stimuli. The other three Hausa NLS (50% of their total number) correctly identified three of the four Hausa-English stimuli. Similarly, 10 of the Hausa NNLS (50% of them) correctly identified all the four Hausa-English stimuli. Three of the Hausa NNLS correctly identified three of the four Kanuri-English stimuli. Hausa NLS had 0% seven times for identifying other Nigerian-English accents.

As earlier shown in the section for comparing the performance of the sub-groups of the Nigerian linguists with their non-linguist counterparts, this individual performance suggests no

difference between Hausa NLS and NNLS in identifying fellow speakers of their Hausa-English. However, Hausa NNLS are more likely to identify some of the other Nigerian English accents.

Overall, only one of the Hausa NLS was 72% (13/18) accurate, while another one was only 38% accurate (7/18). On the other hand, one of the Hausa NNLS was 83% (15/18) accurate. Two other Hausa NNLS were 77% accurate, respectively, while another one was 72% accurate.

11.7.2 Igbo participants

As earlier shown in the section for comparing the sub-groups of Nigerian linguists with their non-linguist counterparts, the comparison of individual overall performance between the Igbo NNLS and Igbo NLS indicates no difference between the two Igbo groups in terms of the highest success rates in classifying the four accents of Nigerian English.

Six Igbo NLS (66.6% of them) correctly identified all the four Igbo-English stimuli, while 7 of the Igbo NNLS (35% of them) correctly identified the Igbo-English stimuli. While none of the Igbo NLS correctly identified all the four Yoruba-English stimuli, two of the Igbo NNLS correctly identified all the four Yoruba-English stimuli. Igbo NLS had 0% ten times at identifying other Nigerian English accents or non-Nigerian foils. One Igbo NL (5% of them) correctly identified one of the four Igbo-English stimuli. This participant is the weakest among the Igbo NLS.

One of the Igbo NNLS correctly identified all Igbo-English, Hausa-English and Yoruba-English stimuli. This Igbo NNL seems to be an extra-ordinary participant among the Igbo NNLS, as his overall performance rate matches the overall performance of the only Igbo phonetician who was also 72% accuracy in the classification task.

Overall, two Igbo NLS were 33% (6/18) accurate respectively, while another Igbo NL (a phonologist) was 77% (14/18) accurate. One of the Igbo NNLS was also 77% accurate.

11.7.3 Kanuri participants

The comparison of individual performance in identifying Kanuri-English stimuli between Kanuri NNLS and Kanuri NLS below indicates that the overall best Kanuri participants came from the Kanuri NNLS group. Similarly, the overall individual performance shows that maximum success rates were achieved by some of the Kanuri NNLS compared to their NLS counterparts. Three Kanuri NLS (60% of them) accurately identified only one of the four Kanuri-English stimuli, while only two Kanuri NLS identified two of the four Kanuri-English stimuli. None of them identified up to three of the four Kanuri-English stimuli. Seven Kanuri NNLS (35% of them) correctly identified the four Kanuri-English stimuli. One Kanuri NL and another Kanuri NNL correctly identified all the four Hausa-English stimuli. Four of the Kanuri NLS had 0% at identifying other Nigerian accents.

The Kanuri NNLS never had 0% for classifying other Nigerian-English accents. Overall, one of the Kanuri NLS was only accurate at 27% (5/18), and another one was accurate at 72% (13/15). On the

other hand, two Kanuri NNLS were accurate at 77% (14/18) respectively, and another one was accurate at 72% (13/18).

11.7.4 Yoruba participants

Two Yoruba NLS (40% of them) correctly identified all the four Igbo-English, while only one Yoruba NNLS (5% of them) accurately identified all the four Yoruba-English. Yoruba NLS had 0% five times in classifying other Nigerian-English accents. Two Yoruba NNLS (10% of them) correctly identified only one of the four Yoruba-English stimuli; they were the weakest individual participants at identifying fellow speakers of their L1 Yoruba.

11.8 Summary and Conclusion

In this chapter, performances of the four groups in classifying accents of Nigerian English were compared. Comparison of overall accuracies of the groups shows marginal differences between the four methods. None of the methods was significantly better than any other. The only variable that significantly raised the accuracy of participants was native speakership. In other words, listeners' accuracy significantly goes up when listening to stimuli of their L1 accents. There are ten sub-groups in the classification task. The sub-groups are eight Nigerian sub-groups, UKPHS and Y-ACCDIST. Out of these sub-groups, the Hausa NLS were the best performing sub-group in accurately classifying stimuli of other accents. While the Hausa NNLS were the best performing sub-group of NNLS, the Igbo NLS were the best sub-group in identifying fellow speakers of their own L1 accent groups. Yoruba NNLS were the poorest sub-group of NNLS, while Kanuri NLS were the poorest sub-group of NLS for having the highest false rejections.

The Nigerian English accents were differently confused by the four methods. Nigerian participants confused more accents of the same Nigerian region (either northern or southern Nigeria) than the accents of different regions. Conversely, the UKPHS and Y-ACCDIST's confusions were mainly between accents of different Nigerian regions (i.e., mixed from northern and southern Nigeria). Apart from the native Hausa speakers' performance in identifying fellow speakers of their L1, Hausa-English was the easiest accent to identify by non-native Hausa Nigerian participants. Yoruba-English was the easiest to identify UKPHS and Y-ACCDIST. The UKPHS and Y-ACCDIST were the most accurate groups compared to the native Yoruba and other Nigerian listeners. The typicality of Yoruba-English did not influence the outstanding performance amongst the Nigerian participants of Hausa, Igbo or Kanuri origins. The UKPHS and Y-ACCDIST outperformed both groups of L1 Yoruba and Kanuri NLS at identifying Yoruba-English and Kanuri-English.

Igbo-English posed some difficulty to UKPHS and Y-ACCDIST as they performed only slightly above chance (33%). This finding suggests a high variability across Igbo-English speakers since both Y-

ACCDIST's training of data and feature matrices used by the UKPHS did not facilitate successful identification of Igbo-English stimuli. It is possible to speculate that the inclusion of non-Nigerian foils posed more difficulty to identifying Igbo-English, as the foils too had no consonantal shibboleths. However, this speculation may not be acceptable since the non-Nigerian foils were not included in the Y-ACCDIST analysis, while Y-ACCDIST was as poor as UKPHS. Despite the suspected variability in Igbo-English, Igbo native speakers were highly accurate and confident in identifying their fellow speakers. Likewise, other Nigerian participants were up to 70% accurate in identifying it.

The material on the cue density analysis above suggests a high inconsistency in identifying the speech samples. It was not always the case that speech samples of high quality and dense cues were accurately identified by all groups, as shown above. Thus, it is possible to speculate that accent identification methods do not rely on the same clues to identify a stimulus of a given accent. For example, the densest Yoruba-English speech sample was the easiest to identify by human methods, but was the only one rejected by Y-ACCDIST. Despite the higher success rates of both the Hausa NNLS and NLS in identifying their fellow native Hausa speakers and the other Nigerians, they had the highest false-acceptance rate. This finding suggests a highest likelihood of falsely accepting other Nigerian English speakers into their Hausa native group. On the other hand, Kanuri NLS who had the highest rate of false rejection had the lowest rate of false acceptance. This finding suggests that Kanuri NLS are most likely to reject false claimants of Kanuri origin.

Having compared all the four methods in classifying the Nigerian English accents and rejecting the non-Nigerian foils, the next and final chapter concerns discussions of the findings of both phases of the research.

Table 11.18: A summary of key comments on the listeners' basis of classifying the English accents

Nigerian linguists			
<p>Hausa linguists Hausa-English</p> <p>Non-th pronunciation, vowel elongation as in Hausa, [p] for /f/, [z] for /ð/</p> <p>Igbo-English</p> <p>Pronunciation closer to Englishman, /r/ versus /l/ confusion</p> <p>Kanuri-English</p> <p>Heavy pronunciation, intonation as in Kanuri, no observation</p> <p>Yoruba-English</p> <p>Frequent use of fricatives /ð/ as in that, thought /h/ elision/epenthesis, [a] for /h/.</p>	<p>Igbo linguists Hausa-English</p> <p>/f/ & /v/ substitution [p] for /f/, [s] for /ð/, /dʒ/ for /ʒ/, superimposition of rising intonation of Hausa phonology</p> <p>Igbo-English</p> <p>Dialect interference, <wh> heavy accent, omission of /t/ word-finally, syllabification, superimposing tone</p> <p>Kanuri-English</p> <p>No observation, excessive use of schwa, Kanuri phonology influence</p> <p>Yoruba-English</p> <p>/h/ dropping & insertion, tone superimposition and syllabification</p>	<p>Kanuri linguists Hausa-English</p> <p>Rolling of /r/, implosive feature of Hausa, [p] for /f/</p> <p>Igbo-English</p> <p><tion> as [ʃon], /t/ & /k/ difficulty, accent, Igbo[gb] appearance, stress as in Igbo</p> <p>Kanuri-English</p> <p>[p] for /f/, [b] for /v/, [ɸ] for /p/ English vowel elongation</p> <p>Yoruba-English</p> <p>Most vowels have rounding feature, /h/elision/epenthesis neutralisation of /f/-/v/, nasality in their English words</p>	<p>Yoruba linguists Hausa-English</p> <p>[p] for /f/, intonation, right stress placement</p> <p>Igbo-English</p> <p>Syllabification, vowel quality, stress placement, Advanced tongue root in their pronunciation</p> <p>Kanuri-English</p> <p>[p] for /f/</p> <p>Yoruba-English</p> <p>Syllabication, wrong stress placement, aspiration, rising and falling intonation placed on every syllable, /h/ elision/epenthesis</p>
Nigerian non-linguists			
<p>Hausa non-linguists Hausa-English</p> <p>[p] for /f/, [z] for /ð/</p> <p>Igbo-English</p> <p>Accent, intonation of Igbo in their English</p> <p>Kanuri-English</p> <p>Intonation, no observation</p> <p>Yoruba-English</p> <p>[a] for /h/, intonation of Yoruba, [s] for /ʃ/ /d/ for /ð/</p>	<p>Igbo non-linguists Hausa-English</p> <p>Stress & intonation, [kh] for /k/, [p] for /f/, wrong stress placement, [f] for /t/</p> <p>Igbo-English</p> <p>/r/ difficulty, intonation, [l] for /r/</p> <p>Kanuri-English</p> <p>No observation</p> <p>Yoruba-English</p> <p>Intonation, [a] for /h/, Their pronunciation is more of commanding.</p>	<p>Kanuri non-linguists Hausa-English</p> <p>[p] for /f/, accent, [z] for /ð/</p> <p>Igbo-English</p> <p><th> emphasis in 'thousand', accent, /t/ difficulty, imitating native speakers, heavy stress</p> <p>Kanuri-English</p> <p>[p] for /f/, primary school pronunciation, [p] for /f/, [b] for /v/, tone, accent</p> <p>Yoruba-English</p> <p>/h/ deletion & insertion, accent, heavy tones, word elongation, intonation</p>	<p>Yoruba non-linguists Hausa-English</p> <p>Intonation, [p] for /f/, accent, vibration of /r/</p> <p>Igbo-English</p> <p>Intonation, accent, /r/ factor, pitch of their voice, a lot of stressing words, [f] for /v/</p> <p>Kanuri-English</p> <p>Intonation, no observation, accent</p> <p>Yoruba-English</p> <p>/h/ elision/insertion, accent, stressing words, [f] for /v/</p>

Table 11.19: A summary of key comments on the listeners' basis of classifying the English accents

UK-based phoneticians			
<p>Hausa-English [s, z] for /ð, θ /, [p] pronunciation, happy vowel, <the> as [z], [ɸ] for /p/ word-initially</p>	<p>Igbo-English NURSE as [ɜ:], quality of STRUT and FLEECE MOUTH to separate Igbo from Yoruba</p>	<p>Kanuri-English /p/ pronunciation, <the> as [di], happy vowel, [p] as /f/, [ɸ] as /p/ word-initially [d] for /ð/</p>	<p>Yoruba-English Intonation, nasalisation, h-dropping, epenthesis velar nasal plus post-velar nasal velar plosive epenthesis</p>

Chapter 12

Overall Discussion of both phases of the study and Conclusion

12.0 Introduction

This chapter involves discussions of overall findings from both phases of the research. In addition, it puts forward a set of recommendations for consideration by border agencies and government bodies intending to employ personnel and/or automatic system in LADO/LAAP casework. It also includes suggestions for future developments in the field of LADO, and specifically, a proposal that the diagnostic feature matrix emanating from this study—which could be drawn from analogous projects—be incorporated into computer software to be used in conjunction with expert human analysis in LADO/LAAP casework.

12.1 Overview of the major findings of the study

This section is concerned with discussions of the main findings of the study and its implication for the field of LADO/LAAP. It looks into the main findings across the chapters concerning the four methods and evaluates the findings against the research hypotheses and questions set out in Chapter 2. To provide a clear structure, discussions of the main points of the findings are provided under sub-sections.

12.1.1 Discussion of the findings of phase 1 of the research

Concerning the first stage of this study that aimed to establish an up-to-date description of the four accents of Nigerian English, three research questions guided the focus of the study. Each of the questions is discussed relative to its answers from the findings.

- (4) In what ways do the four Nigerian English accents spoken by L1 Hausa, Igbo, Kanuri and Yoruba speakers differ from one another?

As far as segmental phonology is concerned, Hausa-English and Kanuri-English differ in the realisation of a few English consonant phonemes and in the distribution of some English sounds. For example, phonemes /p, θ, ð, ʒ, ɲ/ are mainly realised as [ɸ, s, z, ʃ, ɲ] in Hausa-English but mainly realised as [p, t, d, dʒ, n] in Kanuri-English (see Chapter 4 for details). As reported by Jibril (1982), the findings also show that Igbo-English does not have consonant shibboleths to distinguish it from the other three accents. However, Yoruba-English has some specific realisations of English consonant phonemes such as, [s] for /z/ in some cases, [f] for /v/ word-finally and phonetic processes such as /h/ elision, /h/ epenthesis, post-velar epenthesis of /g/ word-finally and l-vocalisation that can be used to distinguish it from the other three accents (see Chapter 4 for details).

The differences between the Nigerian English accents are not apparent in vowel phoneme articulation. However, accents are easily distinguishable through consonant phoneme articulations. This uniformity of many English vowel pronunciations between southern and northern Nigerian Englishes has been argued to be due to the influence of English teachers over their students/pupils. Some of the differences between Igbo-English and Yoruba-English, for example, have been argued to be influenced by the differences between English teachers in the Igbo region and English teachers in the Yoruba region during pre-independence of Nigeria (Awonusi, 2009; Igboanusi, 2006; Jibril, 1982). While Irish-English and Scottish-English teachers dominated the Igbo region, German-English teachers dominated the Yoruba region (Igboanusi, 2006). In addition, Jibril (1982) pointed out that the differences between Hausa-English and southern Nigerian English has decreased owing to the massive post-independence deployment of Igbo-English teachers to northern Nigeria. During the pre-independence period, English was mainly taught by native English teachers in northern Nigeria. After the Nigerian's independence, the native English teachers returned to their home country. As a result, many indigenous English teachers from southern Nigeria took over the English teaching positions in the north.

- (5) Can the differences between the four types of Nigerian English be accounted for by reference to the different L1 phonological systems?

To answer this question, it was hypothesised that the four varieties are distinguishable and that major disparities between them will be attributable to L1 interference and apparent in their phonological and phonetic features.

The findings show that many of the differences are attributable to the differences of the L1 phonological systems. However, other differences between the accents do not suggest the influence of the L1s, yet such differences can be used to distinguish between the accents. For example, the schwa epenthesis syllable-finally and word-finally in Hausa-English is not one of the examples of L1 Hausa influence; the schwa vowel is not one of the five Hausa vowel phonemes. As the syllable structure of Hausa does not allow CC but CV or CVC, this could be a way of avoiding CC structure. This epenthetic vowel is not evident in either Igbo-English or Yoruba-English. Thus, it is possible to use the epenthetic schwa vowel to distinguish Hausa-English from other Nigerian English accents. For Kanuri-English, it can be argued that the schwa vowel epenthesis word-finally is an indication of L1 Kanuri influence due to its frequent occurrence in the same position in Kanuri words. These findings further support the previous position of a number of Nigerian English scholars that L1 influence is not the only source of difference between varieties of Nigerian English (Awonusi, 1986; Bobda, 2000; Igboanusi, 2006).

- (6) Are there any differences between the four current accents of Nigerian English and their past descriptions by scholars such as Dunstan (1969), Jibril (1982), Jowitt (1991) and Sogunro (2012)?

To answer this question, it was anticipated that the research might show at least some segmental features at variance with earlier descriptions owing to natural sociophonetic processes of evolution, mutation and change.

The findings of the study in comparison with the past literature show some differences between the Nigerian English accents. The differences observed mainly affect consonant phonemes and phonetic processes in Nigerian English (see the summary in Chapter 4). For example, the English consonant phonemes /v, z, tʃ/ were previously reported to have different [f, s, ʃ] realisations in Yoruba-English. However, evidence from the current corpus indicates that native Yoruba speakers pronounce such English consonant phonemes as in Received Pronunciation. Thus, the three consonant phonemes above are no longer Yoruba-English shibboleths. This could be due to attainment of high level of education and exposure to standard form of pronunciation in universities. Several university lecturers have been to England and USA for their higher education (mostly postgraduate studies) where they had more contact with native English speakers. This could be the reason for the change in realisation of such sounds, and such changes are also passed on to the lecturers' students. One of the core modules taught in all Nigerian universities is the use of English. The English module includes oral English and is taught in both the first and second year of undergraduate programmes. This could also be another reason for realising the above English consonants as in Received Pronunciation. However, the speakers in the current Yoruba-English corpus are all educated speakers, and older Yoruba native speakers (though not included in the corpus) still use such three shibboleths [f, s, ʃ], as observed in the media (on radio or television), at schools or work places via my personal experience.

In relation to this finding, Igboanusi (2006) observed that the realisation of /v, z, tʃ/ as [f, s, ʃ] is apparent in the speech of basilectal (speakers with primary or junior secondary level of education) and mesolectal (speakers that completed secondary school), and acrolect (speakers with a sophisticated use of English) of Yoruba-English. It should be recalled that the current corpus contained only university undergraduates, graduates and postgraduates, while Jibril (1982) did not categorise his Yoruba-English shibboleths into different social classes. Thus, it is possible to speculate that Yoruba undergraduates, graduates and postgraduates pronounce the English phonemes /v, z, tʃ/ in the native English way. It is not possible however to speculate on whether the other three realisations of the English consonant phonemes /v, z, tʃ/ reported by Jibril (1982) and Igboanusi (2006) are still used among them.

12.1.2 Discussion of the findings of Phase 2 of the research

Concerning the second phase of the research that aimed to test the four methods for the accent classification task, six research questions were asked to guide the investigation. Each of the questions is discussed relative to its answers from the findings.

- (7) How and by whom in a LAAP (Language Analysis in the Asylum Procedure) context should the analysis of spoken English be carried out? Is it native speaker linguists? Or native speaker non-linguists?

To answer this question, it was hypothesised (see Chapter 2) that native speakers of a particular L1, say, Yoruba will perform better when exposed to an L1 Yoruba stimulus than when exposed to other L1s such as Hausa, Igbo or Kanuri. As expected, the findings revealed that L1 Yoruba listeners were more accurate at identifying L1 Yoruba-English stimuli than the other L1s. While Yoruba NNLS were 71% accurate at identifying stimuli of their L1 Yoruba, they were only 34% accurate at categorising the other L1s. As already discussed above, all the other three groups—Hausa, Igbo and Kanuri—were more accurate at identifying stimuli of their L1 than stimuli of the other L1s. Based on the findings, the native listeners performed significantly better at correctly identifying the English spoken by those who share their L1 than that spoken by those who do not. It was revealed that when the L1 represented in the stimulus matches the listener's L1, accuracy of participant is likely to increase approximately two times relative to when their L1s do not match.

Similarly, findings of the NLS group also revealed that the Hausa, Igbo and Yoruba NLS were more accurate at identifying their L1s than categorising the other L1s. Although Kanuri NLS were not as accurate as expected at identifying the stimuli of their L1 Kanuri, they were more accurate than the other three NLS groups (Hausa, Igbo & Yoruba) at identifying stimuli spoken by L1 Kanuri speakers from the other stimuli. It is also observed that the Kanuri stimuli were least correctly identified by all the NLS participants as well as the participants of Hausa, Igbo and Yoruba sub-groups of the NNLS group.

The responses of the Kanuri LS to the Kanuri stimuli were carefully checked and compared with the responses of the Kanuri NLS. It was discovered that those stimuli incorrectly identified by the Kanuri LS were, however, correctly identified by the Kanuri NLS. It is not likely that Kanuri stimuli did not have L1 Kanuri features leading to the inability of the Kanuri LS to identify them since they were correctly identified by the Kanuri NLS.

Since the three sub-groups of the native speaker linguists were numerically better than their non-linguist counterparts at identifying their own L1 speakers, the finding suggests that native speaker linguists are in a better position to carry out analysis of spoken English in a LAAP context. The very few native speaker phoneticians who participated in the survey were highly accurate at 100% as discussed in Chapter 8. This finding suggests that they might be more likely to produce the best analysis than

the non-phonetician linguists. A further discussion of how this analysis should be carried out is provided in the recommendation section below.

(8) If expertise in linguistics is found to be effective, which specific linguistic expertise will be required?

To answer the second question, two hypotheses were formulated:

1. That Nigerian native speaker linguists will outperform their non-linguist counterparts at correctly identifying fellow speakers of their L1 owing to their conscious awareness of language structure and variation that formal study of linguistics brings.
2. That Nigerian native speaker linguists who are also phoneticians will outperform their linguist non-phonetician counterparts.

In relation to the first hypothesis of this question, the findings show no significant difference between the NLS and NNLS. The NNLS were only numerically 0.56% more accurate than the NLS, and such differences were not statistically significant with the exception of Kanuri group—where Kanuri non-linguists significantly outperformed their Kanuri linguist counterparts. Overall, the NNLS were 76.5% accurate at identifying their L1, while NNLS were 76.0% accurate. It is worth mentioning that the overall accuracy of the NLS group was affected by the Kanuri group. While the other three groups' accuracy ranges from 75% to 92%, the Kanuri group was only 35% accurate. Thus, the huge gap between the Kanuri and the other groups drastically decreased the overall accuracy of the NLS at identifying their L1s. Furthermore, the overall results of NLS performance at categorising other L1s revealed that NLS were numerically more accurate than the NNLS by 7%.

To confirm the second hypothesis of the question, as expected, the Nigerian phonetician results indicate that they were overall 64% accurate at identifying their L1 and the other L1s. They were 100% accurate at identifying their L1 and 54% accurate at identifying the other three Nigerian L1s. This indicates that Nigerian phoneticians were more accurate than both the linguist non-phoneticians and non-linguists at identifying their own L1 and other L1s. It could be argued that the performance of the NLS group might have been much better if there were more phoneticians in the group.

(9) Which of the methods performs best?

To answer this question, three hypotheses were formulated:

1. That native speakers will perform best in identifying fellow speakers of their L1s only.
2. That UK forensic phoneticians may outperform UK non-forensic phoneticians owing to their frequent practical experience in forensic phonetics casework.
3. That Y-ACCDIST may outperform the UK phoneticians owing to its high success rates reported in some previous literature (Brown, 2015; 2016; Brown and Wormald, 2017).

The findings support the three hypotheses to some extent. The findings support the first hypothesis, as shown in Chapter 11 in the breakdown of performance for each of the four Nigerian English accents.

Concerning the second hypothesis, the overall results showed that the forensic UKPHS were numerically better than the non-forensic academic UKPHS, albeit the difference failed to reach significance, though the sample sizes are small.

The findings also support the third hypothesis. Overall, Y-ACCDIST outperformed the UKPHS by 5%, though the difference did not reach significance. Y-ACCDIST's higher success rate over the UKPHS was mainly observed in only one of the four Nigerian accents (Kanuri-English). While both Y-ACCDIST and UKPHS had equal performance in identifying the Igbo-English, the UKPHS slightly outperformed Y-ACCDIST in identifying Yoruba-English, and Y-ACCDIST slightly outperformed the UKPHS in identifying Hausa-English accent. Except for Kanuri-English identification, there is a high correlation between the accuracies of the UKPHS and Y-ACCDIST. Despite the non-inclusion of the non-Nigerian foils for Y-ACCDIST's classification task, its performance is very similar to that of the UKPHS. Given that there is interesting variability in the data across the respondent groups, it is an indication that they pick up on different cues to make decisions, and this shows there is no easy answer to the question of who is best.

The findings, therefore, provide strong support overall for the efficacy of native speakership in identifying a fellow speaker of one's L1 group. The strong correlation between self-reported confidence in accent classifications and their accuracy indicates that, in comparison with many other forensic areas, such as lay identification of individual voices (see for example, Braun, Llamas, Watt & French, 2018; Köster & Schiller, 1997; Köster, Schiller & Künzel, 1995; Stevenage & Neil, 2014; Stevenage, Clarke & McNeill, 2012; Thompson, 1987), confidence is a good predictor of accuracy; however, other studies such as Wilson's have reported the opposite. Since statistical significance has shown weak support for the efficacy of linguistics expertise in accents classification, it suggests that, as argued by Nolan (2004), describable cues that are normally displayed in linguistic terms, may not significantly facilitate a positive judgment by a native speaker linguist or a non-native speaker linguist. The participants, irrespective of whether they are linguists or not, will undoubtedly have suprasegmental clues available to them, albeit such clues were not considered in this segment focused study. In addition, native speakers—linguists and non-linguists—will have sub-categorical but salient clues that are established as part of their L1 socialisation.

(10) Are errors of the methods in complementary distribution? If so, which methods should be combined to give optimum performance?

A hypothesis was not formulated in answering the fifth question. Findings of the study indicate that some group errors are in partly complementary distribution. The speech samples used in the

experiments were differently classified by the three human listener participant groups and Y-ACCDIST. Some stimuli that happened to be challenging to identify by one group, were successfully identified by another group. Classifications of each of the speech samples in the four accent groups are given below.

Having observed such performance differences among the three background types and two methods, it can be argued that each of them has relevance (in their own right) that is complementary to others in LAAP (see a further implication for LAAP in the recommendation section). The means of judgement are not always the same even when accurately identifying the same speech samples. Each of the methods has the potential of contributing towards producing a more reliable language analysis. First, the native speakers—linguists and non-linguists— have proven to be reliable in having scored the overall highest accuracy in identifying the stimuli of their L1 accents, even though they were over-confident when they were inaccurate. While saluting the high confidence of native speakers when they were accurate, their over confidence when inaccurate is a good reason for one to be careful and hesitant in making a strong statement concerning confidence/accuracy correlation line. Using feature matrices as further discussed below, the non-native phoneticians are also shown to have the potential of producing some reliable language analysis output particularly using accents with stereotypes such as /h/-elision and /h/-epenthesis in Yoruba-English. On the other hand, Y-ACCDIST has demonstrated its potential in language analysis considering its high performance in classifying two of the four Nigerian English accents: Yoruba-English and Kanuri-English. This concurs with Wilson's (2009) position that sees the potential in combining positive features of each of the groups in her experiment. Wilson observed that, apart from native speakers, non-native speakers of Ghanaian English—academic linguists, postgraduates and undergraduates of linguistics—performed well in her experiment, and the undergraduates' performance was similar to that of the linguists. She argues that native speaker expertise, sufficient amount of linguistic expertise and variation in the individual talent and experience should be considered in selecting a reliable language analyst.

(11) What type of errors did the approaches produce?

A hypothesis was also not formulated in respect of the seventh research question. The findings show that the methods incurred different types of errors in classifying the four Nigerian English accents and the two foils. All the four NNLS sub-groups had higher false-positive than false-negative errors. Similarly, except for L1 KNLS, all the other three NLS sub-groups had higher false-positive errors than the false negative ones. Conversely, the UKPHS had higher false-negative than false-positive errors.

These findings suggest that L1 Nigerian English speakers would likely reject fewer genuine fellow speakers of their Nigerian English accent than accept a non-member of their accent group as a

fellow member. Thus, this suggests that most of the genuine claimants of these accents may likely have their claims confirmed, but there is also a likelihood of accepting false claimants who have lived with genuine speakers of the claimed origin. While both HNLS and HNNLS are likely to confirm a claim of a genuine L1 Hausa speaker, they are more likely to falsely accept a Kanuri speaker who hid his Kanuri origin and claimed Hausa origin. Similarly, all participants of L1 Igbo and Yoruba were more likely to confuse Kanuri-English with Hausa-English than correctly identifying it.

(12) How does other-accent familiarity affect listener performance?

A hypothesis was not formulated with respect to this research question. A combination of familiarity and studying the sound system of a language does not seem to be as effective as being a native speaker for accurate and reliable identification of a place of socialisation. It is also evident that NLS—who stated that they had studied the sound systems of some non-native Nigerian L1s—could not reliably identify Nigerian English speakers of those Nigerian L1 backgrounds. As mentioned earlier, Igbo-English lacks specific consonantal shibboleths compared to the other three accents. Despite this, except for Yoruba NLS, all the other linguist sub-groups accurately identified more Igbo-English stimuli than Yoruba-English stimuli. This suggests that (apart from native speakers) non-native speaker listeners do not only use consonants and vowels but also considered some suprasegmental features to classify other accents of a language, as they categorically stated in their post-listening questionnaire where they provided the basis for their decisions in classifying the accents. Many Nigerian native linguists mentioned tone patterns, intonation displacement, syllabication, different stress placement as their reasons for assigning an L1 to the stimuli.

Apart from Hausa native speaker participants, Igbo non-linguists were the best non-linguist group in identifying Hausa-English stimuli. Though speculative, it is the case that the Igbo people are more mobile than all the other Nigerian L1 groups. As mentioned by some of the Igbo participants in the questionnaire, they had lived for some years in the Hausa-speaking communities before taking the survey. This may have exposed them to the typicality of L1 Hausa-English speech.

Yoruba linguists had the highest success rate in identifying Hausa-English compared to both Igbo and Kanuri linguists. The pre-classification task questionnaire of the Yoruba linguists indicates that three of the five Yoruba linguists had either lived in a Hausa region for some years or studied the Hausa sound system during their undergraduate or postgraduate studies. Though inconclusive, it is possible this is the reason for their high success rate. As Hausa is the largest group in Nigeria, many Nigerians in several Nigerian regions are conversant with its L1 features interfering in the Hausa-English accent. The most common features are the ones considered to be Hausa-English stereotypes: [s, z, φ, b] for / θ, ð, f, v/. While these stereotypes have made Hausa-English speakers widely known across regions of Nigeria, they are not responsible for giving the speakers any prestige over the other varieties. However, as discussed in Chapter 1, scholars such as Ayo Banjo argue that Hausa has more

pronunciation feature similarities with English than Yoruba or Igbo, and this gave Hausa-based English an advantage of being considered more prestigious than the Igbo-based and Yoruba-based English (see sociolinguistic situation section in Chapter 1 for details).

Apart from the native speakers of Igbo, the Hausa NLS were the most accurate in identifying Igbo-English. As stated in the pre-listening questionnaire, none of the Hausa NLS had lived in an Igbo-speaking region before taking the survey. It is possible their high success rate could be attributed to their contacts with Igbo people in northern Nigeria, especially in Kano, as a significant number of Igbo people have lived in the city for decades for trading purposes.

A few linguists were 100% accurate in identifying speakers of other Nigerian English accents. Despite this, they had neither stayed in the regions of the accents in question nor studied their sound systems. Thus, there is not a correlation between participants' performance and contact with speakers of each accurately identified accent.

Similarly, only two Igbo NNLS that correctly identified all the four Yoruba-English stimuli had lived most of their lives in Lagos (a Yoruba state). The other non-linguists had not lived in native regions of the accents in question. For example, only one Igbo NL correctly identified all the four Hausa-English stimuli compared to five Igbo NNLS that correctly identified the Hausa-English stimuli. Some Igbo NLS who reported that they had either studied the Hausa sound system or lived in a Hausa-speaking community for some time could not correctly identify all four Hausa-English stimuli. On the other hand, none of the five Igbo NNLS (that correctly identified all the 4 Hausa-English stimuli) studied the Hausa sound system or lived in any Hausa region.

Thus, only the performance of the above two Igbo NNLS correlates with the familiarity of Yoruba-English speech through a long-term contact while staying in the Yoruba city. It is, therefore, difficult to speculate the influence of familiarity (as a result of contact) on the high success rates achieved by both groups. This finding suggests that the effect of familiarity is only clearly evident in the performance of native speakers identifying fellow speakers of their L1s, while it has less of an effect on identifying a neighbouring accent.

Some NNLS outperformed their NLS counterparts (by scoring 100% accuracy) in identifying fellow speakers of their L1s and speakers of other L1s. As individual performances show, the NNLS had the overall maximum accuracy rates for identifying both fellow speakers of their L1s and speakers of other L1s compared to the NLS. The overall accuracy of individual participants also indicates that some non-linguists were more accurate than their linguist counterparts in the classification task.

This finding suggests that high performance is dependent on the particular experience and talent of the individual rather than a linguistic qualification alone; some participants with lower linguistic qualifications (or without any linguistic qualifications at all) have outperformed those of higher qualifications. These high success rates recorded support the view of Cambier-Langeveld

(2010) and Foulkes, French & Wilson (2019) that individual competence and experience play a vital role in determining the quality of analyses irrespective of the method employed. The individual performances of NLS and NNLS are compared and discussed below.

The following four sections consider other important aspects of the findings that were neither part of the research questions nor part of research hypotheses.

12.1.3 Confidence

As previously discussed in the three chapters of human-based experiments, there was not a significant relationship between confidence and accuracy for the Nigerian non-linguist group, while a significant relationship was observed for the Nigerian linguist and UK-based phonetician groups. Both Nigerian linguists and non-linguists were highly confident even when they were inaccurate, and the individual confidence rating indicates that several non-linguists were even more confident when inaccurate than when accurate (see Chapters 7, 8 & 9).

Although it is observed that there was a correlation between confidence and accuracy for the classification task for the entire two human groups—Nigerian linguists and UK phoneticians. However, more variability was observed in identifying individual accents. As noted by many linguists in past studies, it was also the case that in this study untrained native speakers were more confident than all other linguist participants in making correct and incorrect judgements.

For the Nigerian non-linguist group, there was a correlation between accuracy and confidence for the most challenging accents (Kanuri-English and Igbo-English, i.e., listeners' confidence rises when their accuracy goes up). However, no correlation was observed for the easy-to-identify accents (Hausa and Yoruba). The non-linguists were less confident even when their accuracy of Hausa-English and Yoruba-English rose, and their confidence rose even when they were not accurate.

Conversely, NLS' confidence only rose when the accuracy of Kanuri-English stimuli went up. The few Nigerian phoneticians were also not confident in classifying all the Nigerian English varieties. Previous studies showed that non-linguist native speakers who carried out language analysis had had a high confidence rate even when they were inaccurate. Wilson (2009) observed that untrained native speakers were not cautious in their confidence rating: they had a very high confidence level even when they were inaccurate. Conversely, the findings here reveal that both the Nigerian phoneticians and the linguists were highly confident even when they missed their L1 accents or misclassified other L1 accents. Only UKPHS exercised caution in their decisions, as they had the lowest confidence level for both correct and incorrect responses. There is also a low/no correlation between their accuracy and confidence rates compared to the NLS and NNLS. Neither Nigerian phoneticians nor Nigerian non-phonetician linguists were significantly more cautious than the Nigerian non-linguists in their

judgements. This suggests that linguists' confidence judgments may not be more reliable than non-linguist judgements, albeit this may not also affect their accuracy judgments.

12.1.4 Use of working materials by UK-based phoneticians

The results suggest that feature matrices can benefit analysts attempting to identifying Yoruba-English, and they are useful for identifying Hausa-English and Kanuri-English. The UKPHS accuracy of Hausa-English and Kanuri-English is similar to the accuracy of Nigerian participants in classifying other accents of Nigerian English. Their performance in identifying Hausa-English and Kanuri-English is not as high as the performance of the Hausa and Kanuri native speakers. However, the narrative changes in the case of Igbo-English.

The feature matrices of the four Nigerian English accents were only provided to the UKPHS, as the UKPHS would not be able to perform the task without these. Their better performance could be due to their favourable conditions of having software, headsets, equipment and unlimited time; however, NLS participants were also requested to give their reasons for identifying speakers of each of the four Nigerian English accents. Although the NLS were not provided with the matrices, their basis for classifying the accents (as shown in the post-listening questionnaire) looked similar to that of the UKPHS. The majority of both NLS and UKPHS based their decisions on a few consonants compared to vowels. Thus, the UKPHS' decisions were based on a few consonant shibboleths of Hausa, Kanuri and Yoruba, as shown in the cue density section of chapter 11.

The UKPHS were the most accurate group in identifying the Yoruba-English speakers. As confirmed in their post-listening questionnaire, their decisions for identifying Yoruba-English were mainly based on the /h/-insertion and /h/-elision in Yoruba-English. The overall results of the UK phoneticians are similar to those of the Nigerian participants and Y-ACCDIST. Since UKPHS even outperformed the NNLS, overall, it is worth mentioning the relevance of providing UKPHS with the feature matrices. This suggests that non-native linguists could be as accurate as non-native speakers that had contact with native speakers of a given accent in question within the same country or region. The UKPHS performance, therefore, suggests that an analyst from a neighbouring region or a target accent is not likely to perform any better than a linguist that may at some point study the phonological/phonetic descriptions of a relevant language/dialect to conduct a language analysis.

As Igbo-English lacks unique consonant shibboleths compared to the other three accents, the UKPHS' decisions for this accent were mainly based on vowels such as LETTER, STRUT and NURSE. In addition, the NLS mentioned a few instances of /r/-/l/ merger and /t/-deletion, though these cues were not included in the matrices. Having observed that both the UKPHS and Y-ACCDIST were the poorest groups for accurately identifying Igbo-English with 33% accuracy, these findings suggest that, based on the current descriptions as contained in the Igbo-English matrix, variability in Igbo-English

may not easily be captured in a written description of the accent. Consequently, Igbo-English would not reliably be analysed without the involvement of an experienced Igbo native speaker.

It is worth mentioning the extraordinary performance of native speaker phoneticians in identifying fellow speakers of their L1 accent groups and the correlation between their accuracy and confidence. They are, therefore, in the best position to be involved in a language analysis of their language or a relevant dialect.

In the absence of native speaker phoneticians, native speaker non-phonetician linguists with in-depth expertise of their native language and its varieties are in the best position for language analysis. In the absence of such experts, educated native speakers that have been tested and identified with a strong potential could be competent enough to do the task. However, there would not be any preference of non-linguists (who are not native speakers but share borders with a target accent) over linguists that have never had direct contact with the speakers of a target accent.

12.1.5 Y-ACCDIST's feature ranking and its comparison with cues used by human methods

It is observed that Y-ACCDIST and the human listeners used some of the same cues in classifying the Nigerian English accents. Y-ACCDIST's feature ranking was conducted using ANOVA as a feature selection method. This method has ranked two consonants and two vowels as the most critical for distinguishing among Nigerian English accents: /f, t, ʌ, i:/. These segments had also been listed by the human listeners as their basis for classifying the accents. Except for the voiceless alveolar plosive /t/, the other three segments were listed by many of the UKPHS. The feature matrices of the four accents given to the UKPHS did not include /t/. But some of the Igbo and Kanuri NLS mentioned the /t/ as an Igbo-English cue for them. It is observed that /t/ is deleted word-finally in words such as "but" and "a lot" in Igbo-English most of the time and occasionally in Yoruba-English. On the other hand, /t/ is clearly realised in both Hausa-English and Kanuri-English, and it is realised with aspiration word-finally. With these observations, feature selection (by calculating the inter-segment distances of the Y-ACCDIST matrix of the paired segments in question) correctly identified the most critical sounds for distinguishing among the accents.

The voiceless labio-dental fricative /f/ is another consonant identified as significantly improving accent recognition by Y-ACCDIST. This consonant had already been given in the feature matrices given to the UKPHS in advance of their participation. Both the UKPHS and the NLS mentioned /f/ in their list of English consonants with different realisations in Hausa-English and Kanuri-English. There is wide variability in this consonant realisation across the four Nigerian English accents. The UKPHS and NLS observed that the consonant is realised as bilabial plosive [p]. The only Kanuri phonologist that participated in the study mentioned the realisation of the consonant as a bilabial fricative [ɸ] in Kanuri-English, while the researcher further observed its unique Kanuri-English

realisation as [p] syllable- or word-finally. It is also stated in the feature matrices that the consonant is realised as the voiceless bilabial fricative [ɸ] word-initially in both Hausa-English and Kanuri-English, as well as word-finally in Hausa-English. With these observations on the convergence of different human listeners, it can be argued that Y-ACCDIST's feature selection method confirmed the basis for accent identification by the two human groups: NLS and UKPHS.

The STRUT and FLEECE vowels also significantly improved accent recognition, as assessed in the feature selection method of Y-ACCDIST. These vowels had been in the feature matrices for distinguishing the four Nigerian English accents. UKPHS also confirmed that differences in STRUT vowel pronunciation significantly influenced their decisions for the classification task. However, the role of the FLEECE vowel has not been observed by both the UKPHS and NLS. Only the feature matrices concur with the Y-ACCDIST's identification of such a vowel as significantly relevant.

On the other hand, several features were listed in both the feature matrices and the human listeners' post-task comments. Such features were not significant in Y-ACCDIST's feature selection. The [z] and [s] realisations of the voiced labio-dental fricative /v/ in Hausa-English were listed in both the feature matrices and the listeners' comments. The realisation of the definite article "the" as [za] in Hausa-English was also listed. The neutralisation of /f/ and /v/ word-finally in Yoruba-English was mentioned by a Kanuri NL, while post velar nasal [k] epenthesis in Yoruba-English was mentioned in both the feature matrices and in the comments of most of the UKPHS and NLS. Elision and epenthesis of voiceless glottal fricative /h/ in Yoruba-English were mentioned by almost all human listeners as their main basis for identifying Yoruba-English, while vowel nasalisation was mentioned by a Yoruba NL. In the case of Hausa-English, [a] vowel elongation was mentioned in the feature matrices, and this was also confirmed by the Hausa NLS and some Kanuri NLS.

All this information was not significantly considered in the Y-ACCDIST analysis. Having observed this, one can speculate that the feature selection method of Y-ACCDIST (matrices of Euclidian distance of paired phonemes) is dependent on the cross relevance of a particular feature in most if not all of the accents mixed-up in any given classification task because the two consonants and two vowels that Y-ACCDIST identified as significant in its analysis are observed to be relevant to at least three of the four accents.

Since Y-ACCDIST has also shown its potential of being a useful tool for accent classification tasks like the one in this project. It can be used to drastically reduce the workload of an analyst in the process of the analysis, as matrices of inter-segment distances produced by Y-ACCDIST are further analysed using feature selection methods. Since the feature selection method identifies the significant features for distinguishing accents in any given classification task, human analysts can use such information to minimise their processes of analysis. In complement to human analysis, Y-ACCDIST can act on segments where there are no apparent phonetic bases.

12.1.6 Relationship between the density of cues and accurate classifications

The feature matrices of the four Nigerian English accents had equipped the UKPHS before they took part in the experiment. Some of the phoneme realisations in the matrices did not occur in some of the stimuli. Consequently, UKPHS may have misidentified such stimuli due to the absence of certain cues (a single consonant realisation or combination of consonants and vowels) that are not part of the L1 features interfering in the L2 English. Since Y-ACCDIST and a substantial number of Nigerian participants correctly identified the stimuli, it suggests that native speakers' decisions were based on the other clues that may hardly be described using linguistic notations.

The feature selection method for Y-ACCDIST analysis has identified a combination of a small number of consonants and vowels as significant features in distinguishing among the four Nigerian English accents. The feature selection method concurs with some segments in the feature matrices used by the UKPHS before they took the survey.

While it is possible to speculate about the features that non-native speaker listeners such as the UKPHS listed as their basis for identification of accents, on the one hand, it may not be feasible to assume the same impression for native listeners. Even if the native listeners had made a list of some features as their basis for identifying fellow speakers of their accent group in the post-listening questionnaire, this could only form a part of the linguistic features that can be represented using notations. Native speakers are bound to the use of subconscious knowledge of their native accent that is hardly described in linguistic terms using notations, as Nolan (2012) argued. This position is evidenced in the performance of linguist and non-linguist native speakers of the same language. For example, native speaker non-linguists were only able to make a short list of features used for identifying speakers of their L1 group compared to a long list given by their linguist counterparts. Despite the long list given by native speaker linguists, some of them were outperformed by their non-linguist counterparts in identifying fellow speakers of their accent group.

12.2 Conclusion

This research supports Wilson's (2009) position that the value of phonetic analysis should not be ignored in the field of LADO/LAAP. The use of feature matrices has satisfactorily influenced the classification of three of the four accent groups: Yoruba, Hausa and Kanuri. It significantly raised the accuracy of Yoruba-English to the highest level, as UK phoneticians who were the only listener group using matrices which performed the best in identifying Yoruba-English. However, the use of such feature matrices only raised the performance of the participants to 50% for Kanuri-English and 56% for Hausa-English. The native Yoruba speakers were also not as accurate as the UK phoneticians despite their significant performance.

As Wilson (2009) suggested, this research has attempted to (in addition to the other two methods) involve different dialects of Nigerian English and draw listeners from several dialects of Nigerian English in the classification task. As expected by Wilson, asking listeners to classify Nigerian English according to speakers' dialect differences posed challenges to them. Respondents' accuracy drastically decreased when they were presented with stimuli of other accents of Nigerian English, as they were only accurate on an average level compared to their significant performance when exposed to the stimuli of their native accents.

Wilson (2009) reported that the native Ghanaian English speaker non-linguists were highly confident even when they were inaccurate, and she anticipated that native speaker linguists would be more cautious in their analysis. However, the findings of this study indicated that native speaker linguists too were highly confident even when inaccurate. Only UK phoneticians who were non-native speakers of Nigerian English exercised caution.

Many people (both linguists and non-experts) are well aware of the inevitable influence of several aspects of an L1 on a speaker's L2 or any other language(s) that they speak non-natively. While some L1 marks may likely disappear in some aspects of an L2, the phonological/phonetic features are unlikely to completely vanish but only be reduce to some extent. Findings from this study, along with others, have confirmed the high success rates of native speakers in identifying their own speaker group compared to non-native listeners' performance. Thus, it is reasonable to speculate that native speakers are highly likely to remain in the best position to recognise members of their native accent or language. All this does not advocate the use of untrained native speakers only in LADO/LAAP. It only provides further empirical grounds—as the performance of eight different Nigerian native speaker groups in identifying fellow members of their native accents show—that their native ear should never be underrated. The involvement of native speakers should only be considered as one of several steps within the asylum application process.

12.3 Recommendations:

(1) Research on different accents of L2 speakers should continue not only to identify evidence of L1 interference. Some differences among accents of the same L2 (e.g., Nigerian English) that are not attributable to the speakers' L1 can still be apparent. Such feature differences may not attract the attention of native speakers of the L2 accents but can be very useful in distinguishing among the accents. For these reasons, these features should be given equal importance in research to document additional differences among proximate accents of the same L2.

(2) One of the tasks recommended by Wilson (2016) is to ask asylum seekers to listen to authentic speech samples of a person that natively spoke the language or dialect of the claimed region or a person faking a genuine variety of the language in question. Wilson hypothesised in this regard that a

genuine asylum claimant will significantly outperform other listeners in identifying fellow speakers of their L1s and in rejecting non-native speakers of their L1. The test can be conducted by mixing genuine speech samples with other proximate samples and asking the asylum seekers to distinguish between them.

Since this study also suggests a similar recommendation, Wilson's hypothesis is further confirmed and supported. Almost all the sub-groups of Nigerian native speakers (both linguists and non-linguists) were significantly accurate (71% -- 92% accurate) in identifying fellow speakers of their L1s. Authorities should also consider testing asylum seekers' ability to identify one of them. The authorities can ask them to identify fellow speakers of their L1s amidst several mixed speech samples. However, this may not have to be as exactly recommended by Wilson. It may not include faking a speech of a fellow speaker.

(3) Databases for collecting speech samples of dialects, regions or nations in question should be established. It is possible for a language to undergo some changes. In addition, speakers of the same language or accent can be different based on social factors such as age, gender and education level. For these reasons, the corpus database should include all speech samples of diverse sub-groups of dialects, accents or languages.

(4) Cambier-Langeveld (2010b, p. 27) noted that language analysis conducted by native speaker analysts is cross-checked by supervising linguists through sourcing relevant publicised information or consulting another native speaker. Rather than going this way, it may be much better if multiple genuine/authentic speech samples are made available for the native speaker analysts to work on, refer to or compare with the initial actual recordings of the asylum applicants in question.

12.3.1 Reliability of language analyses

(5) Reliability of testing for identifying potential and right human analysts could be enhanced if human personal experience of a supervising linguist is supported by software-based tools such as Y-ACCDIST. The same results that are repeatedly given by both the human descriptions and Y-ACCDIST could be more reliable than an analysis conducted by one method. The confidence of human analysts is expected to rise if most of their impressionistic analysis is confirmed by automatic machines.

(6) Cambier-Langeveld (2012, p. 103) asserts that asylum cases' reliability is ensured by continuous cross-checking of analysis of recordings by different analysts within the same agency or from other agencies. Concerning this assertion, the analysis of false rejections and false acceptances of the four methods of this study suggests a specific procedure of ensuring the reliability of verifying a particular claimed origin. These findings suggest involving native speaker analysts from both origins to analyse the same speech materials at different times. The reasons for proposing the method are given below. The error analysis of the four methods compared in chapter 11 revealed that Hausa

native speakers (both linguists and non-linguists) are most likely to accept non-Hausa-English speakers, mostly Kanuri-English speakers, as their fellow speakers. Native Kanuri linguists are least likely to accept non-Kanuri native speakers such as Hausa and other Nigerian L1 speakers into their L1 group. The implication of this for LADO is that more Kanuri speakers that may falsely claim Hausa origin have better chances of being accepted by Hausa native speakers compared to the Hausa speakers claiming L1 Kanuri origin.

The claimed origin should have already been stated by an asylum seeker in this case. The next task for both analysts is to verify such a statement to confirm or reject the claimed origin. The established origin could either be a rejection or a confirmation of the initial claim. If the claimant is a genuine Hausa native speaker, it is assumed that the Hausa analyst will confirm that he is a genuine native Hausa speaker, while a Kanuri analyst is likely to reject him/her. Three hypotheses are possible for this kind of analysis:

- The speech could be identified as Hausa by both analysts
- It could be identified as Kanuri by both; it could be identified as Hausa by the Hausa analyst to confirm the claimed Hausa origin, or
- The Kanuri analyst could reject the claimed Hausa origin and identify it as a native Kanuri speaker.

The Kanuri NLS are less likely to accept a false Kanuri origin claimant compared to the native Kanuri NNLS. The Kanuri NLS may, therefore, not perform well in confirming a genuine Kanuri origin claim. Failure to do so is to the detriment of the concerned asylum seeker. On the other hand, they are more likely to reject a false Kanuri claimant to the advantage of the concerned arriving country. This finding suggests the need to involve both Kanuri NL and NNL in analysing a speech of claimed Kanuri origin.

(7) The first step of the procedure is to ask an NNL Kanuri analyst to carry out the analysis. If the NNL analyst identifies the speech as produced by a genuine native Kanuri speaker, the sample needs to be forwarded to a Kanuri NL analyst for a second analysis. If the second analysis also confirms the Kanuri claimed origin, it is highly likely and reliable that the claimant is a genuine native Kanuri speaker.

(8) For Hausa, the claimed Hausa origin should first be forwarded to a Hausa NL analyst for verification analysis. If the Hausa NL accepts/confirms the claimed Hausa origin after analysing the sample, given the high rate of false acceptances in the Hausa native-speaker groups, and the low rate of such in the Kanuri NL group, the sample should be forwarded to a Kanuri NL analyst for a second verification. If the Kanuri NL rejects the sample for not belonging to Kanuri native group, this strengthens the initial outcome of the first analysis of accepting the claimed Hausa origin. However, if the Kanuri NL confirms the claim of L1 Kanuri origin, then the first analysis is doubtful.

Although these suggestions may look time-consuming and highly expensive to relevant bodies, they are possible and more reliable than the single verification process as far as more proximate L2 accents such as Kanuri-English versus Hausa-English are concerned.

Since there was not a statistically significant difference between the NLS and their NNLS counterparts in identifying fellow speakers of their L1s, and NLS were also not significantly better than the NNLS at classifying other non-native accents of Nigerian English, despite their initial confirmation of studying the sound systems of the non-native accents in question.

Therefore, studying the L1 sound system of an L2 English speaker does not guarantee a significant success rate in distinguishing the accents of such an L2 English speaker from other proximate accents. In the absence of a native speaker linguist analyst, the alternative reliable non-native linguist analyst should therefore be one who studied both the sound system of the L1 of the L2 speakers and the sound system of their L2 accent.

12.4 Suggestions for Further Direction for Research

This study and two previous studies (Wilson, 2009 and Cambier-Langeveld, 2010b) have contributed to the LADO debate—supervised native speaker versus expert linguist only—, and all of them are based on L2 English but not L1s. A next line of research is to compare different methods of humans and machines in classifying dialects of people's L1s.

Unlike the UKPHS, the Nigerian native speaker linguists were not given feature matrices before taking the survey. Their responses were entirely based on their native exposure to their accents. It is unknown whether studying the phonetic detail of the accent groups can raise their average performance of classifying the non-native accents of Nigerian English to a significant level.

Native listeners were not categorised based on their L1 dialect differences in this study. Although it will be time-consuming, it would be interesting to collect L2 English samples of speakers of different L1 dialects and present them to L2 English speakers of the L1 dialects for another classification task. This will determine whether or not listeners' accuracy will rise when exposed to stimuli spoken by fellow speakers of their own L1 dialect, i.e., whether speakers of L2 can be distinguished based on the differences of their L1 dialects.

The feature matrices that have consistently shown to be significant in distinguishing the accents across all or a majority of the methods tested could be incorporated into computer software to be used in conjunction with human experts in LADO/LAAP casework. Features that have been identified as distinctive for distinguishing the accents make a good choice for incorporation into computer software. This could be achieved through a joint research project that will involve interested native speaker consultants, relevant linguists, phoneticians, software engineers and speech technology experts.

The effect of age was not considered in this study despite the availability of the participants' ages in the data. It would, therefore, be interesting to find out how differences of age among human listeners affect performance of accent classification.

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Appendix A

1. Information sheet and consent form given to the prospective respondents of the study

UNIVERSITY *of York*

DEPARTMENT OF
LANGUAGE AND
LINGUISTIC SCIENCE
Heslington, York, YO10 5DD, UK

INFORMATION SHEET

PLEASE KEEP THIS INFORMATION SHEET AND A SIGNED COPY OF THE CONSENT FORM FOR YOUR RECORDS

You are invited to take part in a research study. Before you decide whether to participate it is important for you to understand why the research is being done and what it will involve. Please take the time to read the following information carefully. If there is anything you do not understand, or if you want more information, please ask the researcher.

Title of study:

A Comparative Phonological analysis of varieties of English spoken by native speakers of Nigerian languages (Hausa, Igbo, Kanuri and Yoruba) for the determination of speakers' origins

Researcher: Muhammad Umar Gombe

What is the research about?

The research aims to find-out various varieties of English produced by the native speakers of the three languages (Hausa, Igbo, Kanuri and Yoruba). It seeks to determine the level of phonological influence the native languages have in the way English is spoken.

Who is carrying out the research?

The research is carried out by Muhammad Umar Gombe, a PhD student in Linguistics at the Department of Language and Linguistics, University of York, United Kingdom. I am carrying out this research as part of the requirements to be fulfilled for the PhD degree in Linguistics.

Why have you been chosen to participate?

You have been invited to participate in the research because you are a native speaker of (Hausa/Igbo/Kanuri/Yoruba) and have attained a proficient level in English.

What does the study involve?

The study will be conducted in four Nigerian Universities (Bayero University, Kano, University of Nigeria, Nsukka, University of Maiduguri, Maiduguri and University of Ibadan, Ibadan). It involves three parts: (1) talking about your life, working and travel experiences, (2) reading two short passages aloud and (3) describing pictures. Each session of the task will last seven minutes. The researcher himself is the sole collector of the study's data.

2. Consent form given to the prospective respondents of the study

A comparative phonological analysis of varieties of English spoken by native speakers of Nigerian languages (Hausa, Igbo, Kanuri and Yoruba) for the determination of speakers' origins

Researcher: Muhammad Umar Gombe

Consent form

This form is for you to state whether or not you agree to take part in the study. Please read and answer every question. If there is anything you do not understand, or if you want more information, please ask the researcher.

Have you read and understood the information leaflet about the study? Yes No

Have you had an opportunity to ask questions about the study and have these been answered satisfactorily? Yes No

Do you understand that the information you provide will be held in confidence by the research team, and your name or identifying information about you will not be mentioned in any publication? Yes No

Do you understand that you may withdraw from the study at any time before the end of the data collection session without giving any reason, and that in such a case all your data will be destroyed? Yes No

Do you understand that the information you provide may be kept after the duration of the current project, to be used in future research on language? Yes No

Do you agree to take part in the study? Yes No

If yes, do you agree to your interview being recorded? Yes No

(You may take part in the study without agreeing to this).

Do you agree to the researcher's keeping your contact details after the end of the current project, in order that s/he may contact you in the future about possible participation in other studies? Yes No

(You may take part in the study without agreeing to this).

Your name (in BLOCK letters): _____

Your signature: _____

Researcher's name: Muhammad Umar Gombe

Date: _____

3. Language background questionnaire given to the prospective respondents of the study

University of York
Department of Language and Linguistic Science
Language Background Questionnaire
Date: January 20, 2019

Contact Information:

Name: _____ Email: _____

Phone: _____ Today's Date _____

Please answer the following questions to the best of your knowledge:

PART A

(1) Age: _____ (in years)

(2) Education: _____

Primary school (s) attended

Name of school _____ for how long _____ public/private

Name of school _____ for how long _____ public/private

Secondary school attended

Name of school _____ for how long _____ public/private

Name of school _____ for how long _____ public/private

Universities attended

Name of the University _____ for how long? _____ undergrad/postgrad

Name of the University _____ for how long _____ undergrad/postgrad

(3) Place of Birth

Town/Village _____ Local Government _____ State _____

(4) What is your occupation?

(5) Movement in Nigeria

Have you ever lived in any other region(s) of Nigeria? If so, please provide details (name of region(s), durations, specify years):

(6) Native language: _____ (the language your parents spoke with you as a child)

(7) Other languages. Do you speak any other language(s)? If so, please specify which?

(8) Before learning English, did you have native or native competence in more than one Nigerian language? If yes, (please specify)

(9) Level of proficiency.

Language _____

<i>Level</i>	<i>Reading</i>	<i>Writing</i>	<i>Speaking</i>	<i>Listening</i>
<i>Basic</i>				
<i>Intermediate</i>				
<i>Advanced</i>				

Language _____

<i>Level</i>	<i>Reading</i>	<i>Writing</i>	<i>Speaking</i>	<i>Listening</i>
<i>Basic</i>				
<i>Intermediate</i>				
<i>Advanced</i>				

Language _____

<i>Level</i>	<i>Reading</i>	<i>Writing</i>	<i>Speaking</i>	<i>Listening</i>
<i>Basic</i>				
<i>Intermediate</i>				
<i>Advanced</i>				

Language _____

<i>Level</i>	<i>Reading</i>	<i>Writing</i>	<i>Speaking</i>	<i>Listening</i>
<i>Basic</i>				
<i>Intermediate</i>				
<i>Advanced</i>				

PART B

(10) Do you consider yourself a speaker of Standard Nigerian English? Yes/no.

If yes, please rate your level of proficiency:

Standard Nigerian English

<i>Level</i>	<i>Reading</i>	<i>Writing</i>	<i>Speaking</i>	<i>Listening</i>
<i>Basic</i>				
<i>Intermediate</i>				
<i>Advanced</i>				

(11) Do you ever communicate in Pidgin English? Yes/no.

If yes, please rate your level of proficiency:

Pidgin English

<i>Level</i>	<i>Speaking</i>	<i>Listening</i>
<i>Basic</i>		
<i>Intermediate</i>		
<i>Advanced</i>		

(12) What is your native tribe and on a scale of 1 to 10, how strong are your feelings of loyalty to your tribe?

1	2	3	4	5	6	7	8	9	10
No particular loyalty									Extreme loyalty

(13) How strong are your feelings of loyalty to your native language?

1	2	3	4	5	6	7	8	9	10
No particular loyalty									Extreme loyalty

(14) What language do you speak with your family at home?

- (a) Native language
- (b) English
- (c) Both
- (d) Other (please specify)

(15) Who do you speak English with? Please tick as many as relevant options.

- (a) Parents/siblings
- (b) Teachers
- (c) Friends
- (d) Colleagues
- (e) Other (please specify) _____

(16) How did you learn English up to this point? (Check all that apply)

- (a) Mainly through formal classroom instruction
- (b) Mainly through informally interacting with people
- (c) A mixture of both

(17) Estimate, in terms of percentages, how often you use your native language and English per day (in all daily activities combined)

Native language _____%

English _____%

(18) Between your native language and English, which one would you prefer to use in these situations?

At home _____

At work _____

At a party/other social gatherings _____

In general _____

(19) What is your English teachers' nationality/ethnic group?

Primary school English teacher _____

Secondary school English teacher _____

(20) At what age did you start learning English? _____

(21) Have you ever been to a country where English is a native language? If yes,

Country _____ stayed from _____ to _____ purpose of stay _____

Country _____ stayed from _____ to _____ purpose of stay _____

Appendix B

Excerpts used for data collection

1. The Rainbow passage

The Rainbow Passage

When the sunlight strikes raindrops in the air, they act as a prism and form a rainbow. The rainbow is a division of white light into many beautiful colours. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow. Throughout the centuries people have explained the rainbow in various ways. Some have accepted it as a miracle without physical explanation. To the Hebrews it was a token that there would be no more universal floods. The Greeks used to imagine that it was a sign from the gods to foretell war or heavy rain. The Norsemen considered the rainbow as a bridge over which the gods passed from earth to their home in the sky. Others have tried to explain the phenomenon physically. Aristotle thought that the rainbow was caused by reflection of the sun's rays by the rain. Since then physicists have found that it is not reflection, but refraction by the raindrops which causes the rainbows. Many complicated ideas about the rainbow have been formed. The difference in the rainbow depends considerably upon the size of the drops, and the width of the coloured band increases as the size of the drops increases. The actual primary rainbow observed is said to be the effect of super-imposition of a number of bows. If the red of the second bow falls upon the green of the first, the result is to give a bow with an abnormally wide yellow band, since red and green light when mixed form yellow. This is a very common type of bow, one showing mainly red and yellow, with little or no green or blue.

2. The North Wind and the Sun

The North Wind and the Sun

The North Wind and the Sun were disputing which was the stronger, when a traveller came along wrapped in a warm cloak. They agreed that the one who first succeeded in making the traveller take his cloak off should be considered stronger than the other. Then the North Wind blew as hard as he could, but the more he blew the more closely did the traveller fold his cloak around him, and at last the North Wind gave up the attempt. Then the Sun shone out warmly, and immediately the traveller took off his cloak. And so the North Wind was obliged to confess that the Sun was the stronger of the two.

3. The Word list

Kit	More	Horses
Dress	Goose	Comma
Never	Ghoul	Free
Trap	Book	Meter
Lot	Price	Fatal
Strut	Prize	Eighty –eight
One	Fire	Carter
Foot	Choice	Daughter
Bath	Mouth	Frees
After	Power	Either
Dance	Near	Old
Cloth	Beer	Brilliant
Nurse	Square	Freeze
Girl	Start	Clean
Fleece	Birth	Throat
Face	Berth	Gleam
Stay	North	Treacle
Meat	Force	Sing
Palm	Cure	Going
Thought	Happy	Beetle
Goat	Letter	Throne

Beagle	Straight	Everything
Rolls	Spring	Clear
Nothing	Poor	Crank
With	Agreed	Pathetic
Us	Father	There
Neither	Get off	Share
Tuesday	I hit it	Vision
Sure	I pack it	Measure
Bottle	I tap it	Newcastle
Your	Put on	Day
Book	Automatic	Mine
High	Mashed	Wind
Situation	Whole	Choose
Later	Worry	
People	Interview	
Which	Afterwards	
Twice	Inhumane	
Under	Cut	
Carry	Judge	
Stupid	Pure	
Happen	Right	

4. Feature matrices of Hausa-English, Igbo-English, Kanuri-English and Yoruba-English

Matrices of the Features of Hausa, Kanuri, Igbo, and Yoruba Englishes

Features outlined in the matrices below are only indicative of those occurring in each of the four Nigerian English accents. Some variability occurs across and within speakers of each group. There are overall 18 audio clips in the task. These include Hausa-English, Igbo-English, Kanuri-English and Yoruba-English. However, some may not be Nigerian English speakers. You are asked to listen to each of the 18 audio clips and identify the native language of the speakers, using one of the five choices provided on the qualtrics survey. Each audio clip is followed by confidence rating on a scale of 0-100. So you are asked to indicate how confident you are in your choice. You are encouraged to observe as many features as you can when judging the possible native background of each speaker. Sometimes, it takes a bit long for some audio files to boot, but please be patient they will come up within seconds.

The following tables contain the features of Hausa, Igbo, Kanuri and Yoruba English. These include different realisations of consonants, vowels and some phonological processes (e.g. consonant cluster break-up, consonant deletion).

English consonants	H a u s a realisations	K a n u r i realisations	Igbo realisations	Yoruba realisations
/p/		[ɸ] / #_	It is realised the same way as native speakers	
/p/	[ɸ] / #	[p] / #	It is realised the same way as native speakers	
/f/		[ɸ] / #_	It is realised the same way as native speakers	
/f/	[ɸ] / #	[p] / #	It is realised the same way as native speakers	
/v/		[b] / #_	[v] / #_	[b] [v] / #_
/v/	[ɸ] / #	[p] / # mainly	[v] / # mainly	[f] / # mainly
/ð/	[z] mainly [d] occasionally	[d] mainly		[d]
/θ/	[s] mainly [t] occasionally	[t] mainly [s] occasionally		[t]
/ʒ/	[ʃ]	[dʒ]		[ʃ]
/h/ → [∅] Initial /h/ deletion	_____	_____	_____	/h/→[∅] / #_ in Yoruba .i.e. /h/ deletion word initially
/∅/ → [h] Initial /h/ insertion	_____	_____	_____	/∅/→[h] / #_ in Yoruba .i.e. /h/ insertion word initially

Short vowels

English monophthongs	Hausa realisations	Kanuri realisations	I g b o realisations	Y o r u b a realisations
STRUT	[a] [ɔ]	[a]		[ɔ]
LETTER	[a:] [ɔ] for <o>		[e] [ɔ]<o,or,u>	[ɔ]

Long vowels

English long vowels	H a u s a realisations	K a n u r i realisations	I g b o realisations	Y o r u b a realisations
FLEECE	[i] [i:]	[i]	[i:]	[i]
NURSE	[a] [a:] [ɔ] (rare)	[a] [o]		[ɔ:] [e] [e:] [a:] <er, ear>

Diphthongs

English diphthongs	H a u s a realisations	K a n u r i realisations	I g b o realisations	Y o r u b a realisations
FACE	[e] [e:]	[e]		[e:]
GOAT		[ɔ]		[ɔ] [ɔ:]
MOUTH		[au]	[ou]	[a:]
NEAR		[ija]	[ije]	[ije]
SQUARE		[eja]		[e:]
CURE		[uwa]	[ɔ:] [ijɔ]	[uwɔ]
PRICE	[a:] [aɪ]	[aɪ]		[aɪ]

Differences between Igbo and Yoruba

While FLEECE, FORTH and START are more central in Igbo than in Yoruba, they are mostly shortened in Yoruba English.

While Igbo and Yoruba speakers share many vowel features, Yoruba speakers delete or insert the glottal fricative /h/ word-initially. For example: air [he:] high [aɪ], have [a:f]

A voiceless velar plosive is pronounced after the velar nasal by Yoruba speakers. For example: <long> [lɔŋk]

Differences between Hausa and Kanuri

Most of the Hausa speakers pronounce the definite article <the> as [za] while Kanuri speakers use [di].

In Hausa, the HAPPY vowel is realised as DRESS word-finally when orthographically written as <y>. For example: primary and secondary.

Vowel insertion in consonant clusters

Almost all of the four varieties do not have consonant clusters. However, their vowel insertion into English clusters differs. While Hausa speakers prefer KIT and FOOT, Kanuri speakers mainly insert LETTER vowel. On the other hand, Yoruba and Igbo speakers tend to use FOOT vowel in syllable coda position.

If you need a reference list for these materials, please do not hesitate to contact me at: ugm501@york.ac.uk

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Appendix C (Pictures used for data collection)

1. Picture 1



2. Picture 2



3. Picture 3



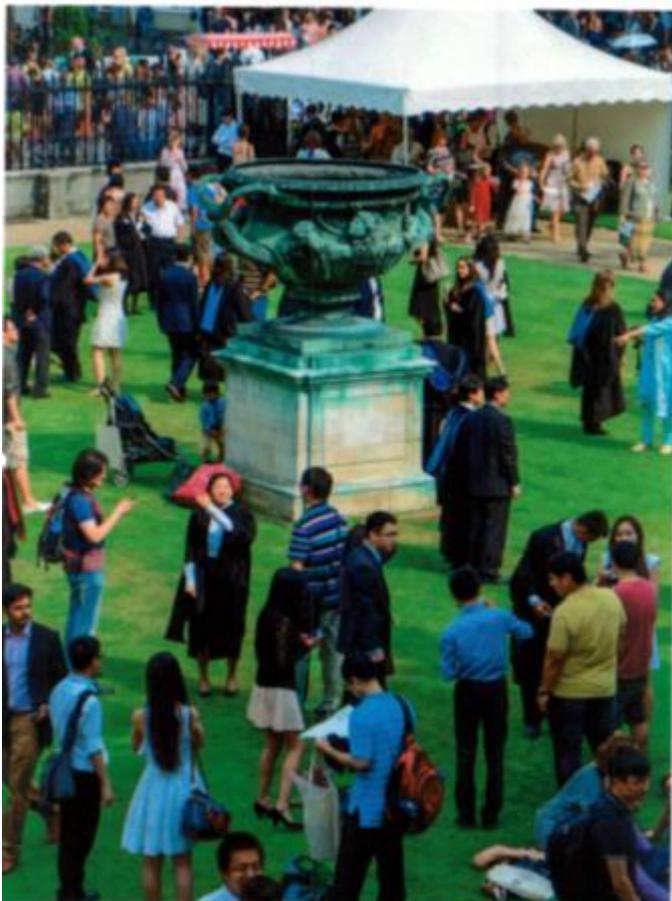
4. Picture 4



5. Picture 5



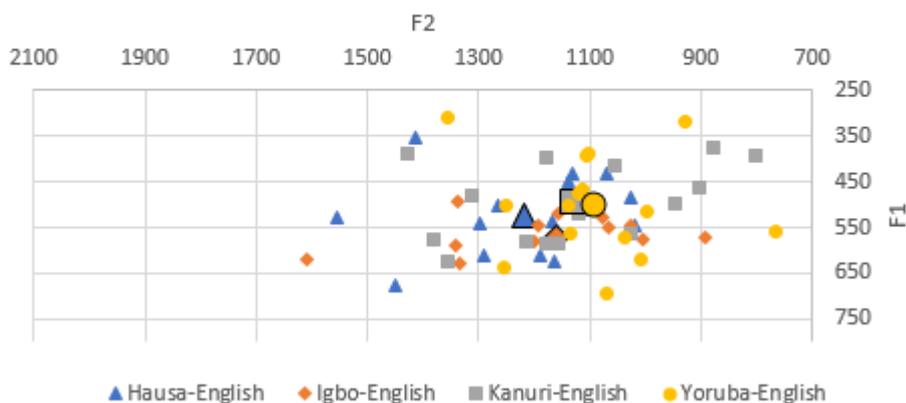
6. Picture 6



Appendix D: Individual versus averaged data points for F1 and F2 values

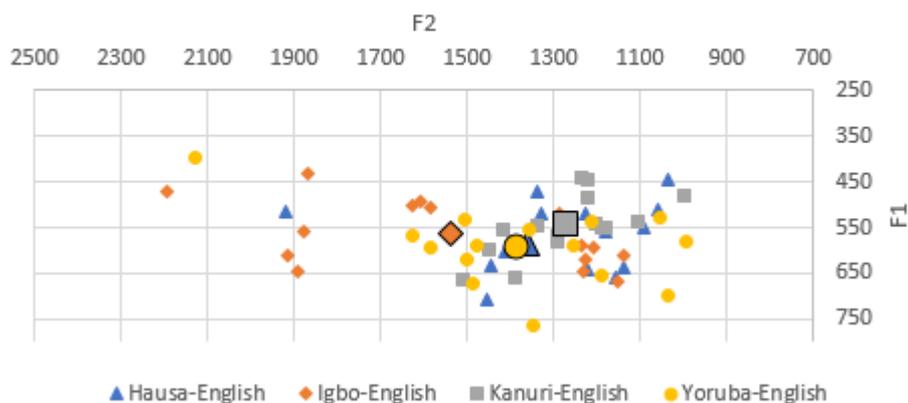
1. STRUT Vowel

Individual & averaged realisation of STRUT by Hausa, Igbo, Kanuri and Yoruba speakers



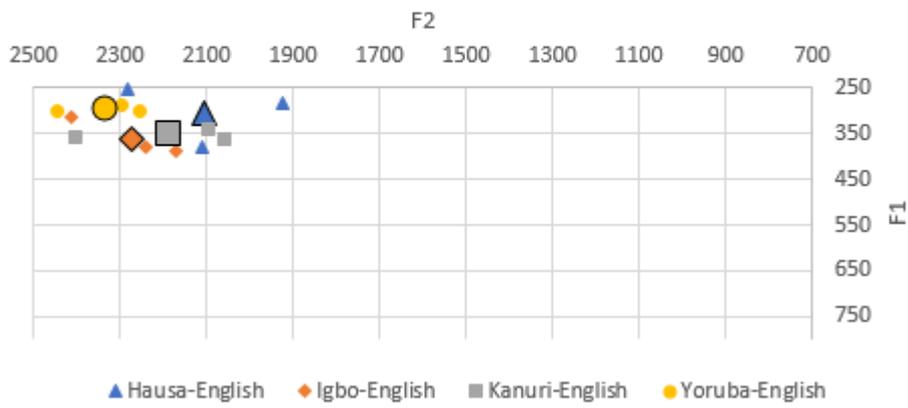
2. NURSE Vowel

Individual and averaged realisation of NURSE by Hausa, Igbo, Kanuri and Yoruba speakers



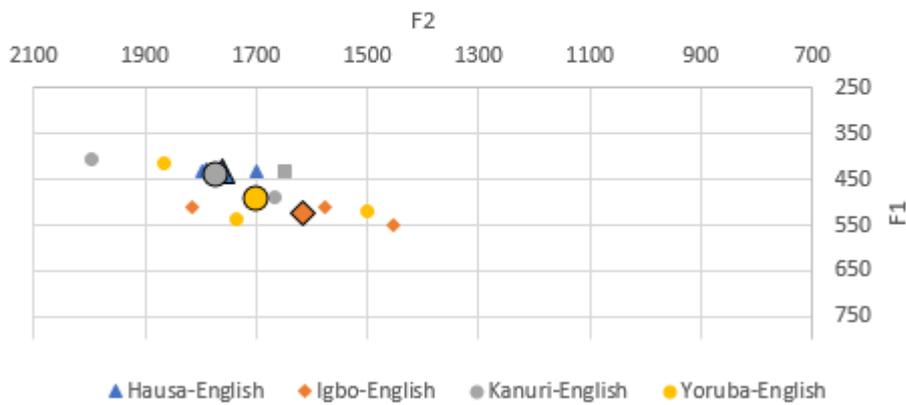
3. KIT

Individual and averaged realisation of KIT by Hausa, Igbo, Kanuri and Yoruba speakers



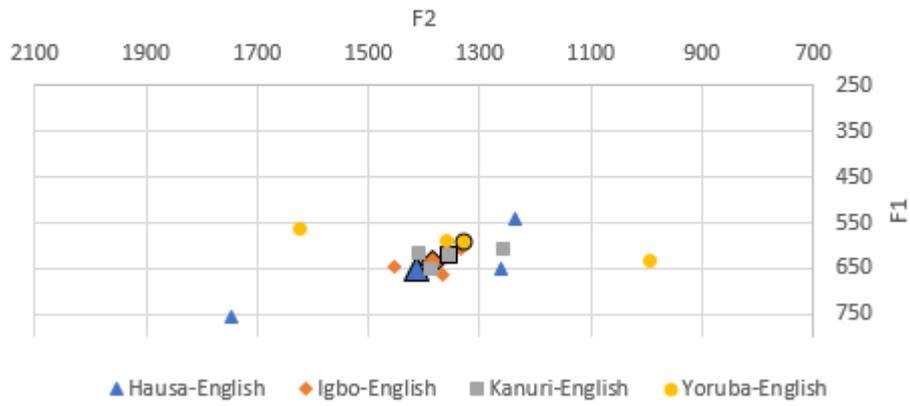
4. DRESS

Individual and averaged realisation of DRESS by Hausa, Igbo, Kanuri and Yoruba speakers



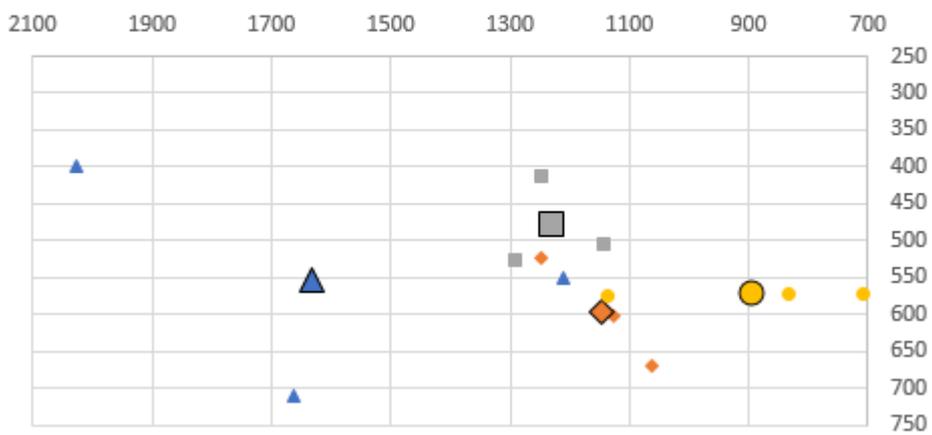
5. TRAP

Individual and averaged realisation of TRAP by Hausa, Igbo, Kanuri and Yoruba speakers



6. LOT

Individual and averaged realization of LOT by Hausa, Igbo, Kanuri and Yoruba speakers



7. FOOT Vowel

Individual and averaged realisation of FOOT by Hausa, Igbo, Kanuri and Hausa speakers

